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Number 1

Government Control of Power

GOVERNMENT control of the supply of power in some communities is not now a matter of academic discussion, it is a fact. That this is so is no surprise to foreseeing observers. It has been long ago forecast in these columns and has been hastened by the tremendous needs of the war industries, by the dangerously progressing margin between the quantity of power produced and the quantity of power wanted, and by the apparently insoluble problem of getting the necessary coal out of the mines and moving it without delay to the points where it is wanted.

Now that the situation has developed to the extent where a system of virtual priority is in effect in some cities and the national need for power is very acute, it is high time to make clear again the critical nature of the emergency that confronts us. In brief, we have the war forces of the government bending every resource with vigor to hasten the manufacture of munitions. We have another government agency in responsible control of the conditions of coal production and, in general, coal distribution and allocation as between different classes of clamoring consumers. The Fuel Administration effort is now supplemented by complete federal control of railroad operation. The sum total of these factors is that we have the government, through those who are producing munitions for it, as consumer, and we have the government as the supreme authority over coal supply. All that is required of the steam electric central station is that it shall take the coal supplies which the government will provide and convert them into the energy which the government (or those to whom it awards contracts) will buy.

The field of activity is thus so narrow that the central station will have to move diligently and with extreme circumspection in order to measure up to the exacting standards that the nation sets. Its aim will be to serve the national interest. If the government orders it to furnish power to certain industries and compliance means cutting off other consumers, there is no patriotic course but to obey. Such an order means discrimination under the state law.

When because of urgent war needs the federal authorities order discrimination they should be asked to put their requirements in writing. Companies will find

it advisable to take up with the public service commissions all questions involving discrimination under state laws. These commissions will act as patriotically as any citizens, but their action will keep the records straight for the lawyers or courts in case of future question. The main thing will be to divert the power unhesitatingly, as the government desires to have it done, but, in doing that, the companies will want clear authority for all drastic steps.

Transportation and Fuel Supply

THE United States government has tackled the biggest job of its career in taking over the railroads. It can thus effect a working merger far closer than anything which would have been permitted to the railroads themselves, and much more efficient, because the question of funds for adequate supply of rolling stock is thereby automatically settled. We earnestly hope that one of the immediate results will be the clearing up of the fuel transportation difficulty, for which no effective cure has hitherto been found. A shortage of fuel in these times is perfectly understandable, yet a breakdown of fuel transportation so serious that factories have to close, schools shut down and power plants run on reduced output is a state of affairs that, broadly, is not excusable. It is now rigorously up to the government to take hold with a firm hand and put its task through even if it has to commandeer the coal mines and enlist the miners to do it.

Every patriot, whether he theoretically believes in government ownership or not, must recognize that it gives opportunity for efficient action which is well worth the while, and should give it full support even to the extent of forgoing the inalienable right of grumbling at inconveniences. These there will undoubtedly be in the rearrangement required to do effectively the things which are necessary. We in this country have yet to learn the lesson that war is a serious business to which private prejudices and interests must give way. We believe that the government by this step will be able to carry out the work of national defence as it could not possibly have carried it out otherwise, and at a speed utterly impossible so long as the transportation systems were not welded into one coherent whole.

Developments in Electrical Industry in 1917

Very Little Progress Made in the Art—Every Energy Bent on Increasing Production and Keeping Essential Industries Going

NO GREAT amount of space is necessary to record the scientific and technical achievements of the past year. With a world-wide war on our hands and with the electrical industry straining every nerve and muscle to meet demands in the face of shortage of labor, material, fuel and transportation, advances, save in isolated cases, have been out of the question. Development has taken place rather in the direction of increased production or the same output against heavy odds.

GREAT PRODUCTION OF ELECTRICITY

The central-station industry turned out more electricity than ever, despite serious handicaps for want of fuel and apparatus in addition to a lack of money for betterments and extensions. Statistics gathered by the ELECTRICAL WORLD indicate that the total central-station output for the year was approximately 27,000,000,000 kw.-hr. More than half of this energy, and we record this with pride, was developed from water power. To develop the rest in steam stations required approximately only 4 per cent of the country's total coal supply, but great difficulty was experienced in securing that small percentage. By and large, the quality of central-station service has not been permitted to deteriorate, although the great bulk of energy is still being sold at the regular pre-war rates. In some instances increased rates have been allowed.

MANUFACTURERS OVERLOADED

Manufacturers of electrical apparatus and supplies have been busily engaged in turning out equipment, but have been unable to meet even very urgent demands. The government has been a large buyer. In fact, the demands of the government upon electrical manufacturers have caused many to subordinate all developments in other directions. Some manufacturers are working 100 per cent in excess of their previous maximum output, the pressure being in part for electrical products and in part for munitions and other war supplies.

JOBGING CONDITIONS EXCELLENT

The year 1917 was the most prosperous in the history of the electrical supply business. This has been particularly true in the industrial centers. The net merchandise profit by reason of increase in values has been larger than for many years past, and the constant rise in values of all merchandise except copper has given an additional and very substantial warehouse profit. During the first six months of the year particularly, the number of orders handled, which after all is a truer indication of the health of the business, showed a substantial increase over the similar period in 1916.

The electrical supply jobbers face the year 1918 with the sure knowledge that building operations as a whole, outside of construction for government purposes, will be approximately 50 per cent of normal, with a corresponding decrease of about 50 per cent in the purchas-

ing power of the contractors. The financial needs of the government, coupled with the uncertainty as to demands of labor for higher wages, will make it difficult for public utilities to secure money for extensions except at a very high rate. This naturally will be reflected in less new work and fewer extensions, with a corresponding decrease in purchases.

BROADER FIELD FOR CONTRACTORS

During the year the electrical contractors have broadened their organization plans by the adoption of a new constitution and by-laws, which have since been ratified by enough state organizations to bring into existence the National Association of Electrical Contractors and Dealers. The organization seeks better standards of practice among contractors, better trade relations between the various national bodies, and, above all, will strive to make the contractor himself a better merchant. Normal electrical contracting work suffered a decline during the year for obvious reasons.

RESEARCH WORK

Research has made good progress, although the lines of endeavor have been considerably different from what they would have been had we not entered the war. As it is, many research men have been devoting their energies to solving war problems, and while it is manifestly impossible to give out results of this type of research, we know that splendid progress has been made. The devotion and energy displayed by research men who are giving their time, many practically without compensation, to government work is most inspiring. In many lines it has been found necessary to do intensified research work to provide substitutes for materials which have been withdrawn from the market or which have become unduly expensive. In fact, the direct war research work is no more important than the indirect work in providing industry with the ways and means of keeping production going in spite of abnormal conditions in regard to materials, etc.

TURBINES AND WATERWHEELS

Experience in the last twelve months indicates that the tendency on the part of operators to purchase steam-turbine units of large capacities will continue. With a view to improving economies still further in addition to increasing the size of the units, the present drift is in the direction of high steam pressure with superheat. This necessitates a more extensive use of cast steel and bronze alloys not subject to the growing action experienced in cast iron subject to higher temperatures. The lines of small steam turbines have been improved in the standardization of the several types. Superfluous sizes and frames have been eliminated, except that certain special designs have been quickly developed and are being supplied to the government in large quantities. Considerable progress has also been made in the adoption of the small steam turbine to very high-temperature steam.

Waterwheel business has fallen off during the past year. However, on account of the scarcity and high price of coal and the growing conviction that if coal is to be conserved the water powers of the country must be developed, renewed activity in hydroelectric developments is anticipated. The falling off in waterwheel business has been due to lack of new developments, reconstruction work remaining about the same, while more extensions were made in 1917 than in 1916. A test recently made on a 5250-hp. horizontal water turbine installed in a paper mill in Maine showed a maximum efficiency of 92.3 per cent. This is considered to be the highest efficiency that has ever been obtained in a horizontal unit. A vertical unit, it will be remembered, showed on test several years ago an efficiency of 93.7 per cent, this latter being, as far as we know, the highest efficiency which has ever been obtained in a waterwheel.

GENERATORS AND TRANSFORMERS

There have been no radical changes in the design of alternating-current generators other than the continued effort to understand and predict temperatures more correctly, thereby reducing the size and the cost of the machines. Even though stresses may be a serious limitation in turbo-generators in the large high-speed units, they seldom if ever are as important as magnetic saturation or temperature rise.

Transformers, especially of the high-tension type, have been a scarcity on the market during the year, and in general manufacturers of transformers have been bending all efforts to increase production. More confidence is placed in large transformer units, and during the year a 8000-kva., 44,000/6600-volt, 60-cycle, self-cooled transformer was installed in a steel mill in Ohio. This unit, both in its rating and in its over-all dimensions, is a distinct advance in the maximum size of self-cooled units. As indicative of the lack of hesitancy on the part of customers to order transformers of very large size, the case of the Detroit Edison Company may be cited. That company has a 25,000-kva. auto-transformer which will transform 12,000 volts to 24,000 volts. Being an auto-transformer, this means that the unit will control an output of 50,000 kva., an amount of power that no one has heretofore been willing to make dependent on a single static transformation.

TRANSMISSION PROBLEMS

Despite unusual conditions there has been great progress made in the manufacture of high-tension insulators. It would seem that more substantial progress has been made last year than at any other time in the last six or seven years. The realization that an insulator involves many factors other than size and weight has done much to permit development along lines which increase reliability and lower the cost of maintenance.

One of the most important problems confronting the electrical industry at the present time relates to continuity of service. It is perfectly evident that if implicit reliance could be placed on transmitted power huge steam generating stations could be more strategically located with reference to coal supply, thereby releasing many coal cars and permitting economies in other directions.

Lightning troubles we shall perhaps always have, but other line troubles are gradually being eliminated. At

the present time the cost of protective apparatus is too large a percentage of the cost of power and switching apparatus in smaller systems, and yet a small installation without protective apparatus menaces the continuity of the main power supply. During the year a new type of arrester, which has the critical voltage characteristics of the aluminum arrester and yet is entirely dry and requires no charging, has been developed. Further developments have also taken place in the building of power reactances cast in concrete.

GREAT DEMAND FOR MOTORS

In the motor market the demand for large as well as for small motors has exceeded the supply. As a consequence there has been no room for any but standard apparatus. Changes have been kept down to a minimum. In machines intended for steel mills the insulation of windings in both motors and generators has been increased so as to secure a greater margin of safety to offset the severe conditions of operation.

Owing to fuel and other conditions a great many manufacturers have turned to electric drive, thereby increasing the normal demand for motors as well as the demand for energy from central-station circuits. The pressure for standard motors is still heavy. Even with fractional horsepower motors, where the government purchases have been comparatively small, sufficient minor operations have developed in essential industries to keep up an abnormal production.

Naturally with the great demand for electric motors there is a similar demand for controllers, and the same general condition of increased production of standard product prevails in the controller field.

This year has witnessed a number of important developments in electric storage batteries, especially for government use, but under present conditions we are not at liberty to discuss these.

WIRE AND CABLES

Wire and cable manufacturers have been very prosperous during the year. The demand for wire and cable even outside of that required for government use has been very satisfactory. Of course, if money continues to be so hard to get and the prices of building materials remain so high, the public utilities will not be inclined to make extensions and normal building operations will remain at a standstill. There remains, however, a large business due to necessary extensions, and there is considerable other development work under way which will call for large quantities of wire and cable.

STANDARDIZATION

The work of standardization during the past year has been confined more to slight revisions of former standards than to any radically new line of work. Horsepower ratings have been adopted for direct-current adjustable-speed motors. Transformer rules covering distribution and power transformers have been finally approved on the subjects of kva. capacities, voltages, voltage taps, temperature rating, multiple connections, insulation tests, etc. On industrial control apparatus a set of symbols and diagrams has been approved. Terminal markings of all motors, generators, transformers and industrial control apparatus have been finally approved. Most of the work referred to has been under consideration for some time and portions of it previously approved.

Save the Power of Our Unused Streams

By FRANKLIN K. LANE

Secretary of the Interior

WHEN Benjamin Franklin caught the lightning on the tail of his kite he did a lot of strange things for this world of which we are only beginning to learn. Among these are the uses to which flowing water may be put.

The old-fashioned waterwheel, which was the motive power of our early industries, is now converted into a turbine which generates electricity, and this has as great a variety of uses as the muscles of a man's arm or a horse's shoulder.

Among the other strange things done by Benjamin Franklin was to give an added and peculiar value to the ledges of granite which confine our Western streams and turn them into dam sites, useful for purposes of power generation.

How many of these there are on public land not yet disposed of no one knows, but we have several hundred under withdrawal, and these should be freed from withdrawal and turned into use just as quickly as possible; for, as the muscle of man or horse can raise a few barrels of water from the well to supply stock or irrigate the garden patch, so can the power of the stream, turned into electricity, be used to raise millions of barrels of water to irrigate alfalfa farms or orchards. And this is now one of the most common uses of electric power in the West, and, in fact, in some of the Eastern States where irrigation is found of value.

The waters that flow down our streams are only a small portion of the rain and snow which fall.

There are streams that follow their courses underground just as clearly marked and as valuable, if once discovered, as the streams above ground. And to tap these is a part of

making America. Cheap gasoline is doing it in some places; cheap coal in a very few; but cheaper electricity is doing it in a large way.

Then, too, there is that mystifying miracle of drawing nitrogen from the air for chemical use, which can be done only with great power, but is being done in Germany, Norway, Sweden, France, Switzerland and elsewhere, and by which an inexhaustible substitute for the almost exhausted nitrates of Chile has been found.

This is already a great industry in Europe, and will by necessity become greater in the United States than elsewhere, because of



FRANKLIN K. LANE

our size and need and opportunity.

To increase the yield of our farms and to give us an independent and adequate supply of nitrogen for the explosives used in war we must set waterwheels at work that will fix nitrogen in lime. And there are still more intimate uses for this power—in places in Montana it is so cheap that it operates the churn, the sewing machine and the vacuum cleaner, and supplies light to the house and fuel to the kitchen range. Indeed, for the possible uses of electricity there is no measure.

In order to put into use the potential power of our streams we must have legislation under which the withdrawn lands may be availed of and the power sites on our streams developed.

To Save Fuel Use the Central Station

A Statement by the United States Fuel Administration,
prepared for the ELECTRICAL WORLD

FUEL saving through the conservation of electric power is one of the many important problems before the United States Fuel Administration. The order putting into effect two "lightless nights" a week has resulted in a substantial saving of coal—approximately 250,000 tons a year will be saved according to the best available figures.

In recent letters sent out by Fuel Administrator Garfield state administrators have been urged to obtain the co-operation of all electric public utility concerns in the elimination of all wasteful uses of electricity. Many of the state officials have reported that large savings have been effected already and that plans are under way for further conservation.

One of the most vital suggestions yet to come before the Fuel Administration has to do with the shutting down of the small isolated plants furnishing electrical energy. The largest and best managed electric light and power stations that are burning coal are using it with the greatest economy known in engineering practice. They have high-pressure boilers with ample heating surface, superheated steam, mechanical stokers, the most economical electric generators, steam turbines and high-vacuum condensers. They have water and steam meters, coal-weighing machines, pyrometers, carbon-dioxide indicators and recorders, and keep continuous records of their output and their coal consumption.

Considering the fluctuating demand for energy, it is not to be expected that by any

changes of apparatus they can make any further important saving of coal.

The smaller stations and those that are not up to date in their equipment and methods of management can, however, make a great saving of coal by acquainting themselves with what is being done in the best plants and by copying them as far as possible. Hourly records of output and of coal consumption should be started, and premiums for coal saving should be given to the engineers and firemen.

The coal consumption in the large electric plants per kilowatt-hour is less than half of that of the average small plant of less than 500-kw. rating. Everything possible, therefore, should be done by the large stations to cause the voluntary closing of the small isolated plant.

The way to do this is to reduce the charges for power service as far as a reasonable return on the invested capital will permit. A general overhauling of prices charged for energy should be made, reducing the figures for power to encourage the abandonment of the small isolated plant, saving half the coal used by the latter, and recouping the loss of revenue by raising the figures for light, thus encouraging customers to be less wasteful in its use.

It is a recognized fact that there is an enormous waste of coal due to the extravagant and luxurious use of electric light.

[EDITOR'S NOTE.—In pointing to the economy of central-station service the Fuel Administration, of which Dr. Garfield is the head, is following its consistent policy.]



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DR. H. A. GARFIELD

Manufacturers Aiding the Nation

Their War Machine for Freedom and Democracy Is a Connecting Link Between the National Forces and the Electrical Manufacturing Industry

BY ROBERT K. SHEPPARD

Representative of the Associated Manufacturers of Electrical Supplies on the General War Service Committee of the Electrical Manufacturing Industry

IT HAS been an old American adage that "time is money." To-day time is measured in lives, not money. Because our unit has changed, because time measures itself in the lives of the boys "over there" and yet to cross to France, it is clearly the duty of the electrical manufacturing industry to find the way in which time can best be used to give the aid that our nation must have if we are to win the war.

The electrical manufacturing industry is not alone in recognizing the critical nature of the emergency. A multitude of other industries have formed their war service committees.

The Advisory Commission of the Council of National Defense did a splendid, unselfish job. The preliminary work of that and other agencies and individuals is bearing fruit, and systematic mobilization of all industries is steadily progressing to a war basis. A sympathetic observer sees this when he visits Washington, and it gives courage to go forward with one's fellow manufacturers to build up machinery for helping the government with all of the facilities that we have.

The General War Service Committee of the Electrical Manufacturing Industry is to make a connecting link between the industry and the tremendous forces, now gaining headway in Washington, created to see that the national government gets what it needs. As a focus for the smaller committees representing groups of manufacturers the general committee will act to co-ordinate the different movements and make the composite result most effective.

As an example of the kind of work that is to be done by group committees, we have the results accomplished by the wire and cable group. What it is doing illustrates the kind of co-operation that we ask from each of the group committees of the industry. The basis of success of the wire and cable group is the unswerving loyalty of the manufacturers behind the group. They have said to their group committee: "You are the commander, we are here to obey." It is that kind of co-operation that we must provide back of the group committees and, therefore, back of the general committee.

IT IS A PATRIOTIC JOB

The committees are sure to be effective. This is a war emergency. The job is something that is patriotic, that will provide the channels through which each can expedite the total productiveness of business much more rapidly than any other known method.

Some manufacturers have found as the war has developed—more will find as time passes—that there is a change in the sources from which business is obtained. Mill conditions which were regarded as balanced are no longer so adjusted, because the demand is super-normal for some products but has become sub-normal for others. George N. Peek has been placed in charge of the industrial division of the War Industries Board

in Washington, so that working through the various war service committees of American industries he may systematize the conversion of facilities which are idle to-day or would be idle next month or next summer and make them of value for the business of war.

We who are serving on the general committee—and I feel that I may speak also for the members of all of the committees—are conscious that we are doing this work because the business of war requires that it be done, not because we individually think that it ought to be done. It is done because the manufacturers agree that it ought to be done. They believe that it is the right and best way to work out for the government the problems that touch production in our plants.

The general committee represents the industry. The group committees represent the divisions of the industry. This is not in any sense an association matter alone, because the entire industry, and not merely the association, wants to serve the nation. It is a big patriotic effort that we are making. It is costing men something to do it, and it is going to cost every manufacturer something to do his part, but it is something that will help to save our country. That is the demand, that is the aim. Production to meet the government needs is the first consideration. If the man outside of the association can produce twice as much as the man inside, give that man the business.

CLASSIFY THE BUSINESS

There are four classes of business which the industry will have to consider carefully from this time forward: First, the direct government business; second, the indirect government business; third, the essential but non-government business; fourth, the non-government and not-essential-to-the-war business. I would not call the last "non-essential business" because it helps to keep factories in operation and it means a return on our capital and taxes for the government.

These four groups should be considered searchingly when a manufacturer thinks of the way in which his plant ought to be producing. If the plant is capable of production for the government directly, it is a patriotic duty to be doing it; if it is capable of production for the government indirectly, it is a patriotic duty to be doing it; if it is capable of production for the essential but non-government business, it is a matter of just as much loyalty to be doing that and the non-essential-for-war business ought to be considered last.

It is the first two of these classes of business that mean direct payment of money by the government, the circulation of the vast sums which are being raised for the war. The third and fourth are in large measure the sources of supply of the money with which we must pay our taxes to the government. A certain amount of taxes will be levied because of our profits on government business, direct and indirect; but I have full faith



THE RAPIDLY GROWING NAVY CALLS FOR GREAT QUANTITIES OF ELECTRICAL SUPPLIES

that the great body of electrical manufacturers could not feel that they were doing right if they profiteered. Therefore, the business that is directly or indirectly for the government and the business that is essential but non-government will be done at a minimum and reasonable profit, not because the government says it should be so, but because patriotism tells the manufacturer to do it that way.

It is right that the burden of the war should be distributed, that every concern, large or small, should do its share. It is for the interest of all and for the individual interest of each one that every manufacturer in the industry shall take his share of the load.

Suppose that a manufacturer needs a million parts of a certain product because of a pressing demand from the navy. Under ordinary conditions he would know where he could get the parts. But if these parts had to be produced in say twenty working days, any one producer would be swamped. So the manufacturer would apply to the appropriate group committee of the makers of those parts. That committee would arrange with individual manufacturers to take the orders, one 50,000, one 100,000, one 200,000, etc.

Another illustration of what committees may do is mirrored in to-day's labor situation. A serious shortage may be found in one community. The manufacturer tells his group committee of his difficulty, the group committee communicates with the General War Service Committee of the Electrical Manufacturing Industry, which in turn has access to the labor division of the War Industries Board. The secretary of the general committee will consult with other group committees of the industry. The problem will be solved by finding a district in which for essential industries there is a surplus of labor and diverting that labor to the districts where shortage exists.

Another problem may have to do with the question of factory quarters. A manufacturer may be threatened by unforeseen conditions affecting the lease of his plant and does not know how to meet them. He has a certain amount of government business and knows that it is essential to the war. He feels that the problem is not big enough to interest the authorities in Washington. Under these circumstances he goes to his group committee and his group committee to the general committee. The matter is taken up with Mr. Peek, director of the industrial division of the War Industries Board. The difficulties over the lease are arranged, or a new location is found, or the problem is solved at once in some other way.

It was only a few days ago that LeRoy Clark, chairman of the wire and cable group, had a call from a man who was doing government business. The caller had tried by the usual purchasing methods to get a large amount of wire but had been unable to do it. He said: "I cannot find it. What am I going to do about it?"

Mr. Clark replied: "You get authority from some one in Washington for this group committee to negotiate with you and we will see what we can do."

The caller got the authority and the subsequent conversation was something like this: "This article in the schedule we will supply to you next week; this one in four days; this one in seven days; this one in ten days."

The entire requirement, which that man could not find in the country, was ready for delivery to him in two weeks.

These illustrations make plain the usefulness of the committee organization, the war machine which the electrical manufacturers are creating and backing, to help retain for the children of this generation and all time to come the freedom which we received as a sacred heritage from our fathers.

The Fuel Famine of 1917

With Sufficient Cars at Disposal of Coal Operators No Shortage Would Have Existed—
More Coal than Necessary Would Have Been Available

BY J. D. A. MORROW

General Secretary National Coal Association

THE year just closed has witnessed one of the most remarkable conditions in the bituminous coal industry ever known in the United States. The nation has been short of coal. Possessing the greatest resources of coal in the world, with abundant labor to mine this coal and with ample equipment at the mines to bring it to the surface, the country has nevertheless been held for weeks past in the grip of a fuel famine.

There need not have been a fuel famine in 1917; there need not have been even a coal shortage. That there was a famine, with its attendant suffering, was due solely to inadequate transportation facilities. Let us look for a moment at the facts. Bituminous coal mines of the country produced in 1917 approximately 540,000,000 tons. This was the greatest output ever recorded. It exceeded the output of 1916 by nearly 40,000,000 tons; it topped the yield of 1915 by nearly 100,000,000 tons.

Great as the output of 1917 was, it could have been greater. There is coal enough in the United States, it has been estimated, to supply the world for thousands of years at the present rate of consumption. There was labor enough in 1917 to bring this coal to the surface in volume far greater than it was brought to the surface. The mines could have met every need of the nation from the standpoint of labor and equipment if they had been permitted to operate to full production.

Plainly, therefore, inasmuch as the nation's needs were not met, something was wrong. It could not have been that there was not enough coal in the ground; the government figures show that there was, taking a general average, sufficient labor during the year to run the mines to a much larger production, and the equipment at the mines was ample to produce much more coal than was actually produced. What then was the trouble? The answer can be told in one word—transportation.

The coal was there, the labor was there, the equipment was there—but the railroad cars were not.

At least 75,000,000 tons of coal—probably 100,000,000 tons—could have been mined in 1917 that still remains in the ground for lack of adequate transportation facilities. The production of 1917 could have been in excess of 600,000,000 tons had the mines been permitted by the railroads to produce as much as they were capable of producing.

The authority of the United States government lies behind that assertion. Reports of the United States Geological Survey, gathered from every coal-producing section of the country, show that week after week lost production has mounted into millions of tons because there were insufficient cars at the mines to transport the coal as fast as it could be produced.

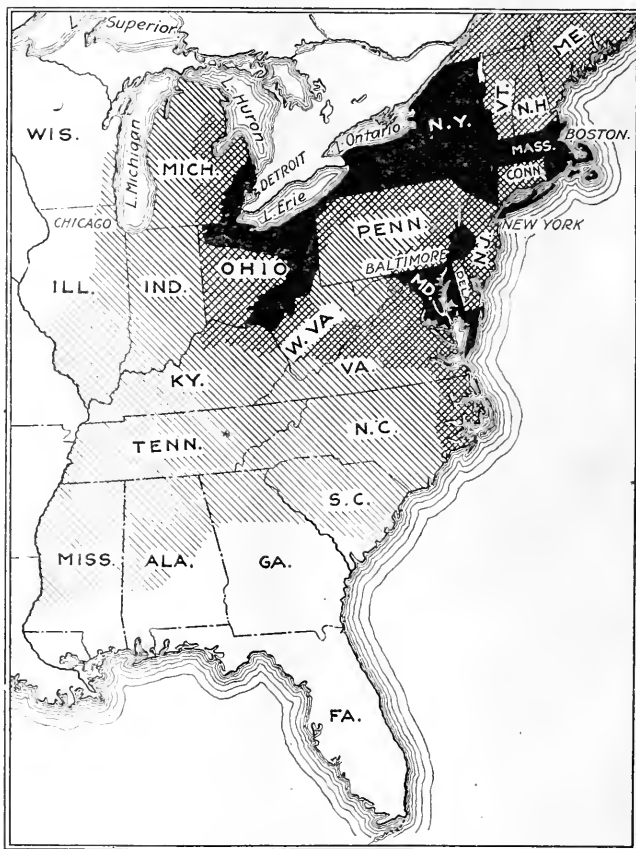
The week ended Dec. 15, 1917—the latest for which the Geological Survey returns are available—witnessed such a car shortage at the mines. The lost production of bituminous coal—and I am citing government figures—because of insufficient car supply in that week alone totals nearly 4,500,000 tons. The week before

that it exceeded 3,000,000 tons; the week before that more than 2,000,000 tons; the week before that nearly 3,000,000 tons; the week before that more than 2,000,000 tons. Thus the story goes—day after day, week after week, month after month, all during the year.

The shortage was particularly acute in some sections. In Ohio, for instance. Ohio has coal mines—enough to supply the entire State and furnish an overflow to its neighbors—yet Ohio shivered during the first cold snap.

At the moment the people of Ohio were in the grip of the fuel famine the Ohio mines were running only part time because of the lack of cars. Here is a report from one field alone in Ohio for four days of one week in which Ohio suffered most.

On Monday mines that could have produced 722 carloads of coal received only 242 cars. On Tuesday mines that could have produced 966 carloads of coal received only 270 cars. On Wednesday mines that could have



SECTION OF UNITED STATES WHERE COAL SHORTAGE WAS MOST ACUTE

produced 998 carloads of coal received only 366 cars. On Thursday mines that could have produced 1158 carloads of coal received only 320 cars. And in that same week car shortage and congestion in the Pittsburgh field caused a loss of approximately 500,000 tons in bituminous coal production.

While the Ohio and Pittsburgh mines were thus crippled the West Virginia mines were in a similar plight. Here is the lost production at 120 mines in the important Fairmont-Clarksburg section during that week: Monday, 15,000 tons; Tuesday, 33,600 tons, fifty-five mines idle all day; Wednesday, 33,700 tons, forty-nine mines idle all day; Thursday, 30,800 tons, thirty-eight mines idle all day; Friday, 40,000 tons, seventy-four mines idle all day; Saturday, 36,000 tons, forty-seven mines idle.

These illustrations are by no means abnormal. They are selected, it is true, to cover conditions during the week of the first cold snap of winter in the Middle West, because they bring home at that time as at no other the tremendous wastage in production.

It is only fair to add that during this week the railroads were crippled themselves by weather conditions. But the general situation that prevailed at the mines

then had been prevailing for some time previously, and until the government took over the operation of the railroads continued to prevail in many sections.

So far as car supply in its effect on operations of mines is concerned the mine operators feel encouraged by the centralized control of the railroads under Mr. McAdoo. They feel satisfied that sufficient cars will be supplied to keep the mines running regularly somewhere near capacity. If this is done, the producers can keep their men, because the wages now paid are the highest in the history of the industry, and compare favorably with those paid in other lines of industry.

Coal producers expect the production in 1918 to set another new high record. They understand that the war needs of the country will require even more coal than has been produced in 1917. They are entering upon 1918 determined to produce the tonnage required.

Great Progress in Electrical Activity

Statistical Records of Large Growth in the Business of Different Branches of the Electrical Industry in the Year of Entry Into the War

BY T. C. MARTIN

Secretary National Electric Light Association

ALL else that happened in 1917 is subordinated to the vital, comprehensive fact that the year witnessed the entry of the United States into the great war. How we stayed out so long will ever remain a mystery unless we explain, but not excuse, it on the ground of moral and mental unpreparedness. The period from 1914 to 1917, during which we were too proud to fight, was given up to the unprecedented accumulation of wealth; but the lesson was only learned with slow reluctance that national obligations and international duties would require now the expenditure in warfare of all that had been accumulated while Europe was bled white of every resource. The effect of the tremendous change in American feeling and action is seen more distinctly every day in the conditions of society and of industry. Unexpected revolutions are in full swing whose results will go on indefinitely after the war has stopped.

In electrical development several novel phenomena are already noted, while others begin to cast anticipatory shadows of obscure outline. No one predicted or could foresee at the beginning of 1917 what has come to pass in any branch of electricity by way of expansion or restriction. One curious feature of the times is that a tendency has been manifested to limit the use of electrical service just when the stern injunction to economize is heard throughout the land. Saving to win the war is logical, but restriction of electricity is not, since its every successful application is predicated upon some saving in time, effort, money, as against the preceding method. In fact, in its struggle to redeem and use the wasted water powers, the central station utility is at this juncture the leading exponent, after Mr. Vanderlip, of the doctrines of true economy.

INCREASE IN CENTRAL STATION OUTPUT

Any estimate of the electrical figures of 1917 is attended with more than the ordinary elements of doubt,

but as usual there are certain bases upon which calculations can be made. Thus it was assumed last January, in an article like this, that from earnings alone the central station income for 1916 had been \$425,000,000. Data available about the same time put the amount at \$417,000,000. This was larger than the 1915 total by more than 15 per cent. With some 3000 stations engaged in steam heating, ice making, the handling of supplies and other business, a large addition would be made, justifying the assumption that the total reached for 1916 of \$500,000,000 must be a fairly close approximation. A 10 per cent increase on this for 1917 would bring the figure up to \$550,000,000. The increases taken month by month would seem to justify this, especially as the gain in many months was quite considerable. Thus the increase for about 60 per cent of the industry in September, the latest month for which data are to hand at the time of writing, showed an advance over 1916 of 13.8 per cent in income and 13 per cent in output.

There is no reason to believe that output has fallen off, for many plants have been crowded far beyond their total generating capacity. Isolated plants have cried aloud to be hooked up. Industrial plants have begged in vain for a fuller allowance of energy from the circuits. The shortage of coal and the dimming of signs have come too late in the year to cause any marked present diminution in output, whatever may be the results in the next year of such conditions intensified. The long period of rate reductions would appear to have been closed; at least, rate increases have of late been more numerous. The year's net, however, may have been kept down by high costs. But the spirit and principle of economy have also been in active demonstration. Let us then assume, on the whole, for the central station industry an income of \$550,000,000. It must be remembered that, whatever may be the influences to the contrary, the uses of electric light and of

electric power multiply so fast that all accentuated economies and higher efficiencies are offset or absorbed.

ELECTRIC RAILWAY INCREASE

In 1916 the total income of the whole electric railway field was estimated at \$750,000,000. The rate of increase in street railways has not been very high of recent years, and many individual cases have been quite depressing; but the industry in the main has exhibited both staying power and recuperation. Moreover, the increase of travel with that of population goes on, and the larger employment of labor has been a marked cause in various localities of street-car crowding. This has occurred in spite, or because, of very low increase in new track or new cars. On urban lines the increase in gross has been noteworthy despite local strikes, and numerous increases in rates of fare have had their effect. A very large increase is to be noted on electrically equipped suburban sections of trunk roads and in the operation of electrified portions of such steam roads. Of course, the higher rates of wages and material have kept down the net, but the gross has certainly been 5 per cent higher and may even be 7 per cent or 8 per cent. It is fair to put the total for 1917 at \$800,000,000.

INCREASE IN TELEPHONE EARNINGS

The extent to which the conditions of the times affect electrical utilities is strikingly shown in the fact that while for the period of eight months the American (Bell) Telephone & Telegraph Company's earnings rose from \$171,608,490 to not less than \$194,337,712, the operating net income was but \$47,439,392, as compared with \$47,586,666. The whole gain of nearly \$23,000,000 was thus negated with \$150,000 more thrown in; but the gain was there all the same, and in due time the larger interest charges due to rapid increases of capital will work out to advantage. On the basis of total operating revenues of the Bell system of \$270,000,000, the past year would show at 10 per cent increase an amount well in excess of \$290,000,000. For telephony as a whole, including the independent systems, a total of, say, \$425,000,000 might be set down. This may be high, but probably not far out of the way. There has been a tremendous use of the telephone throughout the year.

TELEGRAPHY KEEPS PACE WITH OTHER SERVICES

What applies to telephony as a convenience turned to necessity applies equally to telegraphy, and it is therefore not surprising that the time-honored key and sounder have quite largely come into their own again, while both cable and wireless have been worked to the limit in spite of all censorship. For the telegraph 1917 has been a year not less fat than 1916, and so long as the war goes on the prospects for an extra dividend or two each year are quite rosy. Should the last quarter of 1917 equal in gains the preceding nine months, the Western Union system will undoubtedly be able to point to the best year in its history. The gross for ten months was not less than \$63,471,538, as compared with \$50,508,030. If to the gross earnings of the two great telegraph systems, including their land and cable lines, be added the wireless proceeds and the earnings of fire-alarm, burglar, police and kindred systems, a total of \$175,000,000 seems likely.

Just what to set down for isolated plants remains as much of a problem as ever. Many such plants have been

taken over by central stations, and the argument is more than ever that way in days of fuel famine and large water-power transmission; but doubtless the service of many isolated plants has been unduly heavy, even if it does not reach \$200,000,000 all told, as estimated once in these pages. The sum of \$150,000,000 is submitted as possibly near the mark.

COSTS AFFECT MANUFACTURING TOTAL

All estimates as to electrical manufacturing partake of the nature of guesses and as compared with the data of other years are just now of a peculiarly limited value. As was pointed out last year, the enormous advances in prices for raw material have "queered" any real comparisons. It is indeed remarkable that quotations for electrical supplies and apparatus have not gone much higher in view of exaggerated production costs and the active demand. There have naturally been notable advances in many articles, but as in the case of our swollen export trade the higher prices of raw materials are a partial explanation. On the other hand, there must be some economic reduction or saving due to larger production and the adoption of methods militating more keenly against waste. The total for the year may easily be up to \$600,000,000. The latest government figures are about \$360,000,000 for 1914, before all the startling jumps in raw material, wages, etc., took place, and the average increase of 10 per cent annually of the term 1909 to 1914 would in itself bring the total up to around \$475,000,000. This, however, would not include several groups of electrical supplies in wood, glass, porcelain, etc. Hence the estimated \$600,000,000 is not out of the way. The process of calculation is somewhat complicated also by the fact that many electrical manufacturers are in the munition business. Such figures as are obtainable are impressive. Thus the General Electric Company in connection with its latest necessary financing for more plants has stated its orders for 1917 at the striking amount of \$240,000,000.

The miscellaneous group of electrical industries and utilities was placed in 1916 at \$125,000,000. No reasons exist for believing the amount to have been any smaller in 1917. Summing up, therefore, the subjoined table may be presented for what it is worth.

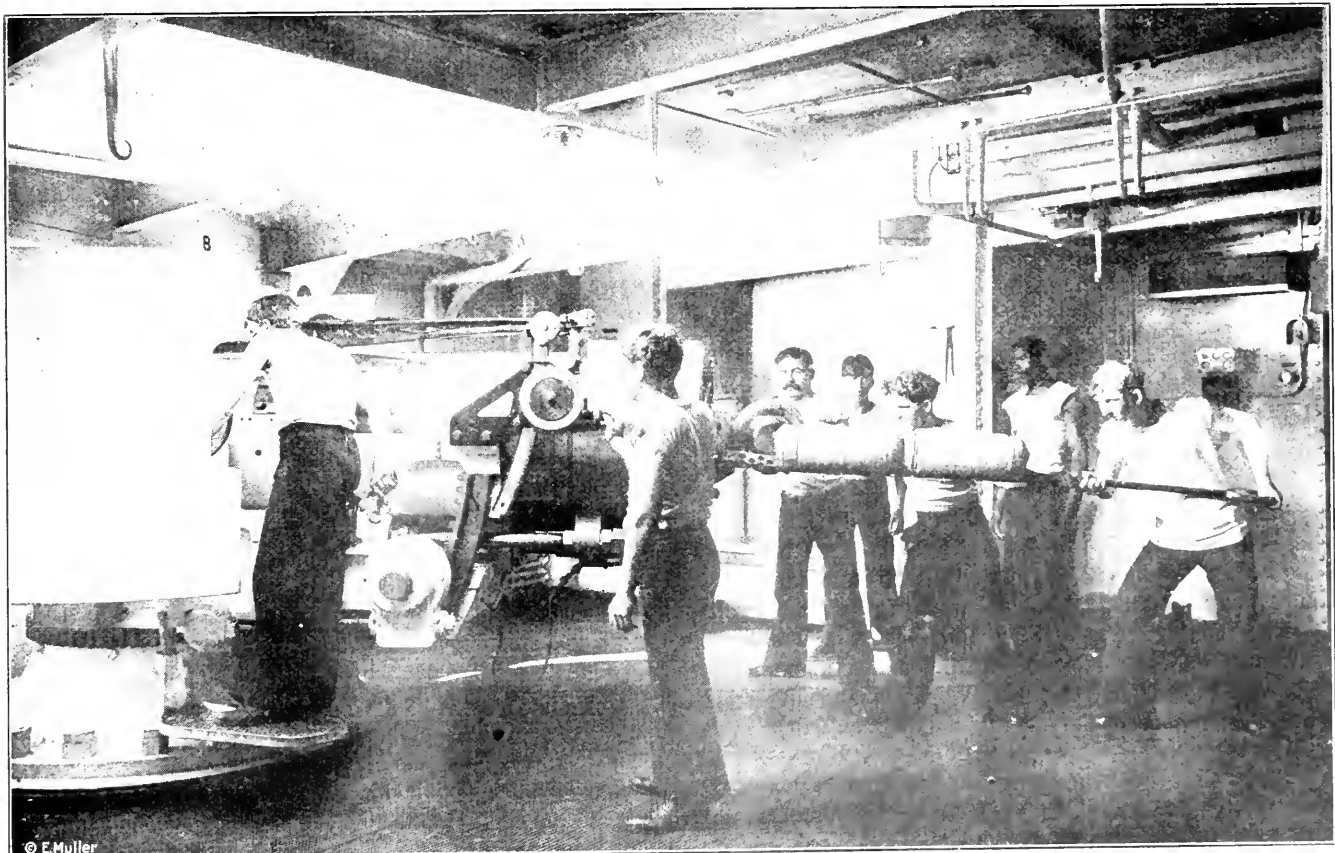
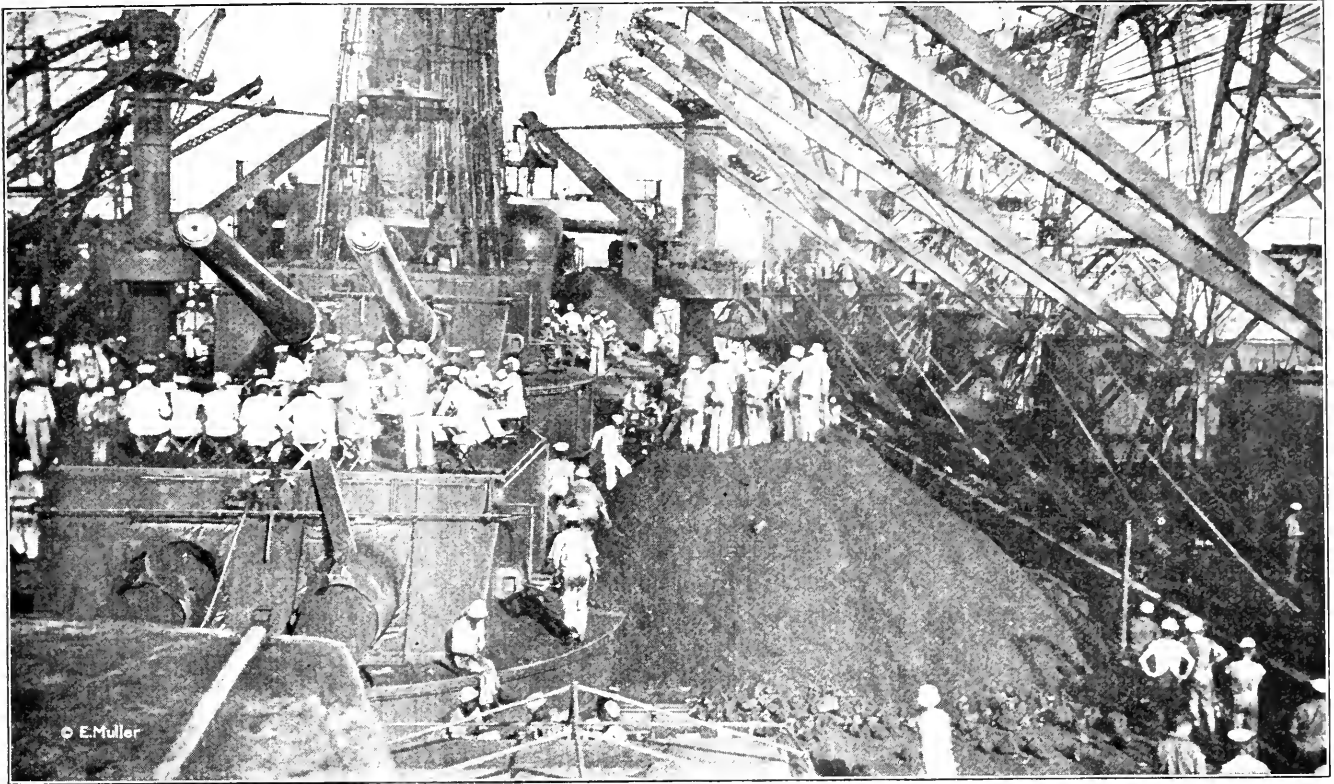
ELECTRICITY IN UNITED STATES, 1917

Central stations	\$550,000,000
Electric traction	890,000,000
Telephony	425,000,000
Telegraphy	175,000,000
Isolated plants	150,000,000
Electrical manufacturing	600,000,000
Miscellaneous	125,000,000
Total	\$2,825,000,000

This is \$200,000,000 more than was submitted as an estimate for 1916, or in the vicinity of a 10 per cent increase, which was estimated also as the rate of increase in all recent years, as authorized by the United States Census returns. Such a total is impressive even in these times when billions have sadly lost their significance. It is believed that there is abundant justification for assuming the individual items and the grand total to be reasonably near the reality and as affording a basis of study or prophecy as to the coming curves of 1918.

Electricity Aids Navy in the War

Motors Are Used for Ammunition Hoists, Gun Carriages and Turrets and for Coaling Ships at Sea, Making the Fighting Units Highly Effective



Electrical Interconnection to Conserve Fuel

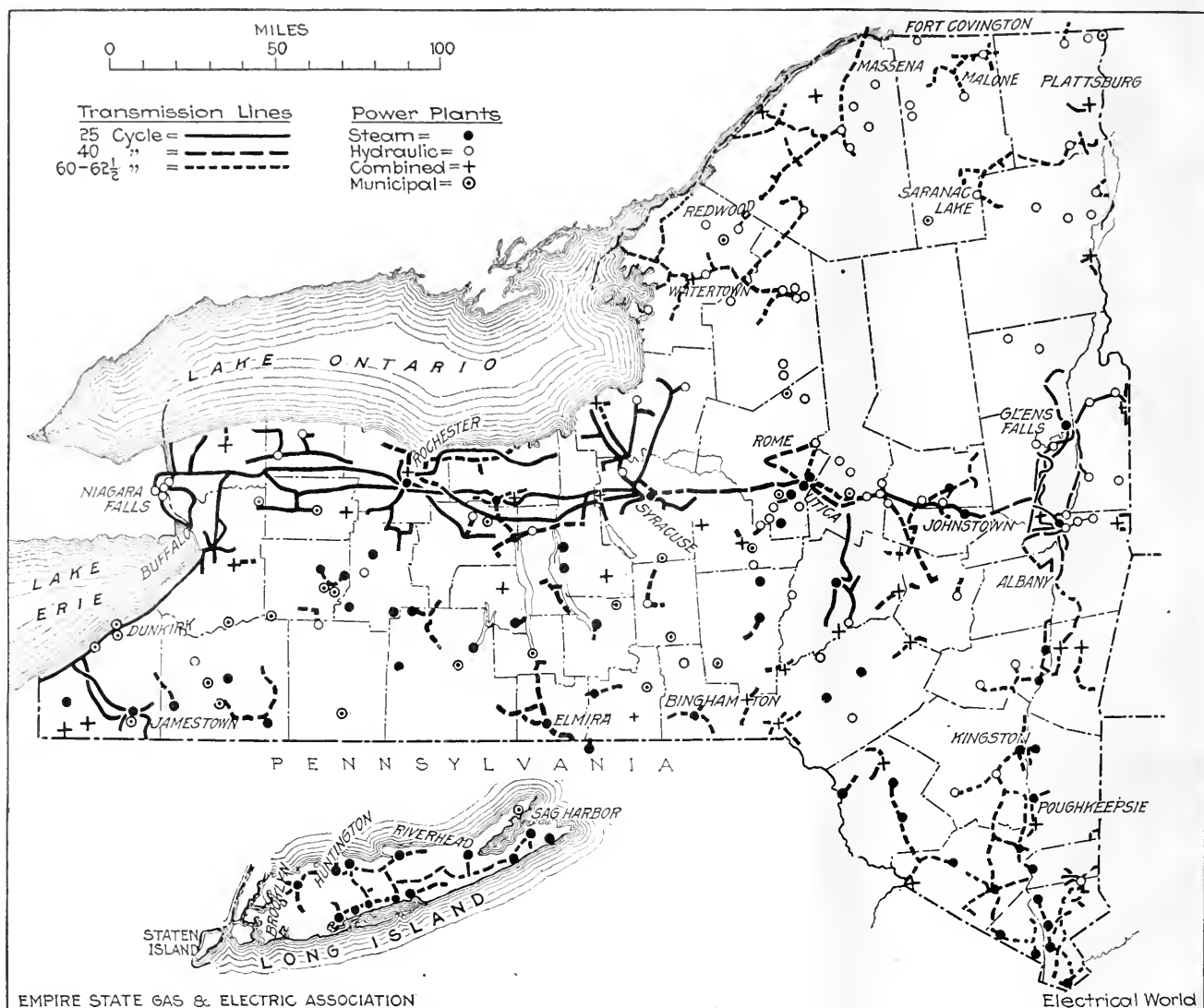
States of New York and California Present Evidence That Extensive Interconnection of Generating Systems Will Give Immediate and Practical Results in Fuel Conservation

THE opportunity for extensive interconnection of generating systems as a means of conserving power and fuel has been given particular attention in the States of New York and California. As a war measure of first importance this subject is receiving consideration from both the utilities and the state regulating commissions. Offering the advantages of

in the ELECTRICAL WORLD of Dec. 29, 1917, page 1260, presented the possibilities of the situation to the New York Public Service Commission, Second District.

A map prepared in the office of Charles H. B. Chapin, secretary of the association, is printed on this page.

The committee in its report shows that construction of transmission lines from efficient large plants to



EXISTING TRANSMISSION LINES IN NEW YORK STATE, SHOWING POSSIBILITIES OF FURTHER INTERCONNECTION

economy in fuel and generating facilities, together with better service to the public, the comprehensive arrangements which are under discussion are evidently forerunners of new policies affecting central stations.

The Empire State Gas and Electric Association, through its committee on war measures, composed of C. A. Graves, chairman, H. W. Peck and F. H. Hill, has taken steps to demonstrate the great value of such interconnection. This committee has made a report which includes a reference to the specific benefits of connecting plants. The association has also, as stated

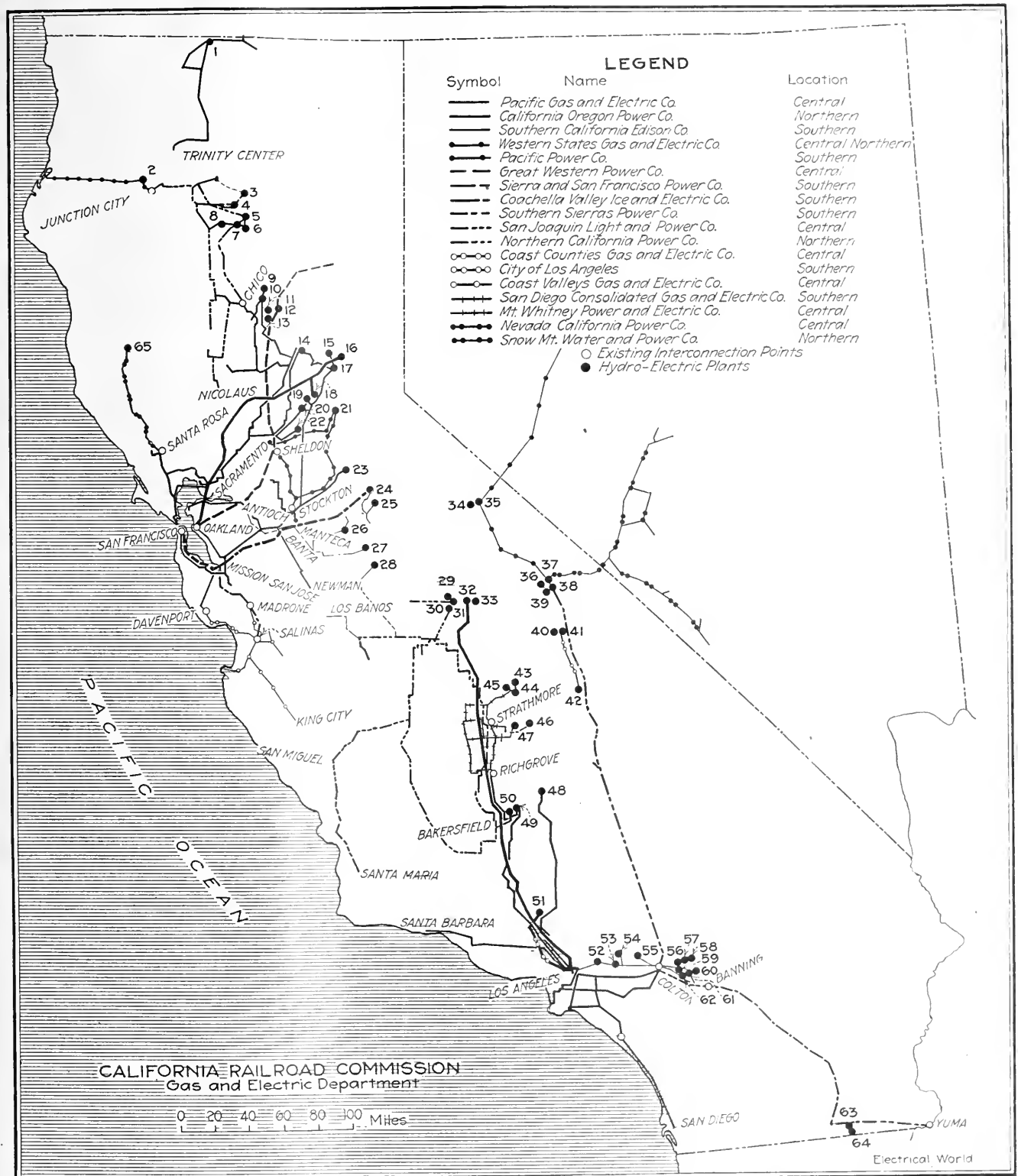
small village plants would make a material saving in coal. Transmission lines would enable many companies which are finding it difficult to obtain additional apparatus for handling increasing load to operate at full capacity because a breakdown or the withdrawal of one unit at one plant would be cared for by distribution of the load among other plants.

With its letter to the Public Service Commission, discussing ways of economizing fuel, the executive committee of the association sent a memorandum in regard to the interconnection of systems. This said in part:

It is suggested that the most immediate and practicable results that may be accomplished in fuel conservation by public utility companies on a broad scale throughout the land can be attained by use of "linking up the companies"; that is, by interconnection and the tying in by transmission tie lines, etc., of adjoining systems. This has been accomplished on a considerable scale under war-time pressure in Great Britain and has also been developed to a considerable scale in the United States under the economic pressure above referred to. In different parts of the country large systems have been developed from huge central production sources, enabling mass production under the most economical con-

ditions, this consolidation of production enabling the smaller and less efficient plants to be shut down wholly or during part of the time. These large central production sources have enabled them to deliver energy to the smaller and less efficient plants under conditions which have largely displaced their own power generation.

This general scheme of linking up accomplishes many purposes in economical power production, making it possible for the centralized plant to avail itself of the diversity factor that exists among a number of smaller and differently situated units. It enables the smaller units to be shut down during the whole summer season when the central



THE INTERCONNECTED TRANSMISSION SYSTEMS OF CALIFORNIA WHICH IT IS NOW PROPOSED TO WELD INTO ONE COMPLETE NETWORK COVERING THE ENTIRE STATE AND REACHING EVERY IMPORTANT CITY

generating plant has a considerable margin of capacity, and even during so-called peak periods it enables the smaller and less efficient plants to confine their operations to the peak hours, when it is necessary to have their installed capacity as a contribution to the total power necessary to handle the load of the consolidated system. Such linking up can often be accomplished by short tie connection or, where necessary, by transmission lines with reasonable expedition and with no great cost.

It is quite practicable to secure immediate results in many cases and enable fuel to be conserved, and such expenditures as may be involved become a permanent investment contributory to the permanent economic advantage that will be derived therefrom to the public as well as to the utilities interested. It is believed that such interconnection of utilities is of more immediate and practical advantage in fuel conservation than any attempt to secure greater operating efficiency in the individual plants.

The Railroad Commission of California has been conducting a detailed study of the benefits that could be gained by certain interconnections of the primary transmission lines of the State. The investigations, under the immediate direction of F. Emerson Hoar, have been planned so as to show, among other things, just how much fuel oil could be saved in stand-by plants, how the combined load factor of the companies involved could be improved by certain tie-ins and how these tie-ins could be best accomplished. The results of this study have not yet been made public, but the map which was prepared at considerable expense to facilitate the work has been released and a special tracing made therefrom for use in the *ELECTRICAL WORLD* is reproduced on page 13.

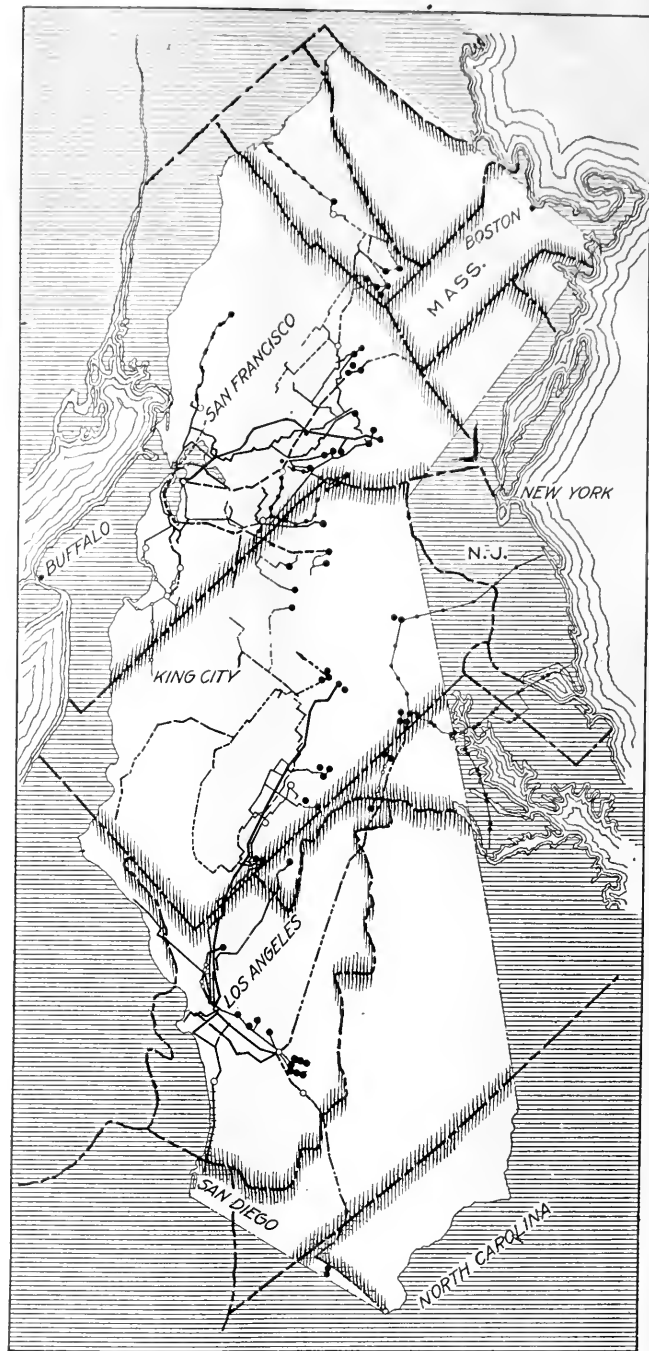
The systems shown on the map last year handled 437,730 kw. developed by hydroelectric energy and 323,317 kw. developed by steam, a total of 761,047 kw. The interconnections now in use or under construction on Jan. 1 are shown in the map by circles. Attention is directed toward six interesting connection possibilities, as follows:

1. A 16-mile (25.7-km.) line from Kennett, on the Northern California Power Company's system, to tie in with the California Oregon Power Company's line at Minorsville.
2. An interconnection at Nicolaus between intersecting lines of the Pacific Gas & Electric Company and the Great Western Power Company.
3. A 15-mile (24.1-km.) line from Manteca, on the Sierra & San Francisco Power Company's system, to a junction with the Pacific Gas & Electric Company's line at Stockton.
4. A 35-mile (56.3-km.) line from King City, on the Coast Valleys Gas & Electric Company's system, to the San Joaquin Light & Power Corporation's line at San Miguel.
5. A 50-mile (80.4-km.) line from Santa Maria, on the San Joaquin Light & Power Corporation's system, to Santa Barbara, on the Southern California Edison Company's system.
6. A trunk-line connection between the central California group of lines that center around the San Francisco Bay region and the Southern California group, which could be reached near Fresno. This latter connection would require a link about 150 miles (241 km.) long, and while it will be a very desirable connection ultimately, it is not receiving serious consideration at present.

It is interesting to note that about 75 per cent of the energy generated for the central group of systems is utilized within 25 miles (40 km.) of San Francisco. The highest transmission voltage in California is the 150,000-volt, 240-mile (386.2-km.) line from Big Creek to Los Angeles.

All of the important lines in the State are operated at a frequency of 60 cycles except those of the South-

ern California Edison Company and the city of Los Angeles system. Frequency changers are being put in where the Southern California Edison line ties in with the San Diego Consolidated Gas & Electric. The Southern Sierras system, it will be noted, has a continuous series of lines of 17,000 volts or more extending for a distance of 450 miles (724.2 km.) north and



THE INTERCONNECTED TRANSMISSION LINES OF CALIFORNIA WOULD STRETCH FROM MAINE TO NORTH CAROLINA, COVERING ELEVEN ATLANTIC STATES

south. Voltages lower than 17,000 are used on some of this company's lines in the southern part of its territory, and if these were taken into account the total distance of transmission would be much greater. In fact, energy generated in a latitude north of San Francisco on this system is delivered wholesale at the Mexican border for still further transmission to consumers south of that line.



Pacific Coast Companies Meet War Problems

Experiences of the California Utilities Under Present Critical Conditions Direct Forceful Attention to Necessity for Full Utilization of Water Power

BY JOHN A. BRITTON

Vice-President and General Manager Pacific Gas & Electric Company, San Francisco

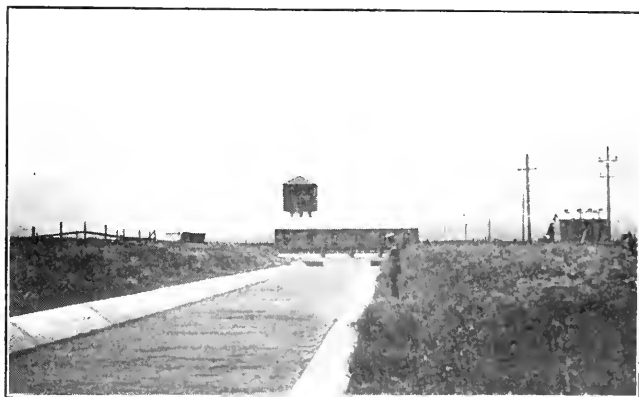
THE situation on the Pacific Coast presents unusual conditions regarding the fuel necessary for the generation of power either for transportation or direct power purposes in that, with the exception of a few coal fields on the northern part of the coast between Oregon and Washington in the Puget Sound country, this section is dependent entirely upon oil.

The withdrawal of large portions of government lands from production a few years ago and the increased demand for oil for industrial and transportation uses have made the Pacific Coast feel more than any other section of the country its situation of dependence on this fuel. While it has developed a greater proportion of hydroelectric power than any other section of the country, due primarily to the very cheap power sold by the developing companies, it has not been able in its development to keep pace with the demands, and the power companies have been driven of late to a very much greater use of steam by means of fuel oil for the generation of energy to fill in the gap between demand and their full quota of hydroelectric power.

The initial hydroelectric plants on the coast were not built with the view of conserving the water, very few of them being provided with sufficient storage capacity. This is because the rivers in California offered in normal flow sufficient power at the time of first development. We are now beginning to feel the stress in the southern part of the Pacific Coast States of the dry season, which accounts for the large proportion of steam power now being used. Whereas in southern California in normal years but 8 per cent of the total output of electric energy was generated by means of steam plants, during the low-water period this year this generation has exceeded 30 per cent.

Fuel oil has increased abnormally in price. From the prevailing rate less than two years ago of 60 cents per

barrel for fuel oil in San Francisco the cost has increased to \$1.35 per barrel, and very little, if any, can be bought even at the now quoted figure of \$1.55 per barrel. Storage of oil is decreasing monthly to the extent of about 1,000,000 barrels, and with no more than 14,000,000 barrels in storage available for fuel purposes it can be seen readily that the situation on the Pacific



IRRIGATION, BRINGING FOOD TO WIN THE WAR, IS A GREAT PART OF THE CALIFORNIA LOAD

Coast is serious and demands on its face the further development of hydroelectric power.

So long as the government of the United States resorts to the method it has pursued in the past of placing such restrictive conditions upon occupancy of government lands, hydroelectric power cannot and will not be developed in California. Instead of imposing restrictions and conditions upon such development, the government should offer a bonus on the capital that is willing to make the investment, because of the greater aid and benefit that that capital will be to the resources

not only of this State but indirectly of the entire United States. Revocable licenses and the imposition of high charges for the use of a limited quantity of government land, on which most of the hydroelectric power companies are located, do not make for stability of capital investment, but practically render it impossible to obtain capital.

As all of the industries in California and all of the utilities and plants are built for the utilization of oil, it would be an almost impossible task to turn to any other fuel; in fact, no other fuel is available at present. Coal is not obtained in sufficient quantities on the coast to take the place of oil, and in these present times and for some time to come transportation of coal either by ships from Alaska and Australia or by rail from Oregon, Washington, Vancouver, or even the Colorado and Wyoming coal fields, is not to be conceived of. There is no electric plant on the coast that can be equipped to burn coal properly within at least three months. The diminution of our oil supply would, therefore, in view of these conditions, practically paralyze every industry on the coast.

I know of no stronger argument in favor of further hydroelectric development than the conservation of the natural resources which are exhaustible against other resources which are practically inexhaustible.

There is one particular satisfaction among the power men of the Pacific Coast, and that is that by reason of their ability in the earlier stages of hydroelectric development to sell power cheaply and by reason of the very low price at which fuel oil was sold, they were able to discourage the isolated power plant, which does not exist to any degree in California.

It is obvious that with the higher costs of operation due to increased cost and scarcity of labor and increased cost and scarcity of materials, higher rates must prevail than have prevailed heretofore. It seems an unfair proposition that producers of commodities, enabled by the exigencies of the situation to obtain more than ordinary profits, should be permitted to do so and let

the utilities of the country bear the burden alone. Not only should utilities have better rates and a better return upon their uncertain investment, but they should be financed by consumers desiring long extensions and should have the aid of the Federal Reserve banks of this country in discounting utility paper.

Regulation by commission must be ineffective unless the commissions realize the necessity at times like these of proper protection of the investments committed to



TRANSMISSION LINES COVER GREAT AREAS

their charge. I am sure that the California commission fully realizes this situation and will give relief at the proper time and in the proper place.

The outlook for the future prosperity of this State never was better. The war necessities have provoked a condition of economy so far as it is within the power of the times to create it, and utilization of products long since neglected and the development of industries heretofore unknown are bound to be constant factors even after the war has ceased, and personally I look for a period in the years to come of the greatest prosperity the coast has ever experienced.



War-Time Value of Hydroelectric Power

BY HENRY I. HARRIMAN

President New England Power Company and President Boston Chamber of Commerce

FOR more than a quarter of a century the engineers have recognized the value of hydroelectric power and have devoted the highest professional ability to its development. Banking and industrial interests have contributed funds and markets for this development; and public utilities, at first sometimes unaware of its economic importance, have entered into co-operative arrangements for the purchase and interchange of energy with large-scale producers and distributors of water power. The foundation for future development has been firmly established.

The present shortage of coal accentuates the value of hydroelectric power service in a most striking way. Vast resources remain undeveloped along the streams of our country, and it is unfortunate that under present war conditions the cost of utilizing waterfalls now running to waste is so great in many instances as to retard capital from service in this vitally important field. The passage of the Shields bill by the Senate is most encouraging, despite the fact that the bill is not wholly satisfactory from the standpoint of the power producer; and it is to be hoped that this bill, or one closely resembling it, will be passed by the House and receive the signature of the President soon. If this is done, the development of much needed power from navigable streams in particular will be facilitated.

Concretely, water power is mitigating hardships of the present fuel situation to an extent that probably is little realized. With a 50 per cent load factor, every kilowatt of installed capacity in a hydroelectric station saves the equivalent of about 5 tons of coal per year, allowing from 2 lb. to 2.5 lb. of coal per kilowatt-hour. The present rate of output of the New England Power Company's water-driven generators is saving central New England 300,000 tons of bituminous coal per annum. From two-thirds to three-fourths of the output of this system is now derived from waterfall. The market is practically sold out for hydroelectric energy in this territory.

While a curtailment of service averaging about one-sixth has been forced upon our industrial power customers by the shortage of coal in auxiliary plants, there is no question that these customers have suffered much less in this way than would have been the case had they been dependent upon their own fuel supplies. In general the curtailment of service has been received patriotically by customers.

During the year just closed it has been impossible to create the usual reserve stocks of coal in New England, and this section of the country received only about 80 per cent of its normal bituminous coal shipments. A heavy demand for power resulted from increased industrial activity due to the war. Users of hydroelectric service have been able to obtain it with regularity and on the basis of contracts placed when the price of coal ranged from \$4.50 to \$5 per ton. This has enabled power purchasers to take long views ahead

in planning factory operations and expansion programs. The stability of water power when developed, barring the fluctuations of flowage in different streams, is a real asset, not only to a company producing and transmitting such energy for distribution, but to industrial organizations controlling such power within their own premises or at sites owned by them distant from their establishments. Complete exhaustion of water power in a system developed along modern engineering lines, with due regard for storage and for close control of outputs at different stations in a transmission network, is most unlikely.

The steam plant, on the other hand, is threatened by a complete tie-up if an adequate supply of fuel cannot be obtained. Three of the larger central stations operating in the New England Power Company's territory at present have only sufficient coal to carry them seventeen days; and by contrast it should be noted that no properly engineered large water-power system is likely to be completely down and out even under the most unfavorable conditions. There is good reason to expect more favorable water conditions before the winter ends; a week or two of mild weather will increase the run-off on the snow-covered and frozen watersheds of the upper Deerfield and Connecticut valleys to an extent that will be very helpful in the existing fuel scarcity, and vigorous efforts are being made to complete the installation of a 45,000-kw. turbo-generator at Providence, R. I., where steam power can be purchased to supplement the requirements of the transmission system of the New England company.

I have been asked whether it would be advisable for the federal government to undertake to finance water-power development in New England, at present deferred by high cost of money, labor and materials. Such a policy would certainly have endless ramifications; it would lead to many varied and scattered demands upon the public treasury from different sources interested in power production from streams, and the heavy calls upon the country for money with which to finance war needs must be met before funds can be spared for developments of the kind referred to.

The question is also affected by the uncertainty of duration of the war. Under favorable circumstances a hydroelectric development of magnitude requires about two years for completion, and in the light of present conditions the situation as regards power demand should be met by private capital rather than by public funds. Certainly until more evidence is forthcoming of the inability of privately owned utilities to solve the problems associated with the production, transmission and distribution of electrical energy for service under war conditions, I should be disinclined to favor governmental entry into this field, the hands of the public authorities being already fully occupied with the huge tasks of war on a scale unprecedented in the history of our country.

Engineering Societies' War Activities

A Survey and Analysis of the More Important Ways in Which National Technical Bodies Have Aided the Government

IN THE year just closed, almost nine months ago to the day, the United States, through President Wilson, formally declared itself at war with Germany. American citizens were prompt to offer their services to the nation, and in this eagerness to serve none were more quick or more prepared than the engineers of the United States.

Anticipating the possibility that this country might find it necessary to answer the insolence of the imperial German government with the sword, the engineering citizenship of the nation, through the national engineering societies, early in 1915, when the conflict in Europe was but a little more than half a year old, started on a concrete program of preparedness.

Since that time the nation's engineering talent through its national association affiliations has tremendously increased its government war-aid activities until at one time not many months ago it seemed for the moment to be defeating its very aims because too many activities often seriously overlapped and frequently conflicted. This crisis, however, is now believed to have passed, and the opinion seems to prevail that through the formation of the Engineering Council harmony of accomplishment will be completely restored and that co-ordinated effort will result.

It is therefore with a view toward showing broadly how those national engineering bodies with which the **ELECTRICAL WORLD** is more intimately connected have endeavored to serve the government that this analysis of the war activities by engineering societies has been undertaken.

FIRST STEP THREE YEARS AGO

The first step was made early in 1915, about two years before the United States actually became a participant in the war, in the formation of a joint committee of representatives from each of the national societies of electrical, mechanical, mining, civil and consulting engineers to co-operate with the War Department in the organization of a National Engineer Reserve. The direct result of this committee's work was the provision by Congress for an Engineer Officers' Reserve Corps, now in full operation, evidences of which are apparent in the great number of commissioned engineers. A tabulation of these in the higher ranks will be found elsewhere in this issue.

In the formation of this reserve the societies were of no small value. The American Institute of Electrical Engineers early sent out a brief military data sheet to its membership. More than 2000 of these filled-out sheets were forwarded to the Institute's representative at Washington, who was chairman of the Institute's committee on national defense, and were turned over by him to the various departments of the army and navy. From these sheets men were selected for their qualifications, and to them were sent application forms for admission to the Reserve Corps.

Besides, in order that the engineers might know exactly what were the requirements for the reserve, the

five societies above mentioned distributed prior to the entrance of the United States into the war two pamphlets, one for the army, the other for the navy. These pamphlets were both based on government reports and orders. In this and many other ways the engineering bodies of the country have been particularly active in giving the widest publicity of the most helpful nature to the nation's requirements and needs in engineering details and personnel.

SECRETARY DANIELS' INVITATION

Following the steps taken to give the engineer a recognized place in national service, as above explained, came the invitation on July 19, 1915, from Secretary of the Navy Daniels to the engineering societies to select each two members for appointment by the Secretary of the Navy to act with Thomas A. Edison as chairman on an advisory committee to assist the Navy Department both instructively and critically in the development of new ideas for naval advance, thereby making available to the navy the best fruits of American inventiveness. Such was the formation of the Naval Consulting Board, the value of which needs here no further exposition.

The usefulness of this board has been greatly increased since its formation through the collection of data on the nation's manufacturing resources. To accomplish this work the engineering societies were again called upon, this time by President Wilson, each to nominate a representative in each state of the Union to act in conjunction with representatives of the other associations to assist in this work of industrial preparedness. A plan for a census and classification of manufacturing industry was put into effect, and by the time the United States had entered the war returns had been received from 27,000 of the larger plants.

The War Committee of Technical Societies, the formation of which was initiated by the Engineering Council, and which is acting in close co-operation with the Naval Consulting Board, has been doing a very valuable work. This committee is composed of two members from each of the national societies of civil, electrical, mechanical, mining, gas, electrochemical, illuminating, mining and metallurgical and refrigerating engineers. At the request of the **ELECTRICAL WORLD**, David W. Brunton, chairman of this committee, has prepared the following statement of the committee's aims and functions:

The general attitude of the government of the United States toward inventors is that it is anxious to receive and consider any new inventions relating to war equipment and operations. To some extent there have been actual invitations to undertake such work.

The technically trained men of the country, who are peculiarly fitted to undertake creative work, appear to be taking but little part in volunteer war invention. This is probably due to the fact that it is not the habit of such men to undertake inventive work until they know what is wanted and have the necessary information for it. With the exception of those technical men who have been able to enter the army and navy and a small percentage actually at work in the va-

rious boards, councils, committees, bureaus, etc., the technical men of the country are merely filling their usual positions in its industrial system. They are, however, in a state of increasing dissatisfaction with this situation. That in a war of science and machinery more than 100,000 trained men, eager and patriotic, should have no direct means of applying their specialized abilities as engineers, electricians and chemists in aid of the nation seems intolerable to them.

To meet this situation the War Committee of Technical Societies was organized. Its purpose is to bring war work to these 100,000 men at their own homes. It will, from every available source, collect those war problems of research and invention which will be useful and valuable to the government, formulate them properly with the aid of specialists, and distribute them to all the membership of the societies accompanied by the data desired so far as this is practicable.

In delivering the results of this organized general work to the government, it is planned to turn over each class of results to the particular agency which now handles that class for the government, such as the Naval Consulting Board, the National Research Council, the Aircraft Production Board, the Council of National Defense, etc. It is the intention to assist and support and strengthen in every way possible each of these existing agencies, and to distribute for them all problems which they desire to have presented to the general membership of the societies.

Recognizing the need for co-ordinating the resources and industries of the country, Congress on Aug. 29, 1916, authorized the formation of the Council of National Defense, which has since played a leading part in the government's war program. To assist the council in a consulting capacity, without pay, an advisory commission was authorized. A number of the national engineering societies were consequently invited to appoint representatives on the committee on science and research of the advisory commission to which the supervision of engineering matters had been assigned.

The following month, at the request of President Wilson, there was created by the National Academy of Sciences, the National Research Council to co-ordinate existing scientific and research organizations and to encourage research in industry and war, to the end that the nation might be strengthened. The work of the Research Council is being carried on through the agency of central committees, including one on engineering. To this committee the national engineering associations were invited to appoint two members each to constitute with the engineer members of the Council the engineering committee. The Research Council through its various committees has been of unusual service to the government. Its members have been able to solve many problems for the different divisions of the army and navy, besides aiding in many instances American industry to turn out new products.

As strictly society functions, however, where the different bodies were working on their own initiative, the classification and cross-indexing of the membership of these societies is perhaps the most noteworthy. Each member has been mailed a questionnaire which, with the necessary exception of "experience" details, is virtually uniform for several of the societies. Some of the societies are doing this work alone, but a number have placed the indexing in the hands of the American Society of Mechanical Engineers, on whose original questionnaire the present general engineering questionnaire was based, each society, of course, paying the expense involved in its work.

Besides giving the customary personal data, the applicant can by a system of easily understood symbols specify exactly what his experience has been and what

are his specialties. By means of a carefully designed system all of these answers are now being cross-indexed, so that at any time the government or industry should need a man or men with certain definite engineering qualifications the engineering societies will be in a position quickly to furnish a list of those best qualified. By this means the government and industry will have for the first time at its command information on specially qualified engineers. In many other ways, seemingly more concrete and apparent, have the engineering societies been able to serve the government.

ACTIVITIES OF THE A. I. E. E.

The American Institute of Electrical Engineers, for instance, has assisted the government in obtaining the services of technical men for the following branches of service: By request of the Bureau of Navigation the Institute nominated eighty five graduate electrical engineers for appointment as lieutenants, junior grade, United States Naval Reserve Force; Bureau of Yards and Docks, candidates for appointment in the Civil Engineer Corps of the United States Naval Reserve Force, for the ranks of ensign, lieutenant, junior grade, and lieutenant; Bureau of Chemistry, electrical and mechanical engineers for special investigations throughout the country; Signal Corps, electrical men for the radio division and the aviation section; Bureau of Navigation, candidates for aviation inspection duty for training as ensigns in the Naval Reserve Flying Corps; Coast Artillery School, department of enlisted specialists, draftsmen, engineers, electricians and radio operators, as temporary non-commissioned officers, and in many other ways.

The American Society of Mechanical Engineers has done similar service in furnishing men in lots from one to a hundred or so for government and civilian service. It has assisted materially in the fuel administration through co-operation with the officers of the Bureau of Mines.

The Illuminating Engineering Society has had a similar experience and through its committee on war service has been able to be of considerable very evident service to the government in the design of lighting for buildings and grounds of aviation camps and for night flying, and also in the design of lighting for other buildings being erected by the Navy Department and the Department of War. This society at the request of Samuel Gompers nominated two members to serve with the committee of labor of the Council of National Defense to take up the question of factory, mill and workshop lighting, (1) to conserve eyesight of workmen, (2) to make factories safe by proper lighting, (3) by giving proper lighting to increase efficiency of workmen, and (4) to increase output and decrease spoilage. A code on lighting was prepared by the members designated by the society and accepted by the government. It has not yet been distributed, owing to the pressure of other work. Five states already have taken up the rules of the code and have either put them into practice or are under way to do so.

These results are by no means all that the engineering societies have accomplished, but they serve to show the effectiveness of such bodies and the valuable assistance that they can render to the government. Just at present plans are being perfected toward co-ordinating these activities under the Engineering Council which

was formed as the outgrowth of a real need for proper consideration of questions of general interest to engineers and to the public, and to provide the means for united action upon questions of common concern. At present the council is concerned only with the electrical, mechanical, civil and mining engineering national societies, but provision has been made for the election to membership of other national engineering and technical societies.

An insight into the co-ordinative principle of the council is gained from a paragraph or two from a recent announcement by the council:

Certain questions relate to the war and the assistance that engineers can render. A committee, to be called the American Engineering Service Committee, was appointed with instructions to invite the co-operation of all engineering societies in tabulating and listing the members of the five societies represented, in order that we as a profession may be in a position to take a larger part in the industries after peace is declared. This tabulation has already in part been done, but in a rather unsystematic and unequal way. It is hoped that the new committee by having additions from other societies may make a final and lasting tabulation of all the engineers in the United States. The list is to be kept in

the Engineering Societies Building for use in government problems and in the industries. At present the committee is devoting its attention to the immediate need of the hour, namely, the procurement of men for special service in the government. A list of specialists in the societies has already been completed.

Another committee, of which David W. Brunton is chairman, is called the War Committee of Technical Societies. The members are Messrs. A. M. Greene, R. N. Inglis, C. R. Corning, G. C. Stone, D. W. Brunton, J. M. Boyle, J. V. Davies, Joseph Bijur, A. S. McAllister, W. D. Richardson and Charles Baskerville. It was appointed to assist any organization in Washington, such as, for instance, the Council of National Defense, the National Research Council and the Naval Consulting Board, in any way in which it can bring to the attention of the engineers of the country the necessity for thought and help in the numerous national problems that arise.

That the engineering bodies of the country have been performing a distinctly valuable war service to the nation is recognized by President Wilson and by the war administration of the government. That these bodies through co-operative and co-ordinated efforts will be an ever-increasing factor in the successful waging of the war is unquestioned.

American Engineers in Service

List of More than Three Hundred Electrical and Mechanical Engineers with Commissions of Captain or Higher

ENGINEERS were quick to place themselves in the active service of the country when war broke out. Already many thousands of them are serving in one capacity or another. To list all of these would be too great a task. As indicative, however, of the extent to which the profession is represented there

follows a list of 336 engineers who have received the commission of captain or a higher rank in the army or the navy. These names were taken from the lists of the American Institute of Electrical Engineers and also from those of the American Society of Mechanical Engineers.

KEY TO ABBREVIATIONS

- O. D.—Ordnance Department.
- E. O. R. C.—Engineer Officers' Reserve Corps.
- S. O. R. C.—Signal Officers' Reserve Corps.
- C. A. O. R. C.—Coast Artillery Officers' Reserve Corps.
- O. O. R. C.—Ordnance Officers' Reserve Corps.
- U. S. R.—United States Reserve.
- N. R. F.—Naval Reserve Force.
- C. A. C.—Coast Artillery Corps.
- S. C.—Signal Corps.

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Utilities Turn to Regulatory Commissions

Success with Which Privately Owned Properties Emerge from Growing Economic Pressure Depends Largely on Judicial Spirit and Breadth of Vision of Those Intrusted with State Regulative Powers

BY WILLIAM J. HAGENAH

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THE year 1917 has witnessed the beginning of what promises to be the most critical period through which privately owned utilities have passed. The forces which have contributed to this condition are not new, although the great war in which we are now engaged has given them impetus and added significance, both because of the acute conditions resulting from our direct participation in the war and because of the economic and social readjustments which will doubtless follow it. The measure of success with which these properties emerge from the growing economic pressure depends largely on the judicial spirit and breadth of vision of those intrusted with the administration of our present machinery of regulation. The guidance and protection of this industry, if the present form of regulation is to succeed, call for sound reasoning and a firm adherence to fundamental economics. Such action as has been taken with respect to these conditions in 1917 gives a favorable promise, but the real test will come in 1918 and probably during two or three years thereafter.

For over twenty years officers and owners of public utility properties, both municipal and private, have beheld with serious misgivings the steady increase in commodity prices and the corresponding decline in the purchasing power of the dollar. During the greater part of this time they have had two methods of protection—reduction of operating expenses through increased efficiencies, and increases in rates. By reason of the larger and more efficient apparatus, costs have now been reduced as far as our present knowledge will permit, and it will require a discovery of radical and far-reaching consequences to give promise of further decreases. Increases in rates by the utilities, a course still open to commercial and industrial establishments through price advances, have been checked by regulatory legislation. At present, therefore, when confronted by tremendously increased operating expenses and emergency regulation designed to reduce the service output, and by legal restrictions preventing an increase in rates, utilities behold net earnings declining to the vanishing point and turn to the regulatory commissions as their only avenue for early relief.

THE REAL TEST OF REGULATION

Five years ago in a similar article the economic movement which gave rise to public service commissions was described as consisting of three stages—first, the period of public protest against the early conditions of unrestricted utility operations; second, the period of legislation during which regulatory statutes were enacted and their administrative machinery developed, and, third, the period during which the industry has been seeking to adapt itself to the new legislation. We are at the present time still in the third stage, with the question as to whether the present

machinery for regulating utilities is successful as yet not definitely answered. Regulation prior to 1917 has had to deal mostly with the adequacy of service and with such periodical reductions in rates as were found justified by the economies and profits resulting from operating efficiency and from the business development incident to the growth of the industry in the community served. Students of the price movement, however, have been calling attention for a number of years to the conditions which were operating greatly to reduce the net earnings and foreshowing their ultimate extinction unless greater attention were paid to the steady rise in prices with its effect on earnings and on the cost of securing new capital.

THE BREAKING OF THE STORM

The storm which for years has been gathering with increasing darkness on the utility and railroad horizon has now broken in all its fury under the strain of war, and with it has come the real test of the present method of regulation. We have entered a period of great economic stress and the end is not in sight. Prices have scored greater advances during the last eighteen months than during the twenty years preceding, which years represented a period of almost uninterrupted advancing prices. The cost of coal, copper, steel, chemicals and other supplies has doubled and in some instances trebled. Wages have been advanced more rapidly than at any other period in the history of the country and yet have hardly kept pace with prices. The demands of labor are constantly increasing, but its efficiency in most instances is decreasing. New forms of taxation have been devised, while the old forms, already burdensome, are being greatly increased. While the industrial power of the country has been developed to a degree previously thought impossible, and under such conditions profits in many lines have temporarily risen, securities of all kinds have experienced the greatest decline in almost a generation. In the midst of these conditions the purchasing power of the fixed unit of income has sunk to its lowest level and the cost of capital has correspondingly advanced. The financing of even normal requirements is practically impossible now and will be extremely difficult at anything less than prohibitive rates for a number of years to come.

The present utility problem, however, is not alone one of increasing commodity prices and costs of capital. Active measures are now also being taken to restrict operations which directly curtail gross earnings. Plant extensions not required directly or indirectly for national purposes are discouraged. Sign lighting and boulevard illumination are restricted. Even in the lighting of homes and offices it is urged that the greatest economy be pursued, and to encourage further the saving of energy it is suggested that clocks be advanced one hour. To the extent that the capacity thus released

may be devoted to power purposes in industries made necessary by the war no present loss may be sustained, but normal conditions in this respect will not promptly be restored by the discontinuance of war contracts.

These are some of the problems which confront the utilities and commissions, but they are not all. The recent abrupt decline in net revenue and the increasing cost of capital are the immediate effects of our present war pressure and are therefore to some extent temporary. There are, however, indications that the disturbed conditions in the utility field this year are due as much to the fear of the conditions which are to follow the war as to the war itself. War is the greatest leveler. Already the structure of supply and demand has practically collapsed. The government has established maximum prices for wheat, steel, copper, coal and other commodities and has accomplished what competition at this time could not do. It is taking over the management of the railroads and other carriers. It will purchase equipment for their use, direct joint use of facilities wherever necessary, and order extensions where most needed for the greatest public good.

Just as it controls the price for the transportation and fixes in addition the price for the supplies that enter into it, so it can and probably will fix the salaries and wages of its employees. If, when the necessity requires, it sees fit to take over the transportation system, it may also take over the utilities, operating them for the general public good, fixing not only their rates but the cost of their supplies and their labor, and if such course is successful as a war measure, the public may come to believe that the same arrangement would be equally desirable for the days of peace.

CONSTRUCTIVE SPIRIT OF THE COMMISSIONS

In the face of these conditions it is encouraging to note the broad constructive spirit with which many of the public utility commissions have approached these problems. Prior to 1917 regulation of rates generally meant regulation downward. The overwhelming majority of cases resulted in reductions in rates, the important instances where increases were granted being so few as to incite each time wide public mention. During 1917 public service commissions have given unusual consideration to price movements and their effect on the public utilities, and as a result many commissions have recently readjusted rates on the basis of the new conditions. In this connection it is worthy of mention that the public criticism which it was always expected would arise in great volume should the commissions grant frequent increases has in practically every instance failed to appear, showing at once a general public understanding of the unfavorable conditions which have been surrounding public utilities and a degree of confidence in the decisions of the commissions that augurs well for the future. If regulation in its present form is to be permanent, it must be realized that the rates which may be reduced when profits are large must be increased when economic conditions endanger a fair return on the investment. The greatest stumbling block to all regulation will be definitely removed when once the public understands that, like the man who may lead a horse to water but cannot make him drink, it may take great liberties with the investment which the utility has already made but no amount of legislation, either that already on the statute books or that which

is constitutionally possible, can compel a dissatisfied investor to supply additional capital.

An analysis of the decisions made in the year just closed shows that the commissions have allowed numerous increases in rates and in some cases have modified standards to the end that operating expenses might be reduced. In over twenty-three different states have increased electric light and power rates been made effective, and increased traction and interurban fares have also frequently been allowed. The increased revenues thus made available have been substantial and often cover a large part, if not all, of the increased costs which had been encountered up to the time when the applications were made. In some states the increases were allowed after exhaustive investigations, but in most cases they became effective by the mere filing of the amended schedules and the absence of protests during the period prescribed by statute. In each case, whether actively or passively favorable to the increases, the commissions have shown a growing appreciation of the problems confronting the utility managements. As offsetting these increases, there have been a few instances of rate reductions, and further reductions will doubtless be made even during the period of the war, for there are still instances where rates covering specific classes of service are apparently too high or where by means of the camouflage of involved schedule forms the entire schedule is being maintained on what appears to be an unreasonable basis.

That the utility commissions should have responded so promptly to the necessities of the case gives promise of the ultimate success of state regulation, unless the social problems growing out of the war should lead to a period of prolonged radical legislation aimed at all corporations but especially at public service corporations. In this year of crises the utilities subject to state regulation have fared far better than corporations dependent on assistance from national bodies or those subject to regulation by municipalities. Additional legislation is still desirable and conditions are rapidly making this urgent. A more general control of the issuance of securities is needed for the protection of both the public and the utility, for the rights of capital are best safeguarded where the commissions are charged with a degree of responsibility over it. Likewise, it may be found both advisable and necessary to legislate with respect to labor, either by adjusting its wages definitely on a basis which varies with the profits of the utilities or by making labor share directly with capital the responsibility for the utilities' success.

Most of the utilities have experienced substantially reduced net earnings, but this is not a time when reductions in earnings traceable to temporary conditions should cause grave concern. When thousands of men are dying in battle and billions of national wealth are being spent for the protection of human rights, utilities, like individuals, must take their place in the ranks and contribute with all for the greatest public good. But it is of the utmost importance at such a time that the fundamental rights of property shall be sustained, that there shall be preserved to the owners the true value of their investment, and that in so far as is possible without doing injustice to the public there shall be made available that measure of return which will maintain the properties and enable them to best meet the requirements of the public. This the commissions have done in 1917.

Light and Power Earnings \$470,000,000 in 1917

Output Increases During Year by 20.9 Per Cent, to Approximately
27,000,000,000 Kw.-hr.—October Income, \$39,300,000,
Output 2,040,000,000 Kw.-hr.

RETURNS to the ELECTRICAL WORLD from 50 per cent to 60 per cent of the central-station industry of the United States indicate that the earnings from the sale of energy for electric lighting and power during 1917 were between \$470,000,000 and \$475,000,000, an increase over 1916 of 14.5 per cent, or about

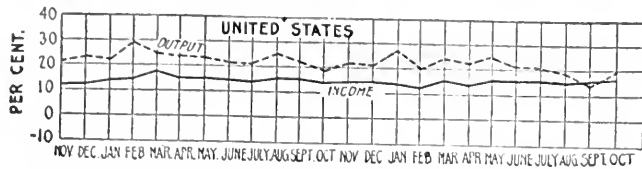


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

\$60,000,000. The output of the industry which was actually sold was in the neighborhood of 27,000,000,000 kw.-hr., which is 20.9 per cent, or about 3,500,000,000 kw.-hr., greater than the output in 1916. These are absolutely the largest increases in gross earnings and output ever registered in the electric light and power industry. In fact, the increase in earnings this year over last year was almost as large as the entire earnings of the entire industry fifteen years ago, while the output increase is greater than the entire output of the industry ten years ago.

The latest month for which the ELECTRICAL WORLD has figures is October. While not so large a percentage of companies reported for that month as had been reporting previously, owing to lateness in getting out

blanks, the reports received indicated earnings from the sale of light and power of \$39,300,000 for October last, in comparison with \$34,300,000 for October, 1916, an increase of 14.4 per cent. The output for last October was 2,040,000,000 kw.-hr., an increase of 19.7 per cent over October, 1916.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

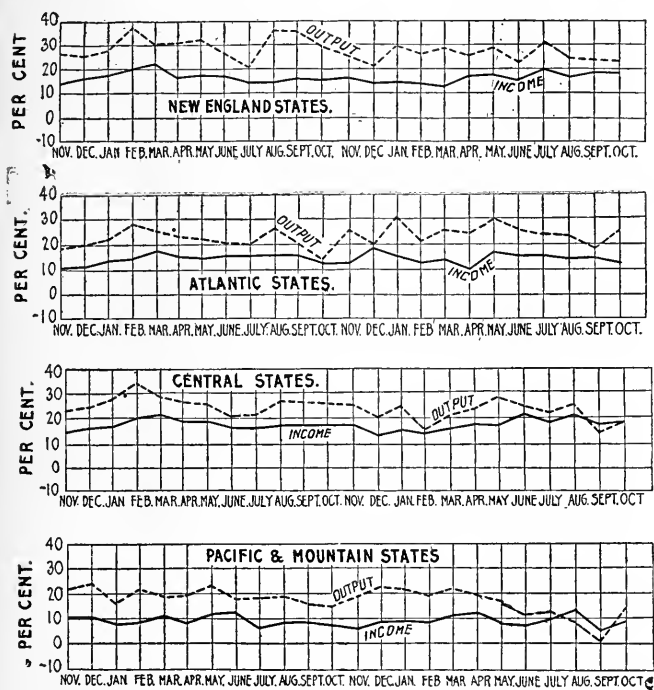
	Percentage of Industry Represented	INCOME FROM THE SALE OF ENERGY			Kw.-Hr. OUTPUT		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
Oct.	61	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.	61	21,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec.	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
1917		1917	1916		1917	1916	
Jan.	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March.	61	23,919,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April.	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May.	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June.	63	23,279,000	20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July.	63	22,768,000	19,680,000	15.8	1,597,482,000	1,159,410,000	21.5
August.	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
October.	51	20,026,000	17,509,000	14.4	1,037,206,000	866,871,000	19.7

Even though the industry has grown to more than two and one-half times what it was five years ago, the percentage of increase is still high. The maintenance of a constantly higher percentage increase indicates an industry which is growing much more rapidly in gross business.

TABLE II—CENTRAL STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
October.	65	\$2,681,000	\$2,331,000	15.2	65	\$ 8,887,000	\$7,930,000	12.1	56	\$6,968,000	\$5,895,000	18.2	87	\$4,213,000	\$3,889,000	8.3
November.	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
December.	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
1917		1917	1916			1917	1916			1917	1916			1917	1916	
January.	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5
February.	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
March.	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
April.	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	17.0	86	4,282,000	3,821,000	12.1
May.	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
June.	64	2,641,000	2,290,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
July.	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
August.	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,778,000	20.9	87	4,819,000	4,270,000	12.9
September.	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
October.	47	2,304,000	1,936,000	18.8	44	7,565,000	6,729,000	12.5	47	7,008,000	5,948,000	17.9	75	3,098,000	2,852,000	8.7
October.	65	107,753,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
November.	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,817,000	293,518,000	18.2
December.	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
1917		1917	1916			1917	1916			1917	1916			1917	1916	
January.	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
February.	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
March.	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
April.	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
May.	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
June.	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
July.	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	55	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
August.	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
September.	64	114,339,000	92,319,000	24.0	61	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
October.	47	86,104,000	69,957,000	23.2	44	328,937,000	253,070,000	25.2	47	394,560,000	334,550,000	18.0	75	225,640,000	197,808,000	14.0

The necessity for a sure supply of power and a quick supply, coupled with the coal situation, has been responsible perhaps more than anything else for the growth of the central station industry during 1917. Large, however, as the industry has grown, it is by no means so large as it would have been had there been available additional capital and additional equipment sufficient to supply the demand. Many companies have found it necessary to refuse to take on additional loads because of the now overloaded conditions of the plant. How much greater the output would have been and the consequent earnings, had money and equipment been



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

in ready supply, there is no way to tell, but from the reports that come in to the ELECTRICAL WORLD it is evident that the figures here presented by no means

down power demand and, therefore, central station output. This is clearly evidenced by the returns for August and September from the Far Western States.

The accompanying diagram shows graphically the

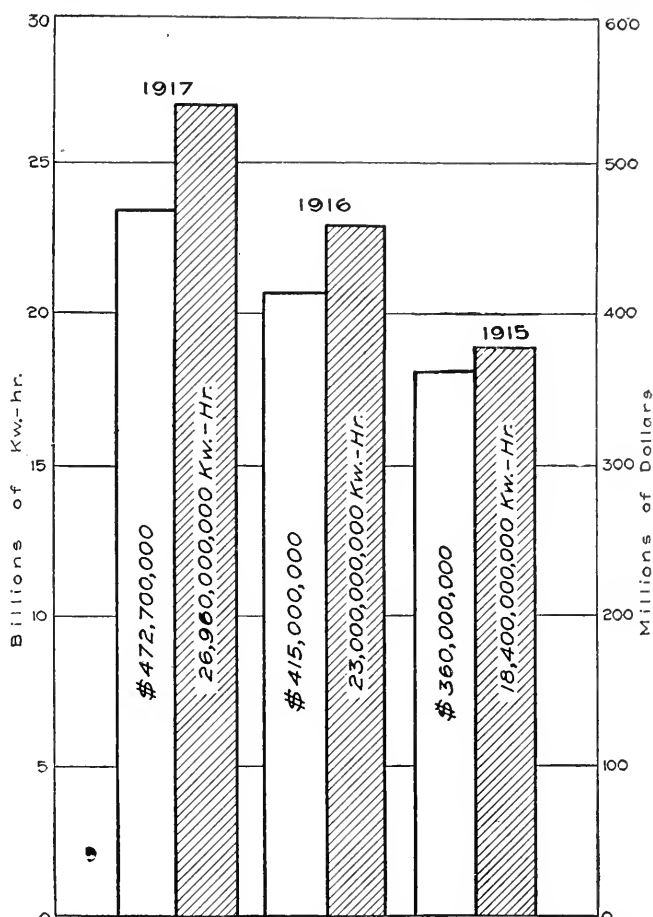


FIG. 7—CENTRAL STATION EARNINGS AND OUTPUT DURING 1915, 1916 AND 1917

growth of the industry during the last three years, while chart No. 1 shows comparatively the monthly income and output of the industry during 1917 as con-

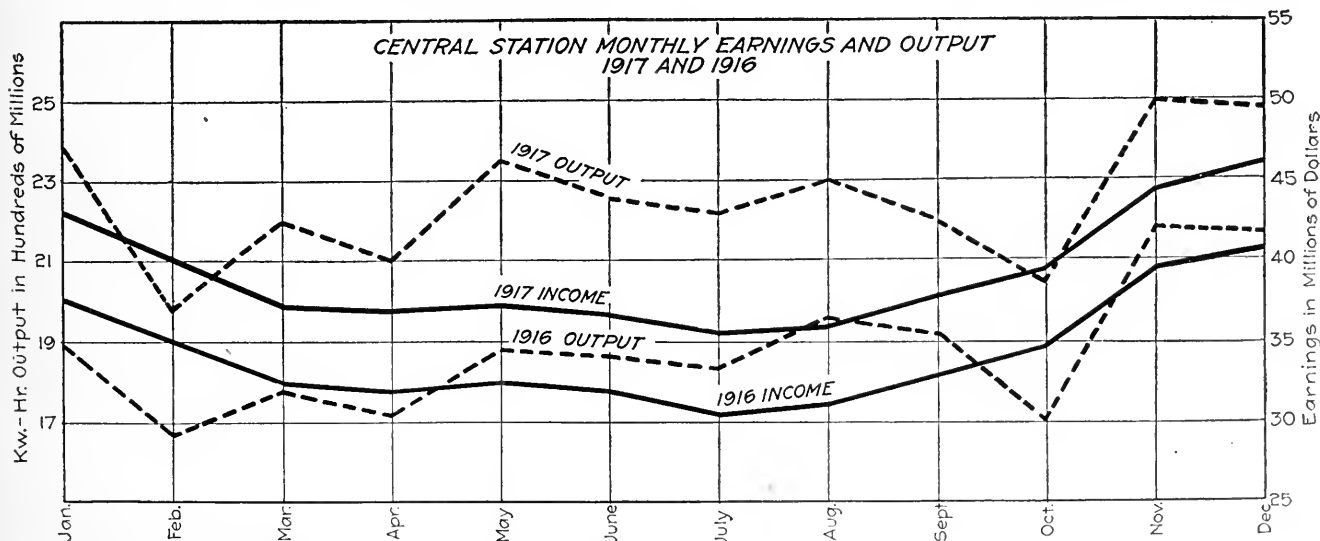


FIG. 6—COMPARISON OF RESULTS OF OPERATION MONTH BY MONTH IN 1917 WITH 1916

represent the entire demand which was placed on the electric light and power industry.

Local conditions of strikes and inability to obtain sufficient labor supply have acted in many instances to cut

trasted with 1916. The remaining curves show graphically by sections the percentages of increase in the industry over the corresponding month of the previous year as contained in Tables I and II.

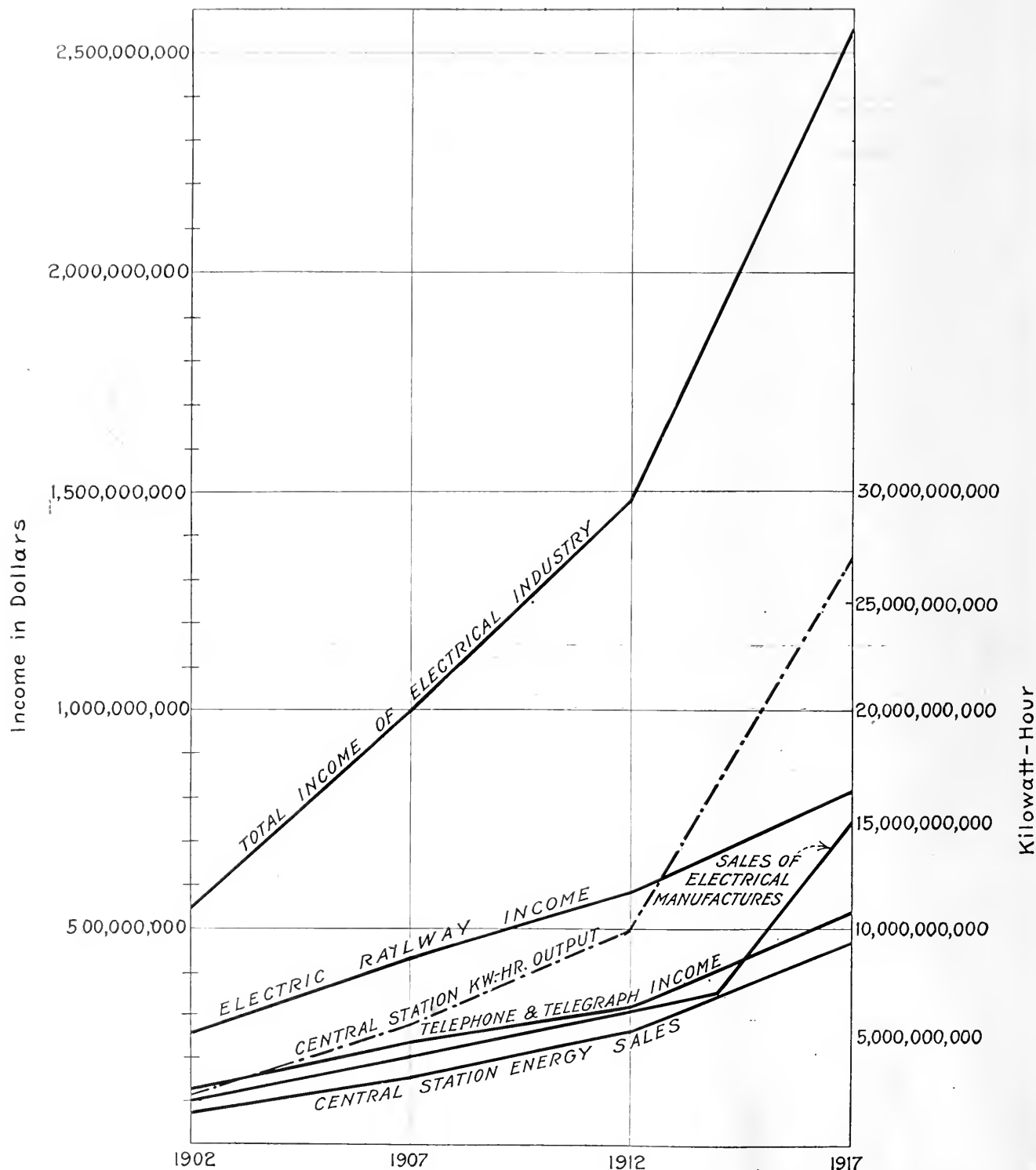
Growth of Electrical Revenue in Fifteen Years

Graphical Representation of Earnings for Central Station, Electric Railway, Manufacturing and Telephone and Telegraph Branches of the Industry Since 1902

SINCE 1902 the earnings of the electrical industry have grown, as shown in the graph on this page, from a sum of about \$550,000,000 to around \$2,550,000,000. These figures include returns from the following branches of the industry: central station, electric railway, manufacturing, and telephone and

telegraph. With the exception of those for 1917, which are estimates by the ELECTRICAL WORLD, the values were taken from census figures.

The graph also includes central-station kilowatt-hour output, which in 1917 was in the neighborhood of 27,000,000,000 kw.-hr.



Organizing Operating Staff to Meet Emergencies

Means for Assuring Communication with Different Parts of System—How Trouble Reports Are Handled—Operating Data Plotted in Order to Aid Analysis of Conditions

BY E. P. PECK

Superintendent of Operation Georgia Railway & Power Company

IN THE course of a few years the system of the Georgia Railway & Power Company has grown from a small utility furnishing energy to Atlanta and a section of the neighboring territory to a great corporation consisting of six interconnecting generating plants, purchasing power from two companies, exchanging power with another and delivering power to a fourth company. Every municipality within its territory is being supplied with energy, as is also practically every industrial plant. Important plants which have recently contracted for energy that are essential during the present crisis and require continuous service are in the cotton-mill, steel, mining, fertilizer and cotton-oil industries. In round numbers, the company has increased its output in 1917 approximately 86,000,000 kw.-hr., as against 23,000,000 kw.-hr. in 1916, a record year. The estimated load for 1918 is 258,300,000 kw.-hr.

KEEPING PACE WITH GROWTH

Keeping pace with this enormous growth of the system and insuring continuity of service at all times have been the big problems confronting the operating department. These have been solved, however, by organizing the department as explained below.

The operating department of the Georgia Railway & Power Company has three main divisions—operating proper, station and substation maintenance and repairs, and operating records. The hydroelectric stations and substations, transmission lines, overhead and underground distribution are maintained by other departments, although the operation of all is directed from the load dispatcher's office.

The system operation is under the control of a chief load dispatcher, who may be considered on duty all the time and whose presence is required in the dispatcher's office during the morning and afternoon peaks. He is assisted by three load dispatchers, who work in eight-hour shifts. Two clerks work in eight-hour shifts from 6 a.m. to 10 p.m., handling the customers' trouble reports, arc-lamp outages, etc.

Regular operating instructions, like cutting in and cutting out machines, lines, etc., are given by the dispatcher on duty. During serious trouble operations are handled by the chief load dispatcher directly, or indirectly through the dispatcher on duty.

In the dispatcher's office is a large map covering one wall of the room which shows all lines, stations, company substations and large customers' transformer stations. Detail prints show the layout of each station and substation, all switching points on the lines, telephone booths, etc. There is also a plug board for keeping track of machines and lines in service.

The dispatchers keep an all-station report giving the hourly loads on each line and station in the system. The "system log," which is made out in this office, shows the time of all switching and interruptions and

is a record of all clearance orders, and in fact everything of importance occurring on the system.

In addition to five telephones connecting the office with the Bell Telephone and Atlanta Telephone companies' exchanges, there is a private-line telephone switchboard on the dispatcher's desk connecting with all of the company's stations, substations, shops, trouble stations and offices of the electric department officials. The private lines are used for general system operation. One interesting feature of the telephone system is that the high-tension telephone lines, which parallel the 110,000-volt power lines, are so fully protected that the lines have been operated in series with a 3-mile (4.8-km.) underground telephone cable to the dispatcher's telephone board for several years without having a single case of cable or switchboard trouble due to high voltage from the overhead lines.

Instructions covering the procedure to follow after interruption to any parts of the service are provided at each station. The instructions cover the method of clearing lines or apparatus in trouble and restoring service as far as possible. The operators are told what to do in case telephone connection with the dispatcher's office is interrupted. The dispatcher knows that, if he cannot communicate with a station to give instructions regarding the restoration of service, certain operations will be made in a given order, so he can handle the rest of the system accordingly.

A series of instruction booklets are being prepared, one for each station, which tell each operator in detail how to start and operate every individual machine in his station. As some of the stations have reciprocating engines, turbines, railway rotaries, 2300-volt customers' circuits, arc circuits and supply lines from other stations, these instructions will be somewhat bulky. However, it has been found that such written instructions are necessary, at this time particularly, since a large number of changes are being made continually in the operating force.

HOW TROUBLE REPORTS ARE HANDLED

All reports of trouble in any part of the company's system, including distribution, are received at the dispatcher's office. Trouble reports from the customers are turned over directly to a group of troublemen who report back to the load dispatcher. When trouble occurs on a transmission line the load dispatcher gives the transmission-line troublemen instructions regarding sectionalizing the lines for tests, and in case of ordinary troubles he handles all of the repairs. If the trouble is extensive, however, it is referred to the superintendent of transmission, who takes charge of the repair work. All transmission-line troubles are reported to the transmission department, even though the dispatcher is handling the details. All station and substation trouble reports are passed through to the test and repair department.

The test and repair department has a well-equipped repair shop and testing laboratory, with a large force of repairmen and testers. This department locates and repairs all troubles in the local station and substation apparatus and often assists other departments in locating and repairing troubles of an unusual nature in their divisions of the work. The department has had to enlarge its facilities very greatly since the beginning of the war.

Pieces of equipment are being repaired and worked over in the shops at present which in former times were considered absolutely beyond repair. An illustration of this is a transformer which had a hole burned through a section of the primary winding, leaving a number of turns open and the ends separated by several inches. These turns were repaired by welding in new sections of copper, wrapping with silk tape and adding new coil insulation. After making the repairs, the transformer was given a severe test and put back in service. The total time of repairs was about three days, whereas several months would have been required to obtain a new coil from the factory. Repairs of such a nature would not have been considered four years ago.

This test and repair department also makes weekly inspections of all of the company's rotary converters, paying particular attention to the alternating-current and direct-current brushes and circuit breakers. The relays on all lines and machines are subjected to an operating test weekly and to a thorough check test by a tester at regular intervals.

INSPECTING THE STATIONS

At least once every week a station inspector visits all of the stations in the Atlanta district, inspecting generators, rotaries, transformers, switches, circuit breakers, auxiliary machines, condition of building and structure, general housekeeping, etc. Oil samples are taken from each high-voltage station transformer and break-down tests on the oil conducted every two months. Reports of every inspection are sent to the superintendent of operation, who issues orders to the proper department covering repairs to any defects found by the station inspector.

Records of the loads of all stations are also sent to the operating superintendent's office. A report of the daily output of all generating stations is made, which is sent to the company officials who are interested. In addition, a number of monthly reports are made showing the grouping of load in various divisions. From the kilowatt peak records and the kilowatt-hour records tabulations and curves, showing hourly, daily and monthly load of each different class of service, are made. The monthly curve sheet also shows the water elevation in the storage reservoir.

All who receive the daily load record sheet also receive a daily interruption report. On this sheet are given interruptions to every class of service, the time the service is interrupted and the cause of the interruption. At the end of each month the interruptions are classified according to the district and class of service, and a summary is made with the same classification.

From the daily interruption reports the operating department works up interruption analysis reports which have been found very valuable. One sheet is

made out for each system, supply and plant and each hydroelectric distribution line. This makes a total of twenty-six sheets. The analysis shows the number of troubles occurring each month, grouped according to the causes. The total number of interruptions each month and the percentage each month are shown, also the total number due to each cause and the percentage of troubles due to each cause. There has been so much demand for this report that all totals have to be extended and copies sent out each month. A total of more than thirty monthly reports is sent out from the operating office.

OPERATING DATA PLOTTED TO AID ANALYSIS

Very close account is kept of all costs in the operating department. The data are plotted on curves which show the average monthly cost of the previous year and labor and material cost for each month of the current year. There are twenty-nine of these curve sheets, showing salaries and expenses of the operating department proper, salaries and expenses of the testing and repair department, operating expenses of each station and substation, and repair and maintenance expenses of

Form 40-2

GEORGIA RAILWAY & POWER COMPANY
INTERRUPTION ANALYSIS

SERVICE AFFECTED

CAUSED BY	January	February	March	April	May	June	July	August	September	October	November	December	Total	Per Cent.
Lightning														
Insulator Failure														
Line Wire Failure														
Atlanta Distribution Lines														
Station Equipment														
Local Substation Equipment														
Hydro Substation Equipment														
Dist. Substation Equipment														
Tall Interruption														
M. F. Interruption														
Switching Error														
Total														
Per Cent.														
Hrs.														
Duration														
Min.														

FORM FOR RECORDING ANALYSES OF INTERRUPTIONS ON GEORGIA COMPANY'S SYSTEM

each station and substation. If any unusual expenses occur during the month, a note is made on the curve showing the reason for the change. This system of keeping expense records has aided considerably in reducing operating expenses at a number of different points.

Practically every variable of which a record is kept is transferred to a curve sheet. This, of course, in the aggregate, requires considerable work, but the clearness with which variations are shown and the ease with which these variations may be compared more than overbalance the cost of the work.

Summarizing, the operating department directs the loading and operation of all stations, substations and lines. It maintains the stations and substations in the central part of the system known as the Atlanta district. It keeps the operating records and works up reports on loads, interruptions and costs.

Spirit of War in the Central West

Electric Utilities Are Patriotically Mobilizing Their Large Resources to Meet the Heavy Demands for Service



SINCE the United States declared war against Germany the central stations of the country, especially in the Central West, have been called upon to introduce readjustment measures of considerable importance. They have supplied men, material and money to help win the war. They have been asked to give more service at a time when the essentials of service, being also the essentials of war, are very costly and scarce. At the beginning of the new year they can look back on the past nine months as a period of constructive achievement, of uncomplaining sacrifice, in which a firm foundation was laid for greater service to the national cause. To give a perspective on this creative work it is fitting to enumerate war-conservation measures which these central stations have taken. Such an enumeration will also serve as a guide in shaping future course and will assist in overcoming handicaps which are to be expected in the coming year.

The problems of both labor shortage and lack of capital for extensions are pressing. Both are difficulties so immediate that plans for conservation receive constant attention. The following is a partial enumeration of methods by which capital is being conserved:

New work deferred.

Many free extensions eliminated and the cost of others transferred to the customer.

Unnecessary repairs deferred.

Existing apparatus rearranged to take more load.

Stocks of material on hand reduced to minimum.

Postponement of municipal improvements encouraged.

In new business selection, where possible, of that with off-peak qualities.

Length of time on deferred payment sales plans shortened.

Customers in arrears eliminated.

So far as capital is concerned, the general policy can be summed up in the query, "What can we get along without?" Estimates indicate that in spite of the

war something more than 50 per cent of normal capital requirements will be expended in 1918 by some very large companies, because these expenditures are absolutely necessary. The increase in business is so large that companies must provide the physical capacity for it by extensions which over a period of years will approximate the average increase in demand. Contracts made before the war enter into this situation. Work will be deferred in some instances if apparatus contracts can be canceled or set further ahead.

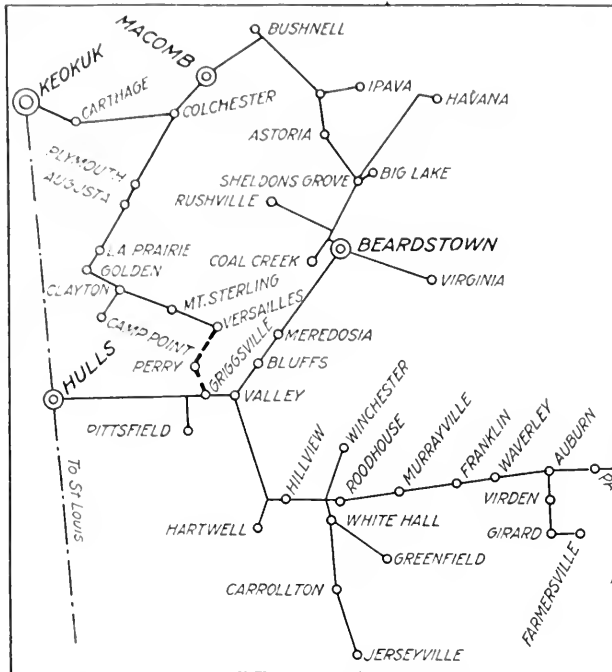
Free extensions have been eliminated in co-operation with the public service commissions, which in general have come to the aid of companies. The postponement of repairs is being handled with judgment, as it is not the intention to permit property to deteriorate through want of necessary replacements. Rearrangement of existing equipment to get greater use factor is being practiced with station apparatus, transformers, etc. The practice of reducing stocks of material is watched carefully, because of uncertain deliveries and transportation. Much effort has been directed to secure co-operation of municipalities in postponing municipal improvements calling for extensive changes in equipment of the companies.

Capital has been conserved further by constant encouragement of the greatest use of power service on an off-peak basis, and manufacturers have co-operated by opening and closing shops at different hours. This not only broadens and reduces power peaks but in some instances is a help to electric railway conditions. Companies have set an example in this practice. In granting credit on larger appliance sales or house wiring, eight months is now considered ample time, whereas twelve months was given formerly. In some cases municipalities have not paid for street lighting for several years, and the illumination has been continued out of civic spirit. It is now being found necessary to stop this.

Some companies have set a "dead line" on all accounts at forty-five days. All of these steps are being taken at a time when new business is clamoring for service.

In the labor problem Middle Western companies have been equally resourceful. Many ways have been developed to lessen difficulties arising from the shortage, as for example:

Organization and duties of employees rearranged.
Women employed.



COLCHESTER LINE WILL RELEASE 18,000 TONS OF COAL A YEAR; THIS IS MORE THAN FOUR TIMES THE SAVING MADE BY LIGHTLESS NIGHTS IN CHICAGO

Labor-saving devices and methods installed.
Schools established to train employees.
Young men in schools employed on part-time basis.
Welfare activities curtailed.
Statistical data formerly furnished to all departments have been eliminated.
Branch offices discontinued.
Package charge established for delivery of lamps or appliances.

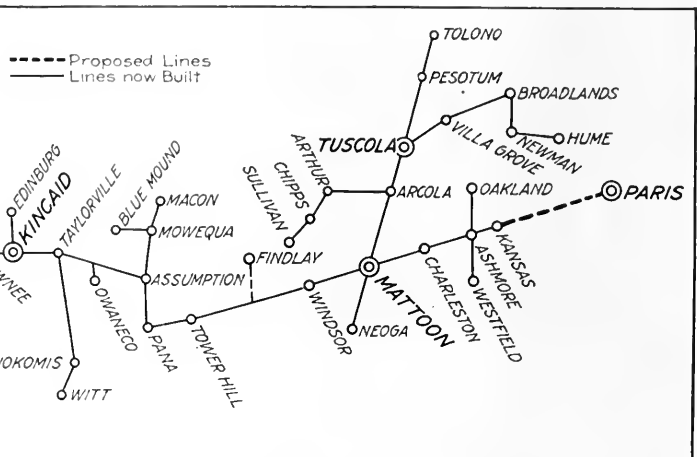


SWEARING IN RECRUITS IN MERCHANTS' HEAT & LIGHT COMPANY (INDIANAPOLIS) ELECTRIC SHOP

Departments formerly separated have been consolidated under one head. All department heads of one large company were drafted. These positions, that for-

merly carried \$250 a month, were filled by eight-dollar clerks, whose salaries were raised to \$125 or \$150 at the start. Women were employed in place of the clerks. The attitude of these clerks following the change was not commendable, but the women have proved very efficient. In fact, the experience of the companies is that women in all clerical work, some commercial work, some shop work, and in street-car washing, have been remarkably satisfactory. Most central-station offices, it is believed, have places for more labor-saving devices than they now possess. There are also many opportunities for eliminating lost motion.

Certain types of skilled labor present a large problem. With substation operators, for instance, the employment department of any large central-station company might not in six months receive an application from



a man. Yet one large company may lose in the next ten months about 140 trained substation employees. These operators have acquired knowledge that can be gained only through four months of intensive training after an apprentice course which also takes time. This company will train additional substation operators so that it will have men to put in the places of its trained forces as they leave. It is selecting men beyond the draft age. Certain companies in cities which possess vocational schools are employing students one-half day each day in positions for which the school is aiming to fit them. This plan is inexpensive and is said to be successful.

In the conservation of fuel most commendable patriotic work is being done. The lines of this effort may be listed as follows:

- Tying in with water power.
- Tying in with large station plants.
- Economies in existing plants.
- Purchase of mines and cars.
- Changing sources of fuel supply.
- Placing steam-heating customers on meter basis.
- Overhauling office and plant-heating systems.
- Enforcing electric sign orders.
- "Skip-stop" electric railway service.
- Lowering quality of steam-heating service to give 68 deg. Fahr.

A famous low-head hydroelectric plant, hitherto loaded only lightly, has been of great value to surrounding steam plants as a means of coal saving. Soon by a single connection to this plant a central Illinois company will take 3000 kw. off its steam stations. On

the basis of 4 lb. of coal per kilowatt-hour and a 35 per cent load factor, this means an annual saving of 36,000,000 lb., or 18,000 tons, of coal.

In the Lake Superior iron range district transmission lines from a hydroelectric plant are nearing completion to supersede a steam plant which furnished energy for the bulk of the power operations there. In another instance a large company contracted to take all surplus energy from two near-by hydroelectric plants so that not one kilowatt of its hydroelectric rating need ever be idle and no water need go to waste there.

In an Ohio city a lighting company has taken an additional 15,000-kw. demand from the electric railway, permitting the latter to dismantle one plant. Owing to the greater economy of the larger station this change saves 50,000 tons of coal a year. The interconnection of small plants with larger plants all over the central territory is effecting a saving in fuel the value of which in the national crisis cannot be overestimated.

Many companies are pushing line extensions to outlying communities having plants operating at anywhere from 35 lb. to 12 lb. of coal per kilowatt-hour. An interconnected company's average consumption is between 5 lb. and 6 lb. of coal per kilowatt-hour, so that a real reduction is effected. Moreover, coal goes to these small companies in carload lots, and owing to methods of handling it in small towns usually the car is delayed many hours longer than if it had been delivered to a large central electric station. In addition to reducing coal consumption and permitting purchases in larger quantities, and thus effecting another economy, the large central station therefore makes a saving also in the number of cars required to transport coal as well as in the labor involved in car movement.

Fuel economies in existing plants are being made by installation of furnaces, stokers, superheaters and better plant instruments. Results engineering is accomplishing real savings, not only in larger plants but in small towns. One operator with a 2000-kw. station has his plant in such excellent condition that it produces energy on 3.52 lb. of coal per kilowatt-hour. Another

company with about 30,000 kw. of rating has reduced coal consumption per unit of energy generated 35 per cent since 1914. While the purchase of mines and cars does not directly conserve fuel, it conserves transportation facilities, which are of equal value and importance. Likewise, if an Illinois company, for instance, changes its source of supply from West Virginia to Illinois or Indiana it assists in the same great movement.

The detailed and painstaking manner in which stations are economizing on fuel is illustrated by the fact that even their own small office and plant-heating systems receive attention.

In the movement to conserve food, electric light and power companies have been of service to the nation. They have:

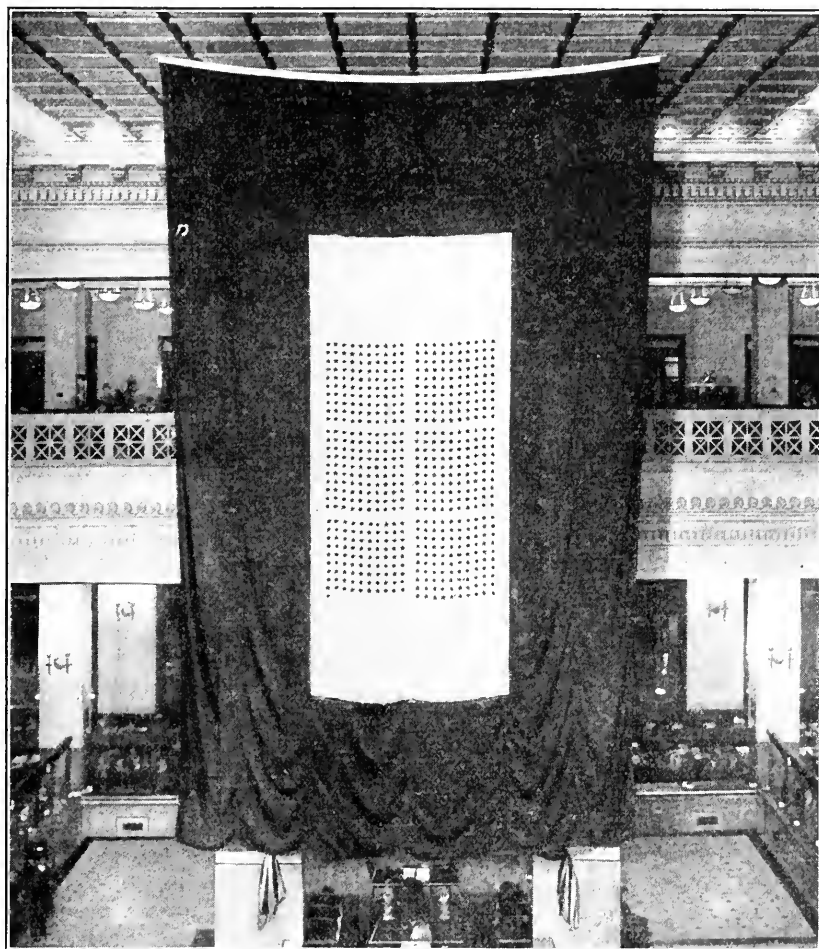
Used their potential positions as public utilities to urge food saving upon the public.

Started war gardens and encouraged others to do so.

Withheld admittedly fair rate advances for electric cooking and heating.

Taught home economics classes, especially in canning and dehydrating.

Electric signs, stickers on bills, newspaper advertisements, electric railway car cards, billboards, window displays and "Four-Minute Men's" speeches have been used by central stations to tell people how to save food. Serious and successful efforts were



SERVICE FLAG OF THE COMMONWEALTH EDISON COMPANY, CHICAGO

made by a few central stations to put the war-garden movement on a more sane basis in 1917. The spring of 1918 will see much more effort if the plans of the electric companies materialize.

That electric cooking rates have not been raised is a striking fact that even the manufacturers of ranges do not seem to appreciate in its full significance. It is explainable largely on the ground that as electric companies realize the inefficiency of the ordinary kitchen stove as a fuel burner and have helped to educate the housewife away from it and toward the use of an economical electric range, they do not desire to lose now the result of all their work. The continuation of classes in home economics is along the same line.

Liberality in aiding the government and war charity financing was characteristic with lighting companies. From the Central West there were several million-dollar

contributions to both First and Second Liberty Loans. A single concern secured more than 6000 members for the Red Cross. One company gave an electric show and turned over a fine profit to the Red Cross. Other war charities have been supported financially and had the assistance of sales helpers. A movement that succeeded in sending 18,000 Christmas packages to French children was sponsored by an Indiana company. At present the companies are helping to sell thrift stamps.

Men with central-station experience have been particularly needed in the war because of their engineering training. The percentage of forces of the Middle Western companies in service ranges as high as 20 per cent. One company raised a complete unit of engineers and turned it over intact to the government. It has scarcely yet been able to replace the men from its own ranks serving in this body. Besides giving its full share of enlisted men and supplying several majors and lesser officers, the industry is filled with men in non-military and unofficial government work. They are found in every position, from that of guiding executive of the State Council of Defense to clerk on the exemption board. No job is too big, no labor too mean.

SERVICE TO ESSENTIAL INDUSTRIES

But the large task has been to maintain electric service to essential industries. It is a revelation to see how thoroughly and satisfactorily this has been done. It is also interesting that this phase of the work is not centered in cities. Companies of which little is known, and which must remain unnamed, have held government priority orders on all equipment needed to get certain work completed and energy on new lines. In obscure communities central-station service is proving invaluable in underwear and clothing establishments working on khaki-colored cloth. In the larger cities the same condition prevails to an even greater extent.

At one city in Indiana 80 per cent of the labor employed is absolutely dependent on central-station power. Several companies have reported 35 per cent increase in industrial power load on account of munition business. Another company in an industrial city sold in October 42,213,000 units of service. Of these, 27,353,000 were for industrial power and 6,643,000 for transportation. A very large part of the total central-station output is going to essential industries. Among these are metal mills, mines, powder mills, shipyards, cereal works, cement mills, tire factories, overalls and apron factories, glove factories, producers of automobiles, tractors and tanks, and a thousand others which are perhaps just as essential.

THE LESSON OF THRIFT

Leaders in the industry see the silver lining without overlooking the cloud. They see definite good accruing to central-station companies from the present conservation program. Past growth has been so rapid that capital expenditures have been on a stupendous scale. The present program of saving is certain to bring to the surface investment economies as well as operating economies. It may be expected, in the opinion of Central Western officials, that this program of saving will affect the whole American nation so that when the war is over not only the utility companies but also a large percentage of individuals will have learned a lesson in thrift which no other single force could teach.

INCREASING OUTPUT WITHOUT ENLARGING THE EQUIPMENT

Generator Rating Can Be Increased 10 to 20 per Cent by Precooling Ventilating Air—Expense Entailed Relatively Small

BY JOSEPH T. FOSTER

Public Service Electric Company of New Jersey

THE question of whether to install air washers or humidifiers for conditioning and cooling the air entering generators is particularly pertinent at this time, since by cooling this air the generator capacity may be increased from 10 to 20 per cent. Furthermore, by cleaning the air possible shut-downs for generator cleaning and, what is more serious, possible burn-outs due to heavily loaded, dirty machines, may be avoided. Obviously, then, this is the quickest and cheapest method of increasing power plant capacity, and as electric companies are at this time confronted with long deliveries, delayed shipments due to present transportation conditions and labor shortages, this subject should receive special attention now.

The purpose of central station companies in includ-

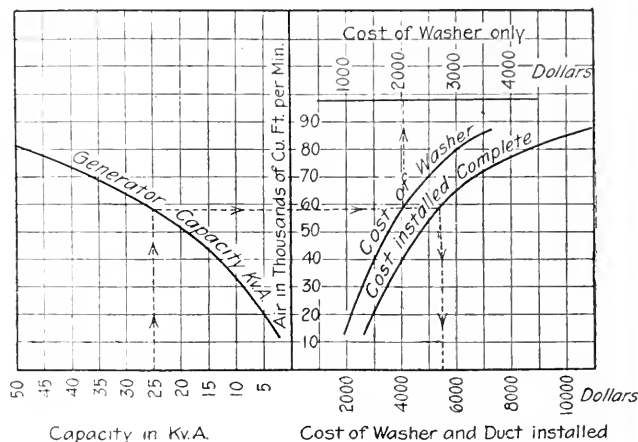


FIG. 1—RELATION BETWEEN KVA. RATING, AMOUNT OF COOLING AIR REQUIRED PER MINUTE, COST OF AIR WASHER AND COST OF WASHER INSTALLED COMPLETE

ing the air washer as standard equipment on turbo-generator installations is twofold:

1. For supplying clean air, free from dust which would coat the windings of the generator and form an insulating covering.
2. For precooling the air by evaporation of water when the air passes through the film of water atomized by the spray nozzles.

Before air-washing equipment was used it was found that the dust and dirt incidental to the unloading of coal and the disposal of ashes fouled the generator by coating the air passages. It was therefore necessary to shut down the generator at least once a year for a period of five or six days for cleaning purposes. In addition to the expense of cleaning, there was the inconvenience and loss of revenue due to shutting down the unit.

Some idea of the cleansing effected by a modern-type air washer can be gained from tests which showed that it was possible to blow several pounds of soot per minute into the intake and have the air at the generator inlet perfectly free from dust.

There is a more or less widespread belief that the

humidifying of the air increases its cooling capacity on the ground that wet air, on account of its higher specific heat, has greater heat-absorbing properties. The effect of this change in specific heat is negligible as far as heat absorption is concerned, because the weight of water vapor present even in saturated air is very small as compared with the weight of the air itself. The difference in the amount of heat absorbed by saturated air as compared with dry air under a given set of conditions is not more than 1 or 2 per cent.

The precooling action of the air washer is, however, of importance. Assume a 12-500-kva. unit which requires 30,000 cu. ft. (850 cu. m.) of cooling air per minute and in which the losses amount to approximately 300 kw. at full load. The heat absorbed per hour, assuming a final temperature of 100 deg. Fahr. (37.8 deg. C.), neglecting the moisture in the air, will be as follows:

Problem.—Given a 25,000-kva. generator, to find the amount of cooling air required, the cost of the air washer and the cost of the washer installed in place.

Solution.—From the intersection of the vertical line through 25,000 kva. and the curve, run horizontally to the vertical scale. The required air is 58,000 cu. ft. (1640 cu. m.) per minute. Running horizontally to the intersection with the first curve, read on the upper scale the cost of the air washer as \$2,050. Running horizontally to the second curve, read on the lower scale \$5,500 as the cost of the complete installation.

An illustration of an air-washer installation used in connection with a turbine plant is shown in Fig. 2. The air, which is drawn through louvers and screens at the left, passes through the washer and then through the generator, from which it is discharged direct to the forced-draft blowers in the boiler-house basement.

This method of operation is employed during summer

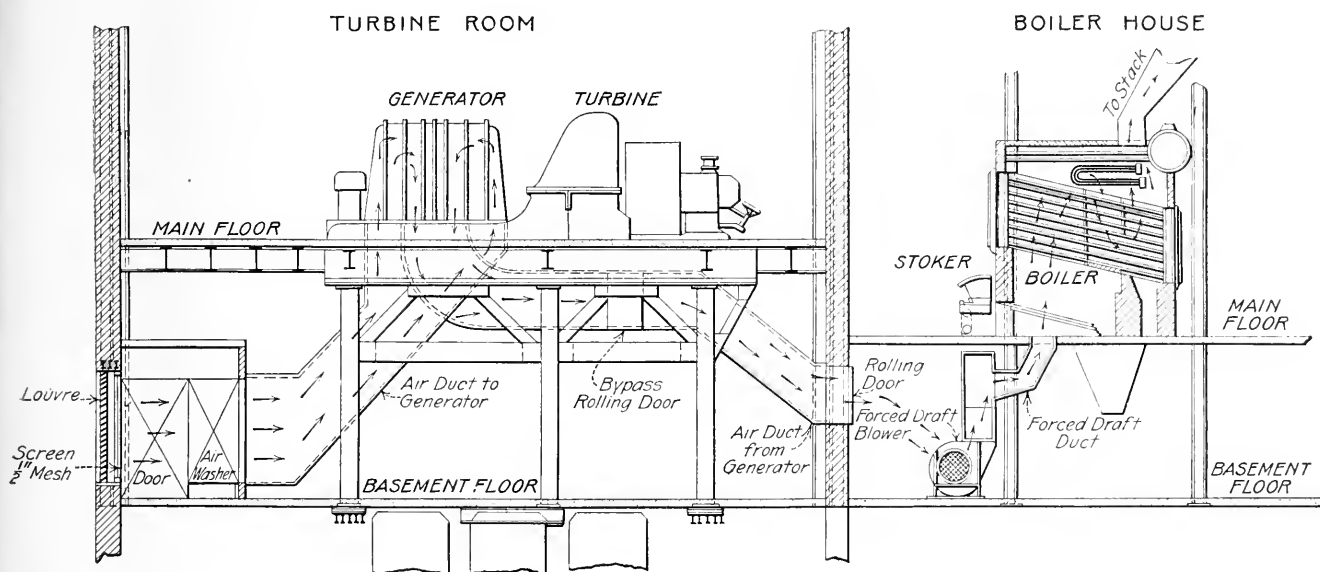


FIG. 2—TYPICAL ARRANGEMENT OF AIR-PRECOOLING APPARATUS FOR TURBO-GENERATOR

I. Air not pre-cooled and entering the generator at 68 deg. Fahr., $0.24 \times 0.07524 \times 1,800,000(100 - 68) = 1,040,000$ B.t.u.'s per hour.

II. Air originally at 68 deg. Fahr., but cooled in the washer to 53 deg. Fahr., $0.24 \times 0.07788 \times 1,800,000(100 - 53) = 1,580,000$ B.t.u.'s per hour.

In the first case, the losses absorbed amount to 1,040,000 B.t.u.'s per hour, or 305 kw.; in the second to 1,580,000 B.t.u.'s per hour, or 463 kw. It may be assumed with fair accuracy that the losses are proportional to the squares of the currents; therefore, $I_2^2/I_1^2 = 463/305$, or $I_2 = 1.23I_1$. The terminal voltage is, of course, constant, hence the kilowatt output when the air is pre-cooled will be theoretically 23 per cent greater than with air at the higher temperature. It is more probable, however, that in practice the gain under the conditions stated would amount to 15 per cent, although gains of 20 to 25 per cent have been realized even where the natural conditions were particularly adverse.

The gain in generating capacity obtained by pre-cooling the ventilating air is large, but is obtained by the expenditure of a comparatively small amount of money, as shown in Fig. 1.

The use of the chart is illustrated by the following:

weather when it is desired to obtain the coolest air possible for the generator. The discharge to the forced-draft blowers of this quantity of heated air improves the boiler efficiency somewhat and maintains a lower turbine-room temperature.

Under winter conditions the louver opening in the outside wall is closed by a rolling door and the air is drawn into the washer from the turbine room through the side door and discharged from the generator by-pass through the sliding door provided for that purpose. Under these conditions the door into the boiler-room basement is closed.

This method of recirculating the air from the turbine room keeps the room at a comfortable temperature. It also does away with the inconvenience of having a partial vacuum in the turbine room due to the removal of large quantities of air from an inclosed space.

The washer to be purchased by the engineer should be of the size specified or recommended by the generator manufacturer, of the heaviest and most durable material, and able to cool the air to at least 85 per cent of the difference between the wet and dry bulbs. At the same time the air resistance through the washer should not exceed 0.375 in. (9.3 mm.) of water and the power consumption should be kept down to a minimum.

Bonus System for the Saving of Coal

Reasons Why Most Systems Are Unsatisfactory—Assigning Definite Tasks to Operators Rather than Requiring Results Has Been Found to Be the Key to Improved Economy in Operation

BY WALTER N. POLAKOV

Consulting Engineer, New York City

THAT the amount of coal available in this country is 17 per cent to 23 per cent short of the requirements is serious enough, but the fact that about one-half of the coal consumed for steam production is used wastefully is appalling. If the needless waste could be eliminated, the national shortage of fuel might be reduced to probably 5 per cent, which could easily be taken care of by a more judicious use of the other half of the fuel produced.

To improve the operating economy of a power plant is not a task that can be accomplished over night, however. Neither can gratifying results be obtained without first clearly defining the aims and plans for the improvement campaign or without the executives or operating officials securing the co-operation of the plant employees. The first thing to do is to place the equipment in first-class operating condition. Second, the maintenance work must be organized so that inspections and overhauling of apparatus will be conducted on a schedule frequent enough to forestall damage and prevent deterioration of efficiency.

The next step will be to investigate thoroughly each unit of equipment and determine by tests its maximum inherent efficiency. Inasmuch as the results are affected by the conditions under which they are obtained, the latter should be carefully noted. When this is done the study and test researches should be conducted on a larger scale in order to establish the relations of conditions governing the operation of individual units on the all-around total plant efficiency. Inasmuch as the final aim is not the highest thermodynamic efficiency but the best operating economy, the preceding findings should finally be modified in order to determine and standardize such conditions, supplies, methods, etc., as would necessarily produce the desired result. In determining the final aims the following aspects should not be lost sight of: Best service to the community, welfare of employees, safety of all concerned, and cost of operation, maintenance, idleness and standby losses.

When this part of the work is done, and not before, can the actual task setting for firemen, engineers, switchboard operators, etc., be considered, as it is evident that with poor upkeep of equipment, unstandardized supplies and methods the operating men cannot maintain the prescribed conditions.

SHIFTING RESPONSIBILITY TO EMPLOYEE

Many easygoing owners and managers of plants, realizing that the actual performance is falling short of that possible, often shift the responsibility from their shoulders to those of the employee by offering a premium for performance which is sufficiently better than the present, leaving it to the employee to secure the "better results." In such cases the management side-steps its duty in not saying *how* the better results can be accomplished and *what* they shall be. Such methods

are sometimes advocated as giving the employee freedom to develop his ingenuity. This sophistry is easily exploded when it is considered that the operating man seldom has time for investigation and researches. His hands are full keeping the wheels turning. Furthermore, measuring and indicating instruments and devices are often lacking. The peculiar requirements of a research man—highly developed power of abstraction and observation, ability to concentrate on one problem to the exclusion of all others—are faculties which are seldom, if ever, found in men engaged in routine operating work.

MANY BONUS PLANS UNSATISFACTORY

It is generally conceded that higher efficiency warrants higher compensation and that stimulation for efficient work is necessary for its perpetuation. However, the lack of careful study of the subject is responsible for many misconceptions. Most of the methods of extra compensation are unsuitable, yet no better plan can be adopted unless the principles and operating conditions are properly organized. The faulty methods may be classified as follows: (a) Profit-sharing plans; (b) premium schemes, and (c) rewarding individual efforts.

Profit Sharing.—Profit sharing is based on the assumption that the employees by their work contribute to the success of the enterprise in securing profits. This would be entirely correct if the employees had the opportunity to control all functions of management, fix the salaries of directors and direct purchases and sales, besides having a veto in financial transactions. As long as they are expected, however, to work under the conditions provided by the management, with equipment and material furnished by the management, which in turn disposes of the product, the profit or loss is only slightly influenced by the excellence of the work done by the men. If dividends are not declared, the workmen lose their share, perhaps through no fault of their own, since even if they have been working as hard as possible, blunders in policy and mismanagement will offset any good they have done.

Premium Plans.—Premium plans, as worked out in power plants, are very unsatisfactory. The common error of all the attempts in this line is that the final cost of operation is considered as a basis for the award or denial of the premiums. Yet it is perfectly clear that the cost depends not only on the excellence of work but equally, if not in a much larger degree, upon the method and means of upkeep, cost of fuel and supply and its quality, quantity of output, load factor, use factor, etc. None of these factors is under the control of the power-plant employee. Besides, the extent to which different employees contribute to the attainment of economical results is very unequal. While the firemen may effect as much as 50 per cent saving, the

switchboard operator cannot influence more than, say, 5 per cent, whereas the floor engineer can save or waste about 1.5 per cent at the most.

The unsuitability of the premium plan was forcefully demonstrated several years ago in a plant where employees who had been accustomed to earning premiums were unable to do so any longer owing to the use of poorer coal and a reduction in load.

Rewarding Individual Effort.—The rewarding of individual effort is perhaps the most unscientific scheme of all. The same objection exists that was cited before—the responsibility for securing better results is shifted onto men who have no authority to alter the conditions under which they are expected to produce results. The common error in applying the reward is to select arbitrarily one or more isolated factors, like CO₂ in flue gas, carbon in ashes, etc., and reward men

conditions of various plants called for different standards.

The work of establishing standards of performance was based not on actual experiments but on average statistical data of the past, reduced by the guessed percentage suspected as waste. Then an allotment was made for each individual plant as to how much fuel should reasonably be consumed there per month. Similarly, pay rolls were revised and certain labor costs were assumed as reasonable. These two records multiplied by constants arbitrarily chosen (6 for fuel and 4 for labor) added together and divided by 10 gave the figure of merit used as a basis for the payment of bonus, the bonus itself being adjusted on a sliding scale.

The shortcomings of this crude method are apparent:

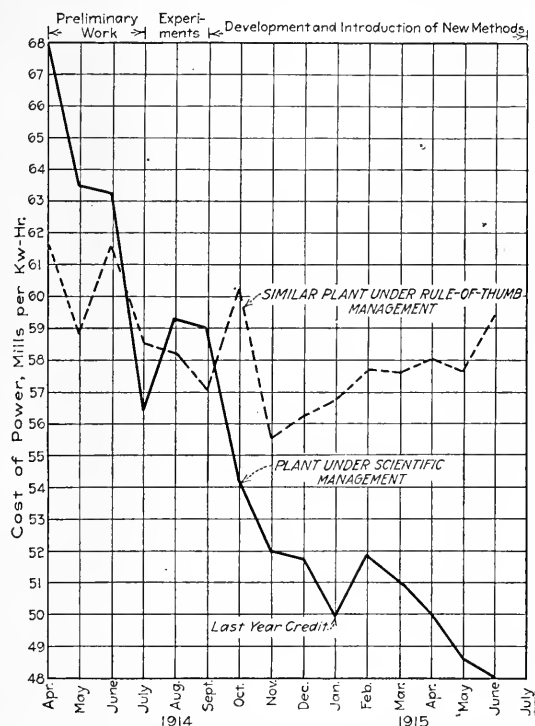
1. Men are left to discover for themselves how to secure the results desired by the management.
2. The management, shifting the responsibility to the men, was uncertain as to the exact amount of saving accomplished due to individual efforts, and therefore could not fix a definite bonus.

TASK-SETTING PLAN THAT BRINGS RESULTS

As opposed to all these methods, the writer advocates the assignment of a well-defined task to each member of an organization. The setting of a task presupposes the complete and detailed knowledge of each and every process performed in the plant and includes reliable information as to what each unit of equipment can do and what are the conditions producing the desired results. This knowledge, once gained through test and research work, is made available by instructions and training. Results necessarily follow conditions; therefore the task really consists in maintaining conditions as prescribed, not in attaining results, inasmuch as they are assured if all requirements are complied with.

To determine whether the men live up to their instructions, and consequently whether they earn their bonus, it is often convenient to judge by final results. However, these are not necessarily definite indications, since results may fall short of predetermination because of conditions beyond the control of the employee. To illustrate: Boiler efficiency may materially drop through no fault of the fireman if baffles and arches in the boilers are not maintained, owing to poor planning, lack of material, etc. Steam consumption may increase above what it should be if cool condensing water is not available. The man may fail to remove the ashes in the prescribed time if the locomotive batteries are not properly charged, the cleaning schedule disorganized, etc. It would be obviously wrong to deny the bonus to the employee who did all that was expected of him but who was unable to produce results through the fault of somebody else or something that could not be prevented by him.

Under such conditions an investigation should be made, not to verify the results, but to find out whether the conditions prescribed by the instruction card were lived up to. If they were, that is all that was expected from the employee and his bonus should be allowed him. This basic principle should apply in all cases. Favorable conditions may produce results slightly better than specified, yet they do not call for any additional reward since they evidently are not due to any extra work on the part of the employee. In other



COMPARISON OF RESULTS SECURED IN PLANTS RUN BY RULE-OF-THUMB AND BY SCIENTIFIC METHODS

obtaining the best results. It is generally overlooked that any one or several of these factors do not indicate the true performance of the whole process. It is often wise to lose in one direction in order to gain more in the final result. Moreover, it is absurd to request men to secure better results without teaching them how to do it and without providing them with instruments showing the progress made.

If one of the advocates of these short cuts would take pains to investigate any of his hobbies—whether high CO₂, or low flue temperature, or good ashes, or anything else that can be produced—he would find that the relation of the factors is complex enough to warrant detailed study. Furthermore, good results cannot be expected unless the equipment used is maintained in first-class operating condition and the supplies furnished are the most suitable and of uniform quality.

A glaring example of inconsistency of the individual-reward plan is offered by the experiences of a Western railroad. Here it was recognized that the actual performance was worse than that possible, and that local

words, the bonus remains constant as long as the terms of the instruction card are complied with, irrespective of whether the results are equal to, above or below a certain predetermined value. In case results are below a specified mark the bonus should be paid in full or not paid at all, depending on the investigation previously mentioned, but never should the bonus be reduced.

TABLE I—TWO TYPICAL REPORTS SHOWING INCREASE OF EFFICIENCY FROM ADOPTION OF METHODS OUTLINED IN TEXT

CASE I		
	Representative Week 1917 (Nov. 17, 1917)	Corresponding Week 1916 (Nov. 18, 1916)
Total coal used, lb.	141,280	506,240
Coal equivalent in shavings, lb.	31,350	38,450
Total fuel used, lb.	472,630	544,690
Total water evaporated, lb.	1,901,170	4,625,250
Actual evaporation, lb. per hr.	10.37	8.51
Average steam pressure.	58	56
Average feed temperature, deg. Fahr.	170	168
Factor of evaporation	1.073	1.075
Equivalent evaporation from and at 212 deg. Fahr., lb. per lb. coal.	11.12	9.15
Average B.t.u. per lb. coal.	14,800	13,550
Boiler efficiency, per cent.	72.9	65.6

CASE II		
	Representative Week 1917 (Nov. 24, 1917)	Corresponding Week 1916 (Nov. 25, 1916)
Total coal used, lb.	452,480	526,400
Coal equivalent in shavings, lb.	29,700	40,350
Total fuel used, lb.	482,180	566,750
Total water evaporated, lb.	5,045,800	4,837,800
Actual evaporation, lb. per hr.	10.45	8.55
Average steam pressure.	58	57
Average feed temperature, deg. Fahr.	163	176
Factor of evaporation.	1.081	1.067
Equivalent evaporation from and at 212 deg. Fahr., lb. per lb. coal.	11.30	9.12
Average B.t.u. per lb. coal.	14,800	13,550
Boiler efficiency, per cent.	74.0	65.4

The knowledge of how to do things properly and the strongest desire to work according to the best methods are of no avail unless the conditions are such that it is possible to apply these qualifications. It is a well-known fact that the daily performance in a plant operating under old-fashioned management falls short of the results obtained during a specially arranged test. This is due chiefly to the failure to plan the work ahead and permanently maintain the conditions prevailing during the test.

In considering conditions which should be maintained to secure the best economy the elimination of causes producing fatigue should be given first rank, as in power-plant work neither the best of machinery nor excellent supplies can produce satisfactory results unless they are handled by men who are not tired, mentally or physically. From experiments conducted with firemen the writer has found that, other conditions being equal, a fireman on a twelve-hour watch is about 4.5 per cent less efficient than the same man on an eight-hour shift.

No one familiar with the common layout of a power plant can over-emphasize the importance of hygienic conditions to enable men to live up to their task day in and day out. While engine rooms not infrequently offer very pleasant and sanitary surroundings, boiler-houses, the most important part of any plant, are often so built as to make them unbearably cold in winter and uncomfortably hot during the summer. Good lighting is so unusual that after looking into the furnace a fire-

man can seldom read the gages or examine anything around the boiler. Good drinking water is rarely provided, and restful seats with backs (seats without backs are as bad as no seats at all) have never been found by the writer in any boiler house. If provided with seats having backs the firemen can clean the fires twice as rapidly as without them.

The absence of elementary conditions of comfort in a working place where the men spend the greater part of their lives is more harmful to the employers than to the employees. Petty annoyances and feelings of discomfort divert the attention of the men from the performance of their duties to means of avoiding the annoyance. Steady attention on the part of the firemen is much more important than is generally realized.

Of no less importance is the hygienic surrounding on the switchboard gallery. Flickering light from lamps on a low-frequency circuit, glare on the glass fronts of instruments, cement floors to walk on, inconveniently located telephones or telautographs, too low log desks, etc., are all excellent means to increase steam consumption per kilowatt-hour and reduce the safety to men, property and service.

It should be at least as much the duty of a management periodically to investigate and test the effect of surroundings on the attentiveness and physical fatigue of men as it is its duty to test coal deliveries and supervise the treatment which equipment receives. There are many ways to ascertain the degree and the character of fatigue, but reference thereto will not be made here for lack of space. Whatever the methods may be, they should be applied at regular intervals to each and every employee, and their individual health-record cards should be kept, using some convenient rating to watch easily the decline or gain of vitality of each man. Should the decline be noticed, measures should be taken at once to find out the cause. If it is of individual nature, good advice or doctor's services should be offered. If it affects a group, the harmful condition must be eliminated as rapidly as possible. Little alterations that are usually required to remove harmful conditions are a great deal cheaper (not to say humane) than breaking in and training a new employee, or even a temporary substitute.

To conclude this rather condensed outline of the prin-

TABLE II—IMPROVEMENT IN PENNSYLVANIA PLANT BY SETTING TASK WORK AND GIVING BONUSES

BOILER ROOM			
Coal used (banking excluded), lb.	48,800	49,200	34,000
Water evaporated, lb.	419,800	408,200	284,000
Actual evaporation, lb. per hr.	8.62	8.32	8.37
Factor of evaporation	1.2187	1.2185	1.2287
Equivalent evaporation, lb. per lb. coal.	10.50	10.13	19.28
Efficiency of generation, per cent.	73.4	70.8	71.8
Cost of fuel per 1000 lb. of steam, dollars	0.0815	0.0845	0.0833
ENGINE ROOM			
Hydroelectric output, kw.-hr.	980	850	30
Steam generated output, kw.-hr.	21,220	20,450	15,070
Load factor, per cent.	79.5	64.4	67.5
Steam per kilowatt-hour, lb.	19.78	20.00	18.85
Coal per kilowatt-hour, lb.	2.30	2.40	2.26
Thermal efficiency of plant, per cent.	10.71	10.27	10.73
Cost of fuel per kilowatt-hour (banking included), dollars	0.00201	0.00204	0.00200

ciples advocated by the writer, it might be of interest briefly to review a few typical cases where this mode of management has been adopted.

Several years ago the writer was asked to specify additional boiler equipment in a plant containing ten

Manning boilers equipped with Jones underfeed stokers. To-day the old plant satisfies the 30 per cent increased demand, using only seven of the old boilers, and the efficiency, which had been slightly below 50 per cent, is now about 73 per cent. No investment of any kind for generating equipment was made, but about \$2,000 worth of instruments was provided, which yields 400 per cent interest. After the instruments were provided and the efficiency raised from 50 to 65 per cent by stopping various leaks, further progress was made by training employees in maintaining high boiler efficiency.

In a Pennsylvania public utility company, where the average efficiency as established by an eighty-day observation of hand-fired Edge-Moor boilers was 54 per cent, without any expense for replacement of generating equipment and with only a few additional instruments, the writer's methods, comprising the task work with

bonus, improved the average daily performance, as exemplified in Table II, about 33 per cent.

The adoption of the same principles in a 32,000-kw. central station, even without paying bonuses, resulted in the improvement of operating economy as represented graphically on page 37, showing how operating cost was reduced about 30 per cent. The dotted line on the chart represents the result of operation of a competing plant in similar service in the same time.

There is hardly any use in multiplying examples, all of which tend to show what opportunities exist for a management which undertakes to carry out the work on the basis of facts and not in accordance with old customs and habits. The greatest industry of this era of power and electricity can thus be carried out in a manner creditable to the engineer and beneficial to the community.

Adapting Existing Lines to Increased Loads

New Outdoor Substation Was Built with Equipment That Was Taken from Other Stations—
Practicable Method of Reinsulating 45 Miles of Line While Alive—
A 26-Mile Line Loss Eliminated

BY E. B. HOOK, JR.

Superintendent Construction Georgia Railway & Power Company, Atlanta, Ga.

FACING unprecedented demands for electric power, due primarily to the many new industrial plants being built, as well as old plants and municipalities shutting down their steam stations in the neighborhood of Atlanta, the Georgia Railway & Power Company has been exerting every effort to extend its lines and provide distribution facilities so as to serve the loads thrust upon it. In view of the great shortage of material and labor this task is not only difficult but expensive. Means for giving continuous service as well as for rearranging equipment and lines

pole line, it was found necessary to raise the line potential to 38,000 volts. The work of raising the voltage on 60 miles of line was quite a job in itself, but in addition considerable preliminary work was necessary in order to prepare for the change. The line in question is the Atlanta-Stone Mountain-Monroe transmission line, originally energized through the Boulevard substation in Atlanta from the Dunlap water-power plant near Gainesville, energy being transmitted over the Boulevard-Gainesville transmission line.

In order to reduce line losses and increase the effi-

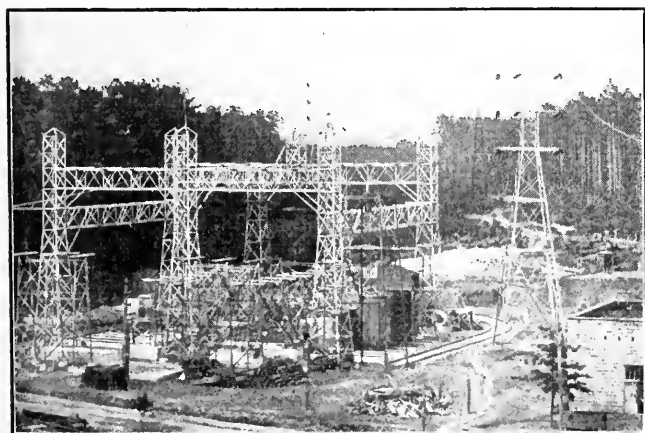


FIG. 1—OUTDOOR SUBSTATION UNDER CONSTRUCTION

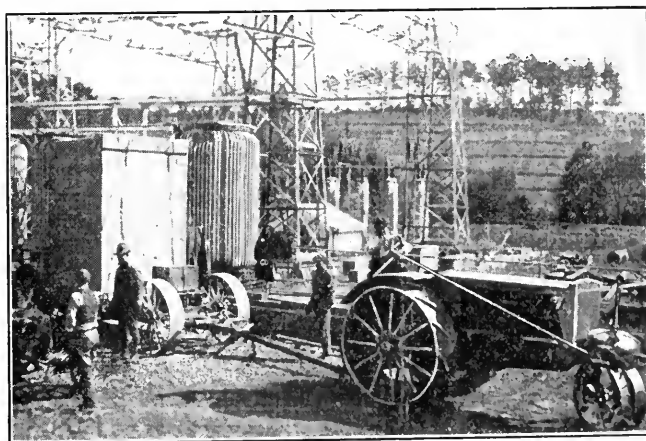


FIG. 2—METHOD OF HAULING TRANSFORMERS TO STATION

necessarily had to be evolved along the most economic lines. One interesting improvement in service which was accomplished at low cost and in a short time without interruption to service is described in detail here.

Owing to a heavy increase in load caused by one of its large cotton-mill customers near the end (Covington) of a 60-mile (96.6-km.) 22,000-volt wooden-

ciency of the Stone Mountain line a 6000-kva. outdoor-type transformer station was built at Norcross, Ga. This station has two 110,000-volt incoming feeder lines from Tallulah Falls and two banks of four 1000-kva., 110,000/38,000-volt transformers connected delta-star. One unit of each bank is a spare. One operator can control the station automatically from a benchboard in-

stalled in a neat brick operating house. Either bank of transformers can be energized from either high-voltage line at will and the load automatically transferred to the bank doing duty.

Owing to the difficulty of obtaining equipment immediately from manufacturers and also to minimize the investment, the system was searched for apparatus that could be spared without causing unnecessary inconvenience. Consequently the apparatus installed at the new Norcross station was collected from various less important points over the system, the steel-frame structure being one that was dismantled and shipped from Fairburn. A standard No. 20 transmission tower was erected in its place. Three of the transformers were moved from Cartersville, three from Marietta and two from Lindale. The dismantling, crating, shipping and installing of these 1000-kva., 110,000-volt transformers was a small-sized job, as each unit weighs over 20 tons and holds 3000 gal. (11,356 l.) of oil. It was necessary before placing them back into service, after shipping, to dry each core and filter the oil just as if the transformers had been assembled new from the factory.

CONSTRUCTION OF TRANSMISSION LINES

From Norcross to Stone Mountain, a distance of 10 miles (16.1 km.), a 38,000-volt transmission line was built on 50-ft. (15.2-m.) creosoted poles. This line being energized at the Norcross station will feed the Atlanta-Monroe line at Stone Mountain, thereby cutting off the Atlanta end of the load and 26 miles (41.8 km.) from the length of the line. The line conductors are No. 20 stranded, bare hard-drawn copper, arranged triangularly, 5 ft. (1.5 m.) between wires. A special wood-pin bracket is securely bolted to the top of the pole for one conductor and a heavy treated wood cross-

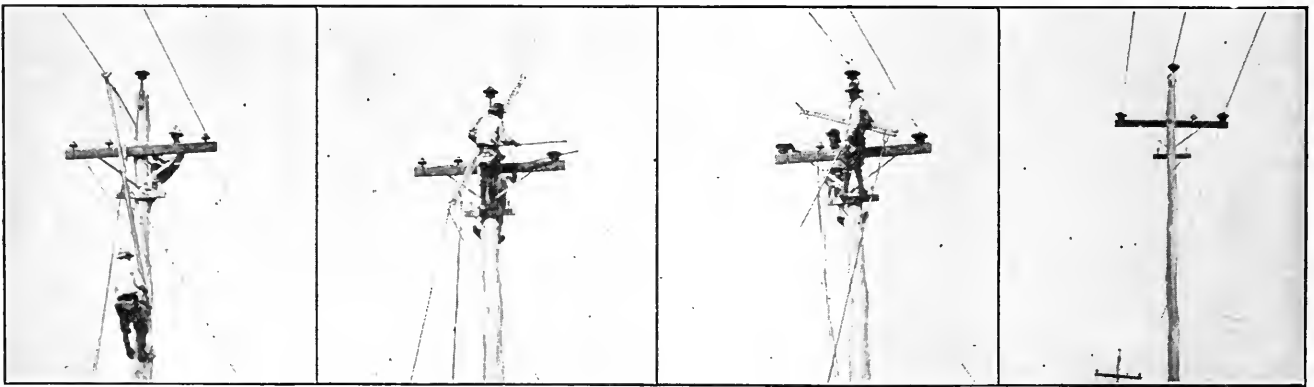
arm and fastened to the top of each pole. The private telephone line, which is 30 in. (76 cm.) below the conductors, on standard 2-pin cross-arms, is transposed every fourth pole.

To raise the voltage of this line it was necessary to completely reinsulate the line, to increase the conductor spacing, to remove the overhead ground wire and to refrain from causing an interruption of even one minute to any of the numerous customers along the entire line. A moment's reflection will reveal the magnitude of this apparently impossible problem, but it was done with a crew of twelve comparatively inexperienced men, four linemen, six ground men, a cook and a foreman, in five months' time.

METHOD OF CHANGING LINE WHILE ALIVE

The first step was the removal of the overhead ground wire, which was taken loose from the pole tops and laid down on the power arms, close to the pole on the side on which there was only one conductor. The ground wire was then cut in sections of about $\frac{1}{4}$ mile (0.4 km.) lengths and pulled off ahead. A tail line was used to hold the free end taut to keep it from whipping into the live wires. Next a specially designed wooden bracket was bolted to the top of each pole with two $\frac{5}{8}$ -in. (1.6-cm.) machine bolts. The top of this bracket extends some 8 in. (20.3 cm.) over the roof of the pole. An insulator was screwed on this bracket by hand and the middle leg of the flat-spaced line raised thereto, giving an equilateral spacing of 60 in. (152.4 cm.) between conductors (Fig. 3).

This move was accomplished by means of a 10-ft. (3-m.) insulated lifting pole, 3 in. (7.6 cm.) in diameter, fastened to the cross-arm by a pivoted collar. The top of the pole is provided with a socket and safety



FIGS. 3, 4, 5 AND 6—STEPS IN CHANGING FROM HORIZONTALLY ARRANGED CONDUCTORS TO TRIANGULAR SPACING TO PERMIT HIGHER VOLTAGE OPERATION

arm attached 50 in. (127 cm.) down the pole for the other two. A private telephone line is strung on the same poles 3 ft. (0.9 m.) below the heavy arm.

The Stone Mountain-Monroe transmission line, the voltage of which had to be raised, was originally constructed in 1913 for 22,000 volts working pressure. It is on 40-ft. (12.2-m.) chestnut poles and about 45 miles (72.4 km.) long. The line conductors, which are 2/0 hard-drawn stranded-copper cable, are strung on 4-in. by 6-in. by 8-ft. (10.2-cm. by 15.2-cm. by 2.4-m.) creosoted cross-arms—two wires on one side of the pole and one on the other. The cross-arm is bolted 3 ft. (0.9 m.) below the roof of the pole and a $\frac{1}{4}$ -in. (1.6-cm.) copper-clad steel ground wire is strung above the conductors

locking jaws for holding the conductor. The pivoted collar which holds the pole to the cross-arm forms a sliding fit around the pole, so that by means of a small set of blocks and tackle a man on the ground can raise or lower the pole at the command of the lineman above, who guides the conductor into its proper position (Fig. 4).

The tie wire was wrapped around the neck of the insulator before it was screwed on the pole-top pin, a small loop left in each end, and the free ends were bent out so that the conductor could be placed directly in the insulator grooves. By means of a small prong on the end of 8-ft. (2.4-m.) switch sticks the lineman wrapped this tie wire around the line conductor (Fig.

5). With a surprisingly small amount of practice the linemen were able to tie in the hot conductor as securely as they could a dead line with a pair of pliers.

The next step was to raise the outside wires off their insulators while higher voltage units were substituted. This was done with the same apparatus, the tie wires being removed by means of a switch stick with prongs, which were filed flat to resemble the end of a screw-driver. As the tie wire was unwrapped from the conductor the free ends were sawed off every few inches with a hack-saw mounted on the end of a switch stick, which is a safety measure to prevent the possibility of the ends of the tie wire coming in contact with the cross-arm or braces as it is unwrapped. After the tie wire was removed the groundman pulled the fall line connected with the lifting pole, thus elevating the conductor and allowing the lineman to unscrew the

on the opposite end of the timber and the process reversed. The old line insulators were used to reinsulate the telephone line.

It is interesting to note that when the crew began the work of increasing the insulation on this line the foreman was the only man that had ever seen the lifting pole in service or an insulator changed on a live line. Nevertheless, the crew changed six complete poles the first day. In a week they were changing fifteen, and after the first month's work they averaged thirty-five to forty poles, a little better than one mile (1.6 km.) per day.

Diminishing Eddy Currents

Prof. Allan B. Field, in patent No. 1,241,503, has devised a method for annulling the excessive heating occurring in the ventilating spaces of turbo-generators.

By the invention an annular laminated ring of magnetizable material is disposed in the annular vent space for the purpose of concentrating a greater portion of the magnetic lines of force entering the vent space and diverting the path in a direction parallel to that of the lines of force traversing the field magnet and magnetizable core members. This arrangement prevents to a large extent the fringing of the magnetic lines of force into the sides of the vent space, with the resulting circulation of eddy currents. As an additional aid toward the accomplishment of the same result, a series of introgressively stepped portions of the core on each side of the vent space is also provided.

Dynamo Brushes with Phenol Resin as Binder

J. Ernest Thomsen of Jersey City, N. J., in patent No. 1,245,009, assigned to the Dixon Crucible Company, suggests the use of the new phenol resin compounds as a binder for carbon brushes for dynamo use. In producing the brushes finely divided carbon is mixed with a phenol or creosol or a compound or mixture containing phenols and creosols, such as pitch, tar or creosote oil, and formaldehyde or a formaldehyde derivative and hexamethylenetetramin. It is preferable not to have the carbon content of the mixture reduced to a uniform degree of fineness. It should preferably consist of particles of graphite of different sizes. If formaldehyde is used, then it is desirable also to add a small quantity, of alkali, as, for example, ammonia, to the mixture.

The strength of the final material as well as its electrical conductivity may be varied by varying the proportion of the carbon to the other ingredients in the mixture. One formula found to give a very satisfactory product is as follows: 64 per cent carbon (containing particles of different sizes), 8 per cent of coal tar, 15 per cent creosote, 3 per cent hexamethylenetetramin. This mixture is then heated to a temperature not exceeding 450 deg. Fahr. (232.2 deg. C.) to drive off the volatile matter, and the remaining mass is ground to a powder.

The powder thus formed is then pressed into molds at a pressure which must vary according to the hardness and density desired in the product. When making the electrode for use as a motor brush, a pressure of 2 tons per square inch (281 kg. per sq. cm.) is satisfactory.

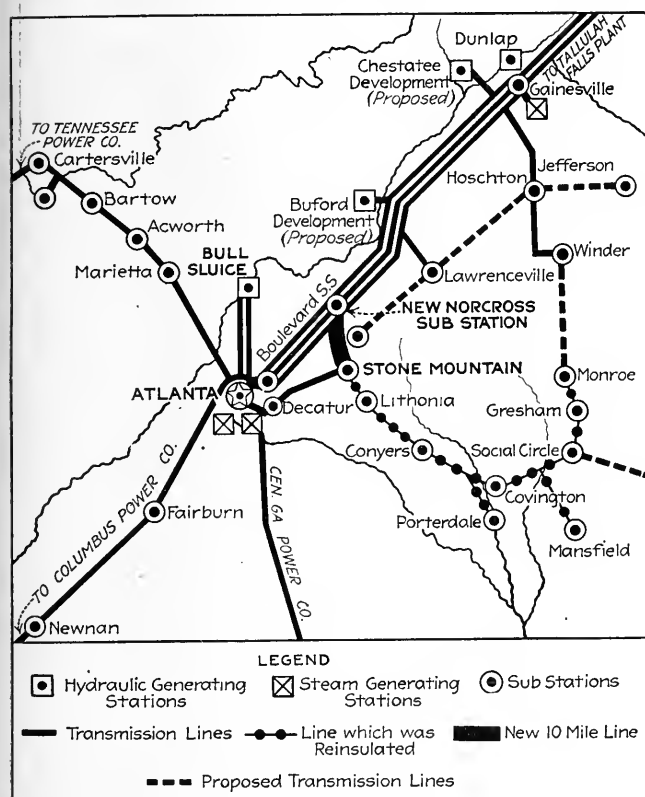
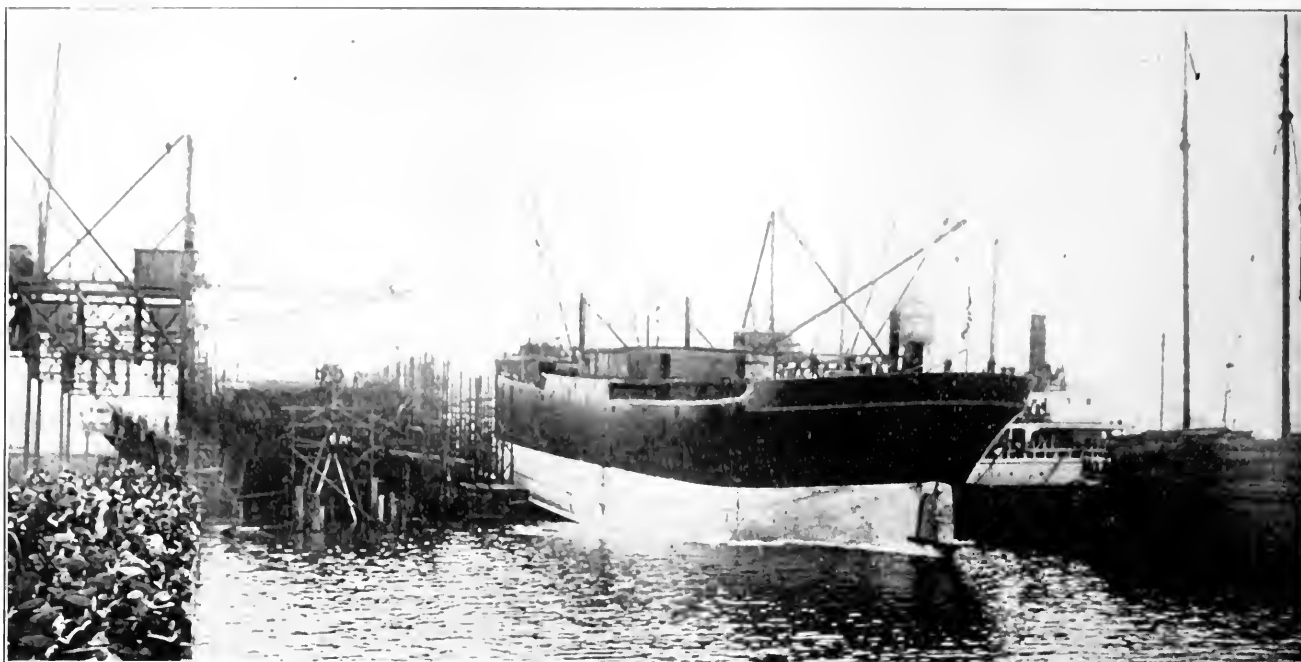


FIG. 7—MAP OF SECTION OF SYSTEM INVOLVED BY CHANGE

old insulator and substitute a new, higher-voltage unit equipped with a tie wire. The conductor was then lowered and tied in as outlined before. The lifting pole was then shifted to the other end of the cross-arm and the third conductor changed in a similar manner.

While making these line changes one of the linemen noticed that a large proportion of his time was consumed in changing the position of the lifting pole, so he obtained a dry piece of 2-in. by 4-in. (5.1-cm. by 10.2-cm.) timber 6 ft. (1.5 m.) long, shellacked it carefully and cut a 2-in. (5.1-cm.) notch in each end. After raising the middle conductor and tying it on the pole-top pin, he lowered the lifting pole to the ground, suspended the treated timber at its middle from a collar around the pole, fitted one notched end over one of the outside conductors, and had the ground man raise the conductor the required distance by pulling on a hand line fastened to the other end of the timber. To change the third insulator the hand line was snapped



SHIPS, SHIPS, AND MORE SHIPS ARE NEEDED. MORE THAN A BILLION DOLLARS IS BEING SPENT TO BUILD THEM, AND ELECTRICITY IS GIVING INVALUABLE AID

Shipbuilding Expedited by Electric Service

Study of the Power Requirements and Description of the Electrical Distributing System for Staten Island Shipbuilding Company, Mariners' Harbor, Staten Island, N. Y.

BY DAVID ELWELL

Lockwood, Greene & Company, Engineers

WHEN the demand for ocean tonnage became pressing about a year and a half ago the Staten Island Shipbuilding Company found itself with a large tonnage of steel vessels contracted for and merely the beginnings of a modern yard in hand in which to build them. It was therefore necessary to provide for the completion of the yard and for an adequate supply of power. A thorough study of the best way of meeting the power requirements was therefore undertaken by the company's engineers, Lockwood, Greene & Company. An outline of this study, with the conclusions reached, is given in what follows.

The whole development comprises not only a complete engine, hull and boiler plant, but includes facilities for every variety of marine repair work, duplicating in the latter respect the company's older plant at Port Richmond. In passing it may be mentioned that this latter yard is operated from a producer-gas power plant containing 220-volt direct-current engine-type generators directly driven by gas engines designed and built by the Staten Island Shipbuilding Company.

The fact that ship repairs are made at the new yard increases the demand for compressed air beyond that required for new vessels and gives rise to a considerable use of steam. This is used for running auxiliaries, where necessary, on vessels under repair and for heating them in winter. A supply of power in addition to that required in a shipbuilding plant only is that used electrically for the operation of floating dry docks for hull repairs.

The power requirements are therefore classified as follows:

KIND OF POWER	PURPOSE
(1) Electricity:	(a) Lighting (b) General motive power (c) Dry-dock operation (d) Air compressors if electrically driven
(2) Steam:	(a) Heating (b) General use around the yard and on ships undergoing repairs
(3) Compressed Air:	(a) Pneumatic tools (b) General yard use

The foundry and pattern shop and storage buildings are about one-third of a mile (5.3 km.) back from the shipyard proper. A low-pressure steam-heating plant was installed there with indirect heating by air circulation for the foundry and direct radiation elsewhere. Alternating-current energy from the lines of the Richmond Light & Railroad Company was at hand when these buildings were completed and was therefore used for woodworking machinery in the pattern shop and for cranes, cupola blowers, etc., in the foundry.

The power load of the foundry being of a limited amount, the heating was preferably handled by a local boiler, as steam pipes from a main boiler plant at the shipyard would have had to traverse public streets for quite a distance. The demand for steam and electric

power here was not enough to have a definite influence on the power calculations in the shipyard. The main yard had a 220-volt direct-current power plant, but being entirely inadequate and in a location needed for other purposes in the new development its use could not be considered.

POWER REQUIREMENTS AND RELATION OF DEMANDS

Studies were made to determine the amount of power required for the various purposes mentioned, the kind and relation of the different demands and load curves.

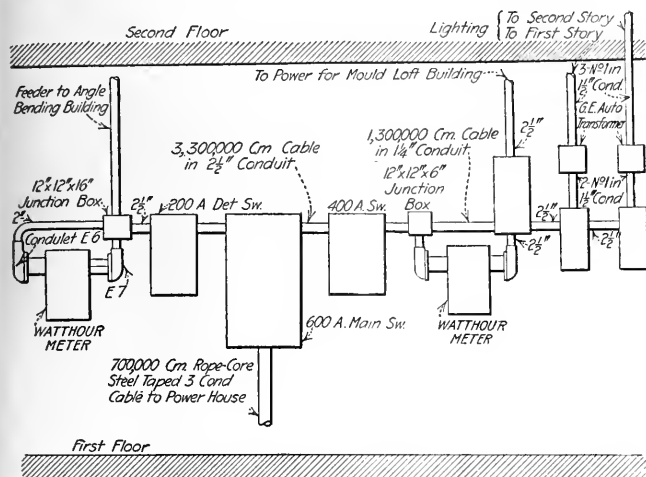


FIG. 1—ARRANGEMENT OF METERING AND SWITCHING EQUIPMENT IN MOLD LOFT

Regarding the lighting requirements, eighteen different buildings (excluding the foundry group) had a demand of 60 kw. For motive power in the buildings, exclusive of compressors, cranes and direct-current requirements, it was found that the average requirement would be 420 kw., with a 500-kw. maximum.

For the three floating dry docks a maximum demand of 500 kw. was computed, with two docks in simultaneous operation, although the annual consumption is only 150,000-kw.-hr. approximately. The actual pumping period varies from one-half to one and one-half hours, according to the size of dock, and the annual power consumption is based on 100 hauls per year and an equal number of pumping periods for setting the keel blocks. For the operation of air compressors, if electrically driven, it would be necessary to have 250 kw. for each of two compressors and 500 kw. for a larger unit, making a total of 1000 kw. This represents a total capacity of about 7000 cu. ft. of air per minute (198.2 cu. m. per second).

On account of the exacting service required of cranes, particularly in the boiler shop and in the machine shop for assembly of engines, etc., and to secure the benefits of dynamic braking, direct-current cranes were preferred to alternating-current cranes. A considerable demand for direct-current energy arose from various adjustable-speed drives in the shops, on machine tools and the electric winches for handling steel at the shipways. This direct-current requirement constituted another item of electric power to be taken into account, running about 300 kw.

Regarding the steam requirements, it was found that 12,000 lb. (5443 kg.) of steam per hour at 2 lb. to 5 lb. (140.6 g. to 351.5 g.) pressure was the maximum necessary for heating, some buildings requiring heat in

whole or part and at temperatures of 50 deg. to 70 deg. Fahr. (10 to 21.1 deg. C.), according to occupancy. High-pressure steam requirements for general use in the yard and for live-steam lines to vessels under repair for driving auxiliaries and heating ranged from a minimum of 75 hp. to a maximum of 400 hp., according to conditions.

All reasonable methods of running the plant were assembled as follows for study:

- I. 1. High-pressure condensing turbines for power, lighting and dock pumping.
2. High-pressure steam-driven air compressors, (a) non-condensing, (b) condensing.
- II. 1. High-pressure non-condensing air compressors.
2. Mixed-pressure turbines for power, lighting and dock pumping.
- III. High-pressure condensing turbines for power, lighting, dock pumping and air-compressors—motor-driven.
- IV. 1. Purchased electric power for lighting, power and dock pumping.
2. Steam-driven air compressors, (a) condensing, (b) non-condensing.
- V. Purchased electric power for lighting, power, dock pumping and air compressors.

Under scheme I it was found that any steam saved by condensing operation of compressors was offset by that required for condenser drive and by the live steam which was required for heating in lieu of the exhaust otherwise available, not to mention the added investment.

With scheme II it was found that the compressors at full load would not pass enough steam to mixed-pressure turbines to meet the demand for shop power, even excluding lighting and dry-dock operation. Consequently high-pressure make-up would always be required for the mixed-pressure turbines, with very large amounts at times of small compressed-air demand. Moreover, the compressor exhaust was just about the amount needed for feed water and building heating, so that a good part of the time the turbines would be running at very poor economy mostly on high-pressure steam. With little or no coal saving from this scheme and an added investment to cover it if adopted, in-

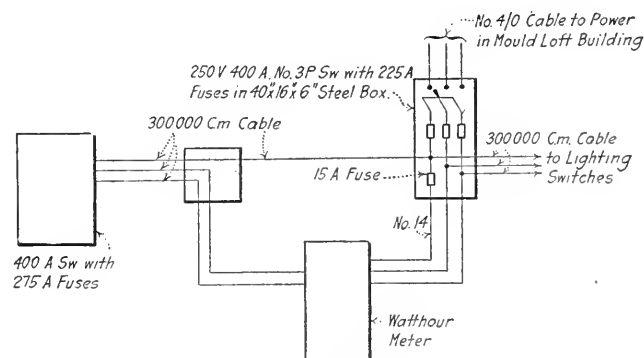


FIG. 2—DETAIL OF PART A (FIG. 1)

creased complication and diminished reliability, a power plant based on scheme II was definitely abandoned.

Scheme III involved increasing the turbine capacity to handle motor-driven air compressors. While the turbines would utilize the steam more efficiently than air compressors, the electrical losses of the latter, if motor-driven, would leave only a slight theoretical saving in this scheme over scheme I. This difference might disappear in actual operation, and the disadvantage of

ingly signed with the Richmond Light & Railroad Company.

Energy for the plant is taken from the electric-service company's aerial lines at a point near the purchasers' substation, which is situated at about the middle of the yard. The energy is measured by an outdoor meter installation. The line splits, one branch running up to the foundry on the power company's street pole line, while the other branch runs underground into the substation.

The essential questions arising in connection with the utilization of the electric power were the method of distribution to be adopted for power and lighting and the voltage to be used. The owners wanted to avoid any personal hazard to operatives even at considerably increased distribution cost by using as low a voltage as practicable. A motor voltage of 220 volts was accordingly adopted. In the substation there was no need of going to such a low voltage, as only the operating force would have access to the premises, therefore 440 volts was selected for serving the direct-connected synchronous motors on the air compressors.

THE LIGHTING SYSTEM

For lighting it was not desired to carry the supply voltage to the various buildings nor was it desirable to run individual low-voltage lighting lines to the different buildings. It was therefore decided to have a single alternating-current three-phase feeder for each building or group of buildings and to split one phase with a 220/110-volt balancing coil to get the desired lighting voltage. Where the lighting load would have been sufficient to cause serious unbalance on the three-phase supply, the load was distributed around the phases, each phase having its own auto transformer.

This arrangement eliminated considerable expense which otherwise would have been involved in purchasing high-voltage transformers for lighting. It increases only slightly the size of the power distributing lines and eliminates the hazard of high-voltage distribution around the yard for lighting.

Aerial distributing lines with the low-voltage employed would have been unsightly on account of their size, and the wires and poles would have interfered continually with the locomotive cranes in the yard. It was therefore decided to run the wires underground. Running underground lines in this yard involved some special considerations. The ground in the yard is largely filled with ashes and cinders and is not much above tide level. This meant that it would always be soft and wet, so that it would have been almost impossible to find a solid bottom on which to rest clay or fiber duct lines incased in concrete. Under such conditions the ducts would surely have settled and caused trouble, especially with the passage of cranes and trucks above. Furthermore, it would have been necessary to waterproof all manholes because of excessive water, and on account of the low elevation of the land with respect to the tide drainage of them would have been practically impossible. Since the yard is well filled with various structures, such as plate racks, tracks for cranes, etc., the installation of concrete-duct lines would have been very difficult. The use of steel-armored lead cable eliminated all the difficulties which the other scheme would have brought up, and it was accordingly adopted.

The substation, which is employed to house the main transformers, distributing switchboard, motor-generator sets and air compressors, is a brick and steel building and contains a traveling crane. The incoming underground service passes through a cell-mounted switch on the street end of the building and thence to the transformers. These have split secondary windings giving a full voltage of 480, which is used for the compressors. The 240-volt, three-phase circuit for the general shop motors is connected with the mid-point of secondary winding of each transformer.

Twelve feet (3.6 m.) from the street end a wire grille runs across the entire substation, with a door at each wall. This fences off the power transformers and forms a back support for the switchboard tie rods. The 240-volt and 480-volt leads from the transformers join their respective busbars on the board which is erected in front of a cable trench running parallel to the grille. A cable trench runs entirely across the power house, carrying the outgoing lines from the switchboard out through the building wall in each direction underground. A similar cable trench running lengthwise of the building, connecting with the transverse trench at the switchboard, carries the circuits to and from the synchronous motors on the air compressors, their exciters, the alternating-current, direct-current, motor-generator sets, etc.

For the outgoing underground circuits the armored cable rises from the trench directly to the switch terminals. The circuits for power-house apparatus are run in rigid iron conduit in the trenches. The trenches are provided with flush-checkered, steel-plate covers in removable sections. Automatic oil switches with transformer trip and inverse-time-element relays are mounted directly on the panels, and manually operated for the alternating-current circuits. Knife switches and carbon-break circuit breakers are used for the 220-volt, direct-current circuits.

The switchboard, except for the air-compressor panels, was furnished by the Westinghouse Electric & Manufacturing Company. The synchronous motors, their exciters and switchboard panels, were furnished by the General Electric Company. The board has been equipped as simply as possible to meet the requirements. Ammeters are provided to indicate load on each power-house circuit and outgoing line. By means of ammeter switches the current in any phase may be obtained, these readings being necessary, as the phases may be slightly unbalanced by the auto-transformers for lighting.

For purposes of cost recording the energy required for each building or group of buildings engaged in an individual manufacturing process is measured by a watt-hour meter on each feeder. In certain cases—that of the mold loft and the plate and angle-bending building, for instance—the load is light enough for a single feeder, so the segregated power for each building is obtained by watt-hour meters in the mold loft where the feeder splits.

The essential ideas which have been followed in connection with buildings and equipment are simplicity, ruggedness and thorough adaptability for the service required. These facts, together with the speed attained on the work, have enabled the owners already to deliver complete steel cargo vessels, now in service on the seas.

Effective Work of Associated Manufacturers

The Thorough Organization by Sections That Has Been Accomplished by
Makers of Electrical Supplies Found to Be of Immediate
Value for War Service of the Nation

THE Associated Manufacturers of Electrical Supplies has followed consistently the lines laid down early in the active career of this influential body. From the beginning the purpose has been to create an organization of intensely practical value to members. It was desired to form a medium through which the manufacturers might co-operate to the best advantage in developing trade relations both broad in scope and with sufficient definite direction to prove of permanent value. This medium, highly developed to a point where it is of great and permanent usefulness to members, has become a factor of great and powerful value to the government in the mobilization of industries for war.

In organizing itself more closely the manufacturing branch of the electrical industry is following the trend of developments in other branches. Among the manufacturers organization is now complete through the Associated Manufacturers of Electrical Supplies, embracing all the many and varied lines of electrical supplies; the Electrical Manufacturers' Club, an agency for bringing the executive officials together twice a year to discuss questions of policy, and the Electric Power Club, an effective established organization of manufacturers of motors, transformers and control apparatus. There is no conflict whatever between either the purposes or the actual work of these different bodies.

As is generally known, each of the three organizations has four representatives who meet in the Electrical Manufacturers' Council, providing an effective means for co-ordinating the work of the individual organizations, so that it may be unified on questions of common interest, while leaving each separate organization with a clearly recognized sphere of operation free to do special work in its own field.

The most distinctive characteristic in the organization of the Associated Manufacturers of Electrical Supplies is the extensive and intensive development through its sections. In effect, the sections carry to different lines of manufactured supplies the benefits of the main organization. It is in a sense as if the supply manufacturers were united in individual organizations and then linked together through a main association in which each one had representation. Actually, however, the membership is held in the parent organization and affiliation with sections is a supplementary procedure to membership in the association.

SECTION ORGANIZATIONS

The organization of the sections is substantially uniform. Each has a chairman, a secretary and a treasurer, with committees covering the special line of product embraced in the work of the sections, in order to centralize and develop their activities. At the commencement of the Associated Manufacturers' movement the sections appeared to be in effect committees of the main association, but they have grown even past

the expectations of the enthusiastic organizers. The attendance and interest in the work of the sections are maintained with unflagging zeal.

While each section is a unit in itself, subject to the authority of the parent association, all have problems of the same character to meet. Under these conditions the nature of the work, inquiry and investigation of the different sections has closely approached uniformity. Necessarily the steady progress in standardization and in some other directions is rightly confined to individual lines in individual sections, but there are many activities in which all sections have a common interest.

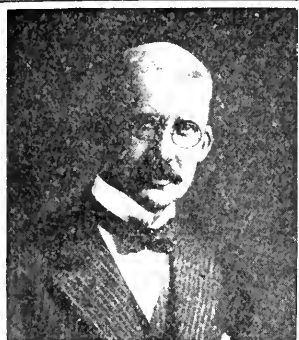
Through its representation on the general war committee of the electrical manufacturing industry assistance will be given the government in meeting its requirements efficiently and with the minimum of industrial disturbance.

WAR SERVICE COMMITTEE'S WORK

It is upon the foundation laid by the three organizations that the general war service committee of the electrical manufacturing industry has built its comprehensive, far-reaching system. As readers of the ELECTRICAL WORLD know, the general war service committee of the electrical manufacturing industry consists of two members each from the three organizations. Sub-committees will be created in each of these organizations to meet such demands as may arise from time to time. With the Associated Manufacturers of Electrical Supplies, which extends into so many distinct lines of activity involving a large membership, it has been found desirable to form about twenty subsidiary committees from the sections, representing different lines of electrical supplies. The thoroughness with which the work of organization of the subsidiary committees has been done is characteristic of the completeness with which the Associated Manufacturers' organization has been perfected in other directions.

In these committees the term "section" is abandoned. The committees are regarded as representing groups of the industry, as, for instance, the wire and cable group. It was decided to forgo the term section because members regard the war service work as primarily in the interest of co-operation with the government. They wish to cover the whole industry, not alone that part, though large, which is in the association, and they therefore offer the services of the various war committees to any manufacturer.

Without the organization of sections which has been built up by the Associated Manufacturers of Electrical Supplies it would have been impossible to form almost instantly when the demand arose so extensive a system of war service committees as has been developed. Time would have been spent in bringing people together. Trade antagonisms would have had to be overcome. In place of this feeling there would have had to be built up the new spirit of co-operation, in-



EDWARD B. HATCH



W. D. STEELE



FRANK W. HALL



J. E. WAY



HOWARD R. SARGENT



CHARLES E. DUSTIN
GENERAL SECRETARY



J. E. MILES



W. R. WILLIAMS



C. O. BAKER



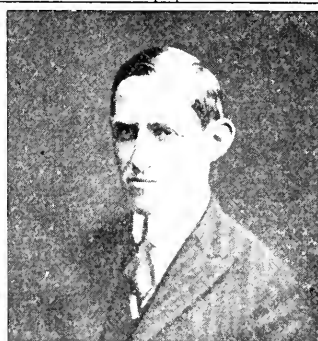
CHARLES L. EIDLITZ



LE ROY CLARK



A. F. CHAMBERLAIN



R. W. SEABURY



J. F. KERLIN



H. W. BLIVEN



J. H. TRUMBULL



E. WHITMORE



D. HAYES MURPHY

tensified beyond the powers of imagination by the entrance of the country into the world war. The necessity of doing this crudely and hurriedly under the spur of sharp necessity due to war has been obviated by the existing organization, which without delay provided the useful machinery for creating war service committees. The association formed the sections for justified trade purposes before war loomed; the country is at once benefited when war comes.

Little limitation is placed on the activities of the sections of the Associated Manufacturers of Electrical Supplies. Generally they may map out their own work and do it through such conferences or committees as seem to them to offer the most effective means. However, all that they accomplish is subject to the approval of the board of governors of the main association, acting on advice of the counsel, before it can become officially the product of the organization. Through this authority, which is exercised continually, the board of governors is able to hold the work of the different sections to conformity with the constitution and the spirit of the organization. By this method of control the sections are guided so effectively that all their activities are strictly in accord with both the letter and the spirit of the law.

On the preceding page are printed photographs of chairmen of the various sections and also of Charles E. Dustin, the general secretary, through whose office the principal work of the sections passes before action is taken on it by the board of governors.

The chairmen of the sixteen sections are:

Attachment Plug Section.—H. W. Bliven, Harvey Hubbell, Inc.

Carbon Section.—J. F. Kerlin, National Carbon Company.

Fan Motor Section.—A. F. Chamberlain, Robbins & Myers Company.

Fuse Section.—H. R. Sargent, General Electric Company.

Industrial and Street-Lighting Fixture Section.—C. O. Baker, Wheeler Reflector Company.

Insulating Materials Section.—J. G. Miles, Westinghouse Electric & Manufacturing Company.

Interior Conduit Section.—D. H. Murphy, American Conduit Manufacturing Company.

Knife Switch Section.—J. H. Trumbull, Trumbull Electric Manufacturing Company.

Lamp Receptacle and Socket Section.—W. D. Steele, Benjamin Electric Manufacturing Company.

Line Material Section.—W. R. Williams, General Electric Company.

Molded or Formed Insulation Section.—Edward B. Hatch, Johns-Pratt Company, has just resigned as chairman. R. W. Seabury, Boonton Rubber Manufacturing Company, has been elected to succeed him.

Outlet Box Section.—Frank W. Hall, Sprague Electric Works.

Panelboard and Switchboard Section.—Charles L. Eidlitz, Metropolitan Electric Manufacturing Company.

Porcelain Section.—J. E. Way, R. Thomas & Sons Company.

Snap Switch Section.—E. Whitmore, Manhattan Electrical Supply Company.

Wire and Cable Section.—LeRoy Clark, Safety Insulated Wire & Cable Company.

Formed in 1915, the Associated Manufacturers of Electrical Supplies had as its first president Robert K. Sheppard, Simplex Wire & Cable Company. H. B. Crouse, Crouse-Hinds Company, the present president, was elected in 1917 to succeed Mr. Sheppard. A. W. Berresford, Cutler-Hammer Manufacturing Company, is vice-president, and J. W. Perry, H. W. Johns-Manville Company, is treasurer.

ARRESTERS ON 150,000-VOLT ENERGY-TRANSMISSION LINE

Results of Investigations of Electrolytic Lightning Arresters on These Lines Given—Method of Overhauling Arresters

BY H. H. COX.

When the 150,000-volt Big Creek system was put in operation six sets of electrolytic lightning arresters were installed, two at each power house and two at the receiving substation. None was installed along the line at any point, but instead each string of insulators on the line was provided with arcing horns. Occasionally there are insulator flashovers, but they seldom occur within 30 miles (48.3 km.) of either the power houses or the substation. Their cause is not definitely known or understood. They occur under any and all load and weather conditions. A few cases only of actual insulator breakdown have occurred. It would appear that the protection afforded by the arresters does not extend more than 30 miles.

Probably the most important function performed by these arresters is the discharging of switching disturbances. The gap setting has been decreased from that recommended by the manufacturers until it is now only about 60 per cent of the minimum given in the instruction book. The present setting, which has been arrived at by trial method, is 10½ in. and 14 in. (26.7 cm. and 35.5 cm.) at the substation and 13 in. and 17 in. (33 cm. and 43.2 cm.) at the power houses. The higher setting at the power house is due to the configuration of the ground at that point.

Charging current is measured once a month and curves are plotted on it. Arresters at one power house were taken out of service after about two and one-half years on account of increasing charging current. The trouble was found to be that the electrolyte had coagulated. These arresters have not been put back into service. Those at the substation were overhauled and new electrolyte put in after three years' service. The charging current had not materially increased, however. Those at the other power house are still in service and are apparently in good condition after four years' service.

In overhauling those at the substation it was found that about 2 per cent of the cones were bad. These were rough and pitted on the surface covered by the electrolyte, and in every case it was plain to be seen that the trouble was due to low electrolyte. These cones were generally distributed through the stacks. When the stacks were reassembled an original method was used by which absolutely uniform filling was obtained. The cones were filled by the usual rubber tube and siphon method, but no particular care was taken about the uniformity. When full the stack was carefully leaned over against the wall until the electrolyte in a properly filled cone just started to spill over. Then those too full ran over until down to the proper level, and it was but a few minutes' work to run over the stack with a rubber tube and fill up the low ones.

In giving the initial charge after refilling only one cell was found in 2800 which would not build up the film. From the foregoing it would seem that the cones would last a long time in the service these arresters are doing.

How System Operators Can Improve Economy

Proper Qualifications of Load Dispatchers—Relations with Station Operators and Line Patrolmen—Coal Saving Proved to Be Possible Through Studying Hydroelectric Conditions

BY HARRY J. BURTON

Consumers' Power Company, Jackson, Mich.

IN ORDER properly to conserve the energies and resources of a modern interconnected transmission system, made up of hydroelectric plants, steam plants and substations, the services of well-trained, competent load dispatchers or system operators are essential. Men of broad operating experience are needed for positions of this kind. They must be familiar with the operation of steam plants, water plants and substations, and with the care and maintenance of high-tension transmission lines.

System operators are in a particularly favorable position for observing the general status of an operating department, and with the guidance of their executives should be able to bring about successful and economical operation.

To operate to the best possible advantage the authority of the system operator should extend to the lines, stations and men, in maintaining the necessary operating conditions. Emphasis should be placed upon the importance of co-operation between all departments and the system operator. Pertinent information withheld from the system operator may result in serious loss to a company.

System operators should at all times be familiar with all the operating conditions existing at the various stations, substations and switching points. They should know the kind of coal used and the cost of it, unloaded, at the different steam plants. They should know the load at which the different generating units operate most efficiently, and the information they receive must be accurate if good and efficient work is to be done. They should be kept informed of the demands for power and of all changes in load as far in advance as possible, so that they can arrange to have different units placed in or out of service at the right time.

RESPONSIBILITY OF SYSTEM OPERATOR

Generating apparatus should not be placed in or out of service without the permission of the system operator, and on small systems boiler-room men should not be allowed to cut boilers in or out of service or to clean fires without his sanction. On larger systems he should at least know how many are available for service at all times. Boiler-room economy is of the utmost importance these days, and boilers should be operated at the most efficient load. Steam plants should not be run with more boilers in service than are actually needed; that is, ten boilers should not be fired when only eight are needed to carry the load. The load curve on steam plants should be straight for efficient and economical operation; that is, a good load factor should be maintained. Boilers can be prevented from "blowing off" during the noon hour and light-load periods by an intelligent handling of the water at hydroelectric plants.

System operators should aim to take care of peak loads with water power, and, as far as is practicable,

water should be conserved for these periods. Sundays, holidays and other light-load periods can often be taken care of by means of water power, thus affording an opportune time to inspect, clean and repair steam-plant equipment.

HYDROELECTRIC CONDITIONS AND COAL SAVING

Much energy can be conserved by a careful study of water conditions at the hydroelectric plants. The nature of the watershed, the amount and time of precipitation and the climatic conditions all affect operation, and some understanding of the flow and formation of a river is needed to know how soon or how much the pond would be affected after a given precipitation or thawing. The operation of floodgates should be checked up from time to time to see that they are in working order, as failure of these gates to work at a critical time may result in much damage and loss.

The determination of the most effective gate opening and the working of water down a river, through several water plants, as well as the handling of plants at times of low and high water, are economic problems that should be worked out so that, if possible, no water shall be wasted, the plants operated at the most effective head and a degree of protection maintained at all times. When extensive repairs to lines or equipment are contemplated, making it necessary to shut down a plant for a considerable period, the system operator should be informed as far in advance as possible so that he can arrange to use all the available water; thus as little as possible will be spilled while the repairs or changes are under way.

System operators should have sketches showing the high-tension wiring in all power stations, substations and switching houses and data showing pole numbers at the principal points along the lines, such as road crossings, trolley stops, telephone test stations and other items descriptive of the lines that would be of assistance in handling intelligently any case of line trouble that may develop. They should keep themselves informed as to the immediate whereabouts of patrolmen, linemen, repairmen and all superior officers, so that there will be no delay in securing help or advice in an emergency.

Competent line patrolmen are an invaluable help to the system operator, and reliable information received from them and acted upon may not only save equipment and prevent an interruption to service but may also eliminate a long period of inefficient operation. For example, a system operator may have planned to use a certain line and plants to carry an important load, and owing to the failure of the line, or to trouble on it, he may be forced to use a line and plants less efficient, and in addition water may be wasted at some of the dams. Accurate information received from a patrolman may prevent the trouble entirely or else give the system oper-

ator time to plan for the most efficient way out of the trouble, should it prove to be inevitable.

System operators should give careful consideration to all high-tension line disturbances or surges that are reported. They may be caused by an arcing ground, and it is a well-established fact that trouble of this nature sets up surges and causes stresses, on delta-connected systems, which tend to weaken insulation on all lines and apparatus connected metallically to the defective part. Arcing grounds must be located and cleared from the system as soon as possible. An experienced operator should have little difficulty in locating transmission-line trouble on a modern high-tension system.

Weather conditions and approaching storms should be carefully noted and suitable preparations to take care of possible trouble should be made by checking up the whereabouts of patrolmen, linemen and repairmen. Reliable means of communication between the system operator and patrolmen, switching points and stations must be maintained, and the system operator should give this important matter careful thought and be prepared to act promptly should one of his lines of communication fail. System operators' messages over the private telephone line should be given preference, and it should be understood by all concerned that any instructions given by them regarding the generation and disposition of power should take precedence over all other instructions. Important messages should always be repeated.

The question of proper discipline is an important matter, and the morale of the men, as well as the condition of the equipment under their care, should have special consideration. All concerned should understand that co-operation with the system operator tends toward safe, continuous and efficient work.

Book Reviews

THE ELECTRIC VEHICLE HANDBOOK. Fifth annual edition. By Frank W. Smith and H. C. Cushing, Jr. New York: H. C. Cushing, Jr. 388 pages, 200 illustrations. Price, \$2.

In bringing this new edition of "The Electric Vehicle Handbook" up to date the authors have had the assistance of William P. Kennedy, consulting transportation engineer, together with the best-known experts in the country on the practical operation and care of the electric vehicle, its storage batteries, motors and accessories. Thomas A. Edison is quoted as saying: "We have needed just the information contained in its pages." It is the only book on the subject published and has proved a valuable reference work for the owner or operator of an electric vehicle of any class.

THE MYSTERY OF MATTER AND ENERGY. By Dr. Albert C. Crehore. New York: D. Van Nostrand Company. 162 pages, illustrated. Price, \$1.

A fascinating little volume, designed to stimulate interest and inquiry in the physics of the microcosm. We human beings live in a world of dimensions capable of directly appealing to our senses. Exactly what these dimensions are is naturally a debatable question; but let us state it as ranging from, say, a millimeter up to

say a few megameters, or through a ratio of about 10^{10} , with a geometric mean at 100 meters. Outside of this immediate world astronomy opens up a vastly greater or megacosmic universe, commencing say at 10^{10} meters and running up to what outer limit we know not, but up to discussed limits of 10^{20} meters, another range of 10^{10} meters, with a geometric mean at 10^{15} meters, or roughly 0.1 light-year. Inside of our immediate world, physics opens up a vastly more minute or microcosmic universe, commencing, say, at 10^{-6} meter and working down to what inner limit we know not, but up to discussed limits of 10^{-16} meter, another range of 10^{10} , with a geometric mean at 10^{-11} meter, a distance suitable for discussing electronic orbits. At the present time, physicists are much engaged in unraveling the mysteries of the microcosmic universe. They seem to be as wonderful as those of the megacosmic or stellar universe. The ultimate laws of matter, gravitation and radiation are intimately connected with the microcosmic world. It may well happen, indeed, that the ultimate conditions of the planets in the stellar universe may be worked out from discoveries yet to be made in the microcosmic universe. The book is written without algebra, but it contains some beautiful geometrical drawings and atomic-model pictures. The volume is to be recommended to all educated persons possessing some general knowledge of physics who are interested in the most recent investigations within the microcosmic world.

THE THEORY OF THE SUBMARINE TELEGRAPH AND TELEPHONE CABLE. By H. W. Malcolm. London, England: The Electrician Printing & Publishing Company, Ltd. 566 pages, 198 illustrations. Price, 18s.

This is a good textbook on the mathematical theory of submarine-cable telegraphy and telephony. It divides itself into two portions or groups of chapters, namely, (1) those which deal with the theory of steady-state simple alternating-current transmission over cables, and (2) those which deal with the theory of transients or arrival curves on such cables. The former theory is not new, having been developed by other writers in the past. The latter theory is new in its development. It was merely outlined by Kelvin and Heaviside. This book makes, therefore, a valuable and much needed contribution to the knowledge of the transient or unsteady state in submarine cables, whereby the arrival curves may be computed under any assigned set of ordinary signaling conditions at the sending and receiving ends. The chapters relate to the following subjects: Mathematical recapitulation, fundamental cable constants, transient and periodic phenomena, the telegraphic equation and its periodic solution, the methods of loading cables, discontinuities and reflections, alternating-current measurements, the telegraphic equation and its transient solution, the part played by signaling apparatus, sending phenomena and the influence of leaks, signaling by inverse currents, sine-wave transmission, distortion and how it is produced, present-day methods of overcoming distortion, the duplexed cable, and the loaded telegraph cable. The volume will be of great value as a reference book to cable telegraphists and to students of electric signaling who have had a good mathematical training.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

THE COST OF INSTALLING UNDERGROUND CONSTRUCTION

Compilation of Expenditure for Average-Sized Conduits Which Should Enable Engineers to Estimate the Cost of Construction Approximately

The following data giving construction costs for an average-sized conduit have been compiled by the National Fireproofing Company of Pittsburgh, Pa. In computing these costs certain basic figures (Table I) were used which will naturally vary in different localities.

TABLE I—BASIS COSTS USED IN CALCULATING COSTS OF UNDERGROUND CONSTRUCTION

	Cost Per Cu. Yd.
Excavating trench	\$0.70
Back-filling trench	0.25
Laying conduit	0.0075*
Mixing and wheeling concrete.....	0.70
Removing surplus dirt.....	1.60
Cost of aggregate for concrete.....	1.53†
Cost of cement.....	0.002*

*Per duct foot.

†Per barrel delivered.

So much conduit is run in suburban and cross-country districts where there is no pavement to replace, as well as under streets previous to paving them, that the cost of replacing pavement does not always have to be considered. When it is necessary to remove and replace pavements, however, the average cost thereof can be found in Table II.

TABLE II—COST OF REPLACING DIFFERENT KINDS OF PAVEMENTS

	Cost Per Duct Foot
Granite block on sand.....	\$0.0147
Brick on sand.....	0.0147
Brick on concrete.....	0.0294
Asphalt on concrete.....	0.0441
Cement sidewalk	0.0147

The figures shown in Table III may be used safely in approximating the cost of materials and labor for brick manholes having concrete floors, sewer connection, reinforced-concrete top and cast-iron frame and cover.

TABLE III—COST OF BRICK MANHOLES*

Number of Ducts	INSIDE DIMENSIONS (FT.)			AVERAGE COST		
	Length	Width	Height	Labor	Material	Total
1 to 3.....	5	3½	4	\$24	\$32	\$56
4 to 8.....	5	3½	5	26	36	62
9 to 12.....	6	4	6	35	45	80
13 to 24.....	7	5	6	45	54	99

*For concrete manholes approximately 25 per cent less than the above values should be estimated.

The following schedule of costs is compiled to serve as a guide in making up of estimates only and is such as will cover average conditions in any district of a city. These figures include cost of all materials (the duct excepted), excavating, removing dirt, mixing and placing concrete, hauling and laying duct, replacing pavement and the expense of city inspection. The

TABLE IV—AVERAGE COST PER DUCT FOOT UNDER DIFFERENT PAVEMENTS

Number of Ducts in Trench	Grass Plot or Unpaved Street	Macadam, Cobble or Wood Block on Sand	Wood Block on Concrete	Asphalt, Grouted Brick or Granite Block on Concrete
2	\$0.150	\$0.180	\$0.250	\$0.300
3	0.120	0.134	0.165	0.200
4	0.090	0.100	0.133	0.160
6	0.070	0.079	0.110	0.120
8	0.060	0.066	0.098	0.110
9	0.055	0.062	0.094	0.105
10	0.053	0.059	0.090	0.102
12	0.050	0.055	0.085	0.096
14	0.047	0.052	0.081	0.092
16	0.044	0.048	0.077	0.088
18	0.042	0.046	0.074	0.085
20	0.040	0.044	0.071	0.082
22	0.039	0.042	0.069	0.080
24	0.038	0.041	0.066	0.078
26	0.037	0.040	0.065	0.076
28	0.036	0.039	0.064	0.075
30	0.035	0.038	0.062	0.074
48	0.032	0.036	0.060	0.071

figures are based on the supposition that the duct line is surrounded with 3 in. (7.6 cm.) of concrete and that the top of the ducts is placed 24 in. (0.6 m.) beneath the pavement surface.

USE OF METERING EQUIPMENT SAVES TRANSFORMER PURCHASE

Rearrangement of Equipment in Distribution System Made Possible by Careful Measurements Eliminates Immediate Expenditure

Striving toward conservation of essential materials in accord with the spirit of the times, the Plymouth (Ind.) Electric Light & Power Company recently worked out a scheme for utilizing existing transformers more efficiently and thus avoided purchasing additional units. In general the plan consisted simply of making load measurements on certain transformers to ascertain what units could be relocated to better advantage as regards their capacities. The apparatus used in making the measurements consisted of two sets of current transformers and one graphic meter. One set of transformers were rated at 160/5 amp., 2500 volts each, and the other at 20/5 amp., 2500 volts each. The meter was a Westinghouse type U, with an eight-day clock and

a 5-amp. scale. This equipment was all placed in a single box in such fashion that several desirable circuit changes could be made on a plug board constructed as a part of the outfit. These circuit combinations made it possible to use the metering outfit and get proper scale deflections on the meter on transformers between 10 kw. and 60 kw. A two to one ratio instrument transformer was used on smaller units.

When a test was made the metering outfit was hung on a pole at the transformer bank. In residential districts the duration of these tests was usually from Monday until Thursday and in the business districts was usually from Friday until Monday. On motor installations records over a two-week period were sometimes taken.

As the result of forty such tests the locations of ten transformers were changed. In general it was found that units in residential districts could serve wider territory and thus release transformers to be removed to the business district, where most of the existing equipment was overloaded. Making the changes which were indicated to be possible by the tests has relieved the company for the time being of the necessity of buying transformers and has bettered the voltage regulation of the system as a whole.

HINTS FOR LINE FOREMEN IN CASE OF ACCIDENTS

Method of Procedure When Accidents Occur to
Men—Two Essentials Must Be Looked to
Promptly—Keeping Cool

The most soul-trying time that comes in connection with the duties of a line foreman is the time when from one cause or another one of his men receives a fatal or dangerous electric shock or burn. Under the stress of such a situation, particularly if the victim is suspended on his safety belt or lying across a high-tension line, many men go to pieces or at least become so excited that no concerted action may be expected. When such an occurrence takes place two essentials should be looked to promptly:

1. The injured man must be brought to the ground as speedily as possible and artificial respiration commenced at once.

2. No time should be lost in summoning medical aid and the company's resuscitating device.

The first of these must be left to the foreman to handle as he may, but he should be relieved of all responsibility regarding the second. This may be accomplished by detailing either the driver or one of the groundmen to reach for the nearest telephone and start the machinery in motion which will bring aid to the scene. The driver is the logical man for this work and should have it regularly impressed on him that this is his "bit" in such an event. By impressing on the men the part they are to play in event of accident the natural confusion will be reduced to a minimum.

Rules for the protection of electrical workmen may be multiplied indefinitely to good effect, but the gospel of accident prevention will be best promoted by instilling into the minds of the men the fact that they are dealing with a force so destructive and rapid in its action that no stone will be left unturned to add to their safety while working with it and that no amount of protective

apparatus will effect its mission unless accompanied by an intelligent and careful co-operation on their part.

The above considerations were brought out by W. C. Pearce, superintendent electrical department Syracuse (N. Y.) Lighting Company, in a paper read at the recent meeting of the National Safety Council.

METHOD USED IN BOSTON TO CONSTRUCT LATERALS

Underground Laterals Are Installed to Care Only
for Services Which Are Definitely Contem-
plated, Thus Avoiding Useless Construction

The policy followed by the Edison Electric Illuminating Company in constructing underground lateral lines and manholes connected with the main line was outlined recently before the Massachusetts Gas and Electric Light Commission by L. L. Elden, electrical superintendent of the company.

The policy that is carried out is to lay such structures to take care of business of which the company has knowledge at the moment, instead of attempting to build for the future development of particular districts. Some years ago the company attempted to lay down laterals in a Boston development where two or three streets had not been accepted, installing ducts to the lot line upon the assurance of property owners that houses were going to be built. About fifty spare ducts were put in, but the plan was unsatisfactory on account of the irregular and uncertain development. In some cases a purchaser would buy two adjoining lots, erecting a house in the middle of the parcel thus obtained and so throwing one service duct out of usefulness, to say nothing of introducing a change in the symmetry of the feed location. In another case a driveway was built in a location which made the lateral useless.

On account of these uncertainties the Boston company now builds only for immediate business. When the city lays out a new underground district the sales force canvasses every house in the region. If the company secures the business in some new locations it installs the pipes, but otherwise no spare pipes go in. At least 25 per cent of all Boston Edison manholes have been built after construction of the main lines of conduit.

FAN ENGINE MOUNTING

Engine Is Mounted in Turbine Room, Affording a
Compact Arrangement

At the Farmingdale station of the Central Maine Power Company a fan engine connected with the boiler draft supply is mounted in the turbine room on a reinforced concrete platform, instead of being placed in the boiler room proper, as is generally the case. The platform is carried about 10 ft. (3 m.) above the floor, and, in addition to providing turbine room supervision for the engine, enables the outfit to be operated in space of little use for other purposes. A short connection with flange coupling runs through the wall between turbine and boiler rooms and a secondary platform above the base of the engine with appropriate ladder connection enables the cylinder and valves to be inspected with ease. The arrangement is compact and affords maximum cleanliness of operation.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

THE CREDIT DEPARTMENT'S RELATIONS WITH CUSTOMERS

**Courteous, Firm and Painsstaking Methods Used to
Collect the Past-Due Accounts, with Service
Discontinued Only as Last Resort**

There are many ways of collecting accounts. Methods employed by some companies irritate and antagonize customers. Other methods create respect. In some instances collection departments set out with the avowed intention of creating a reputation for harshly handling customers in order that the customers' fear of such handling shall assist in reducing a number of overdue accounts. Some utilities have been known to go so far as intentionally to attract the attention of the delinquent's neighbors to the fact that trouble is ensuing over the payment of a bill. In general, however, this is not the accepted plan among more progressive central stations. Their plan generally is to adopt systematic, thorough and painsstaking but withal firm measures of insisting upon payment. It is the endeavor to cultivate the good will of the customer rather than to antagonize him.

METHODS OF A MIDDLE WEST COMPANY

As characteristic of these practices the following description of methods employed by the credit manager of a Middle Western electric lighting utility is of interest: This collection system requires the rendering of three statements on all delinquent accounts, namely, the memorandum of arrears, the collector's statement and the "Important" statement. Formerly these statements were printed on addressographs from stencils used for printing the bills and were filled in by long-hand by statement clerks. Recently, however, the department has adopted a very modern system of rendering these statements through the use of four Underwood-type fanfold statement machines. The operation is now so handled that six copies are made in one operation, namely, memorandum of arrears, cashier's stub of memorandum, "Important" statement, cashier's stub of "Important" statement, collector's statement, office copy of collector's statement.

When an account is ten days past due—that is, twenty days after the bill has been rendered—the company sends the customer by mail the memorandum of arrears, in which is printed the following paragraph:

"Please note that bills listed above have not been paid. As same are past due, the favor of your remittance by return mail is requested."

This statement usually brings payment from customers who have misplaced or neglected their bills. To those who pay no attention to it, it is necessary to render the collector's statement. This is sent out ten days after the memorandum of arrears statement was

mailed. The collector's statement is made in duplicate, one copy being for the collector and one for the office records. It constitutes the first call statement and is the beginning of the collection department's intimate relations with the customer. If the collector is not successful in securing the money on the first call, he leaves a collector's first notice, which shows the amount due and reads as follows:

"Your attention is called to your past due and unpaid account for electricity amounting to \$—, covering dates for electrical merchandise \$—, electric wiring \$—. Please remit or call at our office and make payment without delay."

Five days later, if no collection has been made, the "Important" statement is mailed. This bears a shut-off notice reading as follows:

"We beg to draw your attention to your past-due account as listed above. We request that this account be paid before the close of business on —. Otherwise we shall be obliged, with regret, to enforce our rule relative to discontinuing service."

After allowing three days for the customer to make payment the collector makes his second call to collect or discontinue service. He must, however, interview the customer and get his refusal to pay before service is discontinued. In the event that the customer is not at home he will not shut off the service, but will leave a final shut-off notice which reads as follows:

"We beg to advise that, in accordance with notice sent you for your unpaid account for electricity amounting to \$—, call has been made to-day to shut off service. We hope you will render this action unnecessary by paying bill at once at the main office."

THE THIRD AND LAST CALL

This means that the third call must be made if the customer does not remit. On the third call the customer must pay or service will be discontinued. If conditions are such that the collector cannot reach the meter, the case is turned over to the repair department to collect account or to discontinue service if necessary at the pole. Before this action is taken, however, a letter is addressed to the customer informing him that such action will be taken if the account is not paid. In the event that the service is shut off the collector leaves a slip at the meter showing the amount of the overdue account which was the cause of discontinuing service. Upon the payment of this account the customer can have the service reconnected the same day it is discontinued.

As these various steps are taken memoranda are made on the customer's account at the office so that any inquiry as to the status of his account may be answered.

After service has been discontinued for non-payment

the report is held fifteen days, during which time another call is made to collect the account if possible. If the account is not paid, the contract department is informed of the situation and requested to issue an order to have the meter removed.

DEALING WITH CUSTOMERS WHO HAVE MOVED

The next task of the collection department is to get the money on the final accounts of customers who have moved or whose meters were removed on account of non-payment.

First in order, there is the case of the customer who has moved and is using service at another address. If the balance owed is less than \$1.50, the amount is added to his bill, which will be sent to the new address. If the amount is more than \$1.50, it is given to a collector. If he does not secure the balance, he will leave a notice for the customer. If the customer then does not remit within ten days, another letter is sent requesting payment. Ten days later, if the account has not been paid, a shut-off notice letter is mailed stating that service will be discontinued within three days.

Second, there is the case of the customer owing a final account who gave the company his new address at the time he ordered service discontinued but who is not using service at the new address. The collector calls upon this man and, if he cannot collect the amount, leaves a notice that the balance is due. If payment is not made within ten days, two letters are written at intervals of ten days requesting payment. If remittance is not made then, the collector makes another call. If he is unable then to collect the amount or to get satisfactory promise of payment, credit data are referred to.

If the correct business address of the customer is shown in the credit data, a call is made at this address and then a letter is sent to the business address stating that the account will be sent to an attorney for payment if it is not settled. After this a few more calls are made by the collector to establish definitely the fact that it is impossible to get the money. Then the account is turned over to the company's attorney with all of the collector's reports, copies of letters, credit data, etc. A card is also filed in the credit department's suspense file to prevent the delinquent from securing further service from the company while his account remains unpaid.

Throughout all of these operations it is the intention of the department to exercise patience and to endeavor to cultivate the good will of the customer and at the same time to establish in the mind of the customer respect for the collection department.

UTILITIES REDUCING STOCK OF THE MATERIAL ON HAND

Economic Measure Which Conserves Both Labor and Capital for the Central Station Company, Besides Reducing Insurance Carried

There is at present a quite general movement among central-station companies to reduce the stock of material carried in the warehouses and storerooms. This movement is tending not only toward carrying a smaller quantity of supplies but also toward making use wherever possible of material on hand and the conversion

into money of all surplus material. Quite naturally, this movement carries with it also a corresponding reduction in the amount of insurance which will be carried.

Back of the movement is the desire to conserve capital and to conserve labor. Reducing stocks not only releases money actually tied up in the goods in the wareroom, when this material is used and is not replaced, but in many cases brings to light material which can be resold at present prices with a considerable profit.

This applies only to such material, of course, as is not likely to be needed in the near future. In some instances the stock reductions have been of such extent as to justify reducing the amount of insurance carried, which also effects a saving. With the reduction of stocks carried it is also possible to effect a saving in the amount of labor necessary to handle the stock and in the amount of labor required in taking inventory, two considerations of importance.

METHOD FOR SAVING TIME IN THE FILING OF VOUCHERS

Manila Envelopes Provided for Filing, with Provision for All Account Titles and Numbers, Amounts and Totals

The Agawam (Mass.) Electric Company and affiliated central stations, under the management of the Cabot interests of Boston, file vouchers most conveniently by making use of a method which is described in the following paragraphs:

Vouchers are properly classified under account numbers and are then kept in manila envelopes about

MANUFACTURE		GENERAL EXPENSE	
Current Purchase	1	Automobile Transportation	5
Man. Rent Estate	2	Clerk's Salaries	2
Label at Substation	3	Domestic Allowances	6
Rep. Elct. Plant, Equip. Substa.	4	Freight Insurance	4
Expens. Substation Bldg.	5	Legal Expense	5
Oil and Water-Sub. sta.	6	Office Expense	6
Electricity T. and A. Sub. sta.	7	Taxes	7
Repairs Street Lig. Apparatus	8	Office Salaries	8
Sub. station Supplies	9	Purchasing New Business	9
Total Manufacture		Total General Expense	
DISTRIBUTION		SUPPLY ACCOUNTS	
Material Com. Li.-Labor	1	Jobbing	1
Material Com. Li.-Material	2	Material in Stock	2
Material Com. Li.-Labor	3	Multiple C. Lamp	3
Setting A. - Replacing B.	4	Multiple C. Lamp	4
Tuning C. - Replacing D.	5	Multiple C. Lamp	5
Material Com. Li.-Material	6	Material in Stock	6
Material Com. Li.-Labor	7	Material in Stock	7
Material Com. Li.-Labor	8	Material in Stock	8
Material Com. Li.-Labor	9	Material in Stock	9
Material Com. Li.-Labor	10	Material in Stock	10
Material Com. Li.-Labor	11	Material in Stock	11
Material Com. Li.-Labor	12	Material in Stock	12
Material Com. Li.-Labor	13	Material in Stock	13
Material Com. Li.-Labor	14	Material in Stock	14
Material Com. Li.-Labor	15	Material in Stock	15
Material Com. Li.-Labor	16	Material in Stock	16
Material Com. Li.-Labor	17	Material in Stock	17
Material Com. Li.-Labor	18	Material in Stock	18
Material Com. Li.-Labor	19	Material in Stock	19
Material Com. Li.-Labor	20	Material in Stock	20
Total Distribution		Total Supply Accounts	
Approved for Payment, \$		Approved for Payment, \$	
Department		Department	
Total Property		Total Property	

FACE OF THE ENVELOPE FOR FILING VOUCHERS WHICH IS USED BY A MASSACHUSETTS CENTRAL STATION

9 in. by 11½ in. (22.8 cm. by 29.2 cm.) in dimensions, the face of each envelope carrying all account titles and numbers, with space for amounts and totals under each class, as shown in the illustration which accompanies this article.

Provision is also made for approval signatures, and a record of the check number paying the account and other information can be inscribed in the open spaces which are left on the envelope to serve the convenience of the office.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Lamps and Lighting

An Indirect Lighting System in a Textile Plant.—GEORGE WRIGLEY.—For obvious reasons it is frequently desirable in lighting industrial plants to use a small number of large units rather than many small units, provided that uniform illumination without excessive glare can be obtained. With direct lighting reflectors the size of unit is limited by such physical features as ceiling height and machinery spacing. This paper describes a system embodying the use of the largest approved size high-efficiency incandescent lighting unit, arranged to give the best possible working conditions for the operatives.—*Illuminating Engineering Society.*

Effective Lighting of Factories as Judged by Daylight Standards.—WARD HARRISON.—The author points out that because of the high power and concentration of present light sources greater care must be taken in selection of diffusing accessories to minimize glare and specular reflection, to provide a directed light of ample intensity on both horizontal and vertical surfaces, and to give soft shadows. Consideration is given to the limiting brightness values governing the choice of equipment for different classes of factory lighting. The common forms of factory units are compared as to fulfillment of lighting requirements. In this connection a new diffusing unit, consisting of a large porcelain steel reflector of special design in combination with a silvered lamp cap, is described. Tests of actual working daylight intensities in a number of workshops are reported. Results of an investigation of factory rental costs are shown, and the marked savings in production cost through double-shift operation feasible with artificial lighting of a daylight standard are calculated.—*Transactions I. E. S.*, Nov. 20, 1917.

Generation, Transmission and Distribution

Plans for Long-Distance Transmission.—F. NIETHAMMER.—In the course of an article on the development of a hypothetical electric-service system covering an entire country with its branch stations and 100,000-volt transmission lines the author mentions some interesting figures concerning Germany's consumption of electrical energy in 1916. From 2,600 000,000 kw.-hr. in 1913 the consumption jumped to more than 10,000,000,000 kw.-hr. in 1916, or practically four times as much. The enormous value of hydroelectric power has been impressed upon Austria and Germany, and plans are already under way for the utilization of all the swift mountain currents and waterfalls in the Austrian Alps for manufacturing purposes. Within the next quarter of a century Germany plans completely to electrify its railways and to erect central generating stations, using water power and the vast fields of turf and bituminous coal. All machinery is to be driven electrically, all lights and all heating in cities to be by electricity. Pre-

liminary surveys and plans are already under way.—*Elektrotechnik und Maschinenbau*, Nov. 11, 1917.

Traction

Voltage Rises in Third-Rail Circuits.—D. D. EWING.—A study of the causes of high-voltage rises in third-rail systems is presented in this article, together with oscillograms of such surges. Rises in voltage of two or three times the normal were found possible.—*Electric Railway Journal*, Dec. 15, 1917.

Tramways Render Invaluable Service in Halifax Disaster.—The tramway company at Halifax, N. S., came through the recent disaster with loss of few employees and comparatively little damage to power plant, track and rolling stock. Its speedy resumption of operation was of great assistance in the work of recovery.—*Electric Railway Journal*, Dec. 15, 1917.

Electric Traction in Italy.—A reprint from the report of a parliamentary commission of inquiry into the state railways of Italy, the use of electricity on which dates from 1900, when two systems were inaugurated—one on the Valtellinesi railroad, in the Adriatic district, where three-phase alternating current was used, and one on the Milan-Varese railroad, in the Mediterranean district, where direct current and the third-rail were employed. The former system now has 276.9 km. (172 miles) of single track and 113.7 km. (70.6 miles) of double track, and the latter system has 58.5 km. (36.3 miles) of double track, or a total for the two systems of 449.1 km. (279 miles) electrified. An elaborate table of cost of operation per kilometer as compared with the cost of operation by steam locomotives is included in the article.—*L'Elettrotecnica*, Nov. 15, 1917.

Installations, Systems and Appliances

Mechanically Operated Furnaces.—M. LAMOTTE.—The ever-growing cost of coal makes the utility of mechanically operated furnaces as compared with hand-operated ones a matter of prime importance. Even the most nearly perfect furnaces will differ from 15 to 20 per cent in the amount of fuel consumed when controlled by different firemen. The author takes up the questions of automatic draft and of mechanical feeding and stoking, considering in turn the various forms of apparatus devised for these purposes, the underfeed and endless-chain grates, etc., of different makes. To a questionnaire responded to by twenty establishments widely varying answers were received. One firm, for instance, puts the maintenance cost—material and labor—per grate per hour of operation with one system at nearly seven times, and with another system at nearly eighteen times, the figures reported by another firm for the system used by it. Similarly, the high-estimate firm puts the cost of operation per grate at six times the sum reported by the low-estimate firm.

The amount of fuel consumed by the same furnace in different establishments also varies, according to the reports, by as much as 100 per cent, depending evidently on the quality of the coal and the strength of the draft. In the presence of such divergences, the author says, further experience is necessary before exact conclusions can be drawn.—*Revue Générale de l'Electricité*, Nov. 10, 1917.

Methods for More Efficiently Utilizing Our Fuel Resources.—H. G. BARNHURST.—This article, the seventh of a series on the general utilization of pulverized coal, briefly reviews the extent of the use of pulverized coal in the Portland cement industry and then treats of its later application in other industries. It is being used more and more extensively in metal-heating furnaces, in metallurgical furnaces in the steel and copper industries, and for burning lime and dolomite for making furnace refractories. A field in which enormous quantities of this fuel will be used is in the generation of power in stationary power plants. The article refers to many low-grade solid fuels which can be utilized with good results in pulverized form, and states that the danger incident to the use of pulverized coal has been greatly exaggerated. The preparation and handling of pulverized fuel are discussed in detail in the latter part of the article.—*General Electric Review*, December, 1917.

Electrophysics and Magnetism

Faraday Society Symposium on Pyrometers and Pyrometry.—At a meeting of the Faraday Society held in London Nov. 7, 1917, the general subject of pyrometers and pyrometry was considered in its relation to metallurgy. The first paper, by E. F. Northrup, dealt with the "Production of High Temperature and Its Measurements." The author pointed out that the refractory properties of carbon offer means of obtaining high temperatures, the upper limit of which is the vaporization temperature of that element. The writer presented results of two inquiries—first, what form would an ideal furnace take? second, is it physically possible to reach this ideal electrically? The progress of electric heating is also outlined, as is the measurement of high temperature. The author urges all investigators in the field of high temperature to consider the great possibilities of the metal tin for extending the fundamental temperature scale above 1550 deg. C., the present limit of the gas thermometer. The subject of "Pyrometer Standardization" was discussed by Ezer Griffiths and F. H. Schofield of the National Physical Laboratory. The authors pointed out that it is now generally agreed that the standard scale of temperature should be the thermodynamic. The third paper was presented by Richard P. Brown on the "Automatic Control and Measurement of High Temperatures." The author showed the industrial need for automatic temperature control and the feeling of security that comes to a factory manager whose plant is thus equipped. The principles of a new heat meter developed by the writer are outlined, as are the details of an instrument to control furnace temperatures automatically.—*Metallurgical and Chemical Engineering*, Dec. 15, 1917.

Flux of Energy in Electrodynamical Field.—G. H. LIVENS.—The basis of the theory of energy streaming in the general electromagnetic field is briefly reviewed and the most general form of Poynting's and Macdon-

ald's results is obtained. In addition, Macdonald's own form and an alternative are deduced, and although reasons are given for their rejection in favor of the simpler and more general type of theory first obtained, the former (Macdonald's own form) is retained throughout the succeeding discussion for purpose of illustration. The various theories are then subjected to critical examination on general grounds and subsequently in reference to their behavior in certain special fields, and it is shown that in the present state of our knowledge any alternative to Poynting's theory must be rejected as being wholly incompatible with our physical conceptions of energy and its streaming in the electromagnetic field.—*Philosophical Magazine and Journal of Science*, November, 1917.

Some Fundamental Concepts of Electrical Theory.—H. BATEMAN.—The author develops an electromagnetic theory based on the idea of moving lines of electric force, discussing it from three viewpoints: (1) Permanent and mutual incidence of the lines of force of the different point charges; (2) temporary incidence of lines of force of different point charges but no cutting of lines of force; (3) motion in which the lines of force can cut right through one another.—*Philosophical Magazine and Journal of Science*, November, 1917.

Units, Measurements and Instruments

Measurement of Self and Mutual Inductances.—FRED E. PERNOT.—The author describes a mill method of measuring self and mutual inductances by comparison with known values of resistance and capacity.—*University of California Publications*, No. 12, Vol. 2.

Conductivity of Aluminum.—GUIDO GRASSI.—Results of an examination made to determine the conductivity at diverse temperatures of various samples of aluminum wire as a contribution to the knowledge of the electrical constants of aluminum. Three groups of wires were experimented with, a chemical analysis producing the following results:

	Al.	Fe.	St.	C.	Cu.	Na.	Pb.
I	98.31	1.13	0.50	0.038	Trace	0.013	Trace
II	98.61	1.00	0.36	0.012	Trace	0.011	Trace
III	98.32	1.23	0.38	0.043	Trace	0.019	Trace

The tests were made by the methods of Hockin and Matthiessen, a potentiometer being also employed in one instance, and the fact was established that the increase in the resistance of aluminum from 0 deg. to 100 deg. is proportional to the increase of the temperature. Therefore, the resistance R at temperature t may be expressed: $R = R_0 (1 + \alpha_t t)$, where R_0 is the resistance at 0 deg. and α_t is the coefficient of the temperature referred to 0 deg. Group II showed less resistivity than the other two groups, although it was the richest in aluminum.—*L'Ettrotecnica*, Oct. 25, 1917.

Telegraphy, Telephony and Signals

Private Automatic Telephone Systems.—A description of a telephone system for direct intercommunication by means of automatic plugs. Because of its reliable operation and small expense this system is adapted to the needs of small plants containing fewer than twenty-five instruments, where switchboards or elaborate automatic systems cannot economically be installed. The chief drawback is the ease with which a third party may "listen in" unknown to the conversers.—*Revue Générale de Electricité*, Nov. 24, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

WAR-TIME MEETING IN SOUTHERN CALIFORNIA

Annual Gathering of District Agents and Department Heads, with Earnest Discussion of Problems Under War Conditions

In the spirit of harmonious co-operation to effect every possible economy which will not impair efficiency of service, more than 150 officers, department heads and district agents of the Southern California Edison Company met at the Hotel Alexandria, Los Angeles, on Dec. 27 and earnestly discussed the conditions which confront this important public utility under the war conditions of the times.

In a spirit of optimism and cheerful compliance, with perfect comprehension of what is required and of the individual duty and collective responsibility which war imposes upon those engaged in the quasi-public service, present problems were discussed and those of the future anticipated.

THE COMPANY'S ATTITUDE TERSELY PHRASED

These excerpts from addresses pertinently express the attitude of the company. Vice-president R. H. Ballard said: "The California State Railroad Commission has indorsed this program, and our program will be, 'Do the things that are necessary and let convenience take care of itself after the war.'"

Superintendent of Sales A. W. Childs voiced this epigram: "Unfolding opportunity is the wonder of the electrical industry—the harvest is always being gathered and yet it is always waiting in greater abundance."

The program of papers and addresses was as follows: "Cutting Stationery Costs," R. E. Herman, chief of the stationery department; "Advantages of County District Lighting," W. M. McKnight, agent of the Redondo district; "How the Medical Department May Help Employees," Dr. H. C. Stinchfield, chief surgeon; "Conserving Time," W. L. Frost, assistant general agent; "Utility of the Electric Water Heater," P. J. Denninger, agent for the Whittier district; "Safeguarding the Kilowatt-Hours," H. A. Barry, electrical and mechanical engineer; "Intensive Development of Existing Circuits," A. W. Childs, superintendent of sales; "How Some Expenses Can Be Reduced," D. M. Trott, assistant comptroller; "Why the Light-Weight Car Is Advocated," P. H. Ducker, superintendent of transportation; "Shots at Sundry Targets," S. M. Kennedy, general agent; "Big Creek Hydroelectric Development," E. R. Davis, general superintendent of the northern division; "On the Threshold of 1918," R. H. Ballard, vice-president and assistant general manager.

Of the suggestions for economies and increased efficiency these were emphasized: The imperative duty

of each employee being productively employed for every moment of the working day; the economic crime of **wasting** time in personal conversation during business hours; saving in stenographers' time by making letters shorter, omitting salutation in inter-company correspondence; single-spacing and using short letterheads; making letters take the place of trips from districts to general offices and from general offices to districts; using trolleys instead of automobiles whenever possible and practicable; revising the entire system of forms and blanks and cutting out all that are not positively essential; saving in every little detail, down to doing away with envelopes for inter-company mail and even to the use of holders for the short ends of lead pencils.

LARGE INSTALLATIONS IN 1917

Of the work of intensifying the business under existing lines two of the most important features reported were installations of electric ranges and electric water heaters. The Southern California Edison Company now outranks all other electric companies in these installations, having with the close of the year on its own territory and that of its subsidiary companies, all interconnected, 2867 ranges and 603 water heaters, having sold 1390 ranges and 478 water heaters during 1917. It was intimated that future extensions would necessarily be along very conservative lines, and that in many instances the consumer would be given an opportunity, through deposits, to help the company help him obtain the service desired.

How the "Greater Edison Company," which since its merger with the Pacific Light & Power Corporation last May distributes electricity in a domain geographically equal to Massachusetts, New Hampshire, Vermont, Connecticut, Rhode Island, Delaware and New Jersey, can best serve its consumers, safeguard its investors and do its full patriotic duty by the government, were the big problems for the coming year touched upon by Vice-president Ballard. To conserve fuel by making every drop of available water power do its work, to keep the wheels of manufacture turning, to economize without injuring, to be efficient without increasing investments and see that the money invested for that purpose was not deprived of its income, were set forth as the tasks for 1918.

KEEN INTEREST IN EVIDENCE

The meeting was characterized throughout by an intense amount of interest from those in attendance, and the able discussion of the papers and questions asked clearly indicated a keen desire on the part of the men from all parts of the company's system not only to carry out the economies planned but to suggest other directions where more economies could be either worked locally or applied to all districts.



ACROSS THE FACE OF THE GREAT WHITE WAY OF NEW YORK CITY "ICHABOD" WILL BE WRITTEN. ITS GLORY HAS DEPARTED

RIGID "LIGHTLESS" ORDER MADE FOR NEW YORK STATE

Only on Saturday Nights Will Lighting Be Permitted in Accordance with the Federal Restrictions

A new order, making every night but Saturday "lightless" in New York State, has been issued by Albert H. Wiggin, Federal Fuel Administrator for that State. This order is the outcome of the controversy over the continued illumination of electric signs in its relation to fuel scarcity and war economy, and it followed a less sweeping order previously issued.

Mr. Wiggin and his organization are studying the fuel situation through a conservation committee on fuel. An advisory committee on fuel has been appointed representing the light, heat and power companies. It is composed of L. B. Gawtry, Consolidated Gas Company, New York; F. W. Smith, United Electric Light & Power Company, and Mr. Gillam, New York Steam Company.

The new regulative order of Mr. Wiggin, effective in New York State, follows:

By virtue of powers conferred upon me, I hereby issue the following orders, to take effect Jan. 2, 1918:

1. On Saturday nights lighting is permitted, subject to the restrictions imposed by order of the United States Fuel Administration, dated Nov. 9, 1917, and order of the undersigned, dated Dec. 8, 1917.

2. On all other nights all signs of every kind, including merchants' signs, signs for theaters and all other places of entertainment, display signs, lighting on buildings and

elsewhere, hotels and advertising signs, are ordered to discontinue completely.

3. Stores and offices and commercial buildings not open for business shall not use inside lights more than absolutely necessary for safety. Cluster lights and illuminations generally must be reduced to only so much lighting as is necessary for safety.

4. No more outdoor lighting shall be used than is absolutely necessary for safety of streets, passages, dangerous places and protection of the public, or as may be required by law.

5. No person, partnership, corporation or association furnishing electricity or gas or using the same shall use any coal, oil or gas or other fuel for supplying of electricity or gas, excepting subject to the restrictions and conditions contained in this order.

6. County administrators are directed promptly and strictly to enforce this order.

Harry T. Peters, chairman of the fuel conservation committee which is studying conditions for the Fuel Administration in New York, has made public the preliminary results of a survey of the amount of coal held by public service corporations. He found that in most cases unprecedented inroads were made into their reserves in December.

Mr. Peters pointed out that many thousand persons are dependent upon these companies for light and heat and millions for transportation, and expressed the opinion that any attempt to commandeer their already depleted reserves would be a serious mistake. On the contrary, Mr. Peters urged fuel administrators to devote every effort to maintaining the supply of these corporations, and said failure to do so would amount to criminal negligence.

GOVERNMENT REQUISITIONS THE NIAGARA ENERGY SUPPLY

Federal Authorities Take Absolute Control of Production So as to Assure Distribution in Accord with Essential War Needs

To protect the power supply for war industries the federal government requisitioned on Dec. 28 the energy produced, imported and distributed by the Niagara Falls Power Company, Hydraulic Power Company and Cliff Electrical Distributing Company.

A determining factor in the government decision, Washington reports say, was the demand of Canadian authorities that approximately 100,000 hp. imported from Canada be used exclusively for war work.

Statements given out in Washington indicate that it is not expected that operation of manufacturing establishments will be affected materially, as a partial redistribution of the power supply had already been arranged between the War Industries Board and Buffalo manufacturers.

About 110 manufacturers not working directly on war contracts will curtail their requirements to some extent, will use power at hours when munitions factories make minimum demands and will substitute steam for electricity as much as possible.

SHORT COAL RATIONS IN THE OHIO PLANTS

Effect of Coal Pooling Plan Noted at Toledo—Stations at Various Points Obligated to Curtail Service

While a little improvement in the coal situation in Ohio has been noted during the last week, it is still acute. There are hopes of a better supply through the government control of railroads and the coal pools established in the State recently. In Toledo the effect of the pooling plan has been noted already, but sufficient time has not elapsed for a material change at other points.

The Springfield Light, Heat & Power Company on Dec. 28 had a supply of coal that would last until Jan. 1. Some large factories announced that they would have to close at the end of last week if supplies were not secured.

Chillicothe reports indicate that the light and power station has not had more than one car of coal at a time for several days. Domestic coal is very short and some suffering is reported.

The Northern Ohio Traction & Light Company, Akron, on Dec. 28 had a three-day supply of coal, with slight prospects of securing more in time to prevent inconvenience. This company has exerted itself continually to buy coal wherever it could be had.

At Bowling Green the light station had only a small supply at the end of the week, and there was a possibility that energy would have to be discontinued at several factories.

For more than ten days the Ohio Utilities Company has discontinued service to power users at Delaware at 4.30 p.m. to save coal. It is said that coal receipts do not amount to more than half the needs.

The Findlay coal supply has been so short that light service was threatened several times in order that en-

ergy might be used to keep interurban cars in operation.

Difficulty has been encountered by the Ohio Electric Railway in securing fuel for its Lima plant, from which light and power service is furnished. Several streets and many residences have been in darkness as a consequence.

Only a few days' supply was reported at the municipal light plant in Wapakoneta the latter part of the week. The municipal plant at Lebanon is running only from 4 to 9 p.m., because of serious shortage.

The Cleveland Electric Illuminating Company and the municipal plant in Cleveland have supplies which will probably tide them over until further shipments are received.

While conditions at Columbus are serious, the Columbus Railway, Power & Light Company has a supply that will last until conditions clear up somewhat, it is believed.

Most interurban railways entering Cleveland either have suspended limited train service or will do so to conserve coal, as requested by the government.

COAL SITUATION IN KANSAS AND MISSOURI

Agreement Regarding Confiscation for Railroad Use—Cantonment Authorities Ask a Thirty-Day Surplus Supply of Coal

For the first time since the fuel administrators have had charge of the coal distribution in Kansas and Missouri there was reached on Dec. 22 a definite agreement between railroads, administrators and mine operators on the confiscation of coal for railways. It was agreed that where roads have to confiscate fuel it shall not be from the priority orders which are the emergency shipments from mines.

The situation in and around Kansas City is unique in that the Southwestern Coal Operators' Association is intrusted with the distribution of coal for the government, being first furnished with emergency orders by the administrators, who make a daily canvass through their county chairmen in the two states. In towns where dealers have coal it is ruled that no emergency exists.

Until recently some railways had confiscated coal for their own use from emergency orders. This has been stopped and all confiscated coal will be taken hereafter from other sources if railways find themselves short.

A new phase of the situation in Kansas and Missouri is that pertaining to the amount of surplus coal allowed various industries, including the government army cantonment at Camp Funston, Kan. Cantonment officers ask a thirty-day surplus, which, the Southwestern Coal Operators' Association believes, is far more than necessary and the cause of a great deal of suffering in many Kansas and Missouri towns and cities.

Priority orders give the cantonment preference, operators say, so there would be no danger of shortage there. But demand for a thirty-day surplus has called for much of the available railroad service and coal.

The operators in Kansas and Missouri, comprising the executive force carrying out the wishes of the fuel administrators, have enlisted aid of the administrators in trying to reduce the army's figures as to surplus. If they do not succeed they expect to appeal.

to Washington. Railroads leading from mining territories agreed to cut down their surplus demands.

Fuel conditions in the Southwest, which have been acute for several weeks, improved slightly in the last few days of December.

The opinion of electrical men and coal dealers in Kansas City is that the Fuel Administration "lightless night" order will be more successful if more stringent regulations are brought to bear upon the average citizen, who does not realize the importance of conservation. Companies using electric signs have been the first to observe fully the two lightless nights a week in Kansas City. They and the larger users of energy have co-operated fully with the Fuel Administration. Various small storekeepers, however, have not given full co-operation, and small users are not considering themselves as a part of the movement to conserve fuel.

It is estimated that the "lightless" nights have saved the Kansas City Light & Power Company 150 tons of coal per week. With a proper show of patriotism on the part of the public, the officials of this company say, the present arrangement will be sufficient. Otherwise more drastic action may be required by the administration to make the order successful.

ELECTRIC VEHICLE GROWTH UNDER THE CONDITIONS OF WAR

Steady Increase in Installations of Different Classes
in This Country and in Europe—
War Handicaps

BY A. JACKSON MARSHALL

Secretary Electric Vehicle Section, N. E. L. A.

Along with other resources, the electric vehicle has been drafted to do its part in "making the world safe for democracy." It has been estimated that approximately \$36,000,000 was invested in electric commercial vehicles at the end of the year 1916.

Where England had but 150 electric trucks a little over three years ago, to-day about 1000 are in operation and many more are on order. Were it not for lack of transportation facilities these figures would be considerably greater.

While the success of the electric commercial vehicle has been marked, the success of the little electric industrial truck has been even more so. Likewise in England we find a greatly increased use of electric passenger cars.

In Norway and Sweden vast electric vehicle developments are pending and already large installations have been made which are operating in a most satisfactory manner. Were it possible to freely obtain export permits and shipping facilities to these countries, great quantities of electric vehicles of all types would be purchased and installed.

In Italy the electric vehicle has more recently been recognized somewhat and plans are now being perfected whereby the electric power generated by waterfalls will be utilized extensively in supplying the propelling force for large numbers of electric vehicles.

In far-away Australia and New Zealand, in South Africa, Japan, Mexico, South America, Denmark, France, and, in fact, all over the world, electric vehicles are now being exported in increasing numbers.

In addition to this foreign business, existent and prospective, there is the constantly growing domestic

demand, which gives promise of even greater increases.

It is believed that even although we are confronted with unprecedented conditions which momentarily will throw out of balance usual modes of activity, the future holds vast possibilities for motor transportation and consequently the motor car industry will enjoy a success which will dwarf its present Aladdin-like growth. In this success the public will generously participate because of the improvements and economies which undoubtedly will be effected through the efficient mode of transportation which will come into being, and those concerns and individuals depending more or less on transportation for the success of their business would do well to promptly make plans to enjoy all the advantages which result from properly installed motor equipment. It would not be amiss to suggest that purchases of motor equipment be arranged for at the earliest time possible, for with the abnormal demands on motor manufacturing facilities, the demand will rapidly outstrip the supply.

WITHDRAWAL OF LAND USED FOR TRANSMISSION LINES

Department of the Interior Adopts the Policy of
Withdrawing Land Needed for Transmission
Line Right-of-Way

The Department of the Interior has made the following announcement:

In the Western States permits for the use of water-power sites and for rights of way for electrical power transmission lines are issued by the Secretary of the Interior under acts of Congress which provide for the occupation and use of lands by power companies. If, for instance, a permit were issued for a right-of-way over public lands and these lands were afterward taken up under the homestead law, a renewal of the permit could not be granted by the government, since the land would have passed into private ownership. In such a case a power company, after once having been granted a right-of-way from the government, would be compelled to obtain a renewal from all the individual landowners into whose possession the land had passed. The governmental policy has therefore been adopted of withdrawing land covering the right-of-way needed for a transmission line in order that this narrow strip of land affected may be permanently retained in government ownership. This leaves with the federal government full power to deal with permits for power-transmission lines.

CONTRACTORS' NEW PLAN TO BE MADE EFFECTIVE

Meeting of Executive Committee of National Association of Electrical Contractors and Dealers
to Be in St. Louis on Jan. 22

A meeting of the executive committee of the National Association of Electrical Contractors and Dealers will be held in St. Louis on Jan. 22 to effect permanent organization under the new constitution. The new plan of organization and the broad constitution which make it effective were prepared by a committee consisting of James R. Strong, William L. Goodwin and Earnest McCleary and were adopted at the annual convention of the association in New Orleans last October. Following the action of individual states in adopting the new constitution the St. Louis meeting will represent the official end of the old constitution and organization and the beginning of the new.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Annual Meeting Held at Pittsburgh—Papers of Interest to Electrical Engineers Presented at the Third Session

The annual meeting of the American Association for the Advancement of Science was held at Pittsburgh on Dec. 27 to Jan. 2. The sessions were held in the various buildings of the Carnegie Institute of Technology and the University of Pittsburgh.

In the engineering section the first meeting was devoted chiefly to good roads, pavements, transportation by motor trucks, and similar matters. The second session was on chemical engineering and on educational problems. The third and the last session was of miscellaneous character. Among the papers were: "Measuring Telephone Transmission," R. L. Snyder, plant engineer Central District Telephone Company, Pittsburgh; "The Electrical Safety Work of the Bureau of Standards," M. G. Lloyd, associate electrical engineer Bureau of Standards, Washington; "Higher Harmonics in Polyphase Electric Systems," V. Karapetoff, professor of electrical engineering, Cornell University, Ithaca, N. Y.; "Absorption in Paraffined Paper Condensers," L. Pyle, Washington University, St. Louis; "An Interesting Case of Resonance in an Alternating-Current Circuit," H. K. Dodge, the State University of Iowa; "On Electromagnetic Induction and Relative Motion," S. J. Barnett, Ohio State University; "Eddy-Current and Hysteresis Losses in Iron at High Frequencies," C. Nusbaum, Harvard University; "Influence of a Series Spark on the Direct-Current Corona," S. F. Crooker, University of Illinois. The paper by Mr. Snyder was a symposium of problems which a telephone engineer has to solve in achieving a satisfactory transmission of speech. Mr. Lloyd's paper was an explanation of the National Electrical Safety Code published recently by the Bureau of Standards. He outlined the history of the undertaking and mentioned the various interests that had to be reconciled. The code has no legal force, but has been adopted or recommended by many state and municipal authorities, and by a few branches of the federal government. Professor Karapetoff's paper was an extension of the well-known properties of higher harmonics in a three-phase system to a symmetrical m -phase system. He showed the conditions under which an oscillating neutral may be formed in such a system, or a partial short-circuit created in a mesh-connected m -phase winding. He described the formation of traveling mmf. waves along the air-gap of an m -phase machine and finally deduced the condition under which an m -phase winding may have the N -th harmonic in space due to the n -th harmonic of the current.

The physics section held several meetings together with the American Physical Society.

The discussion on Dec. 29 was devoted to "The Relationship of Physics to the War." The speakers included Lieut. G. P. Thomson (son of Sir J. J. Thomson) and Lieut. Giorgio Abetti of the Italian mission, who gave valuable information on the organization of European scientists for war purposes. The vice-presidential address was given by Prof. Henry A. Bumstead of Yale University on the "Present Tendencies in Theoretical Physics."

The American Metric Association also met.

SECRETARY DANIELS PRAISES NAVAL CONSULTING BOARD

Loyal Sacrifice of Civilian Body Stimulates Interest in War Problems and Leads to Valuable Results

Secretary of the Navy Daniels pays a tribute to the effective work of the Naval Consulting Board in his annual report, sent to Congress recently. He says:

During the year the work of this board, organized and approved by Congress in 1915, has increased very materially in importance and volume, its meetings have been frequent, and the work of its individual members has been such in some cases as to occupy almost their entire time in the service of the government.

Some time before the active entry of this country into war the board called a special meeting to which were invited some fifty of the leading scientists and industrial managers, whose special study fitted them to advise on the methods of meeting the submarine problem. Plans were immediately made to investigate every field to develop a means of preventing destruction of vessels and of defeating the U-boat. The investigation was divided according to the experience of the different members and associated scientists, and with the co-operation and valuable assistance of the various manufacturing companies interested a highly developed system of team work has been attained and results have been accomplished not dreamed of at the beginning of the war.

The services of the board were offered to the Council of National Defense and accepted by that body for the investigation of all inventions submitted. Its services were also accepted by the War Department in an advisory capacity.

Valuable assistance has been rendered merchant shipping by the board's activities. Through its initiative, counsel and work the United States Shipping Board formed its ship-protection committee, taking over the study of the protection of merchant ships, and to this committee was detailed one of the consulting board's most experienced members qualified in shipbuilding and with sea experience. In this field the board's work has resulted in materially reducing the shipping risk, with a consequent lowering of marine insurance rates.

Not the least result of its work has been the stimulation of interest throughout the country in the problems brought up by the war by the general invitation to submit ideas for investigation. Early in the calendar year 1917 this interest manifested itself in the receipt of thousands of ideas weekly, and to care for this the department's connecting office has been greatly enlarged, the office of the board in New York has been organized on a working basis with a large force, and the whole movement has received the approval and hearty assistance of the great national engineering societies. The president of the board, Thomas A. Edison, has been giving his entire time to the work of the board in the service of his country, and has called to his assistance a capable staff who are working diligently upon naval problems.

With war conditions increasing the need for labor and building materials, it was believed to be a wise policy to defer for a time the building of the new experimental and research laboratory. Such experiments as have been warranted have been made in private laboratories generously offered and at the Bureau of Standards. The need for this establishment, however, is more clearly shown than ever, and its support is urgently advised.

The valuable results obtained by the work of this board are of too confidential a nature to make them the subject of a public document. The members have given freely of their time and scientific ability to the service of the nation and have earned the gratitude of all who know their unselfish and patriotic service. I wish to express my sense of obligation for the cheerful co-operation, wise counsel, loyal devotion and personal sacrifice which have characterized the membership of the board of distinguished civilians who responded, long before war was declared, to the selective draft with all the enthusiasm and efficiency of youthful volunteers.

Arkansas Light & Power Company's New Office.—The general office of the Arkansas Light & Power Company is now in Pine Bluff, Ark.

Max Thelen on Public Utility Problems.—Max Thelen, president California Railroad Commission, has inaugurated the University of California extension course on public utility problems. This university extension course is open to all and is directed especially to lawyers, bankers, officials and employees of public utilities, city and county officials and others particularly interested in problems of regulation of public service corporations and in the way in which they are being worked out by the commissions.

Adirondack Power Consolidation Plan.—A new plan has been issued for consolidation of the properties of the Adirondack Electric Power Corporation, Schenectady Illuminating Company, Mohawk Gas Company, Schenectady Power Company, East Creek Electric Light & Power Company and Edison Electric Light & Power Company of Amsterdam. It is a substitute for the plan dated Jan. 27, 1917, and is subject to approval by the New York Public Service Commission, Second District. If not consummated during 1918, depositors will have the right to withdraw their stock on or after Dec. 31, 1918. If the unification is completed there would be outstanding \$11,500,000 of 5 per cent bonds, \$4,300,000 of 6 per cent preferred stock, and \$9,500,000 common stock. For the year ended Oct. 31, 1917, adequate gross earnings for the combined group were \$3,399,734, and net earnings \$1,113,611. Directors unanimously approve the plan, and urge stockholders to deposit their stock with the New England Trust Company, Boston.

Lighting in St. Joseph, Mo.—A proposition of the St. Joseph (Mo.) Railway, Light, Heat & Power Company to furnish energy for the entire street-lighting system of St. Joseph at the rate of 1½ cents per kilowatt-hour for the arc lights and the boulevard lights and \$37.50 a standard for the "white way" was made to the City Council recently. A suggestion that the company take over only the "white way" and the boulevard system at the figures offered was declined by J. H. Van Brunt and H. C. Porter, representing the company, who said that they could not make such a price for so small a contract. The prices offered, they said, could be made only in case the company received the contract to light the entire city. The company offers to bind itself to the contract for ten years but to allow the city to terminate the contract at any time on six months' notice and the purchase of the equipment actually in use. The company figures that the saving in the matter of arc lights would be about \$10,000, while another saving would be effected by the free use of the company poles in the extensions that might be made for additional lights. The expense of equipment for the boulevards alone would cost \$10,000, and equipment for all the street lighting would cost \$20,000.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Opportunities to Serve the Nation.—The army and navy staff departments continue to demand men of engineering experience, especially in industrial lines. At present the outlook is that this demand will continue throughout the period of the war. In calling attention to this the United States Public Service Reserve, Washington (where records of men willing to serve when called will be kept on file), points out that a man of engineering experience has a rare combination of opportunities open to him which are not open to the average patriotic American, as follows: (1) To serve the country in his most effective capacity; (2) to keep in touch with his own profession, with the result that his patriotic service will not have caused him to become rusty by the time peace returns; (3) to become a commissioned officer and receive much better pay than the average man who has wholly subordinated personal interests, and now works for the national good; (4) to perform his service usually in America.

Free Class for Radio Operators at Stevens Institute.—A free evening class to train men as radio operators for the Signal Corps will be started soon by the Stevens Institute of Technology, Hoboken, N. J. Those who actually expect to be called to the colors will be admitted if prompt application is made to Prof. L. A. Hazeltine, head of the department of electrical engineering, under whose supervision the course will be conducted. The definite object of the course, which will require four evenings weekly, is to develop radio or buzzer operators to send a minimum of twenty words per minute. Upon finishing the course, which requires about 200 hours, less for some and more for others, a certificate of attainment will be given. The course is offered specifically for those who desire to enter a cantonment trained and ready to do a specific job. Washington authorities state that "drafted men who attain the required proficiency are practically certain of rapid promotion and increased pay in the army. The rank of corporal and sergeant, with \$36 to \$51 a month, awaits the majority of men thus trained, and in proportion as a man so instructed shows his ability and interest promotion lies ahead of him to the position of master signal electrician, with \$81 a month."

Another Engineer Regiment to Be Organized.—The co-operation of the American Institute of Electrical Engineers has been requested in the organization of the Thirty-seventh Engineers (electrical mechanical). This regiment will be organized at Fort Myer, Va., for electrical installation, operation and

maintenance in France. The officers for the regiment are available from the roster of the Engineer Reserve Corps. The classifications which it is desired to include in the enlisted personnel of the regiment are stationary engineers, motor-truck drivers, electricians, cable splicers, linemen, expert test men, wiremen, armature winders, machinists, pipe fitters, carpenters, blacksmiths, handy men and cooks. The opportunity to try for promotion as non-commissioned officers will be afforded to every enlisted man, as the regiment will be entirely new. The organization will be military as far as training, drills, discipline, etc., is concerned, as it is found that the health and efficiency of the men is in this way most readily maintained. Persons desiring to join the Thirty-seventh Engineers should apply for forms to the commanding officer, Thirty-seventh Engineers, Room 195, War Department, Washington, D. C. No enlistments will be received except by authority of this officer. Men in the draft age but not yet called may also make application.

"Material Costs Have Reached Their Maximum."—In a statement to stockholders, President Hanson P. Lathrop of the American Light & Traction Company says: "Your company is still passing through a period of high operating costs—prevalent in all lines of business. It is felt, however, that material costs have reached their maximum. Recent purchases show recessions from the high point. The period of high material costs for this company began in the midwinter season of 1916-17, and when that period of comparison is reached it is confidently expected that the usual satisfactory increases in net earnings may again be looked for. The enormous increase in gross business is much the largest in the history of the company, and with one exception the net earnings for the twelve months ended Sept. 30, 1917, were larger than for any corresponding period. Some stockholders have felt considerable trepidation as to the effect of the taxes imposed by the war revenue bill. The increase in the normal tax and the so-called excess profits provision do not apply to your company, holding companies being exempt from these particular provisions. The subsidiary companies will all be subject to the increase in the normal tax, but only four will be subject to the excess profits tax. These taxes, however, have been, to a large extent, taken care of by anticipatory charges made during the current year. When considering the large increase in operating costs in connection with the decrease in net earnings, the conclusions are not wholly unfavorable, but speak well for the future, when operating costs are more nearly normal. For the twelve months ended Sept. 30, 1917, net earnings show a decrease of \$529,153, while increased material and labor cost for the year was: Coal and oil, \$607,700; labor, \$262,400; labor and material, total, \$870,100; taxes, \$553,300; total, \$1,423,400. The total increase in gross business of the subsidiary companies for the above period is \$2,077,300.



D. J. ANGUS

D. J. Angus, who recently purchased an interest in and associated himself with the Esterline Company of Indianapolis, Ind., as treasurer, takes the responsibility of the engineering department and of the design and development of new lines of instruments and apparatus. Prior to his acquiring an interest in the Esterline Company Mr. Angus was associated with J. W. Esterline in a large consulting engineering business which has been developed in the Middle West. Mr. Angus began his career as an engineer in the construction department of the Milwaukee Electric Railway & Light Company, later handling electric construction for the Wisconsin Telephone Company and also the Semet Solvay Process Company of Milwaukee. He spent the years 1906 and 1907 in special work and investigation at the University of Wisconsin, and for several years following he was identified with some of the large electrical developments in the States of Michigan and Wisconsin. In 1909 he again took up the study of special electrical subjects, this time at the engineering department of the Michigan Agricultural College. In 1910 he became associated with Mr. Esterline in consulting engineer practice embracing the design, construction and operation of power and industrial plants and the design and development of new equipment and processes. Although yet a comparatively young man, Mr. Angus has taken part in some of the pioneering work in the development of the industry. In 1909 he did original work in the testing of transmission-line insulators with high-frequency currents and designed and built commercial apparatus embodying the application of this method of testing. He was one of the early advocates of charging for demand on a measured kilovolt-ampere basis, and as early as 1911 he made a commercially successful application of this system of charging. Furthermore, he designed the world's largest electric meter for the Mississippi River Power Company at Keokuk.

Major John Coffee Hays, formerly president of the Mount Whitney Power Electric Company, Visalia, Cal., is in charge of the newly created utilities department at Camp Lewis, Wash.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Earl G. Burwell has resigned as salesman for the Colorado Springs Light, Heat & Power Company to become commercial manager of the Wyoming Electric Company at Casper, Wyo. Mr. Burwell, prior to his association with the Colorado Springs company, was cashier of the Birmingham Railway, Light & Power Company.

W. H. Frost has joined the engineering staff of the United Gas & Electric Engineering Corporation as assistant electrical engineer. For a number of years Mr. Frost has been a member of the engineering department of the New York Edison Company, where he has had supervision of the design and construction of new substations.

Capt. Edwin W. Moore, president of the Bare Wire Company and chief senior aide to Major-General John F. O'Ryan, commanding the Twenty-sev-



E. W. MOORE

enth Division, United States Army, has returned to Spartanburg, S. C., after having been in New York for some time in conference with the Major-General, who has just returned from France. Captain Moore has been identified with the wire and cable industry for a number of years and has been a prominent figure at trade and contractors' conventions.

Harry Engle, for a number of years connected with the electric-lighting business in Youngstown with various concerns, and until recently with the Youngstown Heating Company, is now with the Mahoning & Shenango Railway & Light Company in an executive capacity, it is announced, and has been associated with the company since Nov. 1. Mr. Engle was formerly associated with the Mahoning County Light Company as secretary.



G. L. KNIGHT

G. Laurence Knight, head of the engineering department of the Edison Electric Illuminating Company of Brooklyn, was elected president of the Brooklyn Engineers' Club at the annual meeting held on Dec. 20. Mr. Knight, who was born on Feb. 20, 1878, received his electrical engineering education at Drexel Institute, from which he was graduated in 1900. After graduation he entered the employ of the Philadelphia Electric Company as a switchboard operator, and in the following year he took a position as an electrical draftsman with the United States Navy. In 1902 he became mechanical draftsman for the New York Edison Company, resigning in the same year to become manager of the Walker Electric Company, which was engaged in the manufacture of switchboards. From 1903 to 1905 he was chief draftsman for the New York Edison Company at the Waterside station, and from 1905 to 1908 he occupied the same post with the Brooklyn Edison Company. He was appointed designing engineer for the Brooklyn company in 1908 and is now head of the engineering department. Besides being a fellow of the American Institute of Electrical Engineers, Mr. Knight has long been a member of the standards committee and the electrical apparatus committee of the N. E. L. A., and for the last two years he has been chairman of the latter committee.

Obituary

John Henry Goehst died Jan. 1. He was the oldest employee of the Commonwealth Edison Company in length of service, having been construction superintendent for many years. Mr. Goehst had been with the company and its predecessors since 1882. He was a pioneer in the electrical industry, having been associated in early days with Luther Steiringer, Ward Leonard and others. He was greatly interested in the early history of the industry, was chairman of the history committee of the Commonwealth Edison Company and held many positions of influence in the company. Mr. Goehst also was president of the Federal Sign System, Electric. He had been long ill.

New Mexico Electrical Association.—The next meeting of this association will be held at Silver City, N. M., Feb. 11-13.

Northern White Cedar Association.—The twenty second annual meeting of the Northern White Cedar Association will be held at the Hotel Radisson, Minneapolis, Minn., on Jan. 22 and 23. Norman E. Boucher of Minneapolis, Minn., is secretary of the association.

Philadelphia Section of the Association of Iron and Steel Electrical Engineers.—This section will hold a meeting on Jan. 5 (to-day), at which J. C. Reed and Merwyn J. Hocker, electrical engineers of the Bethlehem Steel Company, will present and illustrate a paper on "Electrically Operated Bridges."

Officers' Electrical Section, W. S. E.—The nominating committee of the Electrical Section of the Western Society of Engineers has selected the following ticket for officers for the ensuing year: Chairman, E. N. Lake; vice-chairman, James A. Cravath; executive committee, Charles H. Norwood and Ernest Lunn.

Institute of Radio Engineers.—A meeting of the Institute of Radio Engineers was held Jan. 2, in the Engineering Societies Building, New York City. At this meeting Dr. Albert W. Hull of the General Electric Company presented a paper on the dynatron, an extension of the hot-cathode electron relay.

Pittsburgh Societies to Hold Joint Meeting.—The Pittsburgh Section of the Association of Iron and Steel Electrical Engineers will hold a joint meeting with the American Institute of Electrical Engineers in January. Papers will be presented on the generation, distribution and consumption of power as well as on power-factor correction.

The Engineering Society of York.—At the annual meeting of the Engineering Society of York, Pa., held recently, the following officers were elected for the ensuing year: President, James Rudisill; vice-president, Chauncey D. Bond; secretary, M. Haller Frey, Polack Building; treasurer, Harold A. Russell. The directors are George A. Jessop, Charles L. Berger and Howard J. Longnecker.

Three Hundred and Thirty-sixth Institute Meeting in Boston, New York and Chicago.—The three hundred and thirty-sixth meeting of the American Institute of Electrical Engineers will be an intersectional meeting held in Boston Jan. 8, New York Jan. 11 and Chicago Jan. 14. The same paper will be presented and discussed at the three places. This paper is entitled "Effects of War Conditions on the Cost and Quality of Electric Service." It is by Lynn S. Goodman and William B. Jackson, and is given under the auspices of the committee on economics of electric service. The paper will be presented at the New York meeting by Mr. Goodman and at the Boston and Chicago meetings by Mr. Jackson. Non-members of the Institute who are interested in this subject are cordially invited to attend and take part in the meeting.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 79 of this number.

Future Section Meetings of the A. I. E. E.—The following A. I. E. E. section meetings are scheduled for January: Ithaca, Jan. 18, "Modern Transmission Line Practice"; Lynn, Jan. 9, "Steel Foundry Practice"; Philadelphia, Jan. 14, "Specifications Covering the Construction at Crossings or Overhead Lines of Public Utilities"; Pittsfield, Jan. 17, "Motor Drive in Textile Mills," S. B. Paine; Portland, Jan. 8, "Powdered Coal for Fuel"; Feb. 8, "Electric Smelting of Iron"; San Francisco, Jan. 25, "Corona at High Altitude"; St. Louis, Jan. 23, "Electrical Equipment of New Post-Despatch Building."

St. Louis Jovian League Holds Christmas Feature Meeting.—The St. Louis Jovian League held a very interesting meeting at the American Annex Hotel Tuesday, Dec. 18, in which women relatives and friends of the members participated. As it was the last meeting of the year, it was designated a "Christmas feature meeting." George Platt Knox, assistant superintendent of public schools, was the speaker of the occasion and delivered a lecture, illustrated with slide pictures, entitled "Jerusalem to Bethlehem." The meeting was under the auspices of the Allis-Chalmers Manufacturing Company and was presided over by C. L. Orth, district manager of the company, assisted by Herman Spoehrer, treasurer of the Union Electric Light & Power Company. Among the guests present were Mr. and Mrs. Leonard Matthews, father and mother of Past Jupiter W. N. Matthews, president of the league.

December Meeting of Kansas City Jovians.—The Jovian Electric League of Kansas City held its second successful monthly meeting of the season at the Muehlebach Hotel, Dec. 21, with sixty in attendance. A service flag, with eleven stars, was presented by E. L. Foutch. The honor roll contains the names of P. J. Kealy, president of the Kansas City Railways Company, and K. D. Klemm, president of the Kansas City, Kaw Valley & Western Railway, the former a colonel of infantry, the latter a colonel of artillery. W. S. Woodland, formerly in charge of safety work for the railways company, received a commission at Fort Sheridan as lieutenant of aviation. The other Jovians on the roll are Charles R. Born, R. P. Bailey, R. H. Cowdry, Jr., F. W. Gary, A. E. Herzberg, W. E. Saylor, C. H. Taylor and L. H. Shoemaker. Captain R. W. Simmie, formerly at the front, now in charge of British recruiting at Kansas City, spoke at the luncheon. Major Norton and Lieutenant Robinson of the Engineers' Corps, Fort Leavenworth, were among the guests.

Annual Meeting of the American Metric Association.—The annual meeting of the American Metric Association was held at Pittsburgh Dec. 28 and 29. Most of the sessions were held at the University of Pittsburgh, the first two sessions in conjunction with the social and economic sections of the American Association for the Advancement of Science. The association is working for the most effective co-operation between the United States government and our allies. At this time, when the army and navy are making extensive and increasing use of the metric weights and measures, comes the desire on the part of those in the service to familiarize themselves with the best and most effective methods of applying these units to their particular work.

Relation of Science and Engineering to the War.—The extent to which men of pure science and men of applied science have aided the United States in prosecuting the war was told at length in a paper presented by Prof. Harvey Lemon of Chicago for Major R. A. Milliken, executive officer of the National Research Council, Washington, D. C., before a joint meeting of the electrical organizations of Chicago, Dec. 27. Major Milliken was prevented from delivering the paper himself by an imperative recall to Washington. The author expressed the opinion that the scientist engaged in what is only indirect war work is just as useful and as heroic as the one who is engaged directly in war service. He emphasized the point that it is foolish for engineers and scientists to flock to Washington to learn what they can do to aid the government. Lists of experts in all lines are available at Washington, and when men are needed they are requested to take up the work. Those who are still in civil life should continue to prosecute their work as efficiently as possible. Comments on the direct contribution of science to the war brought out that many problems have already been solved. Advancement has been made in submarine detection. Methods of locating guns by means of sound waves are now so accurate that guns within a radius of 5 miles (8 km.) can be located within 50 ft. (15.2 m.). In a recent battle no less than sixty German guns were located and destroyed through the use of this system. Scientists of the United States have made large strides in gas offense and defense. The scientific mission from abroad advanced the United States a full two months in its scientific war preparations. What is true of the realm of pure science is also true of applied science and engineering. Here also a large contribution has been made. Major Milliken gave quite a complete review of the organization and the eminent personnel of the National Research Council. He also stated that its aim was to give American science an opportunity to assist in winning the war. In closing the author expressed the fervent hope that the work of scientists and engineers in the war would fill the chasm which has been allowed to deepen between physics and engineering. The future of America is linked with science.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Review of Coal Costs.—In the decision of the New Jersey Board of Public Utility Commissioners on the application of the Bridgeton Electric Company to increase rates, mentioned previously in the *ELECTRICAL WORLD*, the testimony showing the following costs of coal at the power station was reviewed: 1904, \$3.40; 1905, \$3.42; 1906, \$3.29; 1907, \$3.32; 1908, \$3.37; 1909, \$3.45; 1910, \$3.30; 1911, \$3.31; 1912, \$3.35; 1913, \$3.33; 1914, \$3.60; 1915, \$3.53; 1916, \$3.70. Reviewing the testimony on coal costs, the commission said: "It was testified that contracts had been made for the supply of coal to Bridgeton, but that no coal had been received under such contracts for some time past, and the prices paid have varied considerably. The average price at the mine for the coal sent to Bridgeton in the first five months of 1917 was \$5.16. In addition to the higher price for coal, the cost of delivering this coal at Bridgeton from the mine, including the delivery in power plant, was \$2.05. During May, 1917, the price paid for coal was \$6.25 at the mine, plus \$2.05 for freight and delivery. The last price, paid about three weeks prior to the date of the hearing, was \$5.65 plus cost of freight and delivery. The increase in the cost of coal results in a material increase in the total cost of furnishing electric service, and might result eventually in a deterioration in the character of service. The testimony submitted at the hearing showed that no more than a fair return was being obtained on the invested capital of the electric service company."

Indiana Fixes Electric Service Standards.—The Indiana Public Service Commission has adopted new standards for electric utilities. They were worked out after many conferences held by Harry O. Garman, chief engineer of the commission, following action by the commission authorizing uniform standards for electric utilities. The standards have to do with records and reports, meters, meter-testing equipment and facilities, meter accuracy, information for consumers, adjustment of bills for meter error, incandescent lighting, deposits by customers, operation and maintenance, standard frequency, standard voltage and permissible voltage variation, voltage surveys and records, interruptions of service, station instruments, station records, accidents, grounding of low-potential circuits, extension of lines, pole identification and many other topics. Conferences with J. Franklin Meyer, associate physicist of the United States Bureau of Standards, and frequent reference to similar standards and similar work of such

commissions as those in New York, New Jersey, Illinois, Wisconsin, California and Kansas, were held before the engineering staff of the Indiana commission was ready to submit the proposed standards to the managers of private and municipal utilities in Indiana for suggestions from them. The purpose is to provide uniform service and to give the small utility the advantage of big utility practice wherever possible. "The big utilities do not need such standardization to such an extent as the smaller plants," said Mr. Garman. "Under these new standards a consumer may know when he is getting good service and the utility managers may know when the utility is delivering good service."

Sale of Property.—In a decision on the application of the Marianna Light, Heat & Power Company for approval of the transfer of its property and franchise rights to the Union Coal & Coke Company the Pennsylvania Public Service Commission holds that where a light, heat and power company purchased its power from a company which subsequently went into the hands of receivers and where by a receivers' sale all possibility of securing power from said company ceased the commission, with much reluctance, will permit the light, heat and power company to sell its facilities to the purchaser of the property which was sold at the receivers' sale.

Requirement of Extensions.—The Pennsylvania Public Service Commission in deciding the complaint of Fred Palmer-Poroner vs. the Consumers' Gas Company of Reading concludes that a utility cannot under all circumstances refuse to make an extension of its service until the same becomes compensatory. A public utility engaged in the business of the respondent is required to furnish service in all parts of the municipality in which it is operating whenever a reasonable demand or prospect for such service is shown to exist. The service cannot be restricted to sections or neighborhoods from which the larger returns will flow, but must also be extended to localities where the business will not be immediately profitable or perhaps even self-sustaining until a later period in the growth and development of the community. Where circumstances so shaped the development of the utility's business that small central blocks or areas containing desirable homes and sites, particularly in a large city, have been supplied with service, it is only a matter of simple justice that the residents on any such block, if they so desire, should be accorded the same privileges and conveniences that their neighbors in adjacent streets are permitted to enjoy. But where there is no demand for service from the residents themselves, and there is no prospect of securing at present more than six small consumers who will use gas for fuel during the summer only, the commission will not compel the gas company to install a new gas main 580 ft. in length at a cost of approximately \$800 until it can be shown by evidence that the persons who are directly affected desire the service.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Power of Commission to Authorize Securities.—By law a public utility has the right to issue whatever bonds and stock may be necessary to carry out corporate powers, acquire property, construct and extend facilities and maintain and improve service, and the Public Utilities Commission has no general discretion to refuse to certify such securities, the Supreme Court of Kansas held (167 P. 1138). The Public Utilities Commission has full power to ascertain the truth of all statements made by a public utility in its application for a certificate validating a bond and stock issue, including the required statement that the capital stock to be secured is necessary for a specified statutory purpose and will be used therefor. The word "necessary" as used in the statute means needful under all the conditions attending the enterprise. The Public Utilities Commission has authority to require proof of need for the issuance of bonds and stock beyond the proof afforded by the verified application.

Right to Operate Under Terms of Charter.—Where an electric light and power company received a charter authorizing it to maintain and operate its plant and dispose of energy, providing that it could not exercise any of its powers within the limits of any town, village or city without the consent of the local authorities, the company could not, under a private grant, provide street-lighting service and supply energy for private consumption in a town without consent of the town board, it was held by the Supreme Court, Appellate Division, of New York (167 N. Y. S. 486) in *Oneonta Light & Power Company vs. the Public Service Commission*, Second District. Although an electric light and power company had a private grant of way to construct its lines, the Public Service Commission, under the section of the Public Service Commissions law requiring the consent of the commission to construction work, had the power to supervise the construction of its lines. The Legislature has the power to prescribe the conditions upon which a corporation of the State may operate. In view of the Public Service Commissions law defining the term "electric plant" to include all realty, fixtures and personalty used in connection with generation, transmission, distribution or sale of electricity for light, heat or power, an electric company attempting under private grant to dispose of energy to private consumers is "beginning construction of an electric plant" within the law giving the commission authority to supervise construction.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

ELECTRICAL TRADE SHOWS STRENGTH IN FIRST WAR YEAR

Review of Conditions Affecting Production, Distribution and Sale of Electrical Products
During 1917

STARTING with a heritage from 1916 of a quarter of a billion dollars of unfilled orders, the electrical manufacturing industry in 1917 far exceeded the record set in 1916 both in billings and bookings. Although the country was engaged in war nine out of the twelve months of the year, the industry has shown on the whole no diminution of output but rather a very considerable increase. Careful and conservative estimates place the 1917 billings of electrical manufacturers in the near neighborhood of \$750,000,000, while unfilled orders at the close of the year were certainly not less than \$300,000,000. Thus the 1917 electrical manufacturing industry can be said to have passed the billion-dollar mark.

EVIDENCES OF BETTER BUSINESS POLICIES

In 1916 the electrical trade, experiencing its first real sellers' market, was for the most part at a loss as to just what to do. There was no precedent—no guide to follow. However, as every one became more accustomed to prevailing conditions a more staple state of affairs emerged. Consequently in the year just closed the industry grasped the opportunity to straighten out many tangles of sales custom, distribution and production. The natural result has been that the industry has closed the year with a better state of competition existing.

Many old practices, including that of protective orders and of price-increase announcements, have seen the beginning of the end. Closer thought has been given to the matter of credits and collections than ever before. The old question of the cash discount has been under fire considerably and, while not settled, is better understood. Besides, there has been an unmistakable tendency among manufacturers in the last half year to hold customers strictly to the "spirit of the law" in discounting bills. Charging interest on past-due accounts has been urged but is not meeting as yet with much enthusiasm.

Trade acceptances are in greater evidence in the trade, and there is a decided movement, particularly among jobbers, to institute a more general use of this credit system.

As a further evidence of a tendency toward better merchandising in the trade, there has been noticed throughout the year a marked desire, particularly on the part of the jobber, to help the retailer become a better business man. The credit men have gone on record as favoring the use of a simple accounting system for the retailer. A system of balanced stocks has been suggested. More helpful attention is being given to the "moral-risk" customer. Greater study has been given to the subject of dealer helps. In all there has been more real action in elevating the retailer than ever before.

Besides, the jobber has been cleaning house of poor business methods. The jobber is paying more attention to business and is not so quick to take trade without a fair and reasonable profit. There has been less price cutting during the past year than ever before. Buying has been more careful and less speculation has been in evidence.

UPWARD TENDENCY OF PRICES

Prices, except for raw materials, had an upward tendency throughout the year, but not to such a marked degree as in 1916. Heating appliances advanced every few months.

Glass and porcelain products increased, as did many other staples. As the year closed announcement was made of the first increase in the price of incandescent lamps. On the other hand, certain products, including wire, were lower in price as the year came to a close. In May, for the first time in the history of the industry, the ELECTRICAL WORLD started publishing current market prices, and it has continued this work weekly ever since.

METAL PRICES LOWER

In the raw-materials market the government price-fixing program, which found expression in September in lowering the price of copper and steel products, has been the dominating factor. Metal prices, except for tin and nickel, were much lower in December than in January. Following is a comparison of metal prices in New York during the first and last weeks of the year:

	Jan. 3			Dec. 24		
	£	s	d	£	s	d
Copper:						
London, standard spot....	133	10	0	110	0	0
Prime Lake	29.00	to	29.50*	Govt. price	23.50	
Electrolytic	28.00	to	29.00*	Govt. price	23.50	
Casting	27.00	to	28.00*	Govt. price	23.50	
Wire base	36.00	to	38.00		27.00*	
Lead, trust price			7.50		6.25	
Nickel, ingot			50.00		50.00	
Sheet zinc, f.o.b. smelter....			21.00		19.00	
Spelter, spot	9.67½	to	9.92½		7.67½	
Tin, Straits	42.75*				85.00†	
Aluminum, 98 to 99 per cent.	55.00	to	58.00*	34.00	to	36.00
Heavy copper and wire	24.00	to	25.00*	22.00	to	22.50
Brass, heavy	14.50	to	15.50*	14.00	to	15.00
Brass, light	10.50	to	11.00*	9.50	to	10.50
Lead, heavy	6.50	to	6.62½*	5.75	to	5.87½
Zinc, old scrap	6.00	to	6.25*	5.00	to	5.50

*Nominal. †None offering.

While business in electrical goods both by manufacturers and wholesale distributors was larger in 1917 than ever before, it was of a very different nature than is the case in normal times. In the past utilities, electric street railway and telephone, and building construction had been the principal markets. To-day the government and industry control the situation. Because of their inability to borrow money except at prohibitive rates utilities have almost entirely withdrawn from the market. In fact, in some instances cancellations of undelivered orders are being requested. Except for factory building, there has been a very heavy curtailment of new construction. Hotels, churches, office buildings, apartment houses, etc., have wherever possible been held over until more satisfactory times. Contractors as a result have not been busy and fixture people have been experiencing a business far below normal.

There have been few new developments of products. Research laboratories have been kept busy largely on government work. There have been a number of modifications of equipment replacing expensive material with less expensive, such as steel guards for brass fans. Electric furnace development, however, has been very large and rapid and many new models were brought out during the year.

STANDARDIZATION PROGRESS

There was during the year considerable progress in standardization, particularly in appliances. About 90 per cent of the 1917 fan production had steel guards and were furnished with cord and plug. Toward the end of the year a standard length of cord—8 ft.—was decided upon. Four blades except in large sizes is now standard, and the old name "desk and bracket" has given way to "non-oscillating." Steps were taken during the year also to standardize appliance plugs. Besides, the committee on trade literature of the Associated Manufacturers of Elec-

trical Supplies has recommended the standard catalog size of 8 in. by 10½ in.

THE PROBLEM OF LABOR

Two of the greatest difficulties that the trade has had to contend with during the past year have been labor shortage and transportation congestion. Both have handicapped production and deliveries. In the electrical manufacturing industry there were fewer strikes and less serious ones than during 1916. Labor, however, was still roving. There was a serious shortage throughout the year in mechanics and similar skilled labor and in unskilled labor. Of the other large class of labor, however, statistics show a growing percentage of unemployed. After the war broke out the labor situation became worse. First, the army and navy took almost 10 per cent of the male labor in the electrical industry and second the government, through cantonment construction and the shipyards, put a severe strain on labor by offering an opportunity to earn the largest wages on record in the United States for that kind of labor. In addition, the female labor supply apparently became less. A large amount of female labor is employed in electrical manufacturing, and the scarcity has hampered production considerably. Higher wages were paid during the year and high-cost-of-living bonuses were given by manufacturers rather generally.

The only ray of hope in the labor market came in the winter months early in the year, when the closing of plants that had completed war contracts for Russia and other warring nations released large numbers of skilled workmen. The entrance of the United States into the war, however, made the demand for this kind of labor more acute than ever.

On Sept. 1 the child-labor law guarantee was demanded of dealers as well as manufacturers.

TRANSPORTATION DIFFICULTIES

Transportation congestion as the year opened was very bad, growing worse until the Eastern seaboard in March was in an almost hopeless condition. This was a great handicap to both buyers and sellers in deliveries already very long. Embargoes were placed on freight for export shipment and a lot of other material eastward bound. The lack of tonnage for export caused docks and warehouses to be filled to capacity, rendering the removal of goods still more difficult. During the summer months, however, the shortage in freight cars was decreased by about a third, but by September it was worse than ever. The transportation situation became still more serious until the government, feeling that private operation could not solve the problem, even with transportation priority orders, stepped in a few days prior to the end of the year and took over the control of all roads under Secretary McAdoo.

CONDITIONS IN LAMP MARKET

Demands for materials, as before stated, were particularly large. Lamp manufacturers for many months found it impossible to keep up with orders. Shortages developed in every section of the country, being particularly acute in the Far West and in New England. Every effort was made to cope with the situation, and by the late fall months the manufacturers advised the ELECTRICAL WORLD that they had just been able to lay in local stocks in most standard sizes but still were behind in miniatures. During the year central stations were placed on the agency plan for Mazda lamps. Under the licensing arrangement the importation of tungsten lamps became illegal.

FAN STOCKS AGAIN DEPLETED

Wholesale fan stocks were sold out earlier this year than ever before, and as in 1916 the season closed with the market practically void of every kind of fan stock. The great hot wave in the first week in August ate up almost all fans available.

Although prices advanced at regular intervals during the year on heating appliances, the output established a new record. In some instances manufacturers announced the increases prior to their going into effect, with the result that buying was greatly stimulated. In November the merger of the Hotpoint, Hughes and General Electric domes-

tic heating appliance businesses into the Edison Electric Appliance Company was announced.

TURBINE PRODUCTION SOLD OUT EARLY

Turbine production for 1917 was early sold out, and by the first of June 1918 and 1919 production for larger sizes had been booked, with orders running to 1920. The largest single order on record, 200,000 kw. in turbines, was placed in May.

Transformers and motors in large sizes were particularly hard to obtain after the middle of the year. Production has been booked far ahead. In the early fall it was estimated by good authority that manufacturers were 150,000 motors behind orders.

The second-hand market flourished as never before during the year. High prices prevailed. Dealers found it very difficult to secure equipment. Much of this equipment was ordered only until such time as new goods could be delivered. In this way some machines were sold and resold many times during the year. The government frequently found the second-hand men to be very valuable when especially quick deliveries were needed.

WAR HEIGHTENS DEMANDS FOR MANY PRODUCTS

The declaration in the first week in April of the existence of a state of war opened a large demand for many electrical products. The sale of floodlamps for protective purposes increased in a few weeks 500 per cent. This demand, however, was soon satisfied and sales then dropped off. Flash-lamp manufacturers were soon swamped with orders owing to the military and export demand.

The need for greater production and for efficiency in labor and saving in time brought unparalleled sales of electric industrial trucks. Manufacturers are working at capacity production and are booked many months ahead.

Furthermore, the direct government demand for cantonments and shipyards was large and, besides, it was almost entirely for immediate shipment. For a time it looked as though the government buying would entirely disarrange the manufacturing of the country, but the producers quickly took steps to co-operate with the government in the matter of placing contracts. Committees of wire and other device manufacturers took the government orders and apportioned them among the different factories so that none were burdened more than others. As a result the government received a better price and better deliveries and the industry was upset as little as possible.

In order that the government and factories working on government contracts might obtain electrical goods as quickly as possible the priority plan was introduced. This worked all right for a while, but in the late fall it became evident that the amount of priority orders was fast approaching the entire production. Steps, however, have been taken to remedy this and to make sure that only bona-fide "war" orders receive priority.

EXPORTS OVER \$50,000,000

Exports increased considerably during the year up to the fall months. In March electrical exports for the first time passed the five-million-dollar mark. For the fiscal year closed June 30, 1917, exports were \$52,158,773. Owing to the falling off in the last few months of the year it is very doubtful if the exports for the calendar year 1917 surpassed the above figure. Foreign demand was larger than could be handled. An interesting sidelight is the growing export demand for electric heating and cooking appliances brought about by the high price of coal abroad.

Collections were in general particularly high during the year. January and February collections set new high records. The entrance of the United States into the war, however, caused accounts to be settled with less freedom for a month or two. The two Liberty loans brought some slackening in collections, but nothing very serious in the electrical industry.

Thus the manufacturing industry and the trade closed the year in a very satisfactory and strong position. Jobbers' stocks have been pared down and unfilled orders are large. Competition is better and the business is generally on a more sane basis. The war has not lessened the business of either jobber or manufacturer, merely changed it.

WIRE PRODUCER EXPECTS DEMAND TO BE LESSENED

Central Stations and Trade Generally Are Urged to Watch the Market More Closely than They Have Done Heretofore

Adverting to the subject of wire base the other day, the head of one of the important departments of a prominent manufacturer of electrical apparatus, equipment, supplies and accessories said to a representative of the ELECTRICAL WORLD: "Conditions affecting the status of wire base should be better known and understood by the trade. If a buyer should appear, it is my judgment the wire men would quote him all sorts of prices. I figure that the nominal price of base is 34 cents, but we are naming 30 cents. I will admit that the drawer of wire, after paying, say, 24.67½ cents, unless he bought in larger than car lots, when 23.50 cents would be the price, estimates that it costs him about 4 cents between the copper producer and the running through his mill. The cost of finished product is arranged on such basis.

"Now, it looks to me as if there would be a falling off in the demand for copper next year, which may be accounted for on the ground that the requirements of central stations and public utilities will be less. The central stations are already taking precautions to protect themselves by refusing to make extensions unless the cost of the work is advanced. Industrial customers in the great manufacturing districts along the Atlantic seaboard have been notified that increased light or energy will be furnished only when they are engaged in governmental work. In these cases an official certificate to this effect must be forthcoming, otherwise the application is peremptorily refused. The disposition of the central station is to take on no further load.

"All this means that the demand for wire will be less than it has been for some time. Consequently I look for easier conditions—in deliveries and quantity, if not in price—than have prevailed for some time. The trade should therefore keep itself in closer touch with the market and look and inquire for inside information. Jobbers and dealers would then be in a better position to figure more understandingly on their requirements and place orders."

NEW PRICES OF LARGE INCANDESCENT LAMPS

Detailed Prices of Mazdas and Graphitized Filament Units, as Effective Jan. 1, Grouped According to Regular Schedules

Following the exclusive announcement in last week's ELECTRICAL WORLD of the advance in the prices of incandescent lamps, effective Jan. 1, 1918, the appended tables give the price schedules complete on large Mazda and graphitized-filament units. The prices are arranged according to regular schedules, which are as follows:

Schedule 1—Mazda lamps for standard lighting service—straight-side and pear-shape bulbs—110 to 125 volts.

Schedule 2—Mazda lamps for standard lighting service—straight-side and pear-shape bulbs—220 to 250 volts.

Schedule 3—Mazda lamps for ornamental-lighting service—round and tubular bulbs—110 to 125 and 220 to 250 volts.

Schedule 4—Mazda vacuum lamps for sign-lighting service—straight-side bulbs—11 to 12½, 55 to 65 and 110 to 125 volts.

Schedule 5—Mazda vacuum lamps for electric street railway service—straight-side bulbs—for use five in series on 525, 550, 575, 600, 625 or 650-volt circuits.

Schedule 6—Mazda gas-filled lamps for use in series on street-lighting circuits—straight-side and pear-shape bulbs—lamps rated at 5.5, 6.6, 7.5, 15 and 20 amp.

Schedule 7—Mazda lamps for train-lighting and locomotive-headlight service—straight-side and round bulbs—5½ and 6, 30-34 and 60-65 volts.

Schedule 8—Mazda lamps for use with country-home lighting outfits—straight-side and pear-shape bulbs—16-cell (28-32 volts).

Schedule 9—Mazda daylight lamps—pear-shape bulbs—110 to 125 volts.

Schedule 10—Mazda gas-filled lamps—concentrated filaments for focusing purposes—round bulbs—5½ and 6, 30-34 and 110 to 125 volts.

Schedule G—Graphitized-filament lamps for standard lighting service—110 to 125 volts.

INCANDESCENT-LAMP PRICES, JAN. 1, 1918

Schedule	Volts	Watts	Bulb	Clear	List Price
Schedule 1—					
Mazda B.....	100-130	10 & 15	S-17	\$0.30	\$0.33
Mazda B.....	100-130	25-40-50	S-19	0.30	0.33
Mazda B.....	100-130	60	S-21	0.35†	0.39†
Mazda B.....	100-130	100	S-30	0.70	0.77
Mazda C.....	100-130	75	PS-22	0.70	0.75
Mazda C.....	100-130	100	PS-25	1.10	1.15
Mazda C.....	100-130	200	PS-30	2.20	2.27
Mazda C.....	100-130	300	PS-35	3.25	3.35
Mazda C.....	100-130	400	PS-40	4.30	4.45
Mazda C.....	100-130	500	PS-40	4.70	4.85
Mazda C.....	100-130	750	PS-52	6.50	6.75
Mazda C.....	100-130	1000	PS-52	7.50	7.75
Schedule 2—					
Mazda B.....	200-260	25 & 50	S-19	0.35	0.38
Mazda B.....	200-260	100	S-30	0.85	0.92
Mazda B.....	200-260	150	S-35	1.30	1.40
Mazda B.....	200-260	250	S-40	2.20	2.35
Mazda C.....	200-260	200	PS-30	2.40	2.47
Mazda C.....	200-260	300	PS-35	3.90	4.00
Mazda C.....	200-260	400	PS-40	5.10	5.25
Mazda C.....	200-260	500	PS-40	5.60	5.75
Mazda C.....	200-260	750	PS-52	7.70	7.95
Mazda C.....	200-260	1000	PS-52	9.00	9.25
Schedule 3—					
Mazda B.....	100-130	15 & 25	G-18½	0.50	0.53
Mazda B.....	100-130	15-25-40	G-25	0.50	0.55
Mazda B.....	100-130	60	G-30	0.70	0.77
Mazda B.....	100-130	100	G-35	1.00	1.10
Mazda B.....	100-130	25	T-10	0.55	0.60
Mazda B.....	100-130	25-40	T-8	1.00	1.10
Mazda B.....	200-260	25-50	G-25	0.60	0.65
Schedule 4—					
Mazda B.....	10-13	2½ & 5	S-14	0.27	0.30
Mazda B.....	50-65	5	S-14	0.30	0.33
Mazda B.....	100-130	10	S-14	0.30	0.33
Schedule 5—					
Mazda B.....	525-650	23-36	S-19	0.30	0.33
Mazda B.....	525-650	56	S-21	0.35	0.39
Mazda B.....	525-650	94	S-24½	0.70	0.77
Schedule 6—	Amp.	Cp.			
Mazda C.....	5.5	60	S-24½	1.00*	1.05*
Mazda C.....	5.5	80-100	S-24½	1.20*	1.25*
Mazda C.....	5.5	250	PS-35	2.35*	2.45*
Mazda C.....	5.5	400	PS-40	4.00*	4.15*
Mazda C.....	6.6	60	S-24½	1.00*	1.05*
Mazda C.....	6.6	80-100	S-24½	1.20*	1.25*
Mazda C.....	6.6	250	PS-35	2.35*	2.45*
Mazda C.....	6.6	400	PS-40	4.00*	4.15*
Mazda C.....	6.6	600	PS-40	5.00*	5.15*
Mazda C.....	7.5	60	S-24½	1.00*	1.05*
Mazda C.....	7.5	80-100	S-24½	1.20*	1.25*
Mazda C.....	7.5	250	PS-35	2.35*	2.45*
Mazda C.....	7.5	400	PS-40	4.00*	4.15*
Mazda C.....	7.5	600	PS-40	5.00*	5.15*
Mazda C.....	15	400	PS-40	4.00*	4.15*
Mazda C.....	20	600	PS-40	5.00*	5.15*
Mazda C.....	20	1000	PS-40	6.00*	6.15*
Schedule 7—	Volts	Watts			
Mazda B.....	25-34	10-15-20	S-17	0.30	0.33
Mazda B.....	25-34	25 & 50	S-19	0.30	0.33
Mazda B.....	25-34	10-15-20-25	G-18½	0.40	0.43
Mazda B.....	25-34	50	G-30	0.70	0.77
Mazda B.....	50-65	10-15-20	S-17	0.30	0.33
Mazda B.....	50-65	25 & 50	S-19	0.30	0.33
Mazda B.....	50-65	10-15-20-25	G-18½	0.40	0.43
Mazda B.....	50-65	50	G-30	0.70	0.77
Mazda C.....	5½ & 6	36	G-18½	1.35	...
Mazda C.....	5½ & 6	72	G-25	1.60	...
Mazda C.....	5½ & 6	108	G-30	1.90	...
Mazda C.....	30-34	100	G-25	1.50*	...
Mazda C.....	30-34	150	G-25	2.00*	...
Mazda C.....	30-34	250	G-30	3.00*	...
Schedule 8—					
Mazda B.....	28-32	5	S-14	0.30	0.33
Mazda B.....	28-32	10 & 20	S-17	0.30	0.33
Mazda B.....	28-32	40	S-19	0.30	0.33
Mazda C.....	28-32	50	PS-20	0.70	0.75
Mazda C.....	28-32	75	PS-22	0.80	0.85
Mazda C.....	28-32	100	PS-25	1.20	1.25
Schedule 9—					
Mazda C-2.....	100-130	75	PS-22	0.80	0.90
Mazda C-2.....	100-130	100	PS-25	1.25	1.35
Mazda C-2.....	100-130	150	PS-25	1.90	2.00
Mazda C-2.....	100-130	200	PS-30	2.50	2.64
Mazda C-2.....	100-130	300	PS-35	3.75	3.95
Mazda C-2.....	100-130	500	PS-40	5.50	5.80
Schedule 10—					
Mazda C.....	100-130	100	G-25	1.50	...
Mazda C.....	100-130	250	G-30	3.00	...
Schedule G-1—					
Gem.....	100-130	20 & 30	S-17	0.22	0.24½
Gem.....	100-130	40-50-60	S-19	0.22	0.24½
Gem.....	100-130	60 mill type	S-19	0.22	0.24½
Gem.....	100-130	50	G-25	0.27	0.30

*Same as previous list price. †Reduced list price.

WHERE THE BOILER-ROOM DEVICE MARKET IS HEADING

Trend Indicated by Census Statistics Shows on
Analysis How Rapidly "Rented Power" Is
Superseding "Owned Power"

The United States census data show that in 1889 only 2 per cent of the total power in the country was "rented power," that is, central station power. In 1904 this ratio had increased from 2 per cent to 3.3 per cent. In 1909 it was 9.4 per cent, and in 1914 it was 17.4 per cent. During the same period and for the five-year intervals above named the electric-motor rating in active service practically doubled with each five years. Since the last five-year census report the greatest three years of industrial activity this country has ever seen have been experienced. Not only has the total of active power-generating apparatus been increasing at a terrific rate, but the gain in the central station percentage column has been progressing by stupendous strides owing to slow deliveries of prime movers and high fuel prices. According to close observers it is entirely safe to estimate that the census report of 1919 will show that 33 per cent of the total power is rented power.

If viewed in their relation to the so-called boiler-room device market, these facts point to a decreasing demand among isolated power plants and an increasing demand for the same or similar equipment among owners of large power-producing companies. The total volume of trade, however, will probably diminish owing to the very large number of isolated plants now going over to central station service. Besides, considerably fewer of the new plants are installing their own generating systems owing to two fundamental factors, (1) inability to obtain satisfactory delivery of plant equipment, and (2) the seriousness of the fuel situation.

METAL MARKET SITUATION

Copper Not Being Hoarded—Stranded Wire Not Equal to Demand—Better Supply of Tin Probable

According to the most reliable sources of information there is no likelihood of the government advancing the price of copper, or of there not being enough metal to meet all urgent needs. Consequently there is no disposition to acquire copper or hoard it for future contingencies. There is a strong demand for wire, and deliveries are none too satisfactory in standard sizes. The stranding machines have not been able to keep up with the demand for the last three years. Rubber-covered as well as slow-burning wire is commanding the greatest attention and largest sale at the present time.

With no tin offering, the price remains nominal. From official reports a large supply may reach the American market from the Straits via the Pacific route, by an arrangement with Great Britain. The latter has now prohibited the sale of zinc, brass, lead and nickel. Copper, steel and iron were already on the prohibited list.

NEW YORK METAL MARKET PRICES

	Dec. 24	Dec. 31
	£ s d	£ s d
Copper:		
London, standard spot.....	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	27.00	27.00
Lead, trust price.....	6.25	6.25
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter.....	19.00	19.00
Spelter, spot	7.67½	7.82½ to 7.92½
Tin, Straits	85.00*	85.00*
Aluminum, 98 to 99 per cent....	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire.....	22.00 to 22.50	22.00 to 22.50
Brass, heavy	14.00 to 15.00	14.00 to 14.50
Brass, light	9.50 to 10.50	10.00 to 10.50
Lead, heavy	5.75 to 5.87½	5.75 to 6.00
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

THE predictions that the sale of holiday specialties would shrink this year has proved unfounded, for the volume in some sections exceeded previous records. In others it equaled that of the year before. Shortages on wire, heavy motors, conduit, etc., are reported in spots, with other staple stocks in satisfactory condition. Everything possible on order was shipped in from the manufacturers and prominent distributors to jobbers and dealers before the books were closed.

A lull has followed the usual stress of selling on the Christmas account, and inventories have occupied the attention of every branch of the trade during the week. Some increases in price have materialized, and others are contemplated with more than a fair chance of realization in the near future. Shipments still are delayed by the embargoes and freight congestion. The governmental railroad control is expected to mitigate the situation in due course.

Trade financial affairs are stated to be in excellent condition. Collections have figured on a basis apparently up to expectations. No loose rein is being drawn on credits.

NEW YORK

With the opening of the new year there is every indication that business will improve in the greater distribution and sale of electrical merchandise. Jobbers' and dealers are still busy with inventories. Orders placed with manufacturers and primary distributors for early delivery cover a wide range of products, chiefly staples. The last week in the year is always quiet, and there was no exception for 1917.

New prices on a higher level went into effect on several items on Jan. 1, and prior thereto, and there is a possibility of further announcements to the same effect. The market is restless on this score.

Financially the trade is in a sound condition, with collections making a new record and credits in good shape.

PANELS.—A new line of panels will be brought out by a manufacturer with the first of the year. The announcement covers about a half dozen types, with a range of prices in accordance with the models and finish. Quotations have not changed on the regular lines.

FANCY FIXTURES.—Goods of the fancy or decorative type in lighting fixtures were expected to advance in price around Jan. 1. Of course, should this prediction prove well founded, it will be due to the feverish condition of the metal market.

CROSS-ARMS.—On Dec. 17 an advance of 10 per cent was declared. Deliveries are tightening up. The congressional committee investigation of the lumber situation has hastened the placing of orders for early delivery, if such a thing be possible. This is tying up the situation.

MOTORS.—From fractional sizes up to 40-hp. motors an increase in price is looked for, but it is uncertain. It may come along any time, Jan. 1 being the date originally fixed for the notice. There is an acknowledged falling off in the buying of these types at present. Shipments are reported as extremely poor.

COLLECTIONS AND CREDITS.—The wind-up of the year and the start of 1918 find collections in a very fair condition. Credit authorities state that no relaxation on their part will be visible for an indefinite period. The "slacker" has no standing whatever.

GLASS INSULATORS.—With an advance of 12½ per cent last month the supply and delivery of insulators is fair. The coal situation is tending to slow up production at the glass factories. The high cost of fuel has caused the elevated price.

PORCELAIN.—The government is reported as having requisitioned everything in porcelain goods. Consequently there is something of a shortage in sight.

RADIATORS.—With the zero weather prevailing during the past week, the demand for radiators and all heating devices was abnormal. The heaviest stocks in the hands of the jobbing distributor were drawn down, and hurried calls for fresh and rush supplies to the factories were made. Large shipments were immediately placed in transit and hurried forward to relieve the market.

HOUSEHOLD SPECIALTIES.—An advance of 8 to 8½ per cent on portable sewing machines and about 10 per cent on washing machines is reported as coming on Feb. 1. A rumor which has been gaining momentum, that domestic heating appliances were to be increased in price Jan. 15, will doubtless be fulfilled in the near future, according to authoritative information. The size of the addition, it is stated, will be dependent on the metal situation, condition of stocks, and other market contingencies.

CHICAGO

The trade generally is resting on its oars after the spurt required to keep pace with the lively holiday trade which developed just before Christmas. Inventories are being taken, and, as is the custom, these are being allowed to occupy practically the entire attention of both the distributors and retailers. Several organizations are also taking advantage of the quiet condition of affairs to hold sales meetings, also giving out-of-town representatives an opportunity to spend the holidays in the city. Probably the feature of the week may be said to be the announcement that lamp prices will be increased.

CHRISTMAS RETAIL TRADE.—The holiday trade was not up to last year's volume. The buying was slow until the last few days before Christmas; then a rush started which lasted until the doors closed on Christmas Eve. A peculiar feature of the buying was that when it did start it was particularly active in the higher-priced appliances. Percolators, sewing-machine motors and all sorts of household devices were in good demand. In some quarters the opinion is given that the holiday trade this year was 20 per cent under what it was last year.

JOBBER'S INVENTORIES.—It is the opinion that the inventories of jobbers' stocks will show values above normal. It is probable that the volume of stock now on the jobbers' shelves is very little in excess of normal. Such items as are carried in more than normal quantities are goods that it seems expedient to carry on account of delivery situations.

CHRISTMAS-TREE LAMPS.—The complaints from purchasers of Christmas-tree lamps last year were numerous. This year they were more numerous. Filament trouble caused this unduly large amount of dissatisfaction. Just blame can hardly be placed on the lamp manufacturers, however, for they have had their troubles in the miniature-lamp field, mostly through no fault of their own.

COPPER WIRE.—Jobbers are on a 35-cent base, with some manufacturers quoting a trifle lower.

CONDUIT.—There are still some stocks of conduit, but the question of the jobbers replenishing them is occupying attention.

LAMPS.—The announcement of a 10 per cent increase in lamp prices was accepted in the most part with the statement that the manufacturers deserved credit for refraining so long from raising prices in the face of rising labor and material costs.

FUSES.—The purchases of fuse companies in the Middle West recently by other fuse companies in the field is said in no way to presage a decrease in prices. It is said in some quarters that the prices of fuses will probably be higher before they are lower.

CREDITS AND COLLECTIONS.—There is very little activity this week, the disposition being to let things slide until the first of the year.

GLASS INSULATORS.—The glass-insulator business is now in such shape that some manufacturers are able to ship orders on the day received, if necessary.

COFFEE-URN HEATERS.—Orders for coffee-urn heaters have been coming in with regularity and in larger quantities than ever before.

BOSTON

Jobbers and retailers generally report an excellent volume of Christmas trade, but possibly from 10 to 15 per cent below last year in holiday specialties and heating appliances. The final week's business was about the same as a year ago. The usual pre-New Year lull followed the holiday. Jobbers and wiring contractors report a very active industrial business, and government work appears to be increasing in volume. House wiring is practically at a standstill, except in repair and alteration jobs, which are giving some of the smaller contractors much-needed work. At Lewiston, Me., shipbuilding is causing active house wiring, however. Collections are reported slower from contractors and central stations, but very good from mill customers. The outlook is clear for a year of extreme activity along war-business lines, including auxiliary productive work closely related to government needs.

Prices remain firm, and deliveries, it is anticipated, will improve somewhat, in priority classes, at any rate, as the result of government control of the railroads. Transportation companies will now be entering the market for supplies through government financing and supervision, and the electrical industry will undoubtedly benefit from their improved status. Curtailment of service of a non-essential character by public utilities has begun, and is likely to increase during the winter. Jobbers' stocks are understood to be large in most lines; the lamp situation is improving, and manufacturers are beginning to accumulate stocks of standard equipment in many lines.

LAMPS.—Supply conditions are better in standard lines. The Westinghouse Lamp Company lost about 500,000 lamps in a recent Boston fire, but about seven carloads of lamps were rushed to Boston, and by to-day it was expected that the situation would be greatly improved. The policy of lamp producers of caring for customers' present needs and discouraging hoarding is bearing fruit.

PORTABLES.—Many of these were moved in the Christmas trade, though the volume of business done fell below last year. Dealers are now well stocked with modern designs for all-the-year-round business. Prices remain unchanged.

CONDUIT.—Jobbers appear to be well stocked at this time, especially in the smaller sizes. There is some reason to hope for better transportation conditions under government control of railroad service, but how much improvement is possible remains to be demonstrated.

WIRING MATERIAL.—Supplies are fairly plentiful in jobbing circles, especially in smaller and lighter products. War work dominates the industry.

WIRE AND CABLE.—Business is falling off a little in the market for the smaller sizes of wire and cable. Factory stocks are beginning to accumulate in these sizes. Deliveries are improving a little on heavier cable, and prices remain steady. The government will be in the market for such material for arsenal, shipyard and naval service for some time to come.

MOTORS.—Raw materials are a little easier in the motor factories. Shipments have not begun to improve much, however. Stocks are uncertain as to regularity of sizes. The demand continues very heavy and prices hold firmly. Even the optimists see little prospect of an early reduction in motor costs.

ATLANTA

The President's recent expression regarding the railroad problem was favorably received in this section, and a feeling of relief is felt by the business interests. The period of suspense is broken and the transportation situation clarified, at least from the viewpoint of railroad financial interests. Express and railroad embargoes have delayed the delivery of a large quantity of electrical equipment shipped from Eastern and Northern points, but even in the face of this condition an improvement is noted in the shipments of a few staples. The volume of business transacted this week is very light, owing

to the fact that the greater portion of the time will be consumed for inventory purposes.

A great amount of activity is being centered at South Florence (Muscle Shoals), Ala., the site of the government nitrate plant. Approximately \$30,000,000 will be spent at this point, and a large electrical supply business is anticipated. The labor situation at present is fairly stable, with the exception of the conditions existing at Gulfport, Miss. The cutting of wires between Pass Christian and Orange Springs prevented the Gulfport and Mississippi Coast Traction Company from serving these points temporarily.

Sales ardor has been somewhat dampened in this section owing to the very acute fuel situation and protracted drought. A number of industrial plants have had to shut down for various periods, and a few central stations suffered power curtailment on account of the fuel shortage. Decreasing water reserve at hydroelectric plants operated by the Southern Power Company, Georgia Railway & Power Company, Columbus Power Company and Central Georgia Power Company has developed into a curtailment and temporary shut-down of customers served by some of the above companies. It is reported that the shortage of both fuel and water has compelled the Central Georgia Power Company, Macon, Ga., to curtail its service to six hours per day. Lack of water at its Tallulah Falls (Ga.) plant compelled the Georgia Railway & Power Company to shut down 150 of its hydroelectric power customers twenty-four hours last week. Essential industries, such as municipal plants, fire pumps and plants working on government war orders, were permitted to operate.

LAMPS.—The trade has received notice of an advance of approximately 10 per cent in price on standard Gem and Mazda lamps to take effect Jan. 1.

RUBBER-COVERED WIRE.—A large quantity of No. 8 down to No. 4/0 solid has been purchased this week from local stocks for steel interests in the Birmingham district, and it is reported that options have been secured on stock replacements now en route. Local stocks are much lower than last week.

SEATTLE

The Pacific Northwest's first war Christmas established a record for holiday trade. However, the effect of the war was shown in buying. The greatest demand was for practical gifts, and electrical dealers generally agree that the sales of Christmas gifts along electrical lines, such as irons, percolators, toasters, stoves, lamps and sewing machines, has never been equaled. However, the usual slump in both retail and wholesale business following a holiday is now being experienced. This slump, of course, pertains particularly to sales of energy-consuming devices by wholesaler to retailer and then to customer.

The volume of business at shipyards and industrial plants was nearly as large as preceding weeks, but sales to mills and camps decreased appreciably, the latter owing to inclement weather and partial Christmas shutdowns.

Stocks of energy-consuming devices are very low owing to the heavy drain preceding the holidays. Dealers are hastening to replenish these stocks, fearing they may be placed on the non-essential list. Shortages of certain kinds of wire, heavy motors, conduits, etc., still obtain.

Reports from three large Northwest cities indicate a noticeable increase in the construction of fireproof buildings. This increase has not been especially noticeable in Seattle. During the past week orders were received from Washington for the erection of additional cantonment buildings at Vancouver, Wash., also at the mouth of the Columbia River, in addition to those recently erected at Forts Stevens, Columbia and Canby, in Oregon. Retailers report a noticeable increase in the sales of fixtures and wiring devices, this being aside from pick-up work at various cantonments.

The erection of a gigantic steel and pig-iron manufacturing plant on Puget Sound is vouched for by the authorities, who assert that construction will commence as soon as permission to buy necessary machinery and equipment is obtained from the General Defense Board. The reported initial units of the plant will cost \$9,000,000 and the fully completed project approximately \$25,000,000. The establishment of the plant will mark the beginning of the greatest period of

industrial development the Northwest has ever known and will presage the location of numerous industries utilizing steel as raw material.

Recently contracts for twenty steel steamships of 8800 tons capacity, to cost approximately \$40,000,000, were awarded to Portland shipbuilders by the United States Shipping Board. These are the first contracts granted the steel shipyards in Portland.

The freight situation is still in a chaotic condition, but recently, as the result of a conference between the railroad and steamship lines, an arrangement has been made which, it is believed, will relieve the congestion of Oriental freight.

SAN FRANCISCO

Christmas trade in electrical goods was disappointing in that it fell below expected volume. All branches of the electrical industry in San Francisco agree on this, and one large jobbing house estimates the volume of Christmas sales as 25 per cent below the amount expected. It is evident that purchases are being made with care. The sale of motor-driven household appliances has been very good, and the preference generally has been for labor-saving devices.

The machine shop and iron workers' strike now in effect has cut down the production of fixtures and accessories used in the electrical trade and has also temporarily closed down considerable construction work. However, government contracts are not being interfered with. Government action in taking over the railroads has had no effect on the Pacific Coast field. On being asked for an opinion on this point some of those who order large freight consignments stated that if any changes occur as a result of this action they are most likely to be beneficial. Because of the time allowance which Pacific Coast dealers are accustomed to make on Eastern orders, the time in transit is a smaller factor in delivery quotations than in the case of Eastern cities. Only recently have delays in transit been added to factory delays in making delivery quotations, and it is hoped that traffic plans as revised under government supervision may improve this condition.

Contractors continue to find fairly good business in industrial work and on construction contracts in interior towns. Shipbuilding activity is calling for a constant supply of materials, but local jobbers are concerned over the announcement that the United States Shipping Board plans to place orders with manufacturers. There is a question as to whether this plan would be at all feasible on the Pacific Coast.

Applications for rate increases have been filed with the railroad commission by several of the larger light and power companies, and pending decisions on these questions extension of generating plants is being limited to the actual necessity to supply present demands. In fact, some important developments have been stopped because of high prices of labor and equipment until some corresponding rate adjustment is probable.

Credits and collections are in good shape. Special care is usually exercised as books are opened for the new year, but collections have been good and there is no reason for drawing credits tighter.

LAMPS.—While not supplying the demand, manufacturers and jobbers are taking care of customers' actual needs. There have been heavy orders placed recently because of the announced increase in retail price, which took effect on Jan. 1. The demand for carbon lamps has been heavier because of the heavy industrial demand. For example, one large San Francisco plant has an average of several hundred lamps a week required to supply breakage alone.

CONDUIT.—Galvanized conduit stocks continue in bad shape. No price changes have occurred recently, but there is some anticipation of a rise in the near future.

GLASS INSULATORS.—For telephone and telegraph lines glass insulators are expected to increase in price again in January. There was a 10 per cent increase in price on this line in December. Stocks are fair to good, but deliveries are very bad.

INSULATED WIRE.—Both weatherproof and rubber-covered have shown a tendency to decrease in price, but stocks are still in poor condition.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
B & S. Size	List per 1000 Ft.
No. 14 solid	\$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor	
No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
No. 14 Solid	List to \$61.00
Less than coil	List +10%
Coil to 1000 ft.	10% to \$59.17
No. 12 Solid	List to \$71.00
Less than coil	List +10%
Coil to 1000 ft.	10% to \$68.87

Twin-Conductor	
No. 14 Solid	List to \$105.00
Less than coil	List +10%
Coil to 1000 ft.	10% to \$103.50
No. 12 Solid	List to \$135.00
Less than coil	List +10%
Coil to 1000 ft.	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor	
No. 14 Solid	List +10%
Less than coil	List +10%
Coil to 1000 ft.	List—10%

Twin-Conductor	
No. 14 Solid	List +10%
Less than coil	List +10%
Coil to 1000 ft.	List—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List to 10%
1/5 to std. pkg.	15% to 20%
Std. pkg.	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	List to 20%
Std. pkg.	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	28 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
1/16	250	\$5.00
3/16	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/4-in. s. stp. Net to \$75.00	—15% to \$69.75
3/4-in. d. stp. +5% to 75.70	—9% to 72.00
1/2-in. s. stp. List to 100.00	—15% to 93.00
1/2-in. d. stp. List to 100.00	—9% to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/4-in. single strip	\$75.00
3/4-in. double strip	71.25
1/2-in. single strip	100.00
1/2-in. double strip	105.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	\$0.05 1/2	1 1/4	\$0.25
1/4	.06	1 1/2	.33
3/8	.09	1 3/4	.40
1/2	.12	2	.47
5/8	.15	2 1/4	.55
3/4	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$24.75
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00
		\$22.00-\$24.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	Net to . \$55.00	\$25.00-\$37.50
1/4-in.	Net to . \$60.00	\$27.00-\$30.00
		\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

Couplings, List	Elbows, List
1/4	\$0.05
3/8	.06
1/2	.07
3/4	.10
1	.13
1 1/4	.17
1 1/2	.21
2	.28
2 1/2	.40
3	.60

DISCOUNT—NEW YORK

Less than 2500 lb.	2500 to 5000 lb.	4% to 6%	7% to 9%	3/4 in. to 3 in.	9% to 11%
4% to 6%	6% to 9%	7% to 9%	9% to 11%		

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.	2500-5000 lb.	1.3% to 3.7%	4.3% to 6.7%	3/4 in. to 3 in.	6.3% to 8.7%
1.3% to 3.7%	3.3% to 5.7%	4.3% to 6.7%	6.3% to 8.7%		

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	\$5.00 to \$6.00
Discount	.25% to 30%

CHICAGO

List	\$5.00 to \$6.00
Discount	.25% to 30%

FUSES, INCLOSED

250-Volt	30-amp.	Std. Pkg.	List
3-amp. to 30-amp.	100		\$0.25
35-amp. to 60-amp.	100		.35
65-amp. to 100-amp.	50		.90
110-amp. to 200-amp.	25		2.00
225-amp. to 400-amp.	25		3.60
450-amp. to 600-amp.	10		5.50
600-Volt	30-amp.	Std. Pkg.	List
3-amp. to 30-amp.	100		\$0.40
35-amp. to 60-amp.	100		.60
65-amp. to 100-amp.	50		1.50
110-amp. to 200-amp.	25		2.50
225-amp. to 400-amp.	25		5.50
450-amp. to 600-amp.	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	.28%
1/5 to std. pkg.	.38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	.28%
1/5 to std. pkg.	.38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.....	\$5.00 to \$5.75
1/5 to std. pkg.....	4.50
Standard package, 500. List, each,	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.....	\$6.25
1/5 to std. pkg.....	5.25
Standard package, 500. List, each,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.....	100	\$0.30
60-watt—B.....	100	.35
100-watt—B.....	24	.70
75-watt—C.....	50	.70
100-watt—C.....	24	1.10
200-watt—C.....	24	2.20
300-watt—C.....	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25.....	50	.55
25-watt—G 25.....	50	.55
40-watt—G 25.....	50	.55
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30.....	24	.77
Round bulbs 4 3/4 in., frosted:		
100-watt—G 35.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.....	Net
Std. pkg.....	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	Net
Std. pkg.....	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$30.00 to \$31.00
Coil to 1000 ft.....	\$25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$30.00 to \$36.56
Coil to 1000 ft.....	22.30 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100.....	\$20.00 to \$29.00
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CHICAGO

Net per 100.....	\$19.25 to \$24.00
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.....	30.00
103—C.A., 3, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.....	25-30%	20-32%
\$10.00 to \$50.00 list.....	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.....	40%	35%
\$10.00 to \$50.00 list.....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$20.00 to \$38.00
1/5 to std. pkg.....	19.00 to 20.00
Standard package, 2200. List per 1000,	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net	5 1/2 N. C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.....	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.....	15.60 to 20.75	24.20

CHICAGO

	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net	5 1/2 N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.....	\$11.85	\$30.75
1/5 to std. pkg.....	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets.....	500	\$0.32
1/4-in. cap keyless socket.....	500	.30
1/4-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	Net
1/5 to std. pkg.....	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	Net to 14%
1/5 to std. pkg.....	15% to 30%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

Less than \$10 list.....	List to + 5%
\$10 to \$25 list.....	11%
\$25 to \$50 net.....	14% to 15%

DISCOUNT—CHICAGO

Less than \$10 list.....	5% to 10%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24% to 25%

DISCOUNT—CHICAGO

Less than \$10 list.....	+ 5%
\$10 to \$25 list.....	10%
\$25 to \$50 list.....	14%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap

	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List
1/5 to std. pkg.....	15%
Std. pkg.....	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+ 20% to list
1/5 to std. pkg.....	List to —15%
Std. pkg.....	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

	List
Union and Similar—	Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....	List	List to + 10%
\$2.00 to \$10.00 list.....	10% to 20%	5% to 10%
\$10.00 to \$50.00 list.....	20% to 30%	15% to 25%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25%	15% to 20%
\$2.00 to \$10.00 list.....	25%	20%
\$10.00 to \$50.00 list.....	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price.....	\$5.00 to \$7.50
Discount.....	25% to 30%

CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net.
No. 18, less than full spools.....	\$0.44 1/4 to \$0.49
No. 18, full spools.....	0.43 1/4 to 0.45

CHICAGO

	Per Lb. Net.
No. 18, less than full spools.....	\$0.57 1/2 to \$0.65
No. 18, full spools.....	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	
11.	\$15.00-\$18.00	\$13.00-\$14.00	\$11.25-\$11.50	
12.	23.25-27.09	21.30-23.22	19.35-20.85	
10.	32.40-37.80	29.70-32.40	27.00-29.25	
8.	45.70-53.34	41.90-45.73	38.00-41.38	
6.	72.40-84.42	72.36-72.40	60.30-65.50	

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14....	\$18.00	\$13.50	\$12.00
12....	26.95-27.79	23.41-26.95	19.85-23.10
10....	33.24-38.25	30.47-32.27	27.70-30.60
8....	47.04-54.27	43.12-46.43	39.20-43.12
6....	68.25-92.61	62.05-79.23	55.85-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$35.25 to \$40.00
25 to 50 lb.....	36.25 to 39.00
50 to 100 lb.....	34.25 to 38.00

CHICAGO

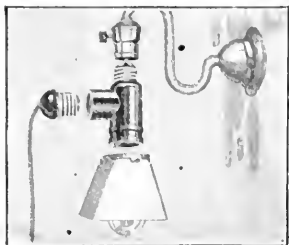
	Per 100 Lb. Net
Less than 25 lb.....	\$40.00 to \$40.35
25 to 50 lb.....	39.00 to 39.35
50 to 100 lb.....	38.00 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Plural Plug Socket

The Central Telephone & Electric Company of St. Louis, Mo., is distributing the plural plug socket shown herewith. The device has a hard-rubber composition covering which has a



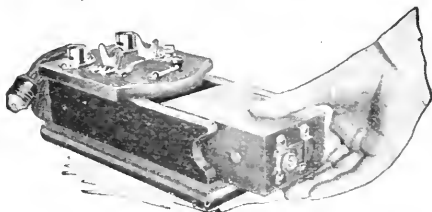
PERMITS USE OF A SHADE

highly polished finish of black. By use of this appliance the lamp is left in the original position and the use of a shade is permitted.

Testing Device for Automobiles

A testing device developed to facilitate the testing and adjusting of the Ford coil unit and for testing automobile lamps of any candlepower or voltage, electric horns, spark plugs, for finding short circuits, grounds, etc., and for starting Ford engines in cold weather, has recently been put on the market by the Jefferson Electric Manufacturing Company of Chicago. One of the most important features of this tester is the fact that it tests the Ford coil unit under alternating current. The Ford coil is wound for and operates in actual service under alternating current.

The No. 28 tester is designed for use with an alternating-current lighting circuit, while the No. 30 tester is identical in every respect with the No. 28, with the exception that it is designed for use where alternating current is not available and receives its energy from a 6-volt storage battery or four dry cells. The tester is assembled in a highly polished mahogany case. All metal parts



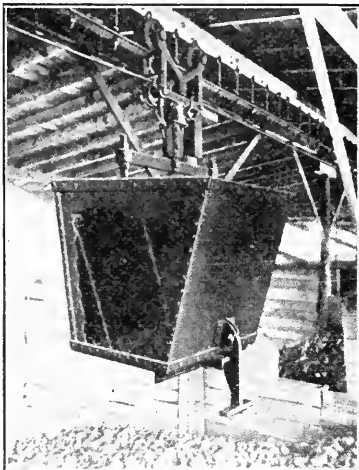
FORD UNIT AND COMBINATION TESTER

ished mahogany case. All metal parts are heavily nicked, presenting a very handsome appearance. The No. 28 is equipped with an extension cord and plug so as to attach it conveniently to any alternating-current lighting circuit.

John F. Godfrey of Elkhart, Ind., has developed a method of unloading coal adapted from the hay carrier device. A bucket of 1-ton capacity is used, which is dropped into a pit at the side of the railroad track and filled from a chute which receives the coal from the hopper bottom of the car. The bucket is hauled up an inclined track, being supplied with trunnion rollers at each side which operate upon the track, and is lowered upon the top of the pile or bin. A trigger releases the bottom of

Coal-Handling Device

The bucket and the weight of the coal causes the bucket to empty, when the spring bottom immediately closes and is ready for another load. In order to get the bucket back to the starting point a double-drum arrangement and a double pulley on the carrier are used. This device has a capacity of unloading about three cars in eight hours.



TWO-WAY REVERSIBLE CARRIER

Socket and Plug

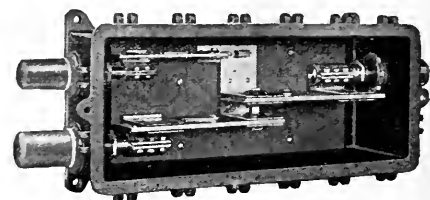
A new General Electric Company wiring device consists of a multi-catch pull socket and swivel attaching plug with current tap. This device can be screwed into a socket and an electrical portable such as fan motor, piano lamp, etc., attached by means of a current tap without the loss of the light in the outlet.

Cable Junction Box

A cable junction box specially designed for electric railway service by the Standard Underground Cable Company of Pittsburgh, Pa., is shown in the illustration. Where feeder circuits are installed underground use of this box makes possible the disconnecting and sectionalizing of different parts of the circuit while alive by simply opening one or more of the quick-break knife switches. The box is mounted on the wall of the manhole and is rendered waterproof by means of liberal gaskets at all points. The cables enter the box through nipples which are mechanically connected to the lead cable sheath by a wiped soldered joint. The main feeder cable passes into the box through the nipples shown in the illustration at the right-hand end and at the lower left-hand corner. The nipple shown at the upper left-hand corner is for the side feed tap leading to the trolley wire.

The box is designed for use with main feeder cables up to 2,000,000 circ. mil. and for side tap feeders up to 500,000 circ. mil. The two quick-break switches in the main feeder circuit each have a current-carrying capacity of 1000 amp. and that in the side tap circuit a capacity of 400 amp. All live parts in the box are mounted on non-inflammable insulating material and separated by ample air gaps.

A very important advantage in the design of this junction box is the patented bimetallic nipple. The rigid portion of this nipple is brass and the malleable portion lead. The wiped joint is therefore made between the lead of the nipple and that in the cable sheath, which method requires much less heat and less skill than in making a similar joint between brass and lead. The nipple is also designed to permit all cable connections to be made away from the box where there is more room

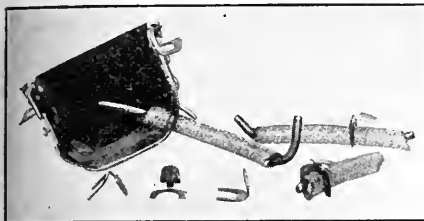


FOR ELECTRIC RAILWAY SERVICE

to work and no metal wall to conduct the heat from the parts to be joined. After all connections are made to the cable the nipple is inserted and clamped in position by means of a nut on the inside of the box.

Flexible Tubing Fastener

The Hyatt Electrical Works, Sacramento, Cal., has developed a fastener for flexible tubing such as is illustrated herewith. It is claimed that this device holds the tubing with a greater degree of positiveness, is more readily installed and takes up less space in the box than



OCCUPIES SMALL AMOUNT OF SPACE

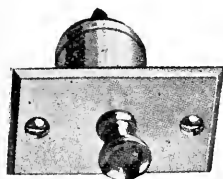
other fasteners. The device is designed for use on $\frac{1}{8}$ -in., $\frac{7}{32}$ -in. and $\frac{1}{4}$ -in. (3.2-cm., 5.6-cm. and 6.4-cm.) sizes of tubing. When used on the $\frac{1}{4}$ -in. (6.4-cm.) size the tongue should be bent to be at right angles to the body of the clamp.

Combination Electric Dishwasher and Table

An electric dishwasher which when not in use forms a convenient kitchen table is being manufactured by the William Campbell Company of Detroit, Mich. The tank in which the washing is done is lined with tinned copper and the soap and water which performs the cleansing operation is agitated by a motor-driven paddlewheel. The cost of operation, according to the manufacturer, averages about 1 cent per hour. Three quarts (2.8 l.) of water is used for each washing operation. The outfit is mounted upon a substantial steel frame. Aluminum is used for the covering of the table top. The weight of the apparatus ready to ship is 165 lb. (74.8 kg.).

Lighting Switch

A lighting switch designed primarily for use on gasoline and electric motor cars has recently been developed by the Industrial Controller Company of Milwaukee, Wis. A single unit of the switch is shown in the accompanying illustration. The switch is of the push-and-pull type and arranged so that when the handle is pushed the circuit



FOR MOTOR CARS

is open and when it is pulled the circuit is closed.

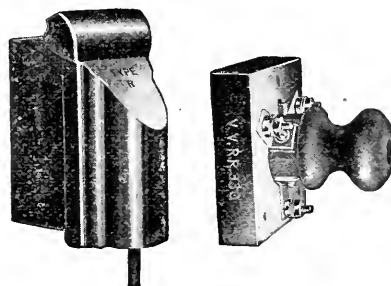
These switches are made with a round metal cylinder or barrel, which permits of round holes being drilled or bored in the dash. The front or face plates are

furnished to correspond with the number of switches in the gang they are used with. These plates are made of heavy metal, have beveled edges and are furnished in various finishes, such as nickel, brushed brass, dull black, etc.

The handle is of metal, larger in size than those ordinarily used and designed so that it may be easily gripped. There are no fiber parts whatever used in the construction of this switch, the insulated moving contact piece being of bakelite, into which the brass parts are molded. The shaft carrying the moving contact extends clear through the switch and is supported at both ends, thereby assuring proper alignment. These switches are furnished in units or in gangs of several switches. They are also furnished for dimming the headlights, either by inserting resistance in series with the lights or by the series-parallel control method.

Receptacle Plug and Box

A heavy-service receptacle mounted in a neatly finished cast-iron box was recently placed on the market by the V. V. Fittings Company of Philadelphia. The box is waterproof, arranged with a gravity closing lid which remains closed whether the plug is in or out. The receptacle is made of



WEATHERPROOF BOX AND RECEPTACLE WITH PLUG

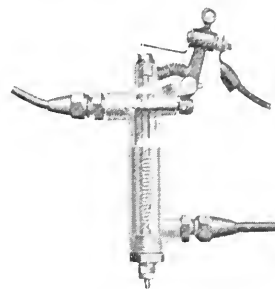
heavy slate thoroughly insulated from the box. The receptacle sits at an angle in order to permit an easy connection and disconnection of the plug. The binding posts for connecting wires are easily accessible, and plenty of room is allowed for wiring. The plug is made of wood so as to stand rough handling and is arranged so that the polarity cannot be reversed.

The complete outfit is made in two-pole, three-pole, and four-pole designs for 30-amp. and 60-amp. ratings. It is made especially for outdoor work for use with portable motors, coal hoists, shipyards, boat-loading machinery, moving-picture machine outlets, etc.

Electrically Heated Auto Primer

An electrically heated primer for automobiles, which both heats the fuel and atomizes it by air, has been placed upon the market by the Master Primer Company, 1523 Fort Street West, De-

troit, Mich. Connected to the carburetor, the heating coil is suspended in a small reservoir of gasoline above which is a small air vent. The outlet is controlled by a lever which operates a valve at the connection to the intake manifold. The same lever makes electrical contact and opens the air vent.



MOTOR SECURES ONLY A HEATED MIXTURE OF AIR AND GASOLINE

With the throttle of the carburetor closed, nearly all of the suction of the motor applies directly on the primer. The motor thus secures only a heated mixture of air and gasoline.

Tests made by the Detroit Testing Laboratory show that the heating coil raises the temperature of the gasoline at the rate of 14 deg. Fahr. (10 deg. C.) per second. Considering that many cars start easily at a temperature of 40 deg. Fahr. (4.4 deg. C.) and nearly all of them at 60 deg. Fahr. (15.6 deg. C.) the primer should start any car in zero weather within three to five seconds. The manufacturer states that tests in cold-storage plants at from -10 deg. to -25 deg. Fahr. (-23.3 deg. to -31.7 deg. C.) indicate that cars actually start in less than seven seconds.

Current Tap

Harvey Hubbell, Inc., of Bridgeport, Conn., is placing on the market a pull-socket current tap. The device is of the same mechanical construction as the ordinary pull socket to which has been added a plug receptacle built into the side of the body. It can be supplied with a $\frac{1}{8}$ -in., $\frac{1}{4}$ -in., $\frac{3}{8}$ -in. (3.2-cm., 6.4-cm., 9.5-cm.) or pendent cap. The flow of current to the lamp base is controlled by the pull chain. The terminals of the receptacle are continuously in circuit.

The use of this socket eliminates the



PULL-SOCKET TYPE OF CURRENT TAP

annoyance of a long cord running from a side-wall outlet. Current can be supplied directly beneath the fixture to operate the various table electrical appliances now in general use without the need of sacrificing the use of the light.

New Incorporations

THE WAALAND (MICH.) ELECTRIC LIGHT & POWER COMPANY has filed articles of incorporation with a capital stock of \$5,000.

THE HAROLD (S. D.) LIGHT & POWER COMPANY has been chartered with a capital stock of \$12,000 by P. J. Suhin, Harry Weeney and David Miller.

THE PEOPLE'S ELECTRIC & GAS COMPANY of Okmulgee has been incorporated with a capital stock of \$75,000 by A. B. De Pesse, G. Ortman and Harlan Reed.

THE MONARCH STORAGE BATTERY COMPANY of Grand Rapids, Mich., has filed articles of incorporation with the Secretary of State. The company is capitalized at \$20,000.

THE PORT ARTHUR (TEX.) TELEPHONE COMPANY has been chartered with a capital stock of \$100,000 by R. S. Shupey, J. W. Williams of Port Arthur and P. K. Higgins of Liberty, Mo.

THE WINDSOR ELECTRIC COMPANY of Steubenville, Ohio, has been incorporated with a capital stock of \$10,000 by H. M. Daugherty, R. L. Bullington, F. T. Wagenhals, E. S. Brown and R. F. Rarey.

THE CROMBIE LABORATORIES, Inc., of Port Chester, N. Y., have been incorporated with a capital stock of \$25,000 for the purpose of conducting a research laboratory for investigating chemicals and electrical properties.

THE ELECTRIC WELDING COMPANY OF AMERICA of New York, N. Y., has been incorporated with a capital stock of \$1,000,000 by W. Schenstrom, J. Kjedstad, and E. Schwarz, 415 Knickerbocker Avenue, Brooklyn, N. Y.

THE WHITNEY-MCNEILL ELECTRIC COMPANY of Augusta, Ga., has been chartered with a capital stock of \$6,000 to manufacture and deal in electrical fixtures. The incorporators are: J. B. Whitney and Joseph B. McNeill.

THE A. & C. MANUFACTURING COMPANY of Yonkers, N. Y., has been chartered with a capital stock of \$9,000 by E. J. and C. R. Abraham of Yonkers. The company proposes to manufacture electrical and gas appliances.

SHAPIRO & ARONSON of New York, N. Y., have filed articles of incorporation with a capital stock of \$250,000, for the purpose of manufacturing gas and electrical fixtures. The incorporators are: D. Shapiro, I. Kaplan and J. Pecker, 1890 Douglass Street, Brooklyn, N. Y.

THE WRIGHTSTOWN UTILITIES CORPORATION of Asbury Park, N. J., has been incorporated with a capital stock of \$25,000 to generate and distribute electricity, etc. The incorporators are: A. F. Cottrell, J. P. Watson and J. C. English, all of Asbury Park.

THE AUTOMOBILE ELECTRIC EQUIPMENT COMPANY of Wilmington, Del., has been incorporated by C. L. Rimlinger, M. M. Clancy and C. M. Enger of Wilmington, Del. The company is capitalized at \$100,000 and proposes to manufacture and install electric storage batteries.

THE CARLSBAD (N. M.) LIGHT & POWER COMPANY has been incorporated with a capital stock of \$150,000 to construct and operate an electric-light plant in Carlsbad. The incorporators are: Mary E. Tansell of Olympia, Wash.; Herbert W. Tansell and Helen S. Tansell of Carlsbad.

THE ELECTRIC FARM & LIGHTING POWER COMPANY of Antigo, Wis., has been incorporated by R. P. Brown, John H. Walechka and J. T. Brown. The company is capitalized at \$25,000 and proposes to manufacture individual or isolated light and power plants and systems and other electrical equipment.

THE DODD WILLIAM MANUFACTURING COMPANY of Jersey City has been incorporated with a capital stock of \$250,000 by Josiah D. Grummon, of New York, N. Y.; Charles E. Corbin of Rahway, and Edw. A. Markley of Jersey City. The company proposes to manufacture mechanical and electrical appliances.

THE ROYALTY PRODUCTION COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$500,000. The company proposes to acquire patents for exploitation of an electrical device to increase the production of oil, etc. The incorporators are: F. D. Buck, M. L. Horty and J. D. Frock, all of Wilmington, Del.

THE PAN-AMERICAN WIRELESS TELEGRAPH & TELEPHONE COMPANY has been incorporated with a capital stock of \$50,000, with no par value, by interests connected with the Marconi Wireless Telegraph company for the purpose of extending the activities of the latter company. The officers are: John W. Griegs, chairman of board; Edward J. Mally, president; Washington Dodge, vice-president; C. J. Boss, secretary, and John Bottomley, treasurer.

Trade Notes

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has been elected to membership in the Rice Leaders of the World Association.

MAGGOVERN & COMPANY of New York City have increased their capital from \$150,000 to \$200,000. The growth of the company's business has been phenomenal.

THE ESTERLINE COMPANY of Indianapolis, Ind., announces the removal of the offices of James G. Biddle & Company, representatives of the New York territory of the Esterline Company, from 90 West Street to 15 Park Row.

FRED R. FARMER succeeded Frank S. Beardslee as president of the Beardslee Chandelier Manufacturing Company on Jan. 1. Mr. Beardslee remains with the company as chairman of the board of directors. In the past year Mr. Farmer has been sales manager of the Gibson Company, Indianapolis, Ind.

THE INTERNATIONAL SIGNAL COMPANY, Brooklyn, is the title of what was formerly the National Electric Signaling Company, the receivership of which has been amicably adjusted and closed. The International company will continue the manufacture and operation of radio-telegraph and radio-telephone apparatus under patent rights of the original company.

A. H. MEYER has been appointed general manager of the Bryan-Marsh Lamp Division, Chicago. Upon graduation from the University of Nebraska in electrical engineering in 1909 he was employed in construction work for a few months, after which he became manager of city sales at the Chicago office of the Bryan-Marsh Company, with which company he has been continuously since that time.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY of New York City on Feb. 1 will remove from 114 Liberty Street to 243 and 245 West Seventeenth Street. The company will occupy the store and basement, which runs through the block to Eighteenth Street. The new quarters will afford ten times the room the company now occupies and it is arranging to carry that much increased stock of its specialties for the jobbing trade.

THE CROCKER-WHEELER COMPANY of Amper, N. J., to meet unusual conditions incident to the war through Dr. Schuyler S. Wheeler, president, on Dec. 27 announced a bonus under which its employees will receive not less than 10 per cent of their wages since Oct. 1, 1917, and during the coming year. All employees receiving less than \$2,500 yearly will benefit, and those who have been in the employ of the company for more than a year will receive 12 per cent of their earnings.

THE CHICAGO FUSE MANUFACTURING COMPANY announces that it has purchased the entire renewable-fuse business of the Multi Refillable Fuse Company, makers of the well-known line of multi-refillable fuses. This transaction includes the conveyance of all merchandise, materials, machinery, tools, designs, patents, good will and unfilled orders, and hereafter these fuses will be manufactured and marketed solely by the Chicago Fuse Manufacturing Company under its trade name "Union." The Chicago Fuse Manufacturing Company will still continue with its line of non-refillable fuses, thereby being in a position to furnish either type of fuse as desired by the trade.

C. T. McDONALD, president and manager of the Multi Refillable Fuse Company, announces that he has disposed of his interest in that company, and after Jan. 1 will devote his entire attention to the Multi Electrical Manufacturing Company at 703 Fulton Street, Chicago. The new company will manufacture and market a complete line of slate base cut-outs and fittings, wire bushings and conduit fittings under the trade name "Multi." Mr. McDonald has been associated with the manufacture of these and kindred electrical supplies during the last fifteen years, and announces that it will be the policy of this company to merchandise its product through agents in different communities.

Trade Publications

SOCKETS. "Quick Catch" sockets are illustrated and described in a circular issued by Harvey Hubbell, Inc., Bridgeport, Conn.

RADIATOR.—The Willis Manufacturing Company of Cleveland, Ohio, is distributing a folder descriptive of its portable electric nitrogen radiator.

PRIMER.—The Master Primer Company of Detroit, Mich., has prepared a folder descriptive of its Master primer with an electrically heated vaporizer.

VACUUM CLEANERS.—The Wise McClung Manufacturing Company of New Philadelphia, Ohio, has issued a folder on its American electric vacuum cleaner.

REHANDLING BUCKET.—The Blaw-Knox Company of Pittsburgh, Pa., has prepared a folder giving information regarding its "Blaw" speedster rehandling bucket.

TOGGLE SNAP SWITCHES.—Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared bulletin No. 16-2, descriptive of its Hubbell surface-type toggle snap switch.

STEAM TURBINE LUBRICATION.—The Moore Steam Turbine Corporation of Wellsville, N. Y., has issued a bulletin on the subject of correct steam turbine lubrication.

POWER-PLANT EQUIPMENT.—Bulletin No. 66, descriptive of power-plant equipment for immediate shipment, has been prepared by the Ross Power Equipment Company, Merchants' Bank Building, Indianapolis, Ind. This bulletin, which is dated Dec. 15, 1917, lists electrical equipment, steam units and miscellaneous items.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY of Plainville, Conn., has just distributed a new bulletin covering its "safety service" knife-switch line and a line of inclosed switches that are not externally operated. The line is complete, covering all general requirements. The two features that are especially emphasized in the design of the "safety service" are, first, that the box cannot be opened until the switch is disconnected, and, second, that when opened the switch cannot be connected until the cover is closed. With these two features no operator at any time can come in contact with a live closed switch.

CABINETS.—The Benjamin Electric Manufacturing Company of Chicago has just prepared its bulletin No. R-2, descriptive of Benjamin-Starrett cabinets. This bulletin is a necessary supplement, it is said, to the Benjamin-Starrett panelboard catalog, S-2. The listings in that book include cabinets, but only so far as certain combination list prices of panelboards complete with cabinets are concerned. Numerous listings in catalog S-2 are for panels only. It was, therefore, left to this bulletin to describe and illustrate cabinets alone for "RA," "SA," "SB," "RG" and "SG" panels and "R" and "S" standard panelboards. Diagrams, illustrations and full data on how the panels are mounted, together with a description of the special mounting plates, are given.

STEEL POLES.—The Bates Expanded Steel Truss Company, 208 South La Salle Street, Chicago, is distributing its 1918 edition "Steel Pole Treatise." This volume contains various valuable data and simplified formulas for steel-pole work. The latter portion of the treatise is devoted to simplified mathematical formulas for computing various pole-line stresses, information that should be in the hands of every construction engineer. Valuable wire data to be used in connection with the mathematical formulas and various other purposes are included. Precise dimensions of original sections before they are sheared and expanded into the poles, together with compilations of the strength of these beams unexpanded when used as beams, girders and columns, are given. A list of users of Bates poles is also included. An interesting article regarding 2500 Bates steel poles recently furnished the city of Chicago is included, as is a brief description of the company's Italian undertaking where a plant at Savona, Italy, is now being built. The index is as follows: "Trolley Poles and Fittings," "Lighting Poles and Fittings," "Combination Structures," "Method of Manufacture," "Tests," "Bates 'H' Sections," "Simplified Mathematical Formulas," "Comparison of Bates Expanded Steel Poles and Tubular Steel Poles," "Prices of Poles," "Pole Fixtures and Fittings," "Wood Pole Decay," "Pole Capacities," "Modern Pole Line Sense," "Concrete Setting," "Valuable Wire Data," "Resultant Force," "A Few Users of Bates Poles," "Street Signs," "Pole Climbers," "Outdoor Substations," "Inquiry, Suggestions," etc.

New England States

PORTSMOUTH, N. H.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 14 for furnishing one electric freight elevator of 2 tons capacity for building No. 45 at the Navy yard, Portsmouth, N. H. Drawings and specifications (No. 2730) may be obtained on application to the above bureau or to the commandant of the navy yard named.

LYNN, MASS.—The General Electric Company has begun work on the construction of its proposed new factory buildings at West Lynn, two of which will be one and two stories, about 25 ft. by 50 ft., and a new administration building, about 70 ft. by 340 ft.

Middle Atlantic States

ANDOVER, N. Y.—Plans are being considered by the town officials of Andover for the construction of a municipal electric-lighting plant.

BUFFALO, N. Y.—Plans are being prepared by the New York Central Railroad Company for the construction of a new power house in Curtiss Street, to cost about \$20,000.

HORNELL, N. Y.—The City Council has applied to the Public Service Commission for permission to construct and operate a municipal electric-light plant in Hornell.

MONTOUR FALLS, N. Y.—The Shepard Electric Crane & Hoist Company has filed a notice of increase in capital stock with the Public Service Commission from \$500,000 to \$1,000,000 for expansion.

NEW YORK, N. Y.—Contract has been awarded by the E. Greenbaum Company, 349 East 103d Street, New York City, to the W. K. Moran Company, 405 Lexington Avenue, for the installation of new power equipment and a new heating system at its packing houses at 320 East 103d Street.

NEW YORK, N. Y.—Plans have been filed and contract awarded by the New York Edison Company for the erection of a one-story addition to its transformer station on Park Avenue, near 149th Street. Plans have also been prepared for the erection of a one-story storehouse at the same location. The Louis Weber Building Company, 171 Madison Avenue, has the contract.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 14 for a new electric-lighting system for the extension of machine shop building, No. 128, at the Navy Yard, New York, N. Y. Drawings and specifications (No. 2728) may be obtained on application to the above bureau or the commandant of the navy yard named.

NAGARA FALLS, N. Y.—To assure the adequate supply of electric power for establishments engaged in war work at Niagara Falls and Buffalo, the United States government has requisitioned the energy generated and distributed by the Niagara Falls Power Company, the Hydraulic Power Company of Niagara Falls and the Cliff Electrical Distributing Company. It is not expected that operation of mills will be affected materially by the new order as readjustment of the power supply has been arranged previously by the representatives of the War Industries Board.

RIVERHEAD, N. Y.—The Long Island Lighting Company of Northport is reported to be negotiating for the purchase of the property of the Riverhead Electric Light Company.

SOUTHAMPTON, N. Y.—The stockholders of the Suffolk, Light, Heat & Power Company have voted to sell the plant and holdings to the Long Island Lighting Company of Northport, which has also recently acquired the electric-light plants at Sayville, Islip, Babylon and Farmingdale.

SYRACUSE, N. Y.—The New York Central Railroad Company has awarded contract for the erection of a new power house (one-story, 25 ft. by 35 ft.) at its West Side yards, to W. M. Ballard, Oneida, N. Y.

CAMDEN, N. J.—An appropriation of \$110,400 as provided for in the annual budget for 1918, including \$13,900 for the Electrical Bureau and \$96,500 for electric lighting, has been approved by the City Council.

GLOUCESTER, N. J.—Plans have been prepared by the Bell Telephone Company, 1230 Arch Street, Philadelphia, Pa., for the erection of a new exchange plant in Gloucester.

MORRISTOWN, N. J.—The Board of Public Utility Commissioners has granted the Morris County Traction Company permission to issue \$1,179,000 for extensions and improvements to its system.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

MORRISTOWN, N. J.—The Morris & Somerset Electric Company, 20 South Street, has been awarded contract for supplying electricity to operate the proposed new aluminum bronze works, to be erected in Morristown by Charles Butters of Oakland, Cal.

NEWARK, N. J.—The Public Utility Commission has approved the application of the Public Service Railway Company for permission to issue \$1,250,000 in capital stock, the proceeds to be used for plant extensions.

NEWARK, N. J.—Permission has been granted the New York Telephone Company by the Township Committee of Hillside, near Newark, to erect poles in Myrtle Avenue, to provide for extensions to its system in the Hillside district.

NEWARK, N. J.—Bids will be received by the Board of Freeholders for the installation of new electric-lighting and power wiring in the laundry building at the Essex County Hospital at Overbrook. The board is also considering plans for improvements to the electric-lighting system and the installation of new boilers at the hospital.

TRENTON, N. J.—The City Commission is considering plans for improvements to the electric street-lighting system, including extensions in Nassau, Dexter and Vine Streets and Phillips Avenue, in the North Trenton district.

TRENTON, N. J.—The Mercer County Board of Freeholders has awarded contract for lighting the Lee and Olden Avenues, Chambers and Southard Streets and the Perdicaris Place bridges to the Public Service Corporation for a period of five years.

BRADFORD, PA.—Plans have been filed by the Kendall Refining Company for the erection of a new two-story power house, 40 ft. by 75 ft., at its works in the East Bradford district. Contract has been awarded to W. I. Uhrh, 574 East Main Street, Bradford.

ERIE, PA.—Plans have been filed by the General Electric Company for the construction of a new power house at its local works, for which contract has been awarded to Henry Sherk, Twelfth and Sassafras Streets, Erie.

ERIE, PA.—Three large housing projects to cost approximately \$6,000,000, it is reported, are under consideration by the American Brake Shoe & Foundry Company, the General Electric Company and the Erie Forge Company to provide accommodations for their employees.

NANTICOKE, PA.—Plans are being prepared for the construction of several extensions to the State Hospital at Nanticoke, including a new one-story power house. McCormick & French, Second National Bank Building, Philadelphia, Pa., are architects; Dr. E. D. Meyer, West Washington Street, Nanticoke, is superintendent.

NORRISTOWN, PA.—Improvements are being made to the local system of the United Telephone & Telegraph Company, including the installation of a new switchboard.

PHILADELPHIA, PA.—Plans are being prepared by Shane Brothers & Wilson, Bourse Building, for the construction of a new one-story power house, about 35 ft. by 40 ft., at its plant at Sixty-third and Market Streets. J. M. Whitham of Philadelphia, Pa., is architect.

POTTSVILLE, PA.—The Pottsville Union Traction Company has filed notice with the Public Service Commission of an issue of \$10,000 in bonds for extensions and improvements to its system.

POTTSVILLE, PA.—Notice has been filed with the Public Service Commission by the Eastern Pennsylvania Light, Heat & Power Company of an issue of \$10,500 in bonds, the proceeds to be used for improvements.

READING, PA.—The Public Service Commission has granted the Reading Transit & Light Company permission to arrange for an appropriation of \$150,000 for extensions and improvements to its system.

WHITE HAVEN, PA.—Plans have been prepared by the Wilmot Engineering Company of Hazleton for extensions to its plant at White Haven, to include a machine shop, pattern shop and power station. The company manufactures iron and steel castings, coal mining machinery, breakers, etc. George W. Wilmot is president.

WILKES-BARRE, PA.—The main power station of the Wilkes-Barre Company on North River Street at the city line is being enlarged to provide space for new equipment, including new switchboard, two boilers of 600 hp. each and a new 5000-kw. turbine. The company will also erect a new high-tension transmission line from Wilkes-Barre to Ludlow and vicinity. This line will supply energy to the colliery of the Quinn Coal Company and other industries along the line.

BALTIMORE, MD.—Plans are being prepared by Gardner & Lindberg, of Chicago, Ill., for the erection of a new power house at the works of Corkran, Hill & Company on Sixth Street, near Wilkens Avenue. The office of the company is located at 221 South Howard Street.

BALTIMORE, MD.—Plans have been filed by the Bartlett-Hayward Company, Scott and McHenry Streets, for the construction of a new transformer house at Ramsay and Poppleton Streets. Contract has been awarded to Morrow Brothers, Fidelity Building, Baltimore, Md.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 21 for the installation of radio towers and tank at Bartaria Bay, La., to cost about \$35,000. Further information may be obtained at the above bureau.

WASHINGTON, D. C.—Plans are being prepared by McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, N. Y., for the construction of a new telephone building for the Chesapeake & Potomac Telephone Company at Thirteenth and G Streets, N. W. The cost is estimated at about \$800,000.

North Central States

CLEVELAND, OHIO.—The New York Central Railroad Company is planning to erect a power house, 40 ft. by 79 ft., in Cleveland. New equipment, including generators, motors, etc., will be purchased. For further information address W. Brahan, East Third and St. Clair Streets.

TOLEDO, OHIO.—The City Council has granted the Mutual Heating & Lighting Company a franchise to lay conduits in Michigan Street, from Jackson to Lafayette Street.

JACKSON, KY.—The power plant of the Jackson Light & Ice Company was recently damaged by fire. The boilers alone escaped injury.

CABERY, ILL.—Bonds to the amount of \$4,500 have been voted for the installation of an electric-lighting plant.

HOMER, ILL.—The property of the Homer Electric Light & Power Company has been purchased by J. M. Copel and T. E. Hughes of Champaign. The plant also furnishes electrical service in Sidney.

JOLIET, ILL.—The Chicago & Joliet Electric Railway Company is contemplating the construction of two substations, to cost about \$50,000. One will be erected at Osgood and St. Louis Streets, and the other at Delwood Park.

MATTOON, ILL.—The Central Illinois Public Service Company has petitioned the Illinois Public Utilities Commission to abandon heating plants operated by the company in Charleston, Virden, Carrollton, White Hall and Moweaqua. The petition is based upon the high cost and scarcity of coal and also the increased cost of other materials, making the heating service in the towns mentioned unprofitable.

WYOMING, ILL.—The Illinois Public Utilities Commission has granted the Public Service Company of Northern Illinois authority to purchase and operate the property of the Stark County Electric Company.

AMHERST, WIS.—The Amherst Electric Service Company, it is reported, contemplates extending its electric transmission line from Amherst to Amherst Junction.

IOLA, WIS.—The Iola Light, Power & Manufacturing Company, recently incorporated with a capital stock of \$25,000, proposes to construct and operate a hydroelectric and auxiliary steam generating plant, saw and planing mill and other industries. Edwin J. George, Bertha and Erna Nehls are the incorporators.

STEVENS POINT, WIS.—Contract has been awarded by the Jackson Milling Company to the Allis-Chalmers Manufacturing Company of Milwaukee, for equipment for a hydroelectric power plant to be erected on the Wisconsin River at Stevens Point. The equipment will consist of six 950-hp. vertical open-flue hydraulic turbines directly connected to six 800-kva., alternating-current motors with governors, and two 200-kw. motor generator sets. The cost of the plant complete is estimated at \$500,000.

CEDAR RAPIDS, IOWA—The Board of Railroad Commissioners has granted the Iowa Railway & Light Company of Cedar Rapids a franchise to construct and operate an electric transmission line along certain roads in Benton County for the transmission of electricity for lamps, heaters and motors.

CEDAR RAPIDS, IOWA—The Hubbard Ice Company is contemplating improvements to its ice plants at 1132 North First Street West and 319 Eighth Street West, at a cost from \$8,000 to \$10,000. The company, it is reported, would like to receive bids on electric wiring. Rufus Lee, 1132 North First Street West, is manager.

EDDYVILLE, IOWA—The City Council is considering calling an election to submit the proposal to issue \$7,000 or \$8,000 in bonds for improvements to the municipal electric-lighting system.

ST. LOUIS, MO.—The Laclede Gas Light Company is planning to establish a plant, at a cost of \$100,000, to repair meters and motor cars.

ST. LOUIS, MO.—An ordinance has been introduced by the Board of Aldermen requiring the Union Electric Light & Power Company to replace all 32-cp. lamps with 60-watt Mazda lamps.

ST. LOUIS, MO.—The J. C. Bullis Manufacturing Company, 1122 South Twelfth Street, it is reported, is taking bids on two 80-hp., horizontal return boilers, boiler feed pump, steam heating, electric wiring and sprinkler system for a one-story building, 218 ft. by 391 ft., to be erected at Penrose, Geraldine and Brown Avenues. William Levy, Wright Building, is architect. The Flad & Humphrey Engineering Company, Chemical Building, is mechanical engineer.

FALLS CITY, NEB.—At an election to be held Jan. 15 the proposal to issue \$60,000 in bonds for improvements to the municipal electric-light plant and \$15,000 for the water works system will be submitted to the voters. E. M. Stevens, Ridge Arcade, Kansas City, Mo., is engineer.

OMAHA, NEB.—The Nebraska Service Station has awarded general contract for the construction of an auto service station to Alexander Beck, Keeline Bank Building. The company is receiving bids for electric wiring, heating and plumbing. The cost of the building is estimated at \$32,000.

BURNS, KAN.—At an election held Dec. 27 the proposal to issue \$10,000 in bonds, the proceeds to be used for the installation of a municipal electric-light plant, was carried.

FORD, KAN.—Bids will be received by the board of education, Ford, until Jan. 8 for the construction of a rural high school building, including steam heating, electric wiring, plumbing, etc. The cost of the building is estimated at \$20,000.

GARFIELD, KAN.—Local business men have entered into a contract with the City Council of Larned for electricity from the municipal electric plant. The local company's transmission line will connect with the Larned system at the State Hospital for the Insane, 3 miles west of Larned, where the municipality furnishes electricity for the State buildings.

WICHITA, KAN.—Contract has been awarded by the Wichita-Walnut Valley Interurban Company for the construction of its proposed interurban railway to the Scott Construction Company of St. Louis, Mo. The line will extend from Wichita to Andover, thence to El Dorado and to Augusta.

WICHITA, KAN.—Bids will be received at the office of the board of education, Wichita, until Jan. 14 for the construction of two six-room additions, one to the Waco Ward School at Twenty-first and Waco Avenue, the other to the Horace Mann Intermediate School at Twelfth Street and North Market Streets. Separate bids to be submitted for heating and ventilating system, plumbing and electric wiring. Copies of plans and specifications may be obtained at the office of Lorentz Schmidt, architect, Wichita, upon deposit of \$15.

Southern States

GRAPHITEVILLE, N. C.—The General Graphite Company, Jefferson Bank Building, Birmingham, Ala., it is reported, contemplates the construction of a hydroelectric plant in Graphite.

TUXEDO, N. C.—The Blue Ridge Power Company is planning to build a hydroelectric plant on the Green River, to develop from 8000 to 10,000 hp., at a cost of from \$800,000 to \$900,000. Contract for dam, 125 ft. high and 300 ft. long, has been awarded to Willard, Boggs & Company of Spartanburg, S. C., at \$100,000. Designs for power house have not yet been prepared. The plans provide for the erection of an electric trans-

mission line to connect Spartanburg, Inman, Campobello, Landrum, S. C., and Tryon and Saluda, N. C. All principal contracts, it is understood, have been placed. John A. Law of Spartanburg, S. C., is president.

COLUMBUS, MISS.—The Columbus Lumber Company is contemplating the installation of new equipment, including boilers, engines, locomotives, etc. The cost of the improvements is estimated at \$70,000. D. F. McCullough is manager.

McCOMB, MISS.—The McComb & Magnolia Railway & Light Company is planning to build about 8 miles of track during 1913, to connect Summit, McComb, Fernwood and Magnolia.

WIGGINS, MISS.—The City Council has engaged Xavier A. Kramer, consulting engineer, Magnolia, to prepare plans for improvements to the electric-light plant and water-works system.

MOUNTAIN HOME, ARK.—A company, it is understood, has been organized to develop the water power on the North Fork River in connection with the erection of large smelters to work up large deposits of zinc and iron ores in north Arkansas and South Missouri. To meet the requirements of the proposed smelters it will be necessary to develop 3000 hp. E. N. Sanderson, 60 Broadway, New York, president of the Federal Light & Traction Company of Springfield, Mo., and others, are reported interested in the project.

ARDMORE, OKLA.—Contract has been let by George H. Siedehoff Construction Company of Kansas City, general contractor, to the Dodge Electric Company of Tulsa, for electric work for the Ardmore Hotel, to be erected in Ardmore, at a cost of about \$200,000.

TIOMINY, OKLA.—The installation of an electric lighting system is under consideration by the City Council.

PAULS VALLEY, OKLA.—The City Council is considering calling an election to vote on the proposal to issue bonds for improvements to electric-lighting system and water works.

BELTON, TEX.—The property of the Southwestern Traction Company, including the interurban line which runs between Belton and Temple, has been sold under the order of the United States Court, the purchaser being F. W. Downs of Temple, for \$170,000, including mortgage bonds. The company, it is stated, will be reorganized and important improvements made to the property.

FORT WORTH, TEX.—The North Fort Worth Ice & Cold Storage Company is planning to install additional machinery in its ice plant at North Fort Worth, increasing the output by one-third.

GREENVILLE, TEX.—The Mineral Heights Street Railway Company is contemplating changing its system from overhead trolley to gasoline motive power.

MARFA, TEX.—The Marfa Electric & Ice Company is planning extensions to its light and power plant, including the installation of new equipment. The company, which has also been granted a franchise to supply the city with water, will sink a number of wells and install pumps.

NAGODOCHES, TEX.—The City Council is planning extensions to the municipal electric-light and power plant, including the installation of a 300-kw., 2300-volt steam turbo-generator set, at a cost of about \$14,000.

ORANGE, TEX.—The International Shipbuilding Company is planning to install a large electric carrying and mono-rail system in its local shipbuilding yards.

Pacific and Mountain States

OLYMPIA, WASH.—The Olympia Light & Power Company is installing a new 400-kw. alternating-current generator in its power plant.

OLYMPIA, WASH.—Owing to bids exceeding the funds appropriated for the construction of a new cottage and power plant at the State Training School for Girls at Grand Mound, the Board of Control has decided to drop the project for the present. The bids exceeded the appropriation by more than \$12,000.

SEATTLE, WASH.—A bill has been passed by the City Council providing for an increase from \$3,000,000 to \$5,000,000 of the lighting fund utility bond issue for the purchase of a completed hydroelectric project. The bill will be an amendment to a bill passed by the Council early in 1917 directing the call of bids and an expenditure not exceeding \$3,000,000.

SEATTLE, WASH.—The engineering department of the Puget Sound Traction,

Light & Power Company is completing the installation of an additional penstock at the White River hydroelectric plant, which is about three-fourths completed. Foundations for the 16,000-kvm. generator and waterwheel have been placed. The plant when completed will cost about \$750,000.

SEATTLE, WASH.—The City Council has passed a bill appropriating \$750 to send Hugh M. Caldwell, corporation counsel, and J. D. Ross, superintendent of lighting, to Washington, D. C., in the interests of the city, to bring about the cancellation of the rights of the Skagit Power Company to the Skagit River power site. The company was given rights on this site several years ago.

SEATTLE, WASH.—The City Utilities Committee has directed A. H. Dimock, city engineer, and J. D. Ross, superintendent of lighting, to make an investigation of the power project on the Snoqualmie Forest Reserve offered to the city by the Skyomish Power Company. The project is offered to the city for \$800,000, and attention is called to the standing timber on the land, which can be disposed of while the dam is being built for \$700,000. The site is 40 miles from Seattle and, it is understood, that an impounding basin can be developed with a capacity of 200,000 acre ft., or double the storage capacity of Cedar Lake after the new masonry dam is utilized. It is estimated that 40,000 (continuous) hp. can be developed.

BROOKDALE, CAL.—The Mountain Light & Water Company of Brookdale has petitioned the State Railroad Commission for permission to discard its flat rates and install meters in the residences of its patrons.

LOS ANGELES, CAL.—Plans for the completion of the municipal power plant No. 2 in San Francisquito Canyon to develop about 25,000 hp. are under consideration by Mayor Woodman and William Mulholland, chief engineer. The cost is estimated at \$750,000.

LOS ANGELES, CAL.—The Board of Supervisors has adopted an ordinance granting the Pacific Electric Railway Company a franchise to construct and operate an electric railway on certain highways and public roads in Los Angeles County for a period of 40 years.

CARLSBAD, N. M.—The Carlsbad Light & Power Company is contemplating the installation of a steam auxiliary plant and proposes to use oil for fuel. The company would like to communicate with manufacturers and dealers in fuel oil equipment. H. Prithard is manager.

Canada

CALGARY, ALTA.—The purchase of a new automatic feed regulator, which will be required in connection with the contract to supply the Western Canada Flour Mills Company with energy is under consideration by the City Council. The cost is estimated at \$2,750 and the commissioners will recommend that it be purchased from the Westinghouse Company. The company has decided to discard its steam plant and equip its works for electrical operation and has contracted for 800 hp.

TRAIL, B. C.—The West Kootenay Power & Light Company contemplates extending its electric transmission line to the property of the Canada Copper Company at Princeton a distance of 110 miles, to furnish electricity to operate the proposed 3000-ton concentrator which the company is planning to build. Plans are now being prepared by Bradley, Bruff & La Barthe of San Francisco, Cal., for the concentrator, to cost about \$1,500,000.

BRUSSELS, ONT.—The Town Council is considering the installation of a new electric-light plant in the near future.

PARKHILL, ONT.—The Town Council is considering the installation of a hydroelectric power plant, to cost about \$12,000.

PERTH, ONT.—The municipality is considering the purchase of the local electric plant, owned by the Canadian Electric & Water Power Company. The Hydro-Electric Power Commission of Ontario is planning the erection of a 26,400-volt transmission line between Perth and Smith's Falls to supply electricity to this town. It is proposed to change over the present generating stations and distribution system from 133 cycles to 60 cycles.

PICTON, ONT.—The Hydro-Electric Power Commission of Ontario is planning to furnish electricity in the towns of Picton, Wellington and Bloomfield, Prince Edward County, by means of a 44,000-volt transmission line from Trenton. The plans provide for the erection of a substation in Picton and also a substation in Wellington to serve the latter plant and Bloomfield, and the erection of a 4000-volt transmission line from Wellington to Bloomfield.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City. Annual meeting, Jan. 14, 1918.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C. Annual meeting September, 1918.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, M. C. Gilman, Toronto Electric Light Company.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

CONNECTICUT ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May 1918.

EASTERN NEW YORK SECTION N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavelly, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chaplin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Jacksonville, Fla., Jan. 7, 1918.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting, May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga. Annual meeting June, 1918, Tybee Island, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill. Annual meeting, Chicago, January, 1918.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railway & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president). Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti, Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MASSACHUSETTS ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. E. Wilson, 263 Summer Street, Boston, Mass.

MICHIGAN SECTION N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn. Annual convention, January, 1918, Minneapolis.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

MISSOURI ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo. Annual meeting Jan. 19, 1918.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 32 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSO-

CIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn. Annual meeting, Minneapolis, Minn., Jan. 23 and 24, 1918.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekum Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PENNSYLVANIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beech St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT. Inc. General Manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Bargebaugh, 703 First National Bank Building, El Paso, Tex. Annual meeting, April, 1918.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill. Annual meeting, Jan. 29-31, 1918, Memphis, Tenn.

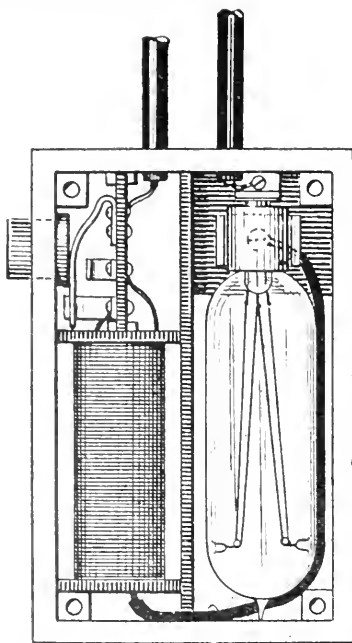
WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, March, 1918.

WISCONSIN ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

(Issued Dec. 11, 1917.)

- 1,249,583. TELEPHONE EXCHANGE SYSTEM; Joseph L. Wright, Cleveland, Ohio. App. filed Dec. 9, 1912. Semi-automatic.
- 1,249,597. ELECTRIC OXIDIZER; David M. Clark, Phoenix, Ariz. App. filed Aug. 20, 1917. Improvements.
- 1,249,630. DOUGH RAISER; Colin F. Hardy, Harvard, Neb. App. filed March 20, 1916. Improvements.
- 1,249,638. ELECTRIC PLATIRON; Adele R. King, New York, N. Y. App. filed Feb. 10, 1917. Provided with cutout switches.
- 1,249,652. ELECTRIC LAMP; Joseph Mersting, Zollikon, near Zurich, Switzerland. App. filed May 10, 1916. Incandescent-filament type.
- 1,249,673. CIRCUIT-CONTROLLING DEVICE; Harry O. Rugh, Chicago, Ill. App. filed March 23, 1914. For use on signaling lines.
- 1,249,682. CONTROLLING SYSTEM FOR ELECTRIC ELEVATORS; William S. Smith, Cambridge, Mass. App. filed Feb. 5, 1916. Push-button system.
- 1,249,711. ELECTRIC CONNECTOR; John Berg, Chicago, Ill. App. filed Dec. 4, 1916. Improvement.
- 1,249,717. COMBINED FIRE ALARM AND ANNUNCIATOR; John Carrigan, Seattle, Wash. App. filed April 27, 1916. Improvements.
- 1,249,729. TROLLEY CATCHER; Charles I. Earl, New York, N. Y. App. filed April 20, 1916. Improvements.



1,249,965—Fuse and Circuit Tester

- 1,249,746. CONTROL APPARATUS; Arthur J. Hall, Wilkesburg, Pa. App. filed Nov. 5, 1915. For use in multiple-unit control systems of electric vehicles.
- 1,249,747. CONTROL SYSTEM FOR ELECTRIC MOTORS; Arthur J. Hall, Wilkesburg, Pa. App. filed Dec. 4, 1913. For a motor car or electric locomotive operated upon a direct-current railway system.
- 1,249,748. CONTROL APPARATUS; Arthur J. Hall, Wilkesburg, Pa. App. filed Dec. 18, 1914. Special relation to means for lubricating the contact segments of drum controllers and the like.
- 1,249,773. TELEGRAPHY; Carl Kingsley, Chicago, Ill. App. filed Aug. 14, 1914. High speed.
- 1,249,782. BALANCED - PHASE - CONVERTER SYSTEM; Ralph R. Lawrence, Dorchester, Mass. App. filed July 24, 1916. Provides means for maintaining proper phase relations and voltage conditions in a polyphase circuit receiving current from or supplying current to a phase converter, particularly of the rotary type.
- 1,249,783. ROTARY-PHASE-CONVERTER SYSTEM; Ralph R. Lawrence, Dorchester, Mass. App. filed July 31, 1916. Provides means for maintaining, throughout variation in load, proper phase relations and voltage conditions in a polyphase circuit receiving current from or supplying current to a phase converter.
- 1,249,787. APPARATUS FOR ELECTRODEPOSITION OF METALS; August Leuchter, Brooklyn, N. Y. App. filed Oct. 5, 1916. Improvements.

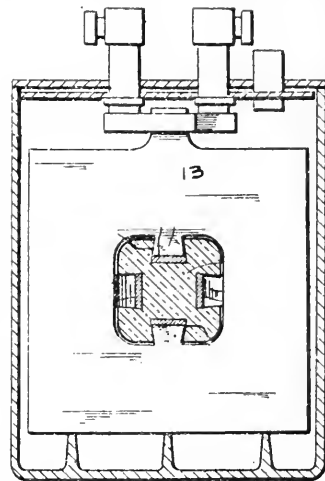
Record of Electrical Patents

Notes on United States Patents

- 1,249,800. TRANSFORMER; Jesse E. Mateer, Wilkesburg, Pa. App. filed Dec. 18, 1914. Means for insulating the high-tension coils.
- 1,249,820. INSULATOR; Harry A. Pharo, Wilkesburg, Pa. App. filed Aug. 10, 1915. Means for supporting conductors securely without the use of the wires or other external fastening means.
- 1,249,821. PROCESS OF MAKING CYANOGEN COMPOUNDS; Herbert Philipp, Perth Amboy, N. J. App. filed June 2, 1910. Improvements.
- 1,249,854. FURNACE FOR TREATING ORES; Gottwerth L. Tanzer, Seattle, Wash. App. filed July 24, 1917. Improvements.
- 1,249,856. CURRENT TAP; George B. Thomas, Bridgeport, Conn. App. filed Jan. 15, 1916. Associated with an electric lamp socket.
- 1,249,857. ELECTRIC SWITCH; George B. Thomas, Bridgeport, Conn. App. filed Sept. 9, 1916. Toggle.
- 1,249,866. ELECTRIC LEAD-IN FIXTURE; Alois F. Walther, Detroit, Mich. App. filed Sept. 2, 1916. For use in connection with garages and buildings.
- 1,249,872. ELECTRICAL SWITCH LOCK; Paul W. Wiggert, Idar Grove, Iowa. App. filed July 10, 1916. Rotary members may be readily moved to inoperative position to prevent the switch from being closed except by a party familiar with the combination.
- 1,249,902. RAILWAY SIGNALING SYSTEM AND APPARATUS; Clyde J. Coleman, New York, N. Y. App. filed July 12, 1907. Improvements.
- 1,249,909. IGNITER FOR INTERNAL COMBUSTION ENGINES; James M. Dayton, Torrington, Conn. App. filed Sept. 26, 1914. Make-and-break type.
- 1,249,953. SPARK-PLUG TESTER; Claude E. Harlan, Watsonville, Cal. App. filed Feb. 19, 1916. Portable.
- 1,249,954. CONTROL SYSTEM; Rudolf E. Hellmun, Pittsburgh, Pa. App. filed Sept. 25, 1914. To prevent the occurrence of "flash-over" conditions in dynamo-electric machines, more particularly electric railway motors, under predetermined conditions.
- 1,249,962. TELEPHONE APPARATUS; Ludwig L. Lundgren, Youngstown, Ohio. App. filed May 3, 1915. Receivers.
- 1,249,965. FUSE AND CIRCUIT TESTER; Lynn D. Johnson, Portland, Ore. App. filed April 7, 1916. For electrician's kit.
- 1,249,978. INCANDESCENT LAMP; George M. J. MacKay, Schenectady, N. Y. App. filed Sept. 8, 1913. Tungsten.
- 1,249,982. MACHINE FOR SUBJECTING AIR TO CERTAIN LIGHT RAYS; Edwin M. Markel, Des Moines, Iowa. App. filed Jan. 23, 1917. For producing ozone by the passage through the air of a brush electrical discharge generated in the machine.
- 1,249,992. CIRCUIT CLOSER FOR COMBINATION LOCKS AND BURGLAR ALARMS; Melvin D. Morton, Gauley Mills, W. Va. App. filed June 6, 1916. Improvements.
- 1,250,010. ELECTRIC ICE CUTTER; Germain Pouchan, San Francisco, Cal. App. filed March 29, 1915. Reducing ice to the shape of small blocks ordinarily cubical, suitable for use in restaurants.
- 1,250,080. SEPARABLE ATTACHMENT PLUG; Reuben B. Benjamin, Chicago, Ill. App. filed Nov. 21, 1908. Improved means for relieving the binding terminals from strain due to a pull on the conductors.
- 1,250,093. STEREOSCOPIC X-RAY APPARATUS; William D. Collidge, Schenectady, N. Y. App. filed March 3, 1915. Improvements.
- 1,250,105. TIMER; Clifton R. Holmes, Montgomery, Mich. App. filed Nov. 6, 1916. Improvements.
- 1,250,116. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, Brooklyn, N. Y. Application filed Oct. 11, 1916. Improvements.

(Issued Dec. 18, 1917.)

- 1,250,120. DECORATIVE ILLUMINATING MEANS; Alfred C. Abramson, Rockford, Ill. App. filed March 13, 1915. Portable lamps.
- 1,250,143. ELECTRIC SIGN; George S. Coleman, Newark, N. J. App. filed Oct. 21, 1916. Motion picture effect.
- 1,250,157. CONTROL DEVICE; Harry H. Fowler, Toledo, Ohio. App. filed May 20, 1915. Relates to interconnected elements of indication and operation.
- 1,250,183. ELECTROLYTIC CELL; Henry C. Jenkins, London, England. App. filed Nov. 22, 1916. An improved method of operating such cells.
- 1,250,209. INDICATING MECHANISM; Harry Y. Norwood, Rochester, N. Y. App. filed March 17, 1914. For indicating temperature.
- 1,250,385. ROTARY SPARK-GAP MACHINE; Clarence H. Teall, Detroit, Mich. App. filed Jan. 18, 1916. For use in connection with wireless apparatus.
- 1,250,402. ELECTRIC-HAMMER SWITCH; Alexander Wendelburg, New York, N. Y. App. filed July 28, 1914. Improved form of electric hammer.
- 1,250,451. CARBURATOR ATTACHMENT; Linn B. Harrod, Little Rock, Ark. App. filed March 28, 1917. Improvements.
- 1,250,460. BATTERY CELL; Walter E. Holland, Detroit, Mich. App. filed March 15, 1915. Edison or alkaline type.
- 1,250,545. FLASHLIGHT; Bernard Benedict, New York, N. Y. App. filed Sept. 8, 1914. Portable.
- 1,250,554. APPARATUS FOR SEPARATING AND RECOVERING DOMESTIC REFUSE. App. filed March 21, 1916. Improvements.
- 1,250,579. MACHINE-SWITCHING TELEPHONE SYSTEM; Charles L. Goodrum, Brooklyn, N. Y. App. filed Oct. 6, 1916. Improvements.



1,250,696—Storage Battery

- 1,250,581. ELECTRIC FIXTURE; Gustav A. Harter, Chicago, Ill. App. filed June 22, 1914. Fixture in which a socket, globe and shade are freely adjustable to facilitate the installation thereof and to accommodate lamps of different sizes.
- 1,250,583. SEMI-AUTOMATIC TELEPHONE SYSTEM; Henry J. Herink, London, England. App. filed March 8, 1917. In which there is a satellite exchange connected with a manual central exchange.
- 1,250,589. SIGNALING HORN; William Kaising, Chicago, Ill. App. filed June 12, 1914. Provision of a new diaphragm-actuating mechanism for devices of this kind.
- 1,250,641. AUTOMATIC CONTROLLER; Hermann Pauli, Peoria, Ill. App. filed Oct. 24, 1914. Improvements.
- 1,250,661. SIGNAL FOR VEHICLES; Edwin H. Roberts, Denver, Col. App. filed Nov. 11, 1915. Operable from the steering wheel.
- 1,250,674. SWITCHING APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Nov. 4, 1914. Suitable for the control of various current paths or circuits for producing desired effects upon or by translating devices included in such paths or circuits, or for simply interrupting or closing such paths or circuits.
- 1,250,696. STORAGE BATTERY; Edward E. Stout, Indianapolis, Ind. App. filed March 10, 1917. Means to equalize the distribution of the lines of force of the current through the battery elements.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Volume 71

New York, Saturday, January 12, 1918

Number 2

Service Depends on Capital Supply

THE shares of public utility companies seem to be in little favor these days, as is evidenced from the quoted prices of various stocks. Some have reached very low levels, despite the fact that many of the properties have increased in value, in earning power and in efficiency. At the low price to-day the stock of some utilities offers a higher return to the investor, but this apparently is a time when investment yield receives scant consideration. And yet it is absolutely essential for the proper development of the industry that the utilities obtain money at reasonable rates, otherwise development will come to a standstill. The prosperity of the manufacturer, the jobber and the contractor depends in large measure on the increased activity of the central station. Moreover, without sufficient capital to meet the rapidly growing demand for electricity, service to the public is likewise curtailed.

Opportunity to Develop Foreign Water Powers

TWO of the allied powers, France and Italy, are very short of coal, and they look to the United States to help them in their distress. Neither country ever possessed much coal, but both have abundant water power, which they permit to run to waste. Being tarred with the same stick, the United States cannot with much grace remind them of this profligacy, and especially now since France has shown more enterprise than we in turning to her undeveloped water powers for relief. Italy, on the other hand, has done little toward utilizing the power of her mountain streams. This condition spells opportunity for American manufacturers of waterwheels and generators. An invaluable service can be rendered both nations by the rapid development of their water power, for not only will it help to solve the coal problem forever, but incidentally it will cut down the export of coal from this country and relieve precious ships for other work.

Changed Conditions in the Jobbing Trade

IN VIEW of competition arising from decrease in purchases and opportunities in other directions, electrical supply jobbers may profitably adjust themselves to changed conditions. Strict economy is essential. Stocks of miscellaneous supplies used in ordinary contracting and building trades will bear watching. To care for industries expanding to meet the war's needs,

larger sizes of conduit, fittings, cables and switches will be in demand. Since skilled mechanics in all lines of business will receive maximum wages and will on that account be in a position to buy, household appliances of a utilitarian nature will probably become attractive. Credits and collections need to be carefully scrutinized and enough cash should be kept on hand to meet emergencies. Diminished profits must also be reckoned with.

Opportunity Knocks at the Door

ELECTRIC utility companies are essential to the country in the conduct of war. There is no substitute for the service which they sell that will not, in comparison, be wasteful of men, money and materials. Realizing their importance, these companies have two courses open to them: either they may voluntarily place all of their facilities and resources at the disposal of the government or they may wait, possibly to be conscripted for service later, but in the meantime getting for their stockholders all that they can out of the situation.

The decision is clearly up to the directors and executives. Will they take the broad view that stockholders' ultimate interests will be best served by voluntarily considering such interests as secondary to those of the country? Failing to take this view, will they be courageous enough deliberately to sacrifice their stockholders' interests to those of the country? Will they have breadth of vision and enough courage to take one or the other of these views and "carry on" in line with such a policy, or will they take the attitude of the narrow-gage politician who considers it more important to secure a post-office building for his home town than to provide ammunition for our troops?

The decision in either case means more than the passage of resolutions to spread upon the records. It may mean a radical change in the point of view both of officials of companies and members of public service commissions. Demands from the public for extension of facilities or for lower rates, demands from employees for increased wages and demands from stockholders for increased earnings can, none of them, receive more than secondary consideration. Every question must be decided on the basis of the conservation of men, money and materials—conservation being understood to mean use in such manner as will aid to the greatest possible extent in winning the war.

Then it is necessary that there shall be developed a spirit of co-operation—not only co-operation between

companies and commissions, but co-operation between them and the Fuel Administration, War Industries Board and any and all other agencies having the same purpose in view of prosecuting the war with vigorous energy to a right conclusion. Old suspicions, prejudices and fears must be forgotten. Each party to such co-operation must assume that the other is at least trying to serve his country to the best of his ability. To place the interests of the country above any other consideration, to develop a spirit of co-operation and a willingness to sacrifice selfish personal desires for power, position, prominence or property, is as good and as practical a program for companies and commissions to adopt as it is for individuals. It is the least that many of us can do.

The Electric Light a Necessity

W E REGRET to note here and there in the public press statements intended to convey the impression that electric light is a non-essential which can be, and in the interest of fuel economy should be, reduced to the minimum possible use. Had that statement been made thirty years ago it might have been backed up by reasonable arguments. To-day it comes pretty near to being a malicious fabrication. So many communities at the present time depend also wholly on electricity for artificial lighting and are using energy so economically generated that any considerable reduction in usage would simply be a public hardship. We believe heartily, as every good American should, that in these times there should be careful economy in all things, but to a public dependent so largely as it is upon electric light for its after-dark activities of every kind the singling out of this particular thing for attack seems to show a singular lack of perspective. A first-class central station turns out the kilowatt-hour on two to three pounds of coal, as every well-informed engineer knows, and this amount of energy will supply a dozen 20-cp. incandescent lamps for considerably more than the average evening's use.

It would be hard to point out a place where a small amount of fuel can produce so great a result in usefulness and convenience. Enough coal is wasted daily in the average kitchen range to supply adequate light for the house it serves. If electric light were replaced by gas or oil, the situation would not be bettered in the least, for both require the use of amounts of fuel not to be neglected and more important than the fuel used in the electric light station. If we really want to save fuel—and such saving is unquestionably necessary—the place to begin is not at the point of highly efficient use, but in those things where waste is notorious, like the range, the furnace and the open grate, the last named being the most absurdly inefficient of all heating devices. There is a remarkable lack of breadth of view in the public perception of war-time economies, a frequent and silly endeavor to single out the sensational instead of getting down to bed rock and devoting attention to the important. This straining at gnats and swallowing of camels is surely not what is most needed in the present crisis.

That the strictest economy all along the lines is desirable goes without saying. It is bad judgment to use light or fuel carelessly and lavishly, and economy should be practiced as a personal virtue when the times are such as to demand the full resources of all. We are not in the least worrying about the business of the electric companies. The needs of the war will keep up their output and increase it, but we do lament the foolishness that in its anxiety to save at the tap condones illimitable spilling at the bung hole.

Motor-Driven Planers

T HE latest of Professor Clewell's interesting discussions of electric drive deals with the special requirements of planer operations. The planer is one of the most important of machine tools and in some respects the least efficient from the standpoint of output, since at best only half of its motion is taken up in cutting, as opposed to the works of lathes and milling machines. The first requirement, therefore, of a scientific drive is that it should operate on the cutting stroke at the speed of maximum efficiency for the particular metal and the cut in hand, and that it should get back for another stroke in the minimum possible time with as little fuss and strain on the equipment as is practicable.

The actual work required in making the cut is a comparatively small part of the cost of the whole planing operation, so that power economy itself is a less important item here than in many other machines. To meet the requirements of the particular cycle of operation necessary two general schemes are in use. The first of these provides an independent motor drive of the planer, using the ordinary belt equipment and eliminating the line shafting. In this case the motor runs at constant speed and the ordinary belt-shifting device takes care of the varying speed required in the cutting stroke and of the swift return necessary. It is not unusual to accelerate the return by automatic change in the field resistance. The obvious difficulty with the arrangement is the heavy demand for power and the severe strains imposed during the mechanical reversal.

Of late planer manufacturers have been looking with more and more favor on the purely electric drive with reversing motor, using dynamic braking to take up the shock of the necessary reversals. A complete electric drive, of course, gives all manner of opportunity for proper speed variation, at the cost of somewhat more complicated and costly motor equipment. The chief advantage gained is a greater degree of flexibility and the practical abolition of the very severe strains arising from inertia of rotating parts. The inertia of the moving platen is small and that of the rotating parts is relatively very high, causing a corresponding violent effort in reversal. With the dynamic braking possible in the directly driven equipment this difficulty is greatly reduced, and when properly adjusted the direct-driven planer ought to be able to do the work with less wear and tear than if belting were employed with a continuously running motor. The balance of cost in the two cases is not altogether easy to figure out, but experience with other electrical drives would indicate that the increased smoothness and flexibility of control with the reversing-motor equipment is well worth the while

in standardized operations where workmen can be taught to use habitually the most efficient speeds. And in this, as in many other similar cases, it is output which counts as the largest item in successful manufacturing, especially when costs of material and labor are running to exaggerated figures.

Lighting Ships Under Construction

MANY shipyards are now working day and night in the effort to supply the enormous demand for new vessels. This task requires constant and efficient illumination of the construction work by night, illumination not only good enough for ordinary night work but sufficient to insure the effectiveness of the workmen, bringing it up as nearly as may be to a daylight standard. A brief article by William G. Hexamer in the current issue gives some extremely useful hints as to the provisions that must be made for this difficult work.

The objectives to be accomplished may be divided into three separate parts or stages of development—first, provisions for lighting along the permanent ways of a character to meet any reasonable demand for this generalized illumination; second, the lighting of skeleton vessels under construction but not yet ready for anything like a standard temporary system, to meet the requirements of local lighting, and, finally, at a certain stage in the operations a systematic wiring plan must be introduced of so general a character that it can be shifted from ship to ship as one after another leaves the ways and is replaced.

In the example discussed the first requirement is met by regular mains on an ordinary 110-220-volt three-wire system reaching as nearly as may be the full length of the ways, at least down to the water line. This simple installation, with outlets every 20 feet (6 m.) for branches and for reaching a parallel two-wire system on each side of the mains, completes provision for general lighting. There is added, however, a junction box conveniently placed for installing the temporary wiring within the ship. Later as the hull progresses a point is reached where double bottoms and other compartments must receive light to meet the local requirements. For this a ten-outlet plug board is placed at the point of greatest demand, to which portable lamps are attached by 50-foot (15.2-m.) lengths of cable. Finally, when the frame is closed in and the decking in place, mains are stretched on porcelain knobs clamped along the edge of the deck on each side of the vessel. These are fed from the permanent outlet provided and each circuit is subdivided into four by knife switches. Taps are taken from these mains to accommodate plug boards,

to which standardized temporary fixtures equipped with 200-watt nitrogen lamps are attached. These furnish a general illumination in the interior of the vessel, while for detail work the portables are retained, the necessary plug boards being installed as the work requires. The mains provided for the permanent ways are utilized for electrical drills and reamers at this stage of construction. It will be seen that this layout is one which fits itself very readily to utilization in ships of various kinds and sizes and gives very flexible provision for the complete lighting of the construction with a minimum of labor as each new keel is laid and the work progresses. It furnishes a capital example of the advantage of systematic methods in accelerating construction.

Intensive Use of Fuel

IN the interest of fuel conservation, attention should again be directed to possibilities of saving through co-operative working between gas and electric companies. This matter has recently been the subject of investigation by the British National Gas Council, with the co-operation of electrical engineers, and some interesting results have been reached. A report is to be laid before the government suggesting, first, that all bituminous coal should be treated for the extraction of its by-products and that gas and electric companies conveniently situated should co-operate through the use of coke as fuel. This is in line with previous studies made in England which have been reported in our columns. The fact is that bituminous coal has constituents which are more valuable from a practical standpoint as gaseous or liquid by-products than they are as mere fuel; and some systematic effort ought to be made to save these incidental values before the coal is thrust into the furnace.

Just at present the fuel supply is so terribly disorganized that the question is not of the orderly utilization of coal but of ability to obtain almost anything that will burn. We recently described the successful use of various low-grade fuels, including even coke breeze, through automatic stokers for raising steam, and boilers gas-fired from coke ovens are already in use. As soon as the situation is cleared up enough to permit an orderly view to be taken, it would be well for the gas and electric companies here to put their heads together with the intention of seeing whether some mutual plan for the better utilization of coal cannot be worked out. Gas and electric companies are no longer, as they used to be, at swords' points, and any vague inherited feeling of distrust ought to be dissipated in view of a common interest in the saving of our fuel supply.

NEXT week's issue will contain an article treating of coal conditions as they affect steam electric central stations throughout the country. There will also be published an illustrated article showing how the United States can effectively aid France and thereby conserve our coal and ships by rapidly developing her water powers in true American fashion. Commencing with this issue, we will devote additional space to technical subjects falling in

The Coming Issues the gap between pure science and applied engineering. These will include investigations of the suitability of different apparatus to operate under different conditions, results of studies which may lead to developments in apparatus or equipment, studies of purely engineering problems with a view to their solution, the evolution of principles which may change present operating methods, etc. Reading pages will be added to care for this extra material.

New England Coal Situation Very Serious

Economy in the Use of Fuel and Increased Efforts to Obtain a Supply Now Matters of Government Concern—Widespread Publicity by Fuel Administrator's Office in the Interest of Coal Conservation

BY JAMES J. STORROW

New England Fuel Administrator

WITH a shortage of 7,801,570 tons of bituminous coal on Jan. 1, 1918, New England faced one of the most critical situations industrially that have arisen anywhere on this continent since the outbreak of the world war.

The railroad congestion now has reduced the car supply for commercial coal at the Pennsylvania mines, bringing New England less than 20 per cent of its contract requirements, with no coal whatever for hundreds of New England plants which depend upon buying spot coal in the market. The taking of tugs and ships for governmental purposes has also greatly reduced the supply of coal moving by water from the West Virginia mines to Boston, Providence, Portland and other New England coal-distributing ports. Unless immediate and effective action is taken by the government within a few days to increase the movement of coal to New England, many hundreds of millions of war equipment which the government is expecting New England to produce will not be produced. Many people do not realize that, even though we are at war, many million tons of coal must be burned for purposes which come ahead even of rifles, cartridges and poison gas.

ENORMOUS COAL CONSUMPTION OF NEW ENGLAND

In the first place, it takes over 13,000,000 tons of coal a year to keep the houses of New England warm and cook the daily food of the inmates. It takes over 6,000,000 tons to keep the New England railroads running. It requires many millions of tons for the trolley lines, without the operation of which employees cannot get to the great Fore River shipbuilding plant and the rest of New England's industrial establishments. Moreover, the gas and electric light plants, which burn millions of tons, must be kept going. It was 30 deg. below zero in northern New England on the morning of Dec. 29.

There is one New England company alone which has undertaken to turn out 3,500,000 yd. (3,200,000 m.) of shirting for our soldiers, 3,500,000 yd. (3,200,000 m.) of khaki, 4,000,000 yd. (3,650,000 m.) of cloth to make overcoats, and 3,500,000 yd. (3,200,000 m.) of blankets. This is merely one illustration.

The New England Fuel Administrator visited Washington on Dec. 29 and conferred with Dr. Garfield, Chairman Hurley of the Shipping Board and Secretary of War Baker. The New England crisis will receive very careful consideration from these officials, with a view to finding a prompt and effective remedy. It is expected that the situation will also be taken up with Secretary McAdoo and his advice and assistance sought, but at this writing it is impossible to state the exact steps which the government will take.

The total consumption of bituminous coal in New England in 1916 was 27,145,752 tons. An estimated

increase of 20 per cent in 1917 is probably low for soft coal, as the New England industries are working under the most intensive pressure ever known and probably to a greater extent than any other section of the country, except perhaps the steel-making districts. Normally New England carries two-thirds of its soft coal by water and one-third by rail. Owing to war conditions, many of the New England coal-carrying bottoms have gone off the coast and cannot be replaced. The already overloaded New England railroads can assume few if any additional burdens. Winter storms and cold weather easily cut down the capacity of these railroads by at least 25 per cent, and the same cut applies to the coal-carrying fleet in winter weather. New England's problem is quite as much one of transportation as of securing coal. It is likely that the shortage will grow worse owing to lack of transportation facilities, and the importance of every possible economy in the use of fuel cannot be exaggerated.

By long custom of the trade, New England has been pre-eminently a spot coal market. The mines have been glad to sell their coal for cash to New England consumers during the summer months while other localities were less ready to buy coal. New England consumers have learned the necessity of accumulating a supply of coal during the summer, owing to the inability of rail and water transportation facilities to carry coal as fast as it must be burned during the winter. Owing to its greater distance from the mines, New England is considered a less desirable market, and at times consumers have been obliged to bid higher prices than other localities in order to divert coal in their direction.

ACUTE SITUATION IN SPOT COAL

The situation in New England in regard to spot coal became acute as soon as the tentative maximum price of \$3 was put into effect by the coal production committee, because New England consumers were prevented from bidding higher than other localities for the coal they needed and the mines and originating railroads at the same price preferred to improve their inadequate car supply by selling coal nearer the mines and so getting their cars back sooner. Now that the two-dollar price is in effect, the situation has grown no better, to say the least. A very large number of New England manufacturers who are dependent upon buying spot coal for their own use have been completely shut off. Most of the coal is going to fill contracts at higher prices, and if there is any surplus of free coal it is being sold nearer the mines. New England today cannot buy a carload of spot coal.

A general response has been received to the requests of the Fuel Administrator's office on behalf of coal conservation, as well as to the orders of the federal

administration. A large amount of publicity material has been prepared and spread broadcast in New England, ranging from suggestions toward the reduction of fuel waste in the home to the publishing of instructions bearing upon improved firing in the industrial and public utility boiler room. The war aspect

THIS REPORT SHOULD BE MADE IN DUPLICATE AND BOTH COPIES RETURNED WITHIN 5 DAYS TO

U. S. FUEL ADMINISTRATOR FOR NEW ENGLAND
STATE HOUSE, BOSTON, MASS.

STEAM PLANT DATA

Name of company _____ Address _____
 Name of plant _____ Location _____
(Make out a report for each plant. Extra blanks will be supplied on request.)
 Average hours per day plant is operated _____
 Kind of coal used _____ Average daily consumption of coal _____ (In pounds)
 1. Number of boilers and horse power of each _____
(State whether water or fire tube)
 a. Natural or forced draft _____
 b. Normal steam pressure carried _____ Maximum variation _____
 c. Are boilers equipped with automatic damper regulator? _____
 d. Are all blow-off connections tight and free from leaks? _____
 2. State average temperature of feed water entering boilers { Observed _____
 { Estimated _____
 a. Are pumps or injectors used to put water in boilers? _____
 b. Do you use an open or closed feed water heater? _____
 3. Number of engines and horse power of each _____
(State whether simple or compound, condensing or non-condensing)
 a. What method of transmission? _____
(State whether mechanical or electrical)
 4. State other purposes and pressures for which steam is used _____
(Such as heating buildings or water, cooking, pumps and process uses)
 5. Is exhaust steam from engines used in whole or in part? _____
 a. State service _____
 b. Do you have a surplus? _____
 6. Is all steam used under questions 4 and 5 supplied with a suitable steam trap? _____
 a. Are steam traps known to be in good working order? _____
 b. How many steam traps return the condensation directly or indirectly to the boilers? _____
 c. How many steam traps discharge the condensation to waste? _____
(Give size and service connected.)
 d. Are any return pipes connected to waste manually controlled? _____
 7. Is steam used from open end pipes? _____
(State purpose, and whether or not a trap could be used)
 8. Are all steam pipes properly insulated? _____
 9. What changes have you in progress which are expected to reduce your fuel consumption? _____
(Give expected date of completion and estimated saving.)

QUESTIONNAIRE OF NEW ENGLAND FUEL ADMINISTRATION

of fuel saving has been constantly emphasized, and the part each individual can play has been set forth clearly. The public in general is certainly beginning to realize the value of economies on a small scale no less than on a large one.

Central stations have displayed a keen appreciation

of the situation and have refrained from taking on a large amount of "non-essential" power business which in normal times would be welcomed with open arms. Realizing the economy in fuel to be derived from the installation of central-station service in a great number of cases, owners of private power plants throughout Massachusetts have been asked by the New England Fuel Administrator to consider the economic possibilities of buying power under favorable conditions, and within a few days a report form has been sent to steam plants, to be returned to the Fuel Administrator's office at the State House, Boston, covering the essential data from which the possibility of more economical use of fuel may be determined.*

This form includes such points as the daily hours of plant service, kind of coal, amount of fuel used, description of boilers, data bearing upon steam pressure, feed-water supply, conditions of piping, blow-off connections, leaks existing, uses of output, type and number of engines, size of generating units, use of exhaust steam, condition of traps, and surplus power available.

The office of the Fuel Administrator is co-operating with fuel users in every feasible way to help them obtain service at greater efficiency and reduced coal consumption, and has offered to assist in engineering analyses of plant conditions with respect in particular to determining the desirability of installing central-station service or effecting other improvements in the coal consumption of steam plants. The so-called "lightless nights" ordered by the federal government are being observed with more and more care, and it is not too much to say that New England is making the most vigorous effort to help herself while seeking the aid of the federal government in order that her industrial life may continue to render the utmost patriotic service in this time of the nation's necessity.

Maximum Load of Commonwealth Edison

The maximum load of this winter, and also in its whole history, for the Commonwealth Edison Company of Chicago occurred at 5 p. m. on Dec. 28, when a total of 410,910 kw. was observed on station meters. Integrated over the half-hour period between 5 p. m. and 5.30 p. m., this amounted to 397,144 kw. Of this, 4814 kw. was used by generating stations for their own power requirements. This amount, together with that consumed in about fifty substations, places the Edison company in the ranks of the largest consumers of its power. The kilowatt-hour output on this day was 5,428,634 kw.-hr., slightly lower than a previous high output, which occurred on Dec. 13 and up to the present constitutes the largest output in the history of the company—5,456,758 kw.-hr. The railway load, as usual, is the predominating factor, amounting to 218,320 kw., while the total Edison load amounted to 176,794 kw. Of the Edison load, on an integrated basis, about 110,000 kw. was 60-cycle, while the direct-current light and power amounted to about 62,000 kw. At the time this maximum occurred the company had a total rated reserve generating capacity of 61,000 kw. in batteries and in reserve steam plants.

*In some quarters the purpose of asking isolated plants to consider the economy of buying power was misunderstood and the Fuel Administrator was charged with issuing central-station propaganda. Absolutely no such intention existed, the sole object being to encourage every possible fuel saving.—Editor.

Long Spans Permitted by Steel Wires a Saving

Practice Followed by Some Pacific Coast Companies in the Substitution of Steel for Copper Has Been Found of Material Advantage—Summary of San Diego Companies' Specifications

BY L. M. KLAUBER

San Diego Consolidated Gas & Electric Company

THE savings which may be effected by the use of steel in the place of copper in lines of moderate length and load warrant careful consideration of the cheaper metal. Steel conductors not only effect a saving due to reduced cost per unit of length, but also, owing to greater tensile strength and reliability, per-

absolute safety. After several branches were put in by the San Diego Consolidated Gas & Electric Company, using $\frac{1}{4}$ -in. (6.3-mm.) standard steel and 550-ft. (167.6-m.) spans, 700 ft. (213.4 m.) was selected as a standard, and many miles of line have been built with spans of this length. Naturally, large sags were necessary with these spans. Although flat construction had always been used in distribution circuits employing copper conductors, the old-style triangular construction, with a pole-top pin, was adopted, with steel to give greater clearances between conductors.

The use of steel conductors and long spans introduces no difficulties. With the greater strains experienced, guying at corners must receive careful consideration. As a rule stubs must be specially heavy and anchored. Anchor guys must be used in quantity; at sharp corners four and six anchors to the pole are occasionally required.

The San Diego Consolidated Gas & Electric Company has now installed in main or branch lines exceeding a mile in length 68.6 circuit miles (201.3 wire miles) of steel conductors of $\frac{1}{4}$ -in., $\frac{5}{16}$ -in. or $\frac{3}{8}$ -in. standard steel. In addition there are 25 miles (75 wire miles) under construction. Also there are 52.5 wire miles of $\frac{1}{4}$ -in. steel in constant-current series circuits. Most of the constant-potential circuits are 11 kv., although a few are 2300 volts.

A brief summary of the specifications used in a recent 11-mile (17.7-km.) extension of an 11-kv. line follows:

Conductor.— $\frac{3}{8}$ -in. extra-galvanized, standard steel, seven-strand.

Spans.—700 ft. Vary as dictated by topography of country, taking advantage of knolls and hill tops. Spans not to be shortened at corners. Maximum single-pole spans to be 1000 ft.; terminate spans exceeding 1000 ft. on double pole structures. In spans exceeding 1500 ft. use high-

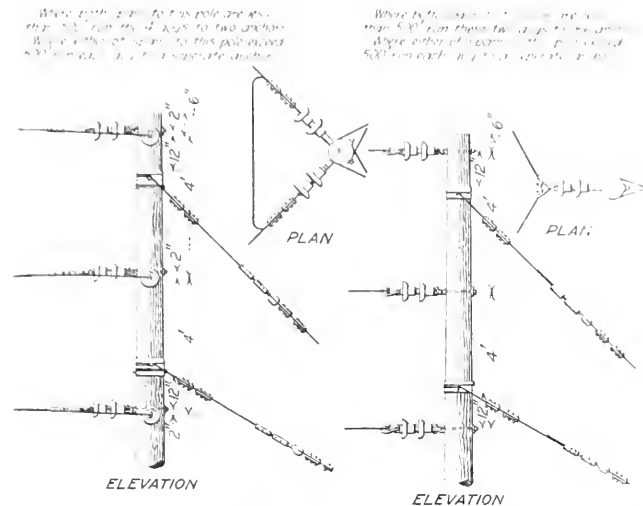


FIG. 1—CONSTRUCTION EMPLOYED FOR 70-DEG. TO 110-DEG. ANGLES AND FOR 0 TO 70-DEG. OR 110 TO 160-DEG. ANGLES

mit wider spacings in supports. Poles, cross-arms, insulators and line hardware have all advanced greatly in price and are often difficult to obtain at any price, and the reduction in the cost of supporting structures by the use of steel is as important as the saving in the conductor itself.

The Pacific Coast companies have for some time past used comparatively long pole spacings with copper conductors and wood-pole lines. Standard spans of 350 ft. (106.7 m.) with No. 6 or No. 4 solid, or 450 ft.

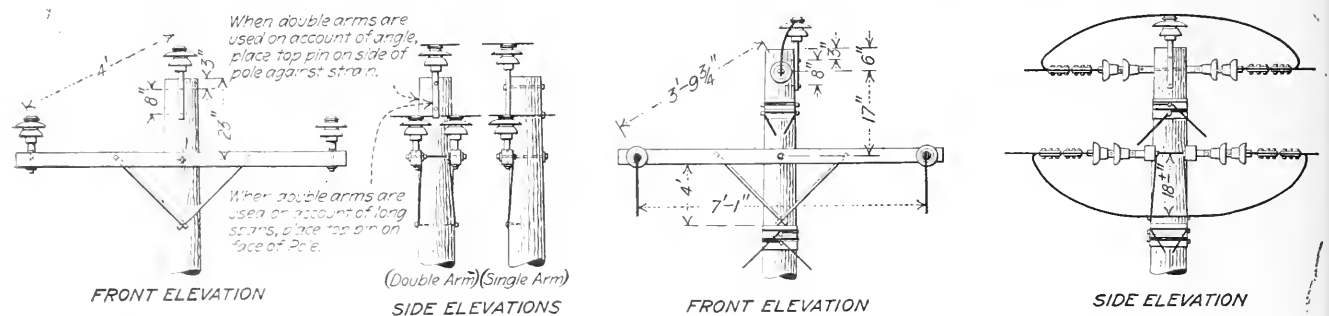


FIG. 2—CONSTRUCTION EMPLOYED IN SPANS NOT EXCEEDING 1000 FT., OR 175-DEG. TO 180-DEG. ANGLES (USE DOUBLE ARMS AT ALL ANGLES, CROSSINGS, AND FOR SPANS 500 FT. OR LONGER) AND FOR DEAD-END POINTS, OR 160-DEG. TO 175-DEG. ANGLES (IN TANGENTS OVER ONE MILE IN LENGTH USE ONE PER MILE)

(137.2 m.) with No. 2 or No. 1 stranded medium hard-drawn bare-copper conductors, have been used extensively without the slightest difficulty.

With the advent of steel conductors it was seen at once that these spans could be greatly exceeded with

strength steel. Shorten spans to 200 ft. where possible in crossing railroads, main highways and telephone toll leads.

Clearances.—Minimum clearances over railroads, 28 ft.; over traveled highways, 24 ft.; over other supply lines or communication lines, 6 ft.

Poles.—Class A Western red cedar with open-tank

treated butts. Standard pole on tangents, 40 ft.; at corners, 45 ft. Other lengths as required by topography. Set at N. E. L. A. standard depths. All poles to be shaved and gained at pole yard.

Wire Arrangement.—Triangular with vertical corners.

Transpositions.—Six-mile barrels unless by special agreement with communication companies.

Cross-Arms.—3½-in. by 4½-in. by 8-ft. Douglass fir, painted with two coats of yellow cement paint.

Braces.—28-in. galvanized N. E. L. A. standard.

Pins.—St. Louis Malleable Casting Company No. 435 R galvanized with felt insertion.

Pole-Top Pins.—Hubbard No. 3020.

Insulators.—Ohio Brass No. 12546 or Locke No. 5155 (27,000 volts).

Strain Insulators.—Locke No. 3039 in pairs. A complete dead-end consists of one spring clevis, two No. 3039 strain insulators, ¾-in. galvanized thimble and two three-bolt guy clamps.

Tie Wire.—Galvanized steel. Use one strand of the ¾-in. conductor 48 in. long. Use a double back tie.

Splices.—Splice with five three-bolt guy clamps and two ¾-in. thimbles. No solder.

Guy.—¾-in. extra-galvanized standard steel, same as conductor. Use double sets of three-bolt guy clamps.

Guy Insulators.—White's No. 506. Use one strain insulator in each guy, 4 ft. to 8 ft. from the pole. Also in the lower ends of guys attached to stubs not anchored.

Anchor.—Use pyramidal concrete anchors except in marshy ground, where treated wood slugs must be used. Where spans adjacent to corners exceed 500 ft. use pairs of anchors. Anchor stub guys in soft ground or where stub holds a corner adjacent to a span exceeding 500 ft. Anchor rods to be standard ¾-in. galvanized, 8 ft. long. Use anchor boxes where required for the protection of persons.

Stubs.—Stubs to be Western red cedar poles 16 ft. 9 in. to 19 ft. 6 in. in length. Minimum top, 28 in.; minimum circumference 6 ft. from butt, 34 in.

Switches.—Line switches, Pacific Electric No. 1420; transformer switches, Pacific Electric No. 422-F.

Hardware.—All bolts, clamps, lag screws and miscellaneous hardware to be galvanized in accordance with N. E. L. A. specifications.

Special Foundations.—Set poles in concrete at heavy marshes. Use trussed pole set in concrete or push brace where anchors cannot be placed.

Operating Characteristics of Motor-Driven Planers

Relative Merits of Non-Reversing and Reversing Motor Equipment for Planers— Emphasis Is Placed on the Method of Control Required Because of the Peculiar Character of the Duty Cycle

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—This article contains an analysis of the duty cycle of the planer and a discussion of the requirements of the driving equipment. The non-reversing motor is described and compared with the reversing equipment. Special emphasis is placed upon the method of control which is required. Incidental items, like the reduced flywheel effect due to the absence of pulleys with the reversing motor, the advantages of dynamic braking, remote control and the automatic action of the master switch in connection with the controller are also treated at some length. Economic advantages are set forth which may result directly from a careful study of cutting speeds and the speeds of the return strokes, increasing the ratio of the latter to the former, eliminating the time losses from belt slip at the points of reversal and the like.

THE duty cycle of the planer possesses peculiar characteristics which must be taken into consideration when selecting a driving motor and the control apparatus. Obviously, the speed of the platen on its return stroke when no cut is being made can be greater than its speed during the cutting stroke when the metal is being removed by the stationary cutting tool. In fact, the speed during the cutting stroke should be adapted to the most economical cutting speed from the standpoint of the cutting tool, the strength of the machine itself and similar items of the same general nature which govern the most economical speeds for lathes and other metal-working machinery. Hence, to increase as much as possible the amount of metal which may be removed during a day it is important to reduce the time of the reverse or return stroke by increasing the speed of the platen for this part of the cycle to as high a value as the machine tool will economically stand. This results in two different driving speeds for each cycle.

Moreover, it is essential for the economical operation of the planer that the time consumed in making the

reversal at the end of each stroke be as small as possible. Hence the motion of the planer must be stopped as quickly as possible at the end of each stroke and accelerated promptly in the reverse direction.

From these elements of the duty cycle it follows that the motor is required to pass through two starting periods for each cycle and that it should be capable of operating at two different speeds for the two strokes. The points at which economy may be effected are in maintaining the most economical cutting speed for each class of material worked upon and for each depth of cut and feed, to brake the equipment quickly at the end of

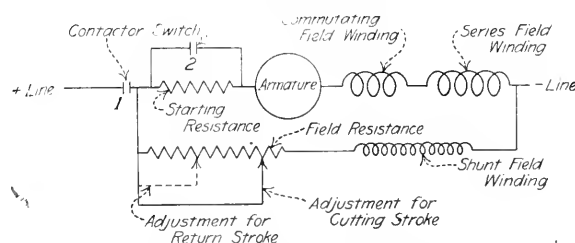


FIG. 1—A METHOD OF CONTROLLING NON-REVERSING PLANER WHICH APPLIES FOR REVERSING EQUIPMENT IF A REVERSING SWITCH IS ADDED AND PROVISION MADE FOR DYNAMIC BRAKING

each stroke, to accelerate it promptly and quickly in the reverse direction, and to maintain throughout the return stroke as high a speed as is consistent with the operation of the planer.

BELT DRIVE CONVENIENT IN ELECTRIFYING LINE-SHAFT EQUIPMENT

Belted motor drive, sometimes termed the "non-reversing" motor equipment, for planers possesses a number of interesting features which will be made the basis for comparison later with the "reversing" motor

equipment. In an arrangement of this kind (Fig. 4A) the chief advantage of the motor drive is that the speed of the motor may be adjusted independently for the forward or cutting stroke as well as for that of the reverse stroke, thus placing the most economical operating speeds at the convenient disposal of the operator.

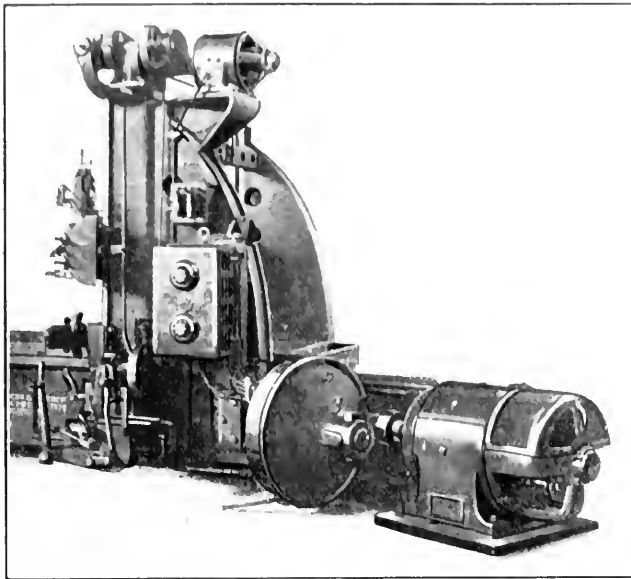


FIG. 2—A 48-IN. BY 48-IN. PLANER DRIVEN BY A 20-HP., FOUR-TO-ONE ADJUSTABLE SPEED-REVERSING MOTOR (CONTROLLER ON PLANER FRAME)

Incidentally, this type of equipment can readily be applied to planers already in operation at relatively small expense and with little or no change in the arrangements in the shop. Moreover, the use of belts and pulleys makes it possible to use a higher speed motor and one with a lower speed range than in those cases where a reversing motor is directly coupled to the machine.

The usual procedure with this equipment is to start the motor either by a hand-operated starting rheostat or by an automatic magnetic starter controlled by a pendant switch in the hand of the operator. The motor then runs continuously in one given direction, whereas the platen is reversed at the end of each stroke by the usual tight and loose pulleys and belts (Fig. 4A). To obtain the two distinct speeds for the cutting and return strokes two field rheostats are used in the controller, connected in parallel with the field, but so connected to the master switch that only one is in the field circuit at a time.

A master switch (Fig. 4D) is usually attached to the side of the planer to insure that only one field rheostat will be in the field circuit during the cutting stroke. At the end of the cutting stroke a trip on the side of the moving platen operates the switch, thus connecting the other rheostat in the field circuit automatically.

A simplified diagram of connections for such an arrangement is indicated in Fig. 1. While this diagram

relates primarily to the non-reversing equipment, it applies equally well with slight modifications to the reversing equipment, which is also described here.

The foregoing notes indicate that the non-reversing equipment is merely one step from the straight line-shaft drive toward the ideal individual motor application. The non-reversing motor affords the distinct advantage of independent control of speed for the two strokes, but the reversal itself as well as bringing the platen to rest are functions of the belts and pulleys. In bringing the platen to rest by change of belts not only must the inertia of the platen itself be overcome but also the flywheel effect of the pulleys. Moreover, to reverse the motion by a belt introduces slippage, which obviously causes a time loss in the interval of reversing, sometimes as much as 10 per cent of the duty cycle.

ADVANTAGES AND DISADVANTAGES OF NON-REVERSING MOTORS

The reversing motor equipment, as its name implies, provides in the motor equipment the function of reversal plus all of the elements of the non-reversing equipment and the facilities of dynamic braking, thus meeting practically all of the requirements of an ideal individual motor drive. Being directly connected to the planer, the speed range of a reversing motor is necessarily greater than in the non-reversing type, being four to one ordinarily in the former and two to one in standard types of the latter.

The controller equipment, which is similar in form to that used with the non-reversing motor (Fig. 1), must have in addition a switch for reversing the direction of rotation and also the connections and equipment required for dynamic braking. The wider speed range

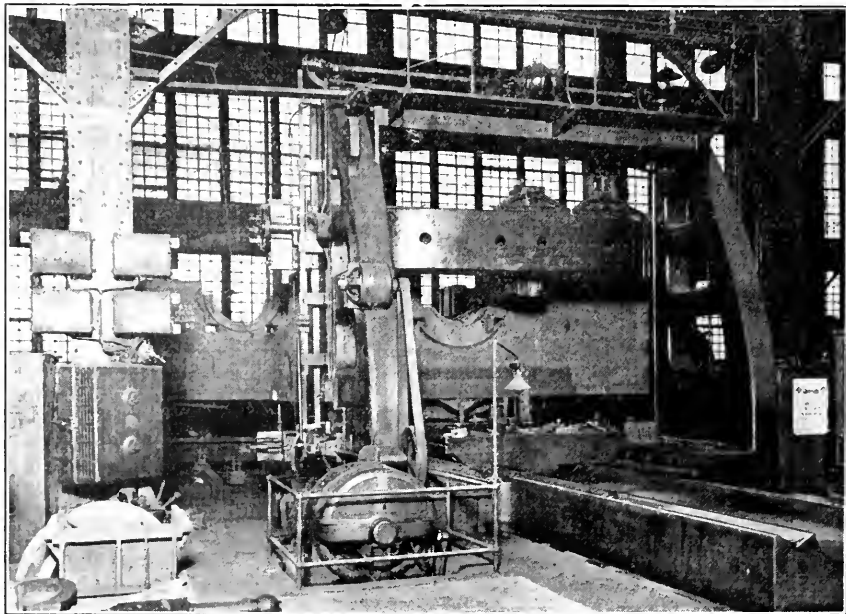


FIG. 3—A 14-FT. BY 30-FT. PLANER EQUIPPED WITH A 75-HP., FOUR-TO-ONE ADJUSTABLE-SPEED REVERSING MOTOR (CONTROLLER ON NEARBY COLUMN)

of the reversing motor, the lower value of the maximum speed and the additional elements in the control all tend to increase the first cost of this type in comparison with the non-reversing type.

From the standpoint of economy, the reversing motor eliminates the belts and pulleys, thus avoiding belt

slip, and the dynamic brake makes it possible to stop the planer before reversal in a more satisfactory manner than by some of the other methods. In one test a planer which was stopped in twenty-four seconds by friction alone was brought to standstill in two and one-half seconds by dynamic braking.

It is perhaps not usually recognized that the advantages of the dynamic brake rest not solely on quickness of stopping, but also on the elimination of brake-shoe wear and on the ability to begin the braking period with less braking action than is effective later on. In other words, this scheme makes it possible to graduate

a planer. A. G. Popcke has shown, for example, that the inertia of a 15,000-lb. (6803.8-kg.) planer platen when moving at a speed of 100 ft. (30.5 m.) per minute has about one-twenty-fifth of the inertia of a 35-hp. motor running at 1000 r.p.m. This gives an excellent idea of the enormous flywheel effects which may be introduced into the mechanical system of a planer by motor drive and why the absence of pulleys resulting from the use of reversing motors may reduce the inertia of the moving system as a whole, and particularly so if the motor has a relatively small diameter rotor. In this connection Popeke shows that a reduction of

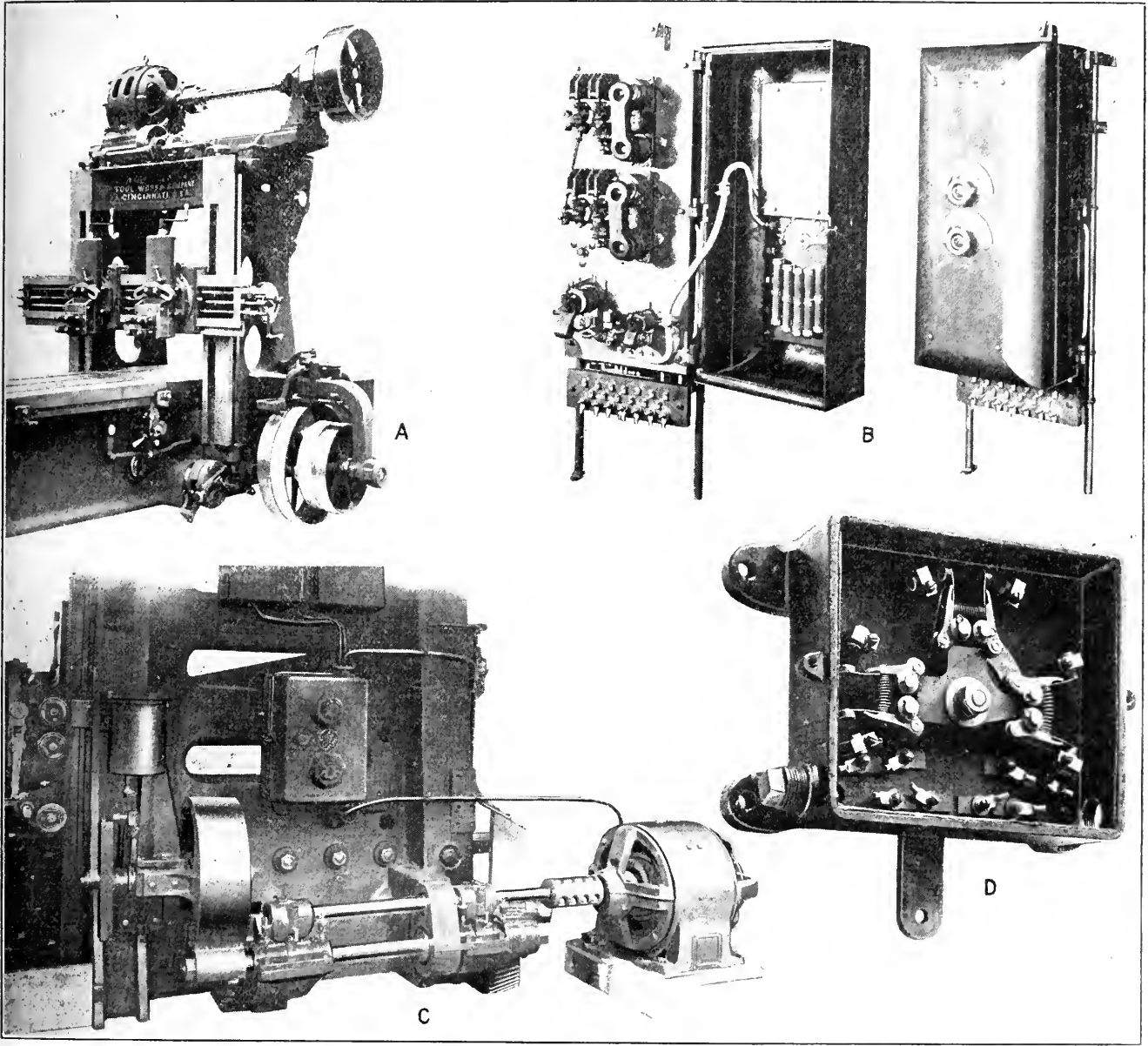


FIG. 4—APPLICATIONS OF MOTORS TO PLANERS AND TWO TYPES OF CONTROL APPARATUS

A—Motor-driven planer with belted connection. B—One type of controller employed for reversing motor. C—Method of connect-

ing motor to planer. D—Master switch for use with non-reversing motors

the mechanical braking forces and to avoid the shock to the system which may result from braking in one step from high speed.

FLYWHEEL EFFECT VS. PLATEN INERTIA

Interesting figures are available to show the flywheel effect of pulleys and of the revolving armatures of motors in comparison with the inertia of the platen of

5 in. (12.7 cm.) in a motor-armature diameter of 19 in. (48.3 cm.) may reduce the inertia or flywheel effect nearly 100 per cent.

Push-button or pendent switches, from which the motors may be started or stopped, are especially desirable if placed in convenient locations, as they save time and relieve the motor and driven mechanism of the strains that might be caused by manual starting, etc.

In one of the ordinary types of planer motor control, for instance, a relay short-circuits the field rheostat and thus permits full field current as long as the armature current is above some given value. As soon as the current drops below the given value the relay again

the labor charge but also the overhead expense which must be assigned to the given operation.

The power for driving such a machine tool per hour may be seen to be a very small relative item even for the larger planers. Any saving in power per hour of operation has, however, an appreciable although small effect on the aggregate hourly cost and should hence be duly considered. Tests on belt-driven planers and reversing motor-driven planers, conducted over a considerable time interval so as to give average values, indicate that the energy consumption per hour may be as much as 25 per cent greater for the former than the latter. One reason for this is that the reversing motor is shut down between operations and at the times of making necessary adjustments in the work, and hence the power consumed will naturally be less than in those cases where belt and shafting losses continue during these intervals. The elimination of line shafting and belting removes the necessity of belt maintenance, repairs and belt renewals and also saves the time required for this upkeep work. Cases have been reported where such upkeep work has amounted to as much as from \$100 to \$500 per annum per planer.

Added to these items there are the economies which result from increasing the cutting speed. Where the belted planer does not possess the required speed changes for giving this most economical speed for given operations, the increased flexibility of the motor control can be made to yield much improved results. Similarly, the ratio of the return stroke speed to the cutting speed may have a considerable bearing on the output. Thus if the most economical cutting speed is obtainable and is used, quite a change may be made in the amount of time available per day for the cutting strokes by increasing the ratio of the return speed to the cutting speed as shown in Fig. 6.

Other advantages of direct-connected motors are the elimination of belt slippage and quick braking made possible by reducing the flywheel effect of the rotating elements. Time may also be saved by the facility with which adjustments may be made in setting up the work by the accurate and convenient control which is afforded in the motor equipment.

When it is not clear that the added investment for a reversing motor or even a non-reversing motor equip-

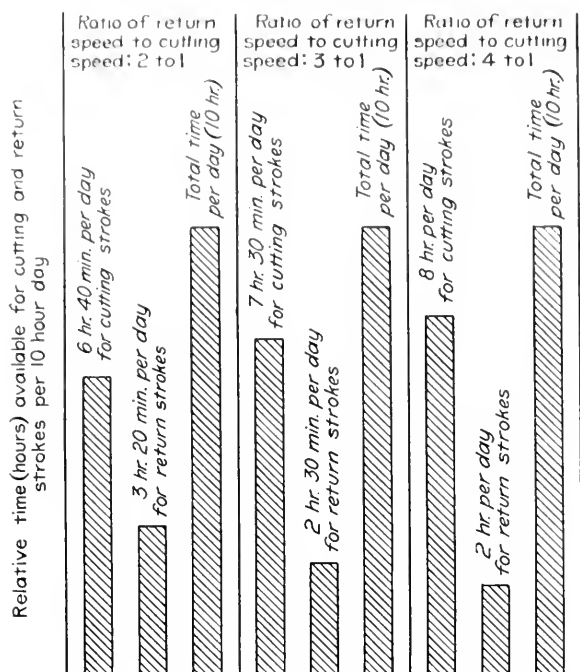


FIG. 5—INCREASED TIME AVAILABLE FOR CUTTING WHEN RATIO OF RETURN SPEED TO CUTTING SPEED IS INCREASED

inserts the field rheostat corresponding to normal speed for the given stroke.

POINTS OF ECONOMY IN METHODS OF DRIVE

While the advantages of the two principal methods of motor drive for the planer, just outlined, are fairly obvious, the substitution of either type for the line-shaft drive must necessarily rest on cost factors or on the points of economy in favor of the motor in contrast to the shaft-driven tool. The items which constitute the operating expense for the average planer are given* in the table.

In this the item "miscellaneous expense" includes general repairs, storage, haulage, tool-room charges and interest and depreciation on the cost of buildings and auxiliary apparatus, such as cranes, lights and the like, which are chargeable in part to each machine tool. A study of this table shows that the machine-hour cost rating will not vary to any considerable extent with the output, and hence it takes the form of a more or less fixed charge, which goes on whether the output is large or small.

Hence, if the motor drive is capable of increasing the output from a given planer per unit of available time per day for productive work, in comparison with the line-shaft-driven planer with the same labor expense, this then constitutes a fundamental and most important economic advantage for the motor-driven tool. This is apparent when it is considered that a larger output for each possible machine hour per day not only reduces

ITEMIZED LIST OF OPERATING EXPENSES FOR TYPICAL PLANERS

Size of Planer	Interest and Depreciation on the Cost of the Planer	Cost of Power (Cents per Kw.-Hr.)	Miscellaneous Expense	Supervision and Clerical Work	Total Machine Hour Rate
36 in.	\$0.04	2	\$0.49	\$0.25	\$0.80
48 in.	0.12	2	0.59	0.30	1.03
56 in.	0.09	4	0.69	0.35	1.17
60 in.	0.18	4	0.70	0.35	1.27
130 in.	0.22	6	2.68	1.35	4.29
7 ft.	0.19	4	1.05	0.53	1.81
10 ft.	0.28	4	1.26	0.64	2.22
10 ft. (heavy)	0.82	6	2.04	1.13	4.05
14 ft.	0.60	6	2.79	1.42	4.87
14 ft. (heavy)	0.97	6	3.89	2.14	7.06

*The table is based on data of the Westinghouse Electric & Manufacturing Company. See also "Handbook of Machine Shop Electricity," by C. E. Clewell, McGraw-Hill Book Company, pp. 430-432.

ment is warranted, it is well to test out the results with graphic instruments and to base the comparison on exact rather than generalized data. The fact that machine-tool builders tend to the adoption of motor drive for new machines, at least for the larger planers, is an indication that its advantages for this class of apparatus are beginning to be recognized by the trade.

Design of Rotor Cores for Electrical Machines

Development of Formulas for Figuring Stresses in High-Speed Rotor-Core Punchings
—Chart Which Makes Computation Simple—Determining
Stresses in Bored and Solid Disks

BY WILLIAM KNIGHT

THE object of this paper is to develop a formula for figuring stresses in core punchings of high-speed rotors due to the centrifugal force of the rotor coils held in slots at the periphery of the core and also to the centrifugal force of the punchings themselves. Both the case of punchings with a hole at the center and that of solid punchings (no hole at the center) will be considered. In the case of punchings with a central hole for mounting on a shaft or a spider the force-fit needed at the bore to assure proper operation at the maximum speed for which the machine is designed will be given.

The following symbols will be used in the calculation:

σ_r and σ_t = radial and tangential stresses at any point of a rotating thin-steel disk of uniform thickness due to the centrifugal force of its own mass and the centrifugal force of projecting masses attached at the periphery.

σ_r' and σ_t' = radial and tangential stresses at any point of a rotating thin-steel disk of uniform thickness due to the centrifugal force of its own mass only.

σ_r'' and σ_t'' = radial and tangential stress at any point of a rotating thin-steel disk of uniform thickness due to the centrifugal force of projecting masses attached at the periphery.

T = tangential stress of a thin-steel ring rotating at the same speed as the peripheral speed of the disk.

F = centrifugal force of projecting masses per square inch of outer surface of the disk.

R = outside radius of disk.

r = radius at the bore of the disk.

x = radius at any point.

E = modulus of elasticity of material = 30,000,000.

ν = Poisson's ratio, for steel = 0.3.

N = revolutions per minute at the maximum speed.

In "Steam Turbines" Dr. Stodola gives the two following general equations for disks:

$$\sigma_r = \frac{E}{1-\nu^2} [(3+\nu)ax^2 + (\psi_1 + \nu)b_1x^{\psi_1-1} + (\psi_2 + \nu)b_2x^{\psi_2-1}] \quad (1)$$

$$\sigma_t = \frac{E}{1-\nu^2} [(1+3\nu)ax^2 + (1+\psi_1\nu)b_1x^{\psi_1-1} + (1+\psi_2\nu)b_2x^{\psi_2-1}] \quad (2)$$

where, in the case of a disk of uniform thickness, $\psi_1 = 1$; $\psi_2 = -1$; $a = -3 \times 10^{-4} \times N^2$, and b_1 and b_2 are two constants depending on the outline of the disk and on the presence or absence of other forces acting on the disk besides the centrifugal force of its own mass. In this case the additional force is due to projecting masses attached at the periphery.

The two constants b_1 and b_2 may be determined for the particular case under consideration and the two formulas then expressed in such a form that anybody who is not familiar with elaborate mathematical manipulation can use them, thus saving time and eliminating chances of making errors.

Letting R equal the radius of the punchings at the bottom of the slot for the time being, $m = x/R$ and $m_o = r/R$.

Calling W the weight of the length of coils and insulation carried in the slots, and R' the radius of the center of gravity of this weight, n the number of punchings in the core and t the thickness, the centrifugal force of the projecting masses per square inch of outer surface of the disk will be: $F = (0.000341 \times WR'N^2)/2\pi Rnt$. Also, the tangential stress of a thin-steel ring of radius R and rotating at the speed of N revolutions per minute is: $T = 8 \times 10^{-6} \times R^2N^2$.

After making the necessary substitutions in formula (1),

$$\sigma_r = -0.408Tm^2 + 43 \times 10^6b_1 - (23.1 \times 10^6b_2)/R^2m^2.$$

To simplify the development of a readily usable formula it will be assumed that at N revolutions per minute the bore of the punchings will have expanded an amount equal to the initial difference in the diameters of the shaft, or spider, and punchings bore. Thus the initial radial pressure at the bore produced by the force-fit is zero at N r.p.m.

At the outside radius of the punchings the radial stress at N r.p.m. is evidently F . At the bore $m = m_o$ and at the periphery $m = 1$. Substituting in the preceding formula for σ_r ,

$$O = -0.408Tm_o^2 + 43 \times 10^6b_1 - (23.1 \times 10^6b_2)/R^2m_o^2 \text{ at the bore.}$$

$$F = -0.408T + 43 \times 10^6b_1 - (23.1 \times 10^6b_2)/R^2 \text{ at the periphery.}$$

From these equations the two unknown values b_1 and b_2 can be derived and substituted in formulas (1) and (2), giving when simplified:

$$\sigma_r = T[0.408(1 + m_o^2 - m^2 - (m_o^2/m^2))] + F \frac{1 - (m_o^2/m^2)}{1 - m_o^2} \quad (3)$$

$$\sigma_t = T[0.408(1 + m_o^2 + (m_o^2/m^2)) - 0.234m^2] + F \frac{m^2 + m_o^2}{m^2(1 - m_o^2)} \quad (4)$$

In both formulas it may be seen that the first term depends on the material of the disk only and is not affected at all by the centrifugal force of the projecting masses. The second term is a function of the centrifugal force of the projecting masses only, and is independent of the mass of the disk. Separating these two terms in both formulas (3) and (4) gives the radial and tangential stresses for the punchings only, as follows:

$$\sigma_r' = T[0.408(1 + m_o^2 - m^2 - (m_o^2/m^2))] \quad (5)$$

$$\sigma_t' = T[0.408(1 + m_o^2 + (m_o^2/m^2)) - 0.234m^2] \quad (6)$$

For the coils only,

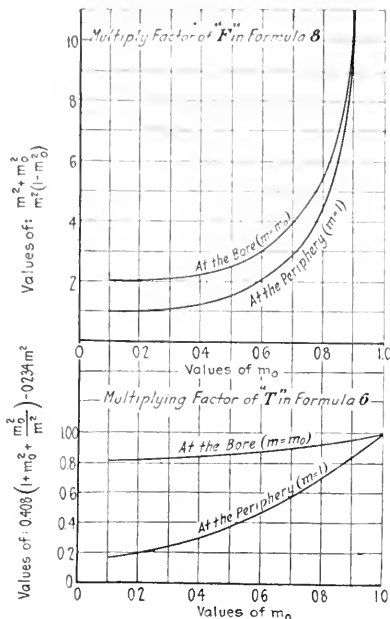
$$\sigma_r'' = F \frac{1 - (m_o^2 m^2)}{1 - m_o^2} \quad (7)$$

$$\sigma_t'' = F \frac{m^2 + m_o^2}{m^2(1 - m_o^2)} \quad (8)$$

Formulas 5, 6, 7 and 8 are perfectly general and apply both to the case of disks with a central hole and to the case of a solid disk (no hole at the center).

STRESSES IN DISK WITH A CENTRAL HOLE

The tangential and the radial stresses at the bore and at the periphery are, in general, the most important to determine. By putting $m = m_o$ in the preceding formulas the stresses at the bore are obtained; by



CURVES WHICH SIMPLIFY THE CALCULATION OF TANGENTIAL STRESSES AT THE BORE AND PERIPHERY OF ROTOR PUNCHINGS WITH A CENTRAL HOLE

putting $m = 1$ those at the periphery are determined, giving:

$$\sigma_r' = 0 \text{ at the bore and at the periphery.}$$

$$\sigma_t' = T(0.816 + 0.174m_o^2) = (N/1000)^2 (6.6R^2 + 1.4r^2) \text{ at the bore.}$$

$$\sigma_t' = T(0.174 + 0.816m_o^2) = (N/1000)^2 (1.4R^2 + 6.6r^2) \text{ at the periphery.}$$

$$\sigma_r'' = 0 \text{ at the bore.}$$

$$\sigma_r'' = F \text{ at the periphery.}$$

$$\sigma_t'' = F \frac{2}{(1 - m_o^2)} \text{ at the bore.}$$

$$\sigma_t'' = F \frac{(1 + m_o^2)}{(1 - m_o^2)} \text{ at the periphery.}$$

STRESSES IN SOLID DISK

In the case of a solid disk with no hole at the center $m_o = 0$. Stresses at the center are obtained by putting $m = m_o = 0$, and stresses at the periphery are obtained by putting $m = 1$, giving:

$$\sigma_r' = \sigma_t' = 0.408T = (N/1000)^2 \times 3.3R^2 \text{ at the center.}$$

$$\sigma_r' = 0 \text{ at the periphery.}$$

$$\sigma_t' = 0.174T = (N/1000)^2 \times 1.4R^2 \text{ at the periphery.}$$

$$\sigma_r'' = \sigma_t'' = F \text{ at the center and at the periphery.}$$

In this way very simple formulas are given for both the tangential and the radial stress in thin disks at any point.

For the case of core punchings with a central hole all the elements are thus obtained which are needed for

specifying what the difference in diameter between shaft, or spider, and punchings bore needs to be in order to make sure that when the machine is running at the highest speed for which it is designed the expansion of the bore is just equal to, or a little less than, the initial force-fit. This condition is obtained by having a force-fit at the bore equal to

$$(\sigma_t' + \sigma_t'')2r/E = 2\sigma_r'/E.$$

In *Engineering* for Aug. 3, 1917, the author gave some general formulas for σ_r and σ_t for disks of uniform thickness and for disks of hyperbolic profile, such as are used for turbine wheels, with a hole at the center.

MAKING THREE ESTIMATES IN VALUATION RATE CASES

Engineering Bases and Methods Used by Illinois Commission in Arriving at Value of Property for Rate-Making Purposes

Bert H. Peck, electrical engineer Illinois Public Utilities Commission, speaking before a joint meeting of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers recently, outlined the Illinois commission methods of making three estimates on value of property in rate cases. These estimates are based on original cost, reproduction cost and normal reproduction cost. The commission worked out methods and developed plans of meeting each problem, and these were discussed by Mr. Peck.

In what the commission terms normal reproduction cost estimate it endeavors to eliminate those elements of equipment or cost appearing in the strictly reproduction estimate which may cause the latter to reflect results abnormally high or low. By abnormal equipment is meant such equipment as conditions indicate is unsuited for the requirements. By abnormal prices is meant those prices which, owing to abnormal market or purchasing conditions, do not truthfully reflect a reasonable result. In the preparation of normal reproduction estimates the commission is not governed by rigid adherence to the inventory, although departure into the realm of speculation is not intended.

It may appear, continued the speaker, that the preparation of three estimates would operate to further becloud issues which often are unnecessarily hazy. The time required is certainly greater than would be required for one estimate, but the situation as a whole may be clarified considerably.

If but one estimate was to be prepared, and that upon reproduction basis, a careful and painstaking engineer would wish as complete data as to conditions surrounding original installation as were available and would also wish to know original costs of equipment so far as obtainable. Thus, even though preparing a reproduction valuation, he would usually secure all data necessary for original and normal estimates. If all available information has been secured the compilation of data of this nature into estimate form is not so serious a task as might be anticipated. Preparation of three estimates enables the engineer to view his problem from as many angles and to present sound engineering opinions to the judicial authorities rather than engineering opinions tempered by opinions of economic justice.

Cyclic Fluctuations in Rate of Lamp Renewal

Investigations Indicate that It Is Not Justifiable to Judge Life Performance from Resultant Renewal Data Unless These Data Cover a Period of More than Ordinary Duration

BY M. D. COOPER

Engineering Department National Lamp Works

HERETOFORE it has not been generally recognized that in a lighting installation of incandescent lamps variations or fluctuations in the rate of renewals may be expected. It is, of course, natural to expect that when an entire new installation of lamps is put into service the rate of renewal for some time will be very low and that ultimately the rate of renewal will increase to the value determined by the average hours' use of the lamps and the average life of the lamps. The fluctuations in the rate of renewal which may be expected to happen in the interval between the initial low rate of renewal and the final expected rate are represented in this analysis for the first time, the writer believes. It is quite surprising to find that the rate of renewal does not rise steadily to its final value but goes through wide cyclic changes, rising on its first peak to a value 40 per cent above its final expectancy and not settling down to practically steady conformance with the expectancy until after the lapse of a period corresponding to the consumption of three or four lamps per socket.

The solid-line curve of Fig. 1 is a mortality or survivor curve which has been derived from careful tests on a large number of 60-watt tungsten lamps, and although it does not apply exactly to all sizes of lamps, it is typical of what may be expected from the sizes most frequently used. This curve is a graphical means of expressing the fact that not all of a lot of lamps whose life rating is, for instance, 1000 hours can be expected to live exactly 1000 hours and then fail. A very small proportion of any lot of lamps can be expected to fail within a short period after installation, although these are compensated for in the average life by those which live beyond their rated life. At first the rate of mortality is very low and steadily increases up to a time shortly subsequent to the average life of the entire lot of lamps. From this time on the rate of mortality continuously decreases until the entire lot of lamps has failed. The dotted-line curve of Fig. 1 shows the rate of failure corresponding to the solid-line mortality curve.

ANALYSIS OF LAMP PERFORMANCE

To analyze what really happens, consider an entirely new installation of lamps and, for the time being, assume that the average hours' use per day for all lamps is the same. After dividing the life of the lamps up into a number of small periods, it is possible to determine from the mortality curve the number of renewals of the original lamps of the installation which will have to be made in each respective period. It is then possible to distribute these renewals among future periods in accordance with the mortality curve and, by continuing the process, to ascertain the total number of renewals which can be anticipated in each respective period in the future. Until the original lamps are well along

toward the end of their life, there will not be very many renewal lamps in the installation, and since the renewal lamps can be expected to survive the original lamps, the curve of the total rate of renewal (Fig. 2) will have a shape more or less closely approximating the shape of the rate of failure curve (Fig. 1) for some time after the installation is put into service. It may be noted that there is a peak of 40 per cent above normal in the total renewal curve at approximately 1300 hours, corresponding roughly to the first peak in the rate of failure curve (Fig. 1). Corresponding to the subsequent decline in the dotted line of Fig. 1, the total renewal curve shows a decided slump from the first peak.

The injection of new lamps into the installation at the high rate corresponding to the first peak will naturally bring about an abnormal rate of renewal at a time about one lamp life later. Owing to the distributing effect of deviation of individual lamp lives from the average, the second peak will not be so pronounced as the first. Likewise subsequent peaks will be still less prominent. As time progresses the oscillations of the rate of renewal above and below the normal value become less and less. Finally after 4000 or 5000 burning hours they become practically negligible.

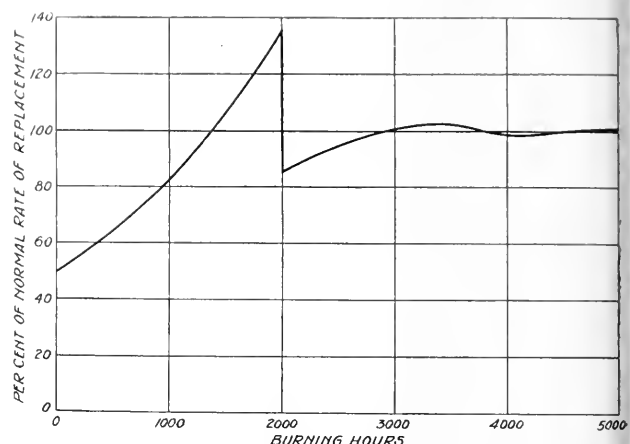
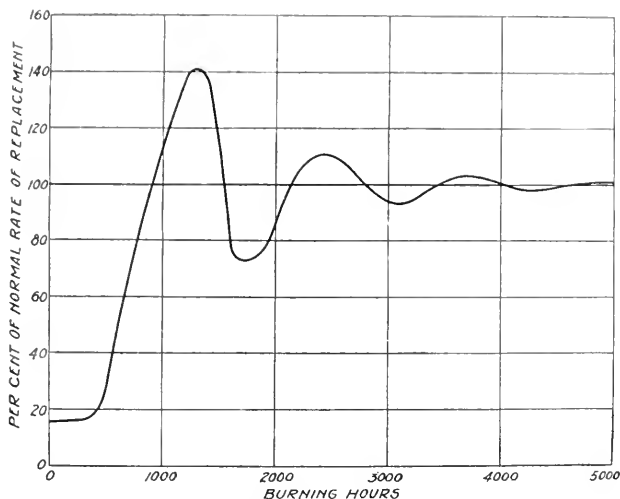
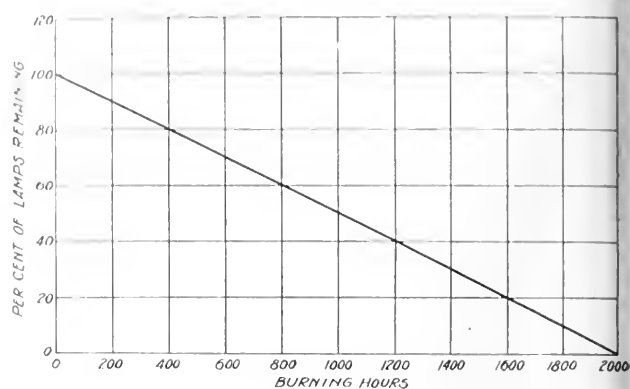
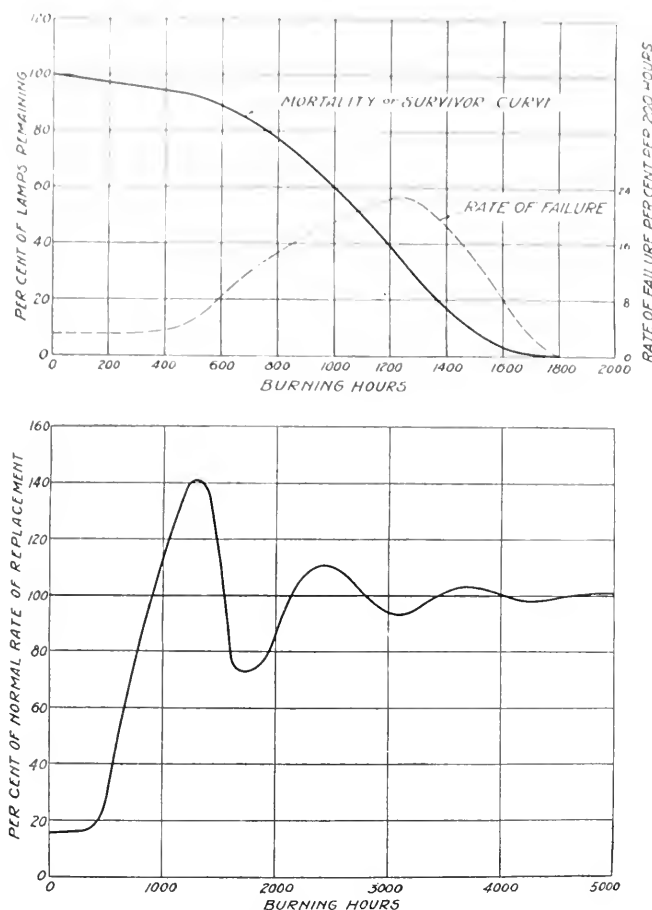
In the preceding discussion it was assumed that the installation of lamps adheres to the mortality curve derived from test as shown in Fig. 1, or, in other words, that all of the lamps in the installation receive the same amount of burning per day. The effect of deviation from average in the burning hours of different lamps or of different parts of the installation is to straighten the resultant effective mortality curve. A mortality curve like the straight line of Fig. 3 is doubtless somewhat beyond the ultimate limit of the straightening effect of diversity in daily hours' use. For such a straight line mortality curve the rate of renewal will show cyclic variations as illustrated by Fig. 4. This curve differs from that of Fig. 2 in a number of details, although the same general characteristics are evident.

As an illustration of the smoothing-out effect on the mortality curve of diversity in hours' use of the lamps, a mortality curve is derived for the following distribution of lamps with respect to hours' use:

No. Lamps	Hours Per Day	No. Lamps	Hours Per Day
10.....	24	100.....	8
20.....	18	200.....	6
50.....	12	500.....	4
70.....	10	50.....	2
Total		1,000	Average 6

A comparison of the standard mortality curve and the mortality curve which obtains in this assumed installation is shown in Fig. 5. This mortality curve lies about halfway between the standard curve and the straight line of Fig. 3. The most significant difference is the attenuation of the lower end of the curve. This

attenuation would have the effect of rounding off the first sharp peak and trough of Fig. 4 and making the curve of total rate of renewal more nearly the same in shape as Fig. 2.



FIGS. 1 TO 4—MORTALITY AND SURVIVOR CURVES, AND CYCLIC VARIATIONS IN LAMP RENEWALS (SEE TEXT)

In deriving Fig. 2 uniform daily hours' use of the lamps is assumed, and Fig. 4 goes beyond the limit of possible effect of diversity in hours' use; therefore, a similar curve for any actual installation must lie somewhere between these two curves (Figs. 2 and 4). The two resultant curves of total rate of renewal show slight quantitative differences, although the qualitative

installation being renewed at one time, could be expected to bring about similar results, although of course in less degree.

If this discussion be extended to cover the possible effect of seasonal variations in the hours' use per day of a lighting installation, it may be seen that there is a possibility for even greater fluctuations in the total rate of renewal per month. As representative of average variations in hours' use per day of lighting installations, the following data from one of the largest central stations in this country are presented, showing the distribution of its annual lighting kilowatt-hour sales among the various months of the year:

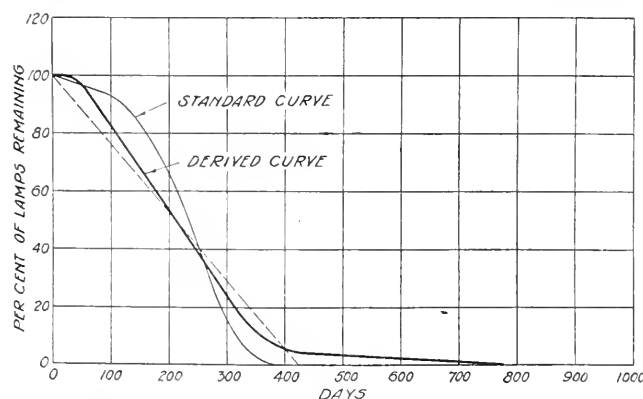


FIG. 5—COMPARISON OF STANDARD MORTALITY CURVE WITH THAT OBTAINED IN ONE PARTICULAR INSTANCE (SEE TEXT)

conclusions from both are about the same, namely, that under perfectly normal conditions the rate of renewal in a new installation of incandescent lamps may be expected to undergo severe cyclic fluctuations and that

Month	Per Cent of Year	Per Cent of Average Month	Month	Per Cent of Year	Per Cent of Average Month
January	10.9	131	July	6.4	77
February	9.3	112	August	6.4	77
March	8.6	103	September	7.4	89
April	7.8	93	October	8.4	101
May	7.1	85	November	9.7	116
June	6.8	82	December	11.2	134

Even in the average for a great variety of lighting installations, the seasonal variation in the hours' use per day amounts to nearly as much as two to one, and in individual cases this variation from winter to summer use may be even more than two to one.

Applying the foregoing data on seasonal variation of hours' use per day, it can be seen that if the peak of the

rate of renewal curve as shown in Fig. 2 occurs in the winter and the succeeding trough of the curve occurs in the summer, the possible fluctuations in the monthly rate of renewal will run from 190 per cent to 55 per cent instead of from 140 per cent to 70 per cent as shown by the curve. Conversely, if the first peak should occur in summer and the succeeding trough in winter, the peak might be reduced to about 110 per cent of normal and the trough increased to 95 per cent of normal, thus very nearly eliminating the fluctuations of the first cycle.

The phenomena which have been discussed may offer a logical explanation of fluctuations in the rate of renewal of incandescent lamps which heretofore have been the cause of unfavorable speculation regarding the uniformity of the lamps. A manifest conclusion from the discussion is that it is not justifiable to judge the life performance of an installation of incandescent lamps from the resultant renewal data unless the renewal data cover a period of time sufficient for the averaging out of fluctuations in the rate of renewal caused by simultaneous replacement of all or a considerable proportion of the lamps in the installation.

ELECTRICAL PREPARATION FOR ORDNANCE BASE IN FRANCE

Importance of Electrical Equipment and Engineers in Preparations that Government Is Making for Our Army in France

Some idea of the extent to which electrical equipment and men qualified for electrical work are being required for the army may be obtained from recent advice regarding the American ordnance base depot now being built in France. This depot, which will be used for the repair and salvage of ordnance material, including cannon, guns, pistols, gun carriages, trucks, leather equipment, etc., will have over 2,500,000 sq. ft. (230,000 sq. m.) of floor space, will engage several thousand employees and require about 8000 kw. in electrical apparatus, principally motors and incandescent lamps, although electric furnaces will also be used in the shrinkage pits.

Energy will be received temporarily from some reliable electric system or systems in France, continuity of service being assured by the utilization of water power and by priority rights on fuel required for generating purposes. A power plant may also be built at the base depot to serve as a reserve. Gasoline and fuel oil are being considered for producing the motive power.

Although the electric service available is 50-cycle, three-phase, standard 60-cycle motors are being used and operated at the slightly lower rating resulting from the lower frequency. Except for large machines like boring lathes and grinders all of the machines are group-driven by alternating-current motors. The boring lathes are individually driven by direct-current motors. In the gun shop alone there are a large number of boring lathes measuring 30 in. to 48 in. (76.2 cm. to 121.9 cm.) in swing and 30 ft. to 60 ft. (9.1 m. to 18.3 m.) in bed length. The individual motors in many cases are mounted on concrete blocks beside the machines. Owing to the weight of most of the ordnance material handled, cranes will be used extensively.

In preparing for this depot the Ordnance Department had to determine where power was available in France

and in what quantities. Considerable information on this subject was obtained from the report by C. O. Mailloux on water-power development in France, while more detailed information was secured through investigating engineers in France. Practically all machine tools, motors and control apparatus were secured from this country through manufacturers who were able to turn out large quantities in a short period. In several cases equipment destined for other places was commandeered by the government for this depot.

Preparation for this depot as well as the present construction work are being carried out under the supervision of Major General William Crozier and Lieutenant Colonel D. M. King.

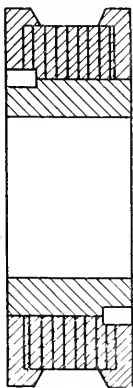
Electrical manufacturers who are in a position to supply government orders promptly and who desire to know the ordnance department's needs can address Colonel King, 613 G Street, N. W., Washington, D. C.

This department also requires the service of draftsmen, electrical engineers, electricians, dynamo tenders, both stationary and locomotive engineers and firemen, boiler inspectors, autogenous welders, etc. Pay ranges from \$30 to \$61.20 per month, depending upon demonstrated ability and place of service. Enlistment is for duration of the war only. In addition to the regular pay, free quarters, rations, clothing, bedding, medical and dental attention are provided by the government. Application blanks can be secured at the nearest recruiting office or by writing to the War Department, Office of the Chief of Ordnance, Enlisted Personnel Division, Washington, D. C. Applicants must be between thirty-one and forty years, citizens or declarants; must be able to speak, read and write the English language and should have no absolute dependents.

High-Speed Slip Rings

In order to meet the requirements for slip rings for high-speed dynamo-electric machinery as regards safety in service, it has been ordinary practice to employ material of very high tensile strength, permitting a sufficiently great safety factor. Materials possessing these qualities, however, have the characteristic of being of relatively poor conductivity, resulting in high ohmic losses, especially in case of machinery for large current strength as employed in electrochemical work. Also by reason of electrolytic phenomena troubles are liable to occur; for instance, copper will be carried off from the negative copper brushes and deposited upon the surface of a slip ring, this deposited copper on account of its unsuited structure resulting in a heavy sparking.

In consequence of this fact W. Gscheidlen of Berlin, in patent No. 1,243,286, suggests obviating the difficulties mentioned by employing as material for slip rings a metal strip, ribbon or band which is wound on edge to form a cylindrical spiral with firmly adjacent turns. A slip ring of this type of construction has a considerably higher tensile strength in peripheral direction than can be obtained in case the ring is made from cast or pressed material.



PINS USED TO
HOLD RINGS
IN PLACE

STANDARDIZATION OF LIGHTING CAN EXPEDITE SHIPBUILDING

Study of the Lighting of Vessels Where Construction Has Not Progressed to Point at Which Permanent Equipment Can Be Used

BY WILLIAM G. HEXAMER
Electrical Engineer Chester Shipbuilding Company

AS EVERY effort in this country must be bent toward expediting the building of ships, standardization of equipment should be seriously considered as one means to that end. Great opportunities are offered along this line in the standardization of the electrical equipment for the temporary lighting of vessels under construction, particularly where the same or similar types of ships are being built. This work may be divided into three subdivisions:

1. The permanent wiring on the permanent ways, which can be so constructed as to cover almost any electrical demand.

2. The lighting of vessels which have not as yet reached the stage of construction where a regular standardized temporary system can be installed.

3. The regular temporary wiring system, which must be so constructed that it can be repeatedly used from one vessel to another without much more than minor changes.

Considering these subjects consecutively, permanent ways can be wired from a three-wire 110-220 volt system. At the Chester (Pa.) Shipbuilding Company's plant it has been found advisable to run three No. 2 mains from a junction box at the head of the ways through 1¼-in. (3.16-cm.) conduit to a point where the water line makes it impracticable to continue. This covers practically two-thirds of the ways. At 20-ft. (6-m.) intervals in this line are installed YX condulets each containing a three to two-wire double-branch cut-out fitted for 30-amp. plug fuses. Two No. 8 wires feed a Q. H. A. condulet on each side of the ways through ¾-in. (1.86-cm.) conduit.

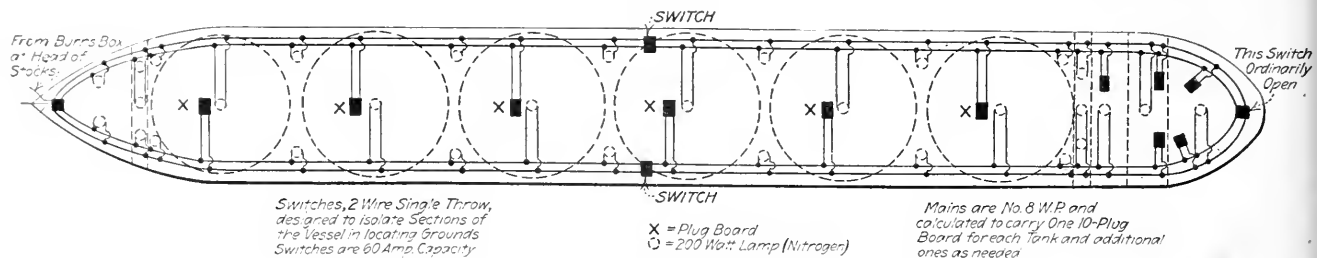
In conjunction with this system there is also installed at the head of the permanent stocks a Burns water-tight box containing a three-wire single-throw 100-amp. knife switch. The box is mounted at the approximate height of the new vessel's forecastle and is intended for temporary wiring when the vessel has reached that

specially designed plug board, with provision for ten outlets, is placed at the point of greatest demand in the Chester (Pa.) Shipbuilding Company's plant. The plug board is as nearly foolproof as one can be made, and is fed from a Q. H. A. receptacle by means of an R. Q. plug and the necessary length of two-wire deck cable. These boards are kept in stock, made up, and are a part of the standardized electrical equipment of the yard.

Portable taps made in 50-ft. (15-m.) lengths and equipped with specially designed plugs of very rugged construction are taken from the plug boards previously mentioned. The plugs are designed to be tapped into one of the outlets of the plug board. One end of the "portable" is attached to a weatherproof receptacle equipped with a 60-watt lamp and a locking guard. Carbon lamps are preferable for portable work as their filaments are more rugged, and, in the writer's opinion, riveters are not the gentlest of workmen.

As the writer's experience has been mostly with vessels containing six cylindrical tanks, the lighting of such vessels from the time that the decking is placed until the permanent electrical equipment is in service will be discussed. In the writer's estimation a tank vessel is one of the worst types to light in a proper way temporarily. After considerable experimenting a solution to the problems presented was reached. Upon the deck of the vessel—or, rather, at the edge of the main trunk deck—a set of No. 8 weatherproof mains is installed. The mains are mounted upon heavy porcelain knobs previously attached to a block about 2½ in. by 8 in. by 6 in. (6.35 cm. by 20.32 cm. by 15.25 cm.) and fastened to the edge of the trunk deck by means of a universal girder clamp. The blocks are made in large numbers and are kept in stock as part of the standard temporary equipment.

The mains are stretched on each side of the vessel and are fed from the permanent outlet previously described and installed at the head of the ways. This circuit is then again subdivided into four sections by means of 60-amp. single-throw knife switches. The sections are ordinarily connected but may be isolated to facilitate the finding of grounds. Ordinarily the switch at the stern is, of course, kept open, but it can be closed in case either side of the three-wire system is blown out, thus keeping the loop complete until re-



LIGHTING CIRCUITS ADVISABLE DURING SHIP CONSTRUCTION

stage of construction, making its own temporary system necessary. The permanent ways in this installation are approximately 430 ft. (170 m.) long.

Lighting of the hull while it is in the first stage of construction is of minor consideration, as there is usually plenty of daylight before the decking is placed. However, as double bottoms and various tanks reach completion temporary lighting by means of portable lamps is necessary. At this point of construction a

pairs can be made. While the switches previously mentioned are part of the standard temporary equipment, they are mounted in strongly made wooden boxes of weatherproof construction. The ordinary slate base switch is used with standard cartridge fuses.

From the mains the taps are taken for the plug boards and for a standardized temporary lighting unit, consisting of an X-5423 Benjamin shade, the usual suspension loop, a No. 1388 guard and a 200-watt nitrogen

amp. This unit is also used in the tank vessels. One unit is placed at the top of each cylindrical tank, one in each wing tank, three in the engine room, three in the fuel tanks and five in the forecastle, making thirty units in all. The units are so arranged electrically that the circuit is as nearly balanced as possible. These units are only for general illumination.

For close work the "portables" previously described are relied upon, one plug board being installed in each tank, and as the work progresses in the other portions of the vessel. As the plug boards have provisions for ten outlets and the standard "portable" has a length of 50 ft. (15 m.), quite a working radius is obtained.

The plug boards before mentioned are built in the yard and are each equipped with 20-amp. link fuses protected by an iron plate.

In freight vessels the problem is very much simplified as the hull is not subdivided as much as in tankers. While the standardized mains are used the general arrangement is much simpler, a single set of heavy mains installed down the center of the main deck being sufficient. Since fewer lighting units are used only half as many plug boards are required. To locate grounds it is, however, advisable to subdivide the mains as in the tankers and use ground detectors. The mains are of ample size for electrical drilling and reaming.

Credit and Collection Prospects for 1918

Strict Adherence to Terms, Better Credit Analysis and Demands on Customers for the Employment of Better Business Methods Are Certain to Be of Greater Importance than Ever

BY M. A. CURRAN

General Credit Manager Western Electric Company

THE prospects of credits and collections in the electrical industry for 1918 must, it seems to the writer, be judged, first, from these prospects for the country's business at large and, second, from the position the electrical industry will occupy as an essential to the war. The country's business at large has been going through a period of readjustment since our participation in the war became assured, but rather slowly until the last few months, when it became more marked. It is likely that it will be much more rapid from now on and continue so until financially and industrially the nation is on a war basis.

The most apparent phase of this readjustment has been the change in the financial situation. From an easy banking condition and a fair investment market we find that the pendulum has swung backward swiftly though smoothly. The banks are ably taking on a heavier daily load, and the investment market is narrowing. The Federal Reserve banks, by exercising their rediscounting and note-issuing functions, are relieving the strain, but the investment market—and by this is not meant the speculator but the distributor of the country's new capital—does not show prospects of early improvement.

The war has the first call on raw products, labor, machinery, power, transportation, communication, etc., of the country. Our financial resources must necessarily go as far and as long as these.

Broadly speaking, as far as the electrical industry is mustered into the ranks just so far will it be assured of production, sales and finances, and as far as it sells to those similarly mustered will its credits and collections be good. This must not be interpreted as meaning that only those directly producing the sinews of war will enjoy good business conditions. We have learned that modern war requires a complex economic underpinning; hence many and various lines of business will share these good conditions. The credit manager's ability to distinguish the relative position of such concerns will be just as important a part of his credit analysis as his appraisal of assets and liabilities.

Government bonds and taxes will withdraw funds

from usual channels and disburse them into unusual ones. True, very little of these billions will leave this country, so at first glance it might seem that there will be just as much money as usual and that therefore business should be as usual. However, war is a waster, not a producer, of wealth, and geography does not mark the economic boundaries of different lines of business.

The government now has under consideration the formation of a committee to cope with the disbursement of capital for necessary financing similar to the one established in England for the same purpose. Such action, it appears, will probably take place, and from this we may expect relief to some extent for the public utility confronted with a narrowing margin of net and the necessity of funding or renewing maturing stocks and bonds, as well as extensions not paid for, or those which are necessary or to which they are irretrievably committed.

The government, through its Federal Reserve banks, principally by issuing Federal Reserve currency against rediscounted paper, of which an important element will be trade acceptances, will largely meet the credit and currency requirements for the distribution of commodities in process toward consumption.

The government by various means will stabilize conditions considerably, and generally promote as active a business situation as possible; but it must be remembered that there is a point beyond which it is economically impossible for any government to become effective. For instance, consider the war savings stamps. It is aimed to raise two billion dollars on these, and practically all of it will come out of the wage earners' small change, which has heretofore been spent in retail establishments catering to him. This expenditure the average American wage earner will reduce largely, and the writer can think of no way in which the government can help these retailers.

Analyses of failure show that overbuying, underfinancing, improper or no accounting, excessive overhead, slow turnovers and unwise credits constitute the bulk of the causes. Business, largely because of unintelligent competition, has tolerated or fostered their

growth—whether knowingly or otherwise does not matter in present circumstances. Each business will have to prove its case, and internal efficiency will be its principal evidence at the bar of economics. We will all have to do, not a little more, but a whole lot better than ever before, and that idea must be sold throughout the trade. There never was a better time for the constructive credit manager to drive home to his customers the importance of intelligent accounting, buying and merchandising, reduced overhead and faster turnovers.

There never was a better time for absolute frankness between debtor and creditor. Many customers are reluctant to give adequate details of their business affairs, and credit managers have passed their orders on more or less sketchy deductions. Customers have likewise been indulged in terms, in many cases the necessity lying not in the nature of the business itself but in the faulty administration of the man. The principal premise for credit in many cases has been the so-called moral quality of the risk—the disposition toward fair and honest dealing. This quality is still highly valuable, but it will need support, that of the ability as well as the will to meet the obligation.

During the business boom of the last few years credit surveillance relaxed, and credit, always cheap in this country, became cheaper still. True, bills were paid, but then it was comparatively easy to pay them. Credit, in sympathy with economic conditions, is going up in price, and that price, I believe, must be as much ability backed by performance as quick assets over liabilities. There will be no room in the era ahead of us for catch-as-catch-can credits.

We, the creditor, the debtor, the business man, without distinction as to character or size of business, have all the common will to win this war and do not hesitate to enlist our efforts and wealth willingly, because we recognize the necessity of concerted action. That's our understanding of patriotism. Sound business is always good citizenship in times of peace as well as war, but it has not been widely enough so recognized. It now becomes a necessity, and therein lies our opportunity for patriotic service, and there should be the same feeling of common cause. It is not emotional patriotism we need now, it is the stern, solid, thinking kind that fully comprehends the task and has the will and the strength to do.

DEEPER CREDIT ANALYSIS NECESSARY

The customer who pleads some general business condition as the cause of non-payment of his bills is well known. Credit men may have analyzed a few such cases and found that this condition touched the customers' affairs only remotely, if at all, and even then the difficulty could generally have been overcome if they had not been brought up in the habit of following the line of least resistance with creditors. The trouble has been that these excuses have not been tested often enough. It is likely that the industry will be confronted with many such customers as business adjustment goes on, and while there will still be liberal consideration, the debtor must prove his case. The former habit of holding a brief for him will be out of date.

Financial statements should be more freely given and taken. Their analysis should extend much further than a mere reduction of net worth or quick assets versus quick liabilities. The character of the business, the

ability of the management, are going to be larger factors than formerly in determining the duration of that net worth and how long the assets will remain quick. What the business has done in past years is not going to be a safe guide to what it will do. The writer believes that, where the ability of the management has been evidenced in the past, that ability will carry the business further during these times than net worth alone. Due consideration should likewise be given to withdrawals for dividends or profits to proprietors, likewise to recent plant extensions which may become useless and unsalable or non-convertible.

Another question which credit men will have to consider will be the financing of the excess profits tax. This will be more difficult for those businesses which have made good earnings but are confronted with unfavorable conditions because of the nature of the business. There are many other questions which will arise as each case presents itself, and the writer would recommend that an answer to each be written by the credit manager on each statement for his own information. Every one has had accounts disastrous for himself as well as the debtor where a knowledge of the situation and its frank discussion would have saved a good business and a good customer. Now more than ever is the time for such knowledge and discussion.

TERMS MUST BE STRICT ON F. O. B. SHIPPING POINT

Government control of supplies will likely result in a generally smaller merchandise investment actually on hand, but delays in transportation will correspondingly increase the merchandise book account, as they will also increase the creditors' receivables. This latter will naturally result in an increased line of credit to each account as the merchandise will be longer in transportation between date of billing and due date of bill. Strict adherence to terms of payment by the debtor on goods sold F. O. B. shipping point will be the creditor's only relief from carrying all the contingencies of the transportation situation.

Recently some businesses, principally retailers in other lines than electrical, have advertised that they would take Liberty bonds in settlement of sales. We all recognize the economic importance of these bonds being held as widely as possible. Aside from this consideration, it is not ethical, in view of the high purpose of these bonds, to reduce them to the medium of barter, common currency. If a customer must or will give up these bonds, they should be sold through the regular channels. Using these bonds in this way is worthy only in so far as paying one's bills is worthy and not otherwise possible.

Every one is full of American confidence. Some do not call it by as nice a name; but, call it boastfulness, cocksureness, headlong optimism, egotism or what, history shows that dividends have been regularly paid on American characteristics. Recent world developments indicate that civilization is in the melting pot, and from it may be expected political, social and economic changes for which history furnishes no precedent. There is one principle that can be relied upon. Business has been and always will be. What it will be rests upon our present stewardship, not only individually but collectively. We are all partners in a grand adventure, and only those who can hold up their end will remain in the firm.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

GETTING GOOD SAMPLES OF BOILER-FEED WATER

Instructions to Be Followed to Insure that the Water Received by the Laboratory Is a True Specimen

BY T. W. REYNOLDS

The following are instructions used by an Eastern company for taking and forwarding samples of boiler-feed water to the laboratory:

Before the bottle has left the laboratory it has been washed so that it needs only to be rinsed with the water which is to be sampled. Upon receipt of the bottle, remove it from the box, detach the tag and rinse the bottle thoroughly with the water which is to be sampled.

The sample should be collected in the bottle if possible, not in some other vessel and then transferred to the bottle. If drawn from a tap allow the water to run for a time before filling the bottle. If taken from a body of water immerse the bottle if possible below the surface and allow to fill for rinsing, and then fill again for sample. The water should be taken from that part of the body of water which most nearly represents the water in use or to be used. This may be at an intake pipe or in a stream from a part far enough from the bank to avoid water comparatively stagnant. Do not allow the water actually coming into the bottle to touch the hands. Fill the bottle to within 3 in. (7.6 cm.) of the top; twist the stopper securely into the bottle, and having attached an envelope with the necessary data, replace the bottle in its case and forward by express.

Most laboratories have a standard blank form calling for certain information, and this should be carefully prepared and filled out.

MILL PRODUCTION INCREASED BY REPLACING STEAM ENGINE

The Constant Even Speed Obtained from a Two-Speed Motor Has Resulted in a Noticeable Increase in Production of a Steel Mill

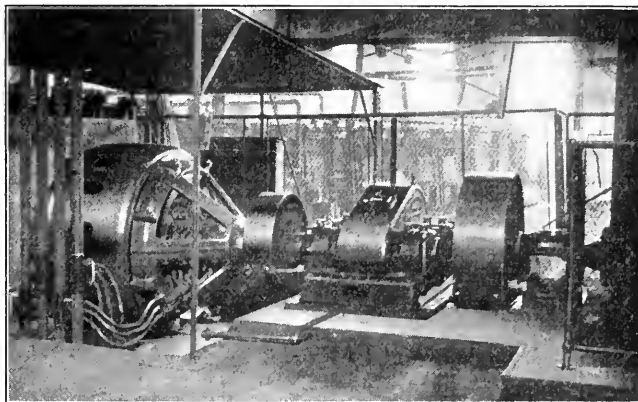
An example of the successful replacement of a steam engine by an electric motor is furnished by the installation in the plant of the Cleveland Hardware Company, Cleveland, Ohio, where drop forgings for automobiles and similar classes of service are manufactured.

For a period of thirty-five years the company had been operating a 9-in. (22.8-cm.) Merchant rolling mill belted to a steam engine which by this time had outlived its usefulness, and it was necessary to install a new drive, as breakdowns were becoming frequent. After a careful investigation into the best-type driving unit the unanimous decision was that an electric motor was the only logical solution of the problem. Absence of any trouble since the installation and an economy of operation better than was anticipated have resulted.

The motor is placed close to and connected by gears to the rolls, and this with the transformers and control constitutes all the apparatus necessary. Energy is obtained from the Cleveland Illuminating Company at 11,000 volts and is stepped down to 2200 volts.

The motor is of the wound-rotor type with a rating of 450 hp. at 900 r.p.m. and 360 hp. at 720 r.p.m. These synchronous speeds are obtained through a double winding designed to give the motor either eight or ten poles, according to the speed desired. The synchronous speeds of the motor are reduced to speeds of the mill shaft of 240 and 192 r.p.m. respectively by means of a herringbone-type gear drive which operates in oil in a completely inclosed case.

The motor shaft is connected to the pinion by means of a Nuttall spring-type flexible coupling especially designed for steel-mill service. A similar coupling con-



TWO-SPEED WOUND-ROTOR MOTOR DRIVING STEEL-MILL ROLLS

nects the gear to a 10-ton open-hearth steel flywheel 12 ft. (3.7 m.) in diameter, which is mounted on two extra heavy pillow blocks, the other end being connected to the rolling mill. The wheel is made in one piece with rectangular arms.

The control of the equipment is handled by a two-panel black enameled switchboard mounted on angle-iron framework. The switches for changing the windings on the motor from eight to ten poles are oil-immersed, one in the primary and one in the secondary circuit. Proper markings are placed thereon so that the mill operator can easily manipulate them. The primary breakers are mechanically interlocked in such a way that only one can be closed at a time.

In case it is necessary to stop the mill quickly, as in an emergency, the running breaker is tripped, which causes all the secondary breakers to open. The operator then closes the reverse breaker, thus quickly bringing the motor to rest.

An idea of the work being done by the mill may be gained from the following figures: In an average eight-hour shift the average tonnage of $\frac{5}{8}$ -in. (1.6-cm.) rounds from 4-in. by 4-in. (10.2-cm. by 10.2-cm.) billets, 90 lb. to 100 lb. (40.8 kg. to 44.9 kg.) weight, 25 per cent carbon, is 35 tons; $\frac{7}{8}$ -in. (2.2-cm.) squares, 45 tons; $1\frac{1}{4}$ -in. by $\frac{1}{4}$ -in. (4.4-cm. by 6-mm.) flats, 40 tons; 100 lb. to 135 lb. (44.9 kg. to 61.2 kg.), 5-in. by 5/16-in. (10.2-cm. by 8-mm.) flats, 35 tons; 2-in. by 3-in. (5.1-

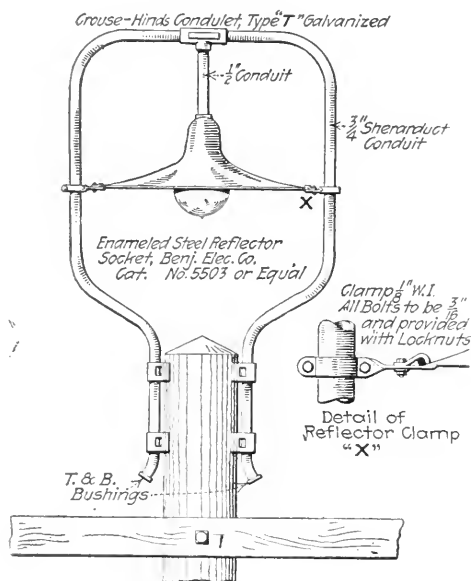
cm. by 7.6 cm.), 40 lb. (18.1 kg.) weight, 15 per cent carbon, $\frac{3}{4}$ -in. by $\frac{1}{8}$ -in. (1.9-cm. by 3-mm.) flats, 15 tons; 50 lb. (22.7 kg.) weight, $\frac{3}{4}$ -in. by $\frac{3}{16}$ -in. (1.9-cm. by 5-mm.) flats, 20 tons; 40 lb. (18.1 kg.) weight, $\frac{3}{8}$ -in. (9.5-mm.) rounds, 20 tons; 55 lb. (24.9 kg.) weight, $\frac{1}{2}$ -in. by $\frac{3}{16}$ -in. (12.7-mm. by 8-mm.) ovals, 30 tons

UTILIZING EXISTING POLES FOR YARD-LIGHTING FIXTURES

Details of Economical Method for Constructing Fixtures for Use in Outside Yard or for Street-Lighting Work

Existing poles supporting wires for various purposes may be in locations advantageous for yard lighting or at least near enough to warrant their use for temporary lighting. In addition, there are cases where economy dictates the use of this method for street lighting. Furthermore, in running a new line it is often possible and practicable, having in mind such use, to locate the poles without an appreciable amount of extra wiring becoming necessary.

Referring to the accompanying drawing, two $\frac{3}{4}$ -in. (1.9-cm.) conduits are bent as shown and secured by clamps to the pole top. The necessary material for this work is four 2-in. by $\frac{1}{2}$ -in. (5.08-cm. by 1.27-cm.) iron straps bent to the circumference of the pole and four 2-in. by $\frac{3}{16}$ -in. (5.08-cm. by 4.8-cm.) iron straps bent around the conduit and fastened by $\frac{1}{2}$ -in. (1.27-cm.) lag screws to the pole. The conduit ends begin with T. & B. bushings and are connected about the center of the pole by means of a galvanized T-conduit from which a $\frac{1}{2}$ -in. (1.27-cm.) conduit is extended to the reflector. The latter is of steel and supported on two sides by $\frac{1}{4}$ -in. (3.2-mm.) iron straps bent around the $\frac{3}{4}$ -in.



METHOD OF USING LAMP-CIRCUIT CONDUIT TO SUPPORT LAMP AND REFLECTOR

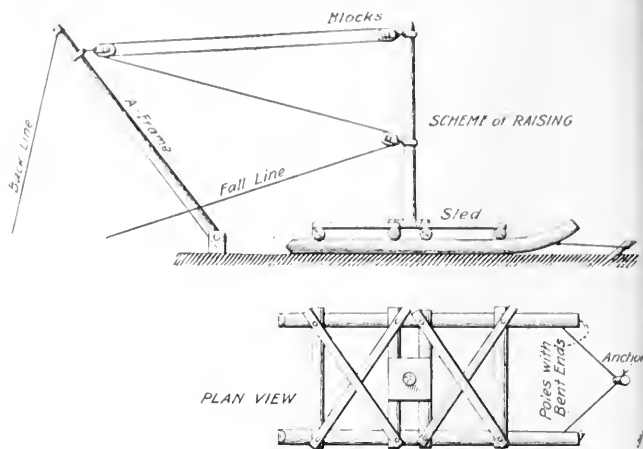
(1.19-cm.) conduit uprights and bolted with $\frac{3}{16}$ -in. (0.48-mm.) bolts and lock-nuts.

The fixture should, of course, be made thoroughly weatherproof by the application of two coats of paint. There is no economy whatever in the paint-saving methods sometimes employed.

INEXPENSIVE GIN SLED USED FOR WINTER WORK

Wooden Poles and Broken Pieces of Poles May Be Utilized to Make an Outfit Designed for Raising A-Frame Towers

The accompanying illustration shows how a gin sled was made by the Iowa Railway & Light Company of Cedar Rapids, Iowa, for raising A-frame towers on a cross-country transmission line. Wooden poles that had



GIN SLED MADE OF OLD POLES WITH BENT ENDS

been broken and old poles that had ceased to be useful except as firewood or "deadmen" were used. This sled was made instead of a wagon because it was cheaper and could be made to stay on the ground better under a heavy pull on uneven ground. It was dragged on the snow or wet earth from pole to pole by a single team of horses. The team was also used on the fall line. When fences were encountered they were cut down to allow the sled to pass.

The runners of the sled were made from poles which had crooked ends to get the desirable "turned-up" characteristics of properly fashioned sled runners. Most of the joints in the sled were made with bolts which were salvaged when the sled was abandoned.

PREVENTING EXPLOSIONS IN BOILER FURNACES

Necessity of Special Consideration When Using Low-Grade Fuel—Apparent Causes and Methods of Prevention

BY GILBERT RUTHERFORD

Probably every one who has operated boilers has at some time encountered the furnace explosion that blows fire doors open and singes the fireman's hair with the hot flame or blows coal particles into his face or eyes. The incident is not uncommon and, although potentially a dangerous occurrence, fortunately in most cases causes only temporary disability. The use of so-called low-grade fuels at this time of coal scarcity and high prices for marketable coal tends to increase the seriousness of furnace explosions. A brief discussion of their cause and prevention, based on the writer's experience, may therefore be of value.

Furnace explosions happen either when the furnace door is opened or when it is closed. The reason for the

explosion is the same in both cases, but the manner in which the explosion is brought about is different in the two cases.

Consider an instance where a furnace is incased in a setting that is new and airtight so that air infiltration is eliminated by plastering up cracks and crevices, etc. No air enters above the fuel bed, and the furnace chamber is filled with combustible gases. The fire doors are closed and the furnace is operating, and at fairly low rate of combustion, which means comparatively high draft for a thick fuel bed. The fireman now opens the fire door to throw on some more coal or to look at the fire or rake it over. There being a difference of pressure between the inside and the outside of the furnace chamber, such that the air rushes from the outside to the inside, the air from the boiler room is caused to rush in immediately and mix with the combustible gases above the fire. Combustion occurs instantly and with such rapidity that it has an explosive effect, blowing out the gas and coal into the face of the fireman. The simplest remedy is to maintain balanced pressures, or nearly so, between the inside and outside of the furnace chamber.

Another common cause of explosion is in cases where the furnace doors are closed after being opened. Suppose a fireman throws a shovelful of slack coal—for example, anthracite dust—upon the fire. To prevent cooling the fires he opens the door wide, throws in the coal as quickly as possible and shuts the door again immediately. While the fire door is open the furnace settings fill with air, partially at least. The slack coal thrown on the fire spreads over the fuel bed and combustible gases are distilled. The gases rising from the fire may contain as much as 30 per cent of combustible. This mixes with the air entrained in the setting, the mixture becomes ignited, a small explosion occurs, and the fire door of the furnace is blown open with considerable force as a consequence.

DRILL ALL CROSS-ARMS

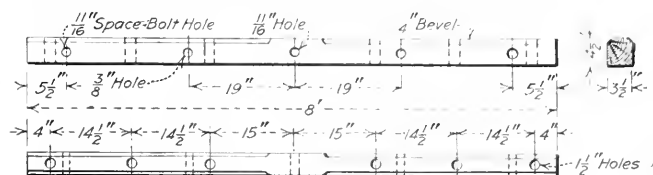
TO TAKE SPACE BOLTS

Found More Economical Inasmuch as Large Percentage of Arms Used in City Construction Are Involved in Double-Arm Pairs

In ordinary city construction most companies employ double arms at railroad and street railroad crossings, at corner poles or curves and at points where one or more wires dead-end. One company made a check of the number of double arms used in city construction, and it was surprising to find that in a typical commercial and industrial district 64.5 per cent of the arms in place were involved in double-arm pairs. In a typical residence district the percentage was somewhat less, being 58 per cent. This large number is, of course, due primarily to the number of lines dead-ended at double-pole corners.

It was decided at once that all cross-arms should be drilled for double arming or space bolts in the process of manufacture. The drilling of an 11/16-in. (1.7-cm.) hole in the side of the cross-arm at each end weakens the arm but little, and as side holes for through bolts and brace bolts must be drilled in manufacture, there is no increase in cost due to the drilling of the space-bolt holes. On the other hand, if this work is done in

the field the drilling is more expensive and is less likely to be done evenly. This is particularly true where it is desired to double-arm an existing single arm, and the work must be done on the pole. Where second-hand arms are reinstalled it will be found that the old field-drilled space-bolt holes seldom match, and new ones



SIX-PIN ARM WITH SPACE-BOLT HOLES AT ENDS

must consequently be drilled. With factory-drilled holes these difficulties are avoided.

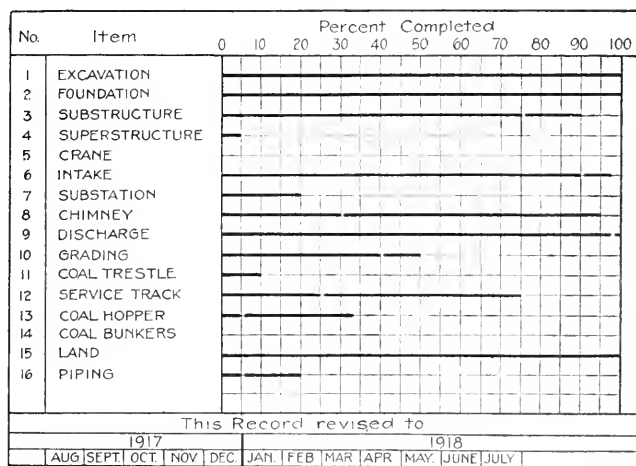
It is found good practice to place the double-arming bolts 5 1/2 in. (14 cm.) from the cross-arm ends. In N. E. L. A. standard four, six and eight-pin arms this puts the space bolts through the arm 1 1/2 in. (3.8 cm.) inside of the center line of the outside pins, as shown in the accompanying illustration.

COMPACT CENTRAL STATION

CHART TO RECORD PROGRESS

Method Is Found to Be Inexpensive, as an Original Tracing Can Be Altered at Any Time When This Is Desirable

A convenient progress chart used by the Turners Falls Power & Electric Company in connection with the construction of its new steam-turbine plant at Chicopee, Mass., is shown herewith. Work on the superstructure to Dec. 1, 1917, was classified under seventeen items from excavation to piping, the percentage of completion at any time being shown by solid heavy lines with breaks for monthly separation, together with the revision data. Two 15,000-kw. units will be first installed, but these have not yet appeared on the chart. The



INEXPENSIVE PROGRESS-RECORDING CHART USED IN A CENTRAL STATION IN A MASSACHUSETTS CITY

method is very inexpensive, as an original tracing can be altered at any time and new prints made to show conditions even under rapid changes.

R. E. Barrett is resident engineer in charge of the construction of the new steam-turbine plant of the Turners Falls Power & Electric Company.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

IDEAS THAT UNDERLIE NEW HEADQUARTERS FOR UTILITY

How the Lobby of a New Building for the Minneapolis General Electric Company Was Constructed to Help Carry Out Company Policy

Larger quarters for the Minneapolis (Minn.) General Electric Company were made necessary when the company so far outgrew its former housing that ordinary routine business could not be handled. In designing the new quarters the company's executives did not overlook the fact that the place in which several thousand customers pay their bills affords a great opportunity to advertise electric appliances. The lobby of the new building was designed to take care of these opportunities.

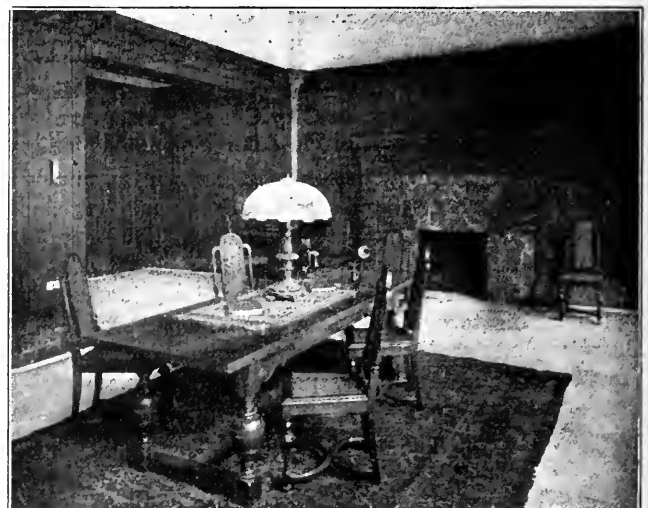
It is not the company's policy actively to engage in merchandising, but rather to do all it can toward advertising appliances. This does not mean that the company will not sell appliances. It does mean, however, that it pays more attention to making an attractive and impressive display and to interesting the thousands of people who visit the lobby each month than to the actual sale of devices from its own shop. That this plan works as intended is shown by the fact that dealers constantly tell the company of inquiries from buyers who have seen some device at the electric company's shop.

The company does not cut prices, sell on installments, employ any system of mail solicitation, or employ salesmen to sell appliances outside the showrooms. List

played a number of the larger electrical devices, such as washing machines, mangles, sewing machines, etc., most of which are placed there by electrical dealers for demonstration purposes. In this way the new lobby has been utilized to apprise patrons of electrical conveniences and to help the local dealers make sales.

Another idea back of the layout of the lobby had to do with the possibility of impressing upon customers the company's policy of interest in their well-being. It has been found that no mistake was made in estimating the advantage the new lobby would give in this direction. To carry out this plan one section of the lobby is fitted as a waiting room, with a large table, ladies' writing desk, telephones, etc. Another feature is the information desk in charge of a competent man prepared to meet the public and not only to impart the desired information but also to give customers the feeling that the company wishes to devote some time to their personal attention. In commenting on this information desk, H. E. Young, sales manager of the company, said:

We have many inquiries a day at this desk and the conversations which we are able to have with these thousands of people give us a very valuable source of information as to how the public feels with reference to our company. We obtain the opportunity of discovering immediately any complaint which the customer may have and of satisfying it, as well as any criticism which appears to be in the public mind with respect to our activities. It is evident that remarks concerning our business are valuable information for the company to have, as they give very good indications of how our company stands in the minds of a great many persons.



DESIGNING AND FURNISHING THE LOBBY OF THE CENTRAL STATION BUILDING TO ATTRACT CUSTOMERS

prices are maintained. A co-operative advertising service is issued with the bills. In this service each local dealer may advertise and is billed for the space he occupies at the exact cost of the space. The central station takes no space on this advertisement, but gives it all over to dealers. On the lobby floor there are dis-

By actual records we have found that every day we are able to discover from one to ten instances of customers who have had a more or less wrong impression of our company, and we are able to correct this. It is evident, therefore, that this amounts to several thousand cases of dissatisfaction in a year which have been removed.

Without this spacious and attractive lobby, therefore,

thousands of people would come into our building in a year's time, pay their bills and leave without getting a correct impression of what our company stands for.

One of the most valuable assets of the arrangement of large pieces of merchandise on the floor is the fact that our clerks are able to talk to hundreds of people every month, and not only introduce these devices into the home but show the customer our interest in being of service to him. Here again we run across many opportunities to relieve patrons of some particular misunderstanding they have had with our company and thereby make additional friends.

On the whole, this lobby is a new means of affording us an opportunity to come into proper contact with a great number of people and impress upon them our policy and our attitude. As a result our company will mean a great deal more to them than simply a cold-blooded business institution whose interest stops with the payment of the necessary money for service rendered.

NEW-BUSINESS PROGRAM FOR COMING SIX MONTHS

Appliance Sales and Keeping of Records That Will Assist in Getting Business at Later Date Are Features of Work

Late in the year 1917 the accompanying tentative program of work for the new-business department was worked out for a Wisconsin utility company operating in a city of something less than 30,000 population. The plan was developed with the idea that the activities of the department should be so controlled as to put on the lines business which would increase the income from existing investment and at the same time would pave the way for a big drive after other business at some future time when conditions are more favorable. The plan follows:

I. Make an analysis of appliance market, which involves calling on each individual residence customer, making a record of the appliances that each has, ascertaining whether they are in good condition and are being used. Explain appliances that customers are interested in and endeavor to interest them in appliances which they do not own.

While obtaining the above records:

1. Make record of unwired houses.
2. Solicit all houses on our lines that are wired but not connected, preferably those that have services already attached to the house.
3. Make record of most profitable line extensions, possible number of customers, etc., so that they can be given attention when we are in a position to make such extensions.
4. Make a record of customers having a minimum monthly bill, using these as "prospects" for additional appliances.
5. Especially solicit the custom of "long-hour burners," such as barber shops, pool-rooms, saloons, restaurants, hotels, confectionery stores, cigar stores, drug stores, etc., that use gas lighting.

6. Offer suggestions to other merchants for the improvement of their installations, endeavoring to raise the standards of illumination.

7. Keep in close touch with the various isolated plants, keeping of their breakdowns, etc., and getting any information which might assist us in selling them breakdown or complete service.

8. Make a record of power installations also in industrial appliance installations which should be of use to us in obtaining additional business along these lines.

II. Care for all complaints which are turned over by the accounting department or otherwise directed to this department for adjustment.

III. Salesroom: Call the attention of all people who sign applications at the office or come there to make complaints to our line of appliances, explaining appliances which are apparently new to the customer. If unable to sell them, take their names as "prospects."

Make exchange of Gem lamps. Keep record of incandescent lamps and appliance sales. Keep record of connections and disconnections, etc.

SCHEDULE FOR EXPENDITURES

1. Send circular letter to every customer on our lines featuring economy in time and operation, convenience, safety and cleanliness of electrical appliances, to be followed by a series of two or three "follow-up" letters, one of these to feature the practicability of electrical Christmas gifts. Approximate cost,	\$500.00
2. The use of space in one foreign-language and one English-language daily paper, featuring seasonal appliances, house wiring in season, commercial lighting, general policy letters, etc. Approximate cost.	500.00
3. Arrange for public lecture for woman's club and domestic science classes, together with demonstration of appliances and serving of electrically prepared refreshments. Approximate cost.	50.00
4. Furnish slides to four moving-picture theaters every week throughout the winter, featuring appliances, etc. Approximate cost	156.00
5. Provide for electric cottage during house-wiring season. Approximate cost	100.00
6. Provide more complete line of window accessories such as glass shelves, pedestals, etc., for window display purposes. Approximate cost	15.00
7. Erect talking electric sign similar to that of Merchants' Light & Heat Company of Indianapolis, also install electric flag. Electric sign and flag to be charged to ten years' advertising. Account for six months. . . .	20.00
Salaries and commission, approximately.	1,100.00
Total	\$2,441.00

This plan contemplates the expenditure of a sum amounting to about 1.1 per cent of the gross annual revenue of the company, which is about one-half the amount usually expended by the company in this class of work.

INTERRUPTION REPORT TO URGE BETTER SERVICE

Form Shows What Caused Outage and of What Consequence to the Public Service Company Each Interruption Proved to Be

The Central Illinois Public Service Company of Mattoon, Ill., has developed a standard form on which each service interruption is reported to the chief executive. Such a report is made each month and covers the company's entire property, comprising some 190 committees. The report sets forth the location of the trouble both as to the districts affected and as to the particular

[illegible]

A CONVENIENT RECORD OF SERVICE INTERRUPTIONS

portion of the system responsible for the outage. In addition to this it gives the number of customers affected and the time lost. From these data are computed the loss in customer-hours. From these facts and a knowledge of what would constitute 100 per cent perfect service there is computed a percentage representing the degree of perfection attained for that

month. Every outage, even though it is but momentary, is counted as an interruption.

Since reporting of this character has been in force there is a noticeable tendency for employees to endeavor to reduce outages to a much lower minimum, so that the service percentage is usually well above 99 per cent, which leaves remarkably little room for improvement.

THE PUBLIC IS SLOW

TO CONSERVE ELECTRICITY

Advertisements Asking Consumers to Aid Company in Combating the Coal Shortage Do Not Bring Quick Action

A Middle Western central station company recently published a large advertisement in one of its local Sunday papers setting forth the exact conditions which confronted the company and laying special emphasis upon the necessity for its patrons to conserve elec-

tricity. Part of the contents of the advertisement are given herewith.

In commenting upon the use of this advertising the executives of the company said:

"The most good from such an advertisement is in informing the public of the actual conditions that exist. The public usually responds very slowly to such requests.

"We have since the publication of the advertisement sent personal representatives about the city making the request directly to our consumers. Moreover, the local United States Fuel Administrator assisted in endeavoring to create interest in conservation. The best we can say, however, is that the public will co-operate with the central station very reluctantly. This does not mean that it did not co-operate, but it means that it has been slow in realizing the importance and absolute necessity of co-operation."

SHORTAGE OF ELECTRICITY

FOR POWER, LIGHT AND STREET RAILWAY PURPOSES

Electric Power Shortage

The electric power situation in ——— and the surrounding territory served by this company has become more acute. This is due to the fact that the existing equipment in our power stations cannot be operated at its full capacity because we have been unable to procure a good grade of coal. However much we may regret our inability to meet the demands upon us—and we most certainly do regret it—the situation must be squarely faced and steps taken to conserve the supply of electricity.

We request those who use electricity for power purposes to give their most earnest consideration to ways in which they can make a saving of current in their business.

We request those who use electricity for lighting purposes to burn fewer lights. Use only one light where formerly two were used.

The foregoing request is made only with a full knowledge of the gravity of the situation, and because we wish to render to all our patrons the best service which the circumstances will permit.

Our Coal Troubles

The coal we are now receiving is of the most inferior grade we have ever had experience with. Our firemen jokingly refer to it as "fireproof" coal because it is so full of dirt that it will barely catch fire. In fact, some actually had corn growing in it as it stood in the car when received, and tests made of the coal have shown it to contain as high as 26 per cent of non-combustible material.

It has been due to this fact that several times recently we have been forced to discontinue service to power customers, to operate cars at half speed for short periods and to operate a reduced number of tripper cars during the rush hours. The poor grade of coal makes it utterly impossible to operate our boilers at capacity and lowers the output of our power station system.

The present serious situation prevails throughout the country—this community is not alone in difficulty, but this company without help cannot attain the desired results. Relief can come only with your immediate and persistent co-operation.

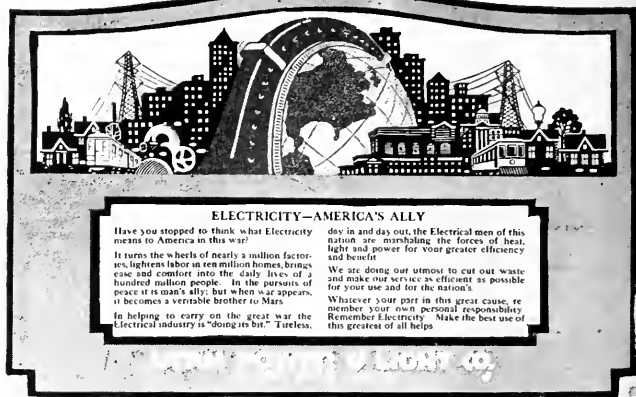
ELECTRICITY VIEWED AS

THE ALLY OF AMERICA

Opportunity at Hand for Central Stations to Give Publicity to the Essential Character of the Electric Lighting Industry

In both the Christmas and New Year's special editions of the Salt Lake City papers the Utah Power & Light Company ran the accompanying advertisement calling attention to the part electricity is playing in winning the war.

The public is not apt to think much of the part that individual industries are taking in this world struggle unless the facts are brought to its attention. Had it



ELECTRICITY IN THE WAR FOR DEMOCRACY

not been for the large amount of publicity it is doubtful if the people of the United States would attach such importance to the shipbuilding industry, and the same is true of other great industries. Of no less importance or value is the electrical industry. The munition plants, the shipbuilding plants, the steel plants and all of the other great war plants depend on electricity to turn out their products.

Of this fact, however, the great public of the United States is not aware. It does not know because it has not had the opportunity to learn. Central stations have here the chance to create good-will and better public relations, besides helping the public to understand the war value of the electric lighting utility.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Methods of Cooling Transformers.—ARTHUR PALME.—Starting with the early dry type of transformer, which depended upon natural draft to dissipate the heat generated in its windings and core, the author discusses the different types of transformer tanks that have been developed to meet the ever-increasing size and changing operating conditions of transformers—a development which has made possible the modern 8000-kva. self-cooling and the 14,000-kva. water-cooled, oil-insulated transformers.—*Power*, Dec. 25, 1917.

Static Transformer Construction.—G. HARLOW.—This subject is discussed under the following heads: Efficiency, subdivided into iron and copper loss; temperature rise; short-circuit conditions and regulation; magnetizing current; flash test and insulation of end turns, and quality of oil.—*Commonwealth Engineer*, Oct. 1, 1917.

Lamps and Lighting

Light Distribution from Projectors.—WALDO C. COLE.—The problem of just what light may be expected from a parabolic reflector under practical conditions is one which it is possible to work out mathematically, as is pointed out in the article. From these calculations it is obviously possible to figure out in advance just how many lamps would be needed to illuminate a given area to a given intensity.—*Journal of Electricity*, Dec. 15, 1917.

Electric Car Lighting.—This article gives a summary of the best practices of representative steam railroads in this country on the important subject of electric car lighting.—*Railway Electrical Engineer*, December, 1917.

Generation, Transmission and Distribution

Gas-Firing Boilers.—T. M. HUNTER.—The author brings out the fact that the gas firing of boilers now has a greater future than ever. Probably the time is not so far distant when the present method of burning coal, together with its valuable by-products, will be considered obsolete and possibly even illegal. It will then be replaced by some type of by-product or coal-distillation plant yielding gas, and this gas will without doubt be largely used for boiler-firing purposes.—*London Electrician*, Dec. 7, 1917.

Electrical Energy from Brown Coal.—Tests made by the City Council of Melbourne, Australia, in a furnace constructed along the lines of a Dutch oven indicate that there will be no difficulty in burning brown coal. With the use of a thick fuel bed a semi-producer form of combustion takes place, the volatile matter and moisture being driven off early and the former burned in the upper part of the furnace by the aid of the air admitted at the bridge. The tests proved that the boiler capacity as rated on the basis of black coal consumption was more than fully maintained with brown coal.—*Commonwealth Engineer*, Nov. 1, 1917.

General Utilization of Pulverized Coal.—H. G. BARNHURST.—From the author's presentation of this subject, there are no insuperable difficulties to overcome in the use of pulverized coal, but merely those which have always hampered the introduction of new methods. Pulverized coal is here to stay, for it is very closely allied to the conservation of national resources.—*Journal Engineers' Club of Philadelphia*, December, 1917.

Traction

New Cars for the Melbourne, Brunswick and Coburg Tramways.—STRUAN ROBERTSON.—Description of lightweight cars that give reasonable seating accommodations for use on this system. The main dimensions and particulars of the cars are given as well as the wiring diagram of contactor connections.—*Commonwealth Engineer*, Oct. 1, 1917.

Handling Electric Locomotives and Motor Cars.—An article on the methods used by representative roads to maintain electric rolling stock and train enginemen.—*Railway Electrical Engineer*, December, 1917.

Installations, Systems and Appliances

Annual Load-Relief Map—Peak-Load and Load Factor Analysis.—WILLIAM LEROY ROBERTSON.—This is a description of an annual load-relief map which is a device for visualizing the entire yearly load of central stations. A review of load characteristics, as exemplified by the annual load-relief map, is included. Notes on daylight saving relative to the decreasing of peak load and improvement in load factor are given. The article also includes an analysis of load factors as applied to base and top loads, demonstrating the large amount of idle capacity peculiar to central stations. The annual load-relief map is valuable in the study and exemplification of all matters having to do with the central-station loads.—*Proceedings A. I. E. E.*, December, 1917.

Electrical Cooking as Applied to Large Kitchens.—W. A. GILLOTT.—The author considers the future of this branch of electrical industry to depend, first, upon close co-operation between the supply company's engineer and the manufacturer, and, secondly, upon the interchange of ideas and experiences. He also points out that in drawing up a scheme for cooking in large kitchens the essential items are reliability, quick service and efficiency. When the working comparisons are considered electricity has sufficient advantages to outweigh any difference in capital cost. These are: (1) cleanliness and absence of fumes; (2) constant heating value; (3) reduced labor costs; (4) less floor space required; (5) economy in food; (6) saving on the renewal of kitchen utensils.—*London Electrician*, Dec. 7, 1917.

Conveyors and Elevators.—W. H. ATHERTON.—The development of the conveyor and elevator for the handling of coal is first outlined, and then the various requirements are considered in detail. Sufficient coal

storage is a vital matter for the power station and introduces problems which are conveniently solved by conveyors. The various types of conveyors and elevators for coal handling and ash handling are considered in some detail, and reference is also made to the suction method of removing ashes.—*London Electrician*, Dec. 14, 1917.

Small Electric Furnaces and Their Uses.—CHARLES R. DARLING.—The author describes typical forms of modern electric furnaces as well as the question of the best methods to follow in operating them.—*London Engineer*, Nov. 16, 1917.

Extensive Use of Heating Appliances in Switzerland.—Reports from various central stations in Switzerland emphasize an enormous increase in the use of electricity for private cooking and heating. The use of electricity for these purposes (coming at the time of day where demands for lighting are low) would be far greater if sufficient electrical cooking and heating appliances could be obtained from other countries. Switzerland looks to America to supply this need if arrangements for the exportation can be made in the United States.—*Schweizerische Wasserwirtschaft*, Nov. 10, 1917.

Charging Machines.—FRED G. SMITH.—Reference is made particularly to the use of charging machines in steel works. Such machines lead to a large saving in labor, as shown by typical cost figures. Owing to the number of independent movements that are required, the wiring is somewhat complicated and requires careful study to avoid annoying breakdown. Also, owing to severe conditions of service, the construction must be rugged. Illustrations are given of up-to-date machines.—*London Engineering*, Dec. 14, 1917.

Electric Heating of Industrial Plants.—F. RUTGERS.—In Switzerland coal is so expensive and the heating demands of industrial establishments so erratic that tests carried out in some plants with electric heaters supplied with hydroelectric energy have shown their desirability even at lower coal prices than obtain at present. Where live steam has to be used for heating it is at present nearly twice as expensive as electric heating from hydroelectric sources. Rooms which are rarely visited by employees can be maintained at medium temperatures simply by warming them during off-peak periods. Where a greater warmth is needed, as in workrooms, 20 to 40 calories are required for each cubic meter on cold winter days, and 15 to 25 calories on milder days. The heat produced by 1 kg. of coal as steam for heating is equal to 5 kw.-hr. to 5.5 kw.-hr. In one textile plant where air required for the drying of the yarn was formerly sent through masonry conduits past steam pipes and heated to 65 deg. it is now heated by eighteen electric resistance heaters. They are connected in series of three to one phase of a two-phase system. Behind the heaters are wire nets which are intended to catch and retain glowing particles or sparks in case of a short circuit. The air is heated to 55 deg. with an energy consumption of 200 kw. If necessary, the electric installation can handle more air and use 300 kw. This represents an hourly production of 258,000 calories. The installation was built by the Oerlikon Machine Manufacturing Company of Zurich and has given excellent satisfaction.—*Schweizerische Bauzeitung*, Nov. 24, 1917.

Wires, Wiring and Conduits

Calculating Electrical Conduits.—CURCHOD.—A method for the rapid calculation to an approximation sufficient in practical work of the section of copper conductors. Use is made of simple diagrams which represent the sections for different current strengths.—*Revue Générale de l'Electricité*, Nov. 24, 1917.

Electrophysics and Magnetism

Total Emission of X-Rays from Certain Metals.—C. S. BRAININ.—A study has been made of the total intensity of the X-ray emission from six metals, platinum, tungsten, silver, molybdenum, copper and cobalt, over a range of voltages extending from 5000 volts to about 33,000 volts. The relations between the energy radiated and the voltage and between the energy and the atomic weight were investigated; this includes a test of the validity of the equation $E = KAP^2$. Below 20,000 volts approximately the energy radiated by platinum and tungsten was found not be proportional to A and P^2 ; above this voltage, however, it was in agreement with the above equation. Molybdenum obeyed this relation throughout the range of voltages, and showed no deviation from this relation when the voltage was increased above the critical voltage from the K radiation. Copper and cobalt seemed to obey this relation below their critical voltages for the K radiations, but above those voltages their emission increased more rapidly than is required by the "voltage squared law." Silver also obeyed this law below the critical voltage for its characteristic K radiation, but above that voltage the emission energy increased less rapidly than is required by the "voltage squared law."—*Physical Review*, November, 1917.

X-Rays and the Structure of Crystallized and Amorphous Carbon.—Debye and Scherrer find, by the method of X-ray examination which they have perfected, that graphite and amorphous carbon are not essentially different, and that amorphous carbon is only graphite in so fine a subdivision that it is impossible to produce it by mechanical means.—*London Engineering*, Dec. 7, 1917.

Telegraphy, Telephony and Signals

Loading Coils Versus Repeaters.—W. N. FURTHMAN.—The author points out that properly designed and correctly installed loading coils are adequate for all long-distance work. In discussing the principles and uses of repeaters or amplifiers, it was pointed out that they are not absolutely required in transcontinental service.—*Telephone Engineer*, December, 1917.

Miscellaneous

England's and Germany's Faith in Electricity.—It is reported that great reliance is placed on intensive development of electric power by Germany as a means toward rapid reconstruction of industrial prosperity. According to the *London Electrical Industries*, England too feels confident of her electrical position. This journal says: "England is the most favorably situated country in the world for deriving public and private benefit from electrical progress. Our population is more conveniently distributed; our fuel supply is far richer and more accessible. England can if she chooses have a supply of electricity, laid on practically everywhere like water, cheaper than Germany or any other big country on earth, and with this priceless blessing

England can not only defy competition in a wide range of manufacturing industries but can bring about a wonderful revival of agriculture and abolish domestic drudgery. Whatever Germany can do we can do twice as well in this field if only our people will drop their pettifogging parochial notions of electrical development and support the establishment of single-minded administration from a broad national standpoint."—*London Electrical Industries*, Dec. 5, 1917.

New Method of Increasing the Evaporation in Boilers.—CARL HERING.—A new thermal principle in the boiling of water is described. The thin film of gas on the flame side of the water-boiling vessel offers an enormously high resistance to the flow of heat. By means of lugs on the flame side of the surface an artificial thermal resistance is established, which greatly increases the flow of heat, provided that these lugs are always proportioned in the proper manner.—*Power*, Jan. 1, 1918.

The Automatic Disposal of Ashes from Power Houses by Means of Ropeways.—J. WALWYN WHITE.—Although the immediate removal of ashes from the power house can be secured by various means, such as conveyors, telfers, suction plant, etc., the range of action of such devices is comparatively limited. If transportation over some distance is desired, then the problem is most easily solved by means of the ropeway. Such plant is efficient and costs but little in operation. A number of ropeway installations especially adapted for this purpose are described.—*London Electrician*, Dec. 14, 1917.

A Physical Interpretation of Entropy.—J. LAROUSSE.—This article has both a didactic and a technical interest—didactic because the author shows that entropy is, at least theoretically, measurable as a quantity of heat and is not merely a "colossal abstraction"; technical because the process of reasoning that is followed makes an excellent basis for the formulation of a simple and clear theory of thermal machines.—*Revue Générale de l'Electricité*, Dec. 1, 1917.

Use of Aluminum in the Electrical Industry.—JEAN ESCARD.—The author compares aluminum with copper conductors, finding that the former are less easily broken, by reason of their greater specific heat and greater surface radiation; that they have 1.67 times the conductivity of copper of the same weight; that insulation is less effective with aluminum because of its greater diameter, though this is a negligible consideration; that aluminum will withstand a heat intensity one-seventh greater than copper, and that from the point of view of susceptibility to puncture experience shows that with equal insulation fatigue it is possible to reduce the thickness of the insulating material when aluminum wires are used—an important factor in price reduction and a compensation for the increased diameter of the conductor. In winding armatures, etc., aluminum has the advantage that bare wire can be employed. Other uses are for electrodes for arc lamps (these are made with platinum points); for connecting wires between the interior filaments of incandescent lamps and the exterior contacts; in the manufacture of cells and batteries, and in making lightning arresters composed of one or more series of aluminum cones or conic basins filled with an electrolyte.—*Revue Générale de l'Electricité*, Dec. 8, 1917.

Cost of Electric Pig Iron.—Based on experiments at Trollhättan, 4 tons of pig iron should be produced per kilowatt-year in a plant using only one furnace, measuring the energy at the furnace. Figured on the amount of energy purchased, the output should be about 3.32 tons per kilowatt-year. Better results may be expected from a plant of two, three or four furnaces. With a plant of four furnaces, it is assumed that an efficiency of 92 per cent can be attained, and with two or three furnaces between 83 and 92 per cent respectively.—*London Engineering*, Dec. 14, 1917.

Books Received

EVERYMAN'S CHEMISTRY. By Ellwood Hendrick. New York: Harper & Brothers. 374 pages.

MECHANICAL PROCESSES. By G. W. Danforth. Annapolis, Md.: United States Naval Institute. 424 pages, 268 illustrations.

BUSINESS LAW FOR ENGINEERS. By C. Frank Allen. New York: McGraw-Hill Book Company, Inc. 291 pages. Price, \$3.

EMPIRICAL FORMULAS. By Theodore R. Running. New York: John Wiley & Sons, Inc. 144 pages, illustrated. Price, \$1.40.

THE LIGHTING ART. By M. Luckiesh. New York: McGraw-Hill Book Company. 230 pages, 43 illustrations. Price, \$2.50 net.

APPLIED MOTION STUDY. By Frank G. Gilbreth. New York: Sturgis & Walton Company. 220 pages, illustrated. Price, \$1.50, net.

PRACTICAL ELECTRICITY. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 646 pages, 548 illustrations. Price, \$2.50.

ELECTRICAL ENGINEERING. By Clarence V. Christie. New York: McGraw-Hill Book Company, Inc. 546 pages, 508 illustrations. Price, \$4.

ELECTRICAL MEASUREMENTS. By Frank A. Laws. New York: McGraw-Hill Book Company, Inc. 720 pages, 442 illustrations. Price, \$5.

HYDROELECTRIC POWER STATIONS. By Eric A. Lof and David B. Rushmore. New York: John Wiley & Sons, Inc. 822 pages, 408 illustrations. Price, \$6.

PRACTICAL PYROMETRY. By Ervin S. Ferry, Glenn A. Shook and Jacob R. Collins. New York: John Wiley & Sons, Inc. 148 pages, 73 illustrations. Price, \$1.50.

THE ELEMENTS OF ELECTRICAL ENGINEERING. Vol. I. By William S. Franklin. New York: The Macmillan Company. 465 pages, illustrated. Price, \$4.50.

THEORY AND CALCULATIONS OF ELECTRICAL APPARATUS. By Charles P. Steinmetz. New York: McGraw-Hill Book Company, Inc. 480 pages, 227 illustrations. Price, \$4.

ENGINEERING MATHEMATICS. A Series of Lectures Delivered at Union College. By Charles Proteus Steinmetz. New York: McGraw-Hill Book Company, Inc. 320 pages, 110 illustrations. Price \$3.

RADIO-COMMUNICATION: THEORY AND METHODS WITH AN APPENDIX ON TRANSMISSION OVER WIRES. By John Mills. New York: McGraw-Hill Book Company, Inc. 205 pages, 120 illustrations. Price, \$1.75 net.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

"COAL BUDGET" PLAN OF FUEL ADMINISTRATION

Vital Coal Needs of Public Utilities to Be Met 100 per Cent, but Consumers of Power to Be Asked to Curtail

The new "coal budget" plan of the United States Fuel Administration, announced in Washington this week, will not adversely affect the electrical industry, speaking broadly, according to statements made personally by Fuel Administrator Garfield to the Washington correspondent of the ELECTRICAL WORLD.

In discussing the new plan, Dr. Garfield pointed out that the statement outlining it, made public on Jan. 8, specifically promises that the coal needs of public utilities, such as power companies, will be filled at the rate of 100 per cent.

That there will be a curtailment of the supply of coal and consequently of power, however, is apparent by a reading of the statement and an analysis of the plan made by other Fuel Administration officials for the correspondent of the ELECTRICAL WORLD. In a few words, the intention of the plan is to cut down on non-essential production, so as to save coal. Thus all industries not absolutely essential to the conduct of the war, but which use electrical energy for power in manufacture, are being asked to curtail their production, and in that way there will be a curtailment of power and consequently of coal.

The brewing industry, as well as industries engaged in producing paint and varnish, wall paper, confectionery, artificial ice, boxboard and glassware, have already made voluntary reductions in production, and to the extent that electrical energy is used in these industries there will be a saving of power and of coal.

The Fuel Administration is now asking that all other industries which can cut down production of materials not essential for winning the war send representatives to Washington for conferences and announcement of patriotic purpose in curtailment of production. It is thought that in this way a reduction between 36,000,000 tons and 50,000,000 tons in 1918 is possible.

The official statement in regard to the plan promises that "fuel needed in 1918 for army and navy purposes, for munition works, for public utilities, for domestic consumers and for factories working on war material will be furnished to the extent of 100 per cent."

Dr. Garfield was asked whether the new "coal budget" plan of giving such public utilities as power companies 100 per cent of their coal requirements means that the Fuel Administration has now worked out a permanent policy for the treatment of the electrical industry for the duration of the war.

"Not in regard to electric lights," he answered. "That subject will be handled by the state administrators in the several communities in accordance with conditions in the various sections of the country."

EXECUTIVE COMMITTEEMEN OF CONTRACTORS' ASSOCIATION

Members Elected by Divisions to Perfect the Formal Organization of the New Association at St. Louis on Jan. 22

In preparation for the organization meeting of the new executive committee of the National Association of Electrical Contractors and Dealers to be held at the Missouri Athletic Club, St. Louis, on Jan. 22, as stated in last week's issue of the ELECTRICAL WORLD, members have been elected by the broad divisions provided for under the constitution. The newly elected members of the executive committee, as announced thus far, are:

Central Division.—Two years: G. M. Sanborn, Indianapolis, chairman; J. A. Fowler, Memphis; J. E. Sweeney, Waterloo, Iowa. One year: Robley S. Stearnes, New Orleans; W. I. Gray, Minneapolis; J. N. Pierce, Chicago.

Atlantic Division.—Two years: W. C. Peet, New York, chairman; W. K. Tuohey, Springfield, Mass.; M. E. Arnold, Philadelphia. One year: George M. Chapman, Waterbury, Conn.; T. H. McKinney, Atlanta, Ga.; Paul H. Jaehnig, Newark, N. J.

Pacific Division.—Names not yet announced.

CHICAGO MAY REDUCE INSPECTION DEPARTMENT

Electrical Inspection Department Claims to Be Self-Supporting and Declares There Is Still Much Inspection Work to Be Done

The Chicago City Council, in order to keep expenses within resources, has proposed, among various methods of retrenchment, to dispense with services of some electrical inspectors. This is evidently based upon decline in new building operations. Victor H. Tousley, chief electrical inspector, objects to such action being taken, declaring that the inspection bureau is self-sustaining and that its duties do not depend on building operations, but are largely concerned with the wiring of old buildings, with additional power and light installations in industrial plants, with constant reinspections to insure that safe work continues safe, with the oversight of illuminated signs, and with investigation of accidents and fires.

"At no time," Mr. Tousley said, "can any community afford to dispense with such a feature of prevention of loss of life and property as is represented by its electrical inspection bureau, especially when that bureau is self-supporting. At this time, and in a commercial and railway center such as Chicago, the thought of reducing such a bureau is beyond the understanding of those who are aware of the extreme dangers attached thereto. This is the time that the husbanding of all resources is of vital interest to the nation."

MANUFACTURERS' COMMITTEE
PERFECTS WAR ORGANIZATION

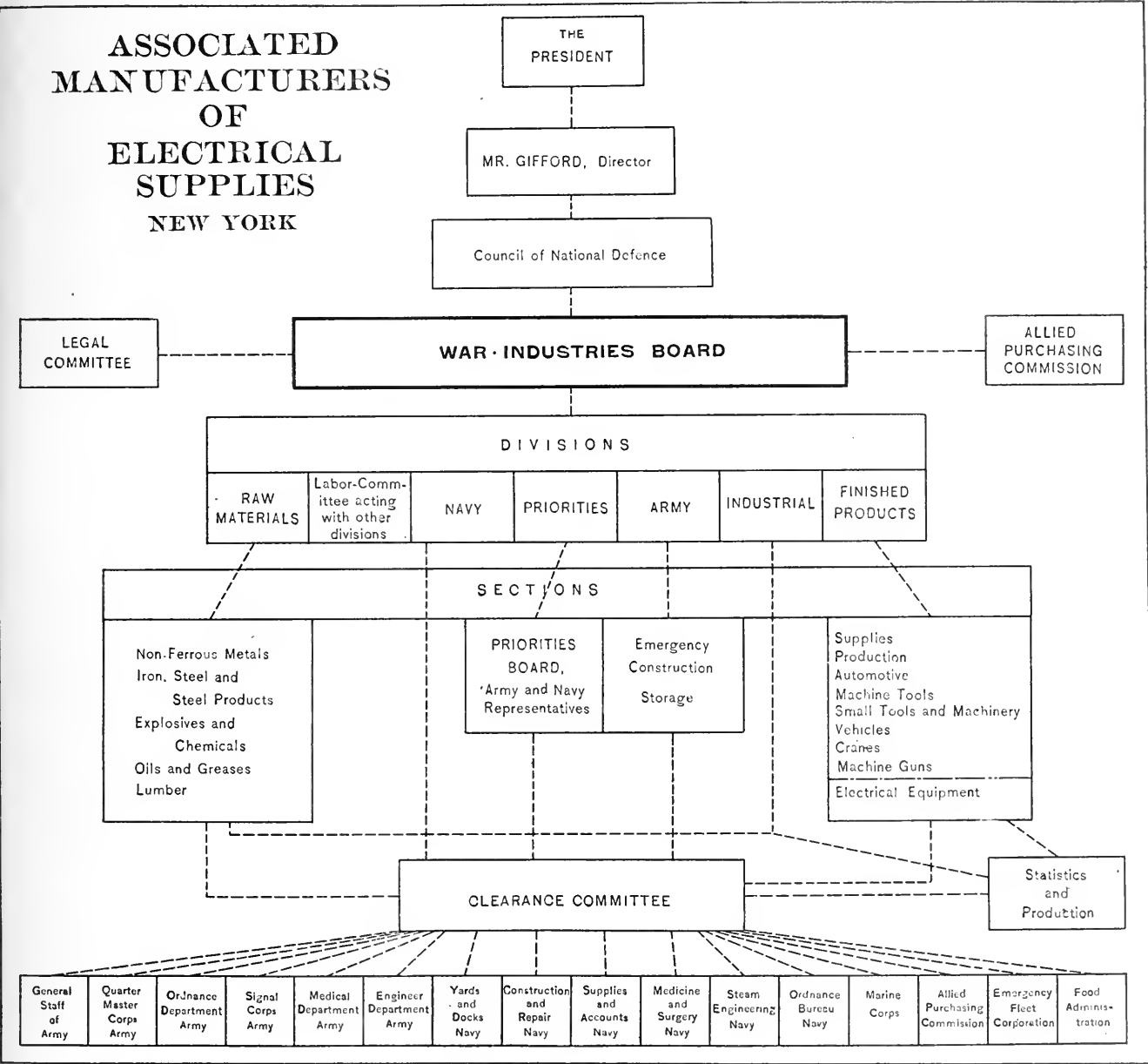
Federal War Service Committee of Electrical Manufacturing Industry Elects Chairman and Secretary-Treasurer

Permanent organization of the General War Service Committee of the Electrical Manufacturing Industry has been effected by the election of Robert K. Sheppard, Simplex Wire & Cable Company, as chairman, and W. W. Nichols, Allis-Chalmers Company, as secretary and treasurer. Mr. Sheppard is a representative of the Associated Manufacturers of Electrical Supplies on the general committee; the other representative of this association on the general committee is J. R. McKee, Gen-

Club on the general committee are Clarence L. Collens II, Reliance Electric & Engineering Company, and J. C. Hobart, Triumph Electric Company.

Mr. Sheppard and Mr. McKee, as stated, represent the Associated Manufacturers of Electrical Supplies on the General War Service Committee of the Electrical Manufacturing Industry. The war service committee within the Associated Manufacturers of Electrical Supplies is composed of Mr. Sheppard as chairman; Mr. McKee, H. W. Bliven, Harvey Hubbell, Inc.; Le Roy Clark, Safety Insulated Wire & Cable Company, and Charles L. Eidlitz, Metropolitan Electric Manufacturing Company.

The accompanying diagram has been presented at the various meetings of the Associated Manufacturers of



UNOFFICIAL DIAGRAM SHOWING IN SKELETON FORM THE ORGANIZATION OF THE WAR INDUSTRIES BOARD AS OF DEC. 6, 1917

eral Electric Company. Mr. Nichols is a representative of the Electrical Manufacturers' Club on the general committee; the other representative of that club is C. A. Terry, Westinghouse Electric & Manufacturing Company. The representatives of the Electric Power

Electrical Supplies to indicate the broad scope of the organization which has been developed at Washington to provide for government needs. The War Industries Board is designed to co-ordinate the activities of the various government departments.

RATE INCREASE IN COAL CLAUSE IN READING, PA.

Amendment to Schedules of the Metropolitan Edison Company Providing for Changes with the Cost of Coal

The Metropolitan Edison Company, Reading, Pa., has filed an amendment to its rate schedule, adding a coal clause, making changes in rates as follows:

The rates provided in Schedules G, I, K, L and M are based upon a price of \$3.25 for one ton of 2240 lb. of bituminous coal, delivered at the plant of the power company. Should the power company be obliged to pay more than \$3.50 per ton for coal delivered, for every additional 25 cents per ton in excess of said sum of \$3.50 the rate will be increased by an additional sum of \$0.00028 per kilowatt-hour of electricity consumed. In like manner, for every 25 cents paid per ton less than \$3 per ton, the rate shall be reduced \$0.00028 per kilowatt-hour of electricity consumed. Increases or decreases shall be calculated in 25-cent units only and fractional parts of said units shall not be considered.

The average price of coal, to be ascertained semi-annually on June 30 and Dec. 31 of each year from the books of the power company, and the increase or decrease of the cost of coal for the preceding term shall be the basis for ascertaining and fixing the amount of increase or decrease to be paid for electricity per kilowatt-hour during the next succeeding period or term of six months.

STATION INTERCONNECTION IN THE TEUTONIC EMPIRE

Progress in Linking Up Generating Systems in Central Europe as Well as in This Country and England

Numerous articles and editorials in the *ELECTRICAL WORLD* have told of the progress of plans for interconnection of generating stations in this country, which are being accelerated by the demands of war. The following translations from Central European papers indicate that a similar movement is in progress in the Central Powers:

According to the *Stuttgart Neues Tagblatt*, a meeting of representatives of all electric central stations in Württemberg, Germany, was held recently at Geislingen, at which it was decided to unite under a single management. Lines will be laid interconnecting the various power houses, and arrangements will be made for the most effective and economical production and distribution of the energy generated. A committee of representatives has been appointed to work out details for the incorporation of a separate distributing company which will handle the entire production and assign the quantities of energy to be produced by each. Although this situation has been created by the extraordinary war conditions, it is the intention of the committee to make the arrangement permanent if it proves satisfactory.

A bill has been passed in the Hungarian parliament, says the *Budapester Hirlap*, providing for the combination of all electric central stations of the country into one huge organization. A central management is to take hold of the work, and all cities and towns in Hungary will receive energy for lighting and power from it. The main object is to relieve power houses which are overworked and to assist those in which demand is not equal to the available supply.

NEW YORK COMPANIES SELL THE WAR SAVINGS STAMPS

Complete Organization at Branch Offices Effected Through a Gas and Electric Light, Heat and Power Group

Upon receipt of a communication from President J. W. Lieb of the National Electric Light Association, the New York gas and electric companies placed their facilities at the disposal of the New York director of the National War Savings Committee. Every one of the twenty-seven gas and electric companies in the metropolitan district has placed the war savings stamps on

Will Silver Serve

TO EMPLOYEES:
Make that 25 cents work for you and Uncle Sam - interest for you - war supplies for him - **BUY** - thru this Company's branch offices

War Savings Stamps

WAR-SAVINGS-STAMP POSTER USED BY UTILITY COMPANIES

sale at every office visited by consumers. The eleven electric companies are the following: Bronx Gas & Electric Company, Edison Electric Illuminating Company of Brooklyn, Flatbush Gas Company, New York Edison Company, New York & Queens Electric Light & Power Company, Northern Westchester Lighting Company, Peekskill Lighting & Railroad Company, Queens Borough Gas & Electric Company, Richmond Light & Railroad Company, United Electric Light & Power Company and Westchester Lighting Company.

Organization of the gas and electric companies for the sale of stamps was effected by Frank W. Smith, vice-president and general manager United Electric Light & Power Company, who has been appointed chairman of the gas and electric light, heat and power group for New York. The companies are:

First, acting as agents, offering the stamps at more than seventy offices.

Second, inclosing with bills and correspondence as well as distributing by hand to millions of customers literature describing the stamps and urging the public to buy them. The seventy offices display cards, posters and banners. Employees selling the stamps do not await inquiries, but suggest the purchase of stamps.

Third, bringing the stamps to the attention of employees by numerous articles. There has been appointed a director of war savings societies, whose duty is to encourage formation of these societies among employees, and a director of speakers, who is actively arranging for speakers to address employee organizations.

ADMINISTRATION BILL FOR WATER-POWER LEGISLATION

**President Wilson, at Conference with House Leaders,
Intrusts New Water-Power Bill to
Rules Committee**

President Wilson had a conference at the White House on the evening of Jan. 4 with members of various committees of the House of Representatives for the purpose of speeding up action in the House on water-power legislation. The President committed to the care of Representative Pou, chairman of the House rules committee, a member of the delegation which conferred with him, a copy of a new water-power bill, which will be known as the administration bill. This measure is one to co-ordinate legislation proposed for years in both houses of Congress dealing with water power not only on the public domain but in navigable streams; and the result of the White House conference, it is authoritatively stated in Washington, will be that the House rules committee will bring in a rule peremptorily requiring the House of Representatives to vote on and pass water-power legislation at an early date.

FINAL SHAPE OF LEGISLATION UNCERTAIN

What is to take place in regard to water-power legislation in the Senate is not yet known. That body passed the Shields water-power bill, a digest of which was printed in the *ELECTRICAL WORLD* of Dec. 22, page 1206, on Dec. 14, and there is a difference between that measure and the administration measure. The Shields measure, in fact, amends the act of 1906 to regulate construction of dams across navigable waters and does not deal with water powers on public lands. These are handled by a different Senate committee from the committee on commerce, which reported the Shields bill favorably. Many committees of both House and Senate have dealt with many different phases of proposed water-power legislation, and to this fact more than to any other consideration has been due the delay in passing water-power legislation which was promised to the country among the so-called "administration conservation measures" five years ago.

In the House of Representatives the red tape which has contributed to this delay seems in a fair way to be cut by the Presidential conference of Jan. 4, for President Wilson, who has had many conferences with House and Senate members and their differing committees without obtaining legislation, committed the new administration bill not to the chairmen of any of the House

committees dealing with water-power matters, but to the chairman of the rules committee. The President is reported by those who attended the conference to have explained with the greatest tact to the committee chairmen that, in view of the differences, he did not know which committee among the water-power committees to intrust with the bill, and that he would solve the problem by giving it to the rules committee, which, as official Washington views it, carried with it the plain implication, "Pass the bill!"

THE ADMINISTRATION BILL AND THE SENATE

Senators in charge of water-power legislation in the upper House are also expecting to have White House conferences. It is certain that the administration bill will be introduced in the Senate or that its provisions will come before a Senate committee in some form, so that when the House passes the administration bill there may be a conference between the House and the Senate. This will provide an opportunity to mold the differences between the administration bill, the Shields bill already passed by the Senate and any measure relating to public lands which may come from the lands committee of the Senate, in case there is no agreement in the Senate to substitute the administration bill for the Shields bill. It is not at all certain that senators will accept the administration bill, and there are some senators who will not fail to exercise the "I object" made famous by "senatorial courtesy" unless they can be made to see that the country imperatively demands legislation at once because of the coal and power shortage, which was President Wilson's motive in committing the new administration bill to the House rules committee.

Although most of the delay has been due to Congress, some is attributable to opposing views held by Cabinet members. These views have been reconciled in the new administration bill, which provides for a water-power commission composed of the Secretaries of the Interior, Agriculture and War. It provides for an executive officer of the commission, appointed by the President for five years; for the payment of rentals, a feature to which there has never been objection of consequence by any interest, and for licenses for water power on public lands as well as public streams for fifty years.

At the end of the license period the licensee will be allowed to renew the license and remain in undisturbed possession until the proposed commission shall have done one of three things:

1. Issue new licenses under laws applicable at that time.
2. Give licenses to new licensees who shall pay for the original fair value of the property.
3. Take the property over upon paying a fair value, the fair value defined to include all work and main transmission lines, plus severance damages for all property not taken over and damaged by reason of severance.

The new administration measure does not include any allowance for enhancement of values on land or water rights, or for any good will for a going concern, etc. It provides for alteration, amendment or repeal by Congress (Congress expressly reserving such rights), but in case of alteration, amendment or repeal such shall not extend to the licensees who have exercised rights or spent money under the bill.

The bill was drawn by General Black and Colonel

Keller, of the Army Engineer Corps, representing the War Department; Edward C. Finney, water-power expert for Secretary Lane, and former Representative Lathrop Brown of New York, now a special assistant to Secretary Lane, representing the Interior Department, and O. C. Merrill, chief engineer of the Forest Service, representing the Agricultural Department, who compiled several years ago a mammoth report on water-power companies, banking affiliations, etc.

Present at the White House conference on Jan. 4 were Thetus W. Sims, chairman of the House committee on interstate and foreign commerce, who recently succeeded Judge Adamson in that position; Scott Ferris, Oklahoma, chairman of the House public lands committee; Asbury F. Lever, South Carolina, chairman of the House agricultural committee, and Edward W. Pou, North Carolina, chairman of the House rules committee, as well as Finis J. Garrett, ranking member of the House rules committee. Representatives Garrett and Sims, as well as Senator Shields, are Tennesseans.

At the Presidential conference it was agreed that a committee of five members each from the House committees on interstate and foreign commerce, agriculture and public lands, fifteen in all, should be created to compose differences as to the various bills which have been under consideration heretofore in the House and to bring together such radical views as have been expressed by Representative Ferris during public debate on water powers, with more moderate views of others.

The committee of fifteen, it is felt in Washington, will be aided materially by the fact that after mature deliberation, advice and conference President Wilson himself has presented a bill upon which he believes all can agree.

COAL SHORTAGE STILL SERIOUS IN MICHIGAN

State Administrator, However, Expresses Belief that Abrogation of Priority Orders Together with Government Control of Operations Will Help

The coal shortage in Michigan has been exceedingly serious for the last month, and particularly during the two weeks just ended. By a supreme effort, however, most central stations have been kept in operation and at least partial service has been given. State Fuel Administrator W. K. Prudden and the county administrators have been unsparing in attempts to secure a sufficient amount of fuel.

A luncheon, presided over by John W. Brannan of the Detroit Edison Company, was held at the Detroit Athletic Club on Jan. 4, when heads of twenty-five of the largest coal-consuming factories in Detroit discussed the situation. They objected to having coal furnished from the Indiana fields instead of West Virginia and Kentucky. They contended that Kentucky and West Virginia coal is of much better quality and the freight rate is lower.

So far 913 street lamps have been discontinued in Detroit in order to conserve coal. The *Detroit Free Press* suggested that the number of lamps might be reduced to 8320 and that the city would then be lighted as well as in 1914, with an allowance for an increase of 25 per cent in population since that time. There were 11,074 lamps in use before the discontinuance of the 913.

At Holland the City Council adopted a resolution that the town should have two lightless nights per week, but this was rescinded because of danger from thieves and thugs and the cost of making necessary changes in equipment and lines.

Conditions at Lansing have been very acute and on Jan. 4 it was said that the supply had been practically exhausted, although many orders had not been filled. Many other towns were suffering in the same way.

Administrator Prudden had almost decided to limit hours of saloons, poolrooms, moving-picture shows and vaudeville theaters, and to ask that inside illumination of stores be discontinued after closing time and that churches hold union services.

Mr. Prudden expressed the belief that the abrogation of priority orders will aid materially in securing fuel for the State. He feels that relief will follow operation of railroads under government supervision.

INTERCONNECTION FORECAST BY MASSACHUSETTS BOARD

Power to Order Interconnection of Electric Generating Stations Sought by Massachusetts Commission from the Legislature as War Measure

Important additional powers are sought by the Massachusetts Gas and Electric Light Commission in its recommendations to the 1918 Legislature, including authority to order plant interconnections and to approve certain contracts for electric service.

The commission points out that the shortage and high cost of coal have revealed as never before the importance of cheap and reliable power to industrial as well as to community life. Considerable progress has been made by the companies in tying together electric generating stations, but the board holds that "in a great national emergency a matter so vital to the public interest should not rest entirely on the initiative of the companies."

To prevent unnecessary duplication of investment and to conserve natural fuel resources, the board recommends that it shall have authority after proper proceedings to require the physical connection of power stations and gas works, the supply of gas or electrical energy to other companies and municipal lighting plants, and the shutting down of such power plants and gas works as may be unnecessary, upon such terms and for such periods as may be just and reasonable, and to exercise the right of eminent domain wherever essential.

During the last two years the board devoted 127 days of hearings to arbitration of the price of street lighting furnished by the Edison Electric Illuminating Company of Boston to the city of Boston under a ten-year agreement concluded in December, 1914. The trial involved a very large expense for both city and company, all of which, the commission notes, must be borne sooner or later by the public.

"If, on the other hand, prices tentatively reached," says the commission, "or considered by the parties in such negotiations required the approval of the board before contracts for a term of years become effective, such extra expense would be avoided and such matters might be disposed of more summarily and with as close an approximation of justice to all concerned as after an exhaustive trial involving many disputed factors which

may affect costs, but with respect to the meaning of which even if an agreement be reached with respect to the facts men will honestly differ. Moreover, the local authorities enter upon such a negotiation at considerable disadvantage, rarely having had any experience with the problem." The commission recommends that contracts for street lighting for periods of more than one year should require its approval before becoming effective.

The tendency toward concentration of production of gas and electricity into large, well-located generating plants has made many companies distributors merely and not producers of gas and electricity. The terms upon which such distributing companies purchase gas or electricity are becoming a matter of vital interest to customers dependent upon them, in the opinion of the board, which says:

"Where the companies involved are independently owned self-interest may well be relied upon to obtain proper terms. When, however, the selling and purchasing companies have a common ownership, this element is wanting, and serious injustice may result, not only to the consumers but also to one or the other of the companies which are parties to such transactions. The board, therefore, recommends that contracts for the purchase and sale of gas and electricity between companies having a common ownership require its approval."

BEGIN HEARING ON THE CLEVELAND RATE CASE

**Company Officials Contend Before Ohio Commission
that Present Rates Do Not Yield Adequate
Returns on Property Value**

The hearing in the rate case of the Cleveland Electric Illuminating Company was begun before the Ohio Public Utilities Commission on Jan. 3.

Company representatives produced exhibits to prove that 3 cents is an inadequate maximum rate. The array of data apparently took the legal and engineering representatives of the city of Cleveland by surprise, as they asked for sixty days in which to prepare arguments and cross-question company witnesses. General Manager Robert Lindsay of the illuminating company said that a deficit has been shown since 1914, and pointed out that it would be still larger if the 3-cent rate should be adopted. Company officials said they regarded 8 per cent as a proper return on the valuation and that there should be an additional 3 per cent for deferred upkeep. The business at present is not yielding such a return, they said.

The valuation placed upon the company's property by the commission is \$19,661,242. The rate will be based upon this valuation unless the Ohio Supreme Court, to which it has been appealed, rules otherwise. The city contends that the commission had no right to allow the company to capitalize \$1,112,070 as the cost of attaching business; that it erred in deducting a depreciation of \$1,506,237 instead of \$2,048,186; that it allowed \$2,059,031 for interest during construction, when the actual amount should have been \$40,821, and that a mistake was made in not considering the actual cost of the property instead of the theoretical replacement value.

On the application of Director of Law Fitzgerald for an extension of time in which to prepare arguments

against the exhibits made, the commission set Jan. 29 for a continuation of the hearing. Engineer F. W. Ballard, employed by the city as an expert, will prepare figures to be used in an effort to disprove the exhibits.

STUDYING TO SPREAD THE PEAK-LOAD DEMAND

**Meeting of Officials of Utilities with Merchants and
Industrial Leaders in Springfield, Mass., to
Remedy Fuel Shortage Situation**

Plans to spread out peak loads, and thus reduce coal consumption by co-operation, are being discussed by officials of the United Electric Light Company and Springfield (Mass.) Street Railway with local merchants and industrial leaders.

At a recent meeting under the auspices of the Springfield committee of public safety, at the Springfield Chamber of Commerce, Walter L. Mulligan, general manager United Electric Light Company, submitted a company load curve for consideration, and emphasized the need of curtailing consumption, especially between 4 p. m. and 6 p. m., in industrial plants. H. M. Flanders, general manager of the railway; J. O. Halliday, superintendent of transportation, New Haven Railroad, and H. S. Knowlton, New England editor ELECTRICAL WORLD, were among the speakers. Fred T. Ley presided, and E. A. Carter, chairman of the local fuel committee, J. C. Robinson, chairman traffic committee, and R. W. Wright, chairman of the manufacturers' committee of the Chamber of Commerce, offered co-operation.

Mr. Mulligan stated that the United company has about 10,000 tons of coal on hand, sufficient for forty days; 60 per cent of the fuel burned is for power service. The shortage has been aggravated by lack of cars and the unwillingness of mine owners to accept coal prices fixed by the government. Low water in the rivers has curtailed hydroelectric production, both at the United company's plants and in the plants of large companies selling hydroelectric energy, so that the United company now receives only about 700 hp., instead of the 4000 hp. normally to be depended upon from river developments. At Indian Orchard the United company built a coal pocket early last year, costing \$70,000, and began purchasing all the coal it could get. Only about 10,000 tons could be obtained, and at an average cost of \$6.65, normal prices being about half this. The company's storage capacity in Springfield proper, at its downtown station, is about 6000 tons. On account of inadequate transportation conditions the company had to hire motor trucks to bring coal from Indian Orchard to the State Street station, Springfield, at a cost of \$300 per day.

The United company, Mr. Mulligan said, would like to see during the present emergency a larger reduction in sign and window lighting. The total station load on Dec. 17, 1917, on the afternoon half hours beginning at 3 o'clock, was: 3 p. m., 13,500 kw.; 3.30 p. m., 13,350 kw.; 4 p. m., 13,600 kw.; 4.30 p. m., 15,500 kw.; 5 p. m., 18,750 kw.; 5.30 p. m., 15,700 kw.; 6 p. m., 13,600 kw. It is estimated that from 25 tons to 50 tons per day could be saved by cutting off, say, 2000 kw. of the peak between 4 p. m. and 6 p. m. This might be accomplished by early closing of factories.

Mr. Flanders pointed out that the street railway

could not handle traffic if the industrial patronage should be thrown upon it at a single time, and suggested that by spreading the closing hours better results might be obtained. Representatives of manufacturing and commercial interests expressed agreement in any feasible co-operation, standing ready to accept any scheme of opening and closing which will help. The best of feeling was evident. A committee was appointed to work out detailed suggestions as to the best rearrangement of hours for different establishments, taking into account load conditions, character of output, essential nature of products, relation to street railway traffic problems, and other points.

Mr. Halliday discussed the difficulties of land and water transportation affecting New England, and Mr. Knowlton outlined the work of other New England communities and public utilities in fuel economy, emphasizing the importance of favorable water-power legislation by Congress, and touching upon fuel-saving possibilities by individual consumers of central-station service.

FACTORY WORK FOR MEN BLINDED IN WAR

Instruction of Blind Workers in Plant of Crocker-Wheeler Company Promises Excellent Humane Results for the Future

It is an old story that when a man or woman loses the power of sight he gains unusual skill with the fingers as partial compensation. This fact has made it possible for them to do excellent basket making, chair



DR. SCHUYLER SKAATS WHEELER INSTRUCTING BLIND WORKMAN HOW TO WIND COILS

caning and other manual work that requires quick fingers and patient effort. The difficulty has been that in the selling of most of these articles they had to compete with machine-made articles sold at a low price.

Another form of occupation ideally suited for these

men and women is being developed by the Crocker-Wheeler Company at its plant in Ampere, N. J. Coils for armatures and similar apparatus must be wound, and no machine has been devised that will do this as well as a workman can do it by hand. The coils of



BLIND WORKERS WINDING COILS

wire are wrapped with tape. Millions of these wire coils are used and their number is growing each year. Wrapping or insulating them with tape is a kind of work very similar to basket weaving and chair caning.

A workroom started about two months ago has already brought happiness into the lives of a group of blind men and women. They have learned to do the work and have almost attained the speed of a normal worker.

When these are proficient they will return to their various countries and carry on the work of making the blind self-supporting by instructing the war blind.

STORM AND LIGHTLESS NIGHT DARKEN CHICAGO'S STREETS

Worst Blizzard Since 1884 Ties Up Four States in the Middle West and Street Lighting Suffers—
Coal Shortage Feared

What is reputed to be the worst blizzard since the winter of 1884 struck Illinois, Iowa, Wisconsin, Michigan and part of Indiana on Sunday, Jan. 6.

The temperature hung around 25 above zero, and the wind, varying from 40 to 60 miles an hour, caused the snow, which lay from 13 in. to 20 in. (23 cm. to 50 cm.) on the streets, to drift to heights of 10 ft. (3 m.) in some places. Most streets in Chicago were under drifts 3 ft. deep, and along some railroad rights-of-way the drifts were deeper. In many instances long-distance telephone communication was cut off. Surface lines and suburban steam railroads moved almost no trains on Sunday and established only very limited service on Monday.

As Sunday was a lightless night, the street-lighting situation was extremely bad. On account of wire trouble about one-half of the street lamps in Chicago were out. This, added to the fact that all display illumination was turned off, made the Chicago newspapers remark that "it was somewhat dangerous for persons to venture into the streets."

FUEL SUPPLY IS SHORT: WAYS TO CONSERVE IT

Chamber of Commerce Committee on Coal Conservation Working to Encourage Small Economies in Hope of Large Results

Under the title "Small Savings That Count," the committee on coal conservation of the United States Chamber of Commerce has issued a letter to members, in part as follows:

The shortage of coal for every day of the ensuing year amounts to about forty ounces or two and one-half pounds for every man, woman and child in the United States. Great economies in the use of coal will be effected by the factories, the central heating, lighting and power plants and the railroads. But small savings must not be neglected. Some opportunity is presented to every person every day to save coal by reducing the consumption of heat, light or power. The responsibility for making these savings is widely diffused among millions of people. The aggregate importance of them is correspondingly great.

Every ounce of coal saved is an outright contribution to the nation's war-time need for fuel. Some persons may easily save their entire quota of forty ounces each day. The following schedule suggests some of the means for saving small quantities of coal. These savings, in the aggregate, will set free thousands of tons of coal for the industries of the country, for the railroads, for the navy, and for the ships that carry our men and supplies to France.

Conserve electric light. Electric energy usually comes from coal. Consult your dealer as to the most economical types of lamps suitable to your conditions and fixtures. A 25-watt lamp used instead of a 40-watt lamp saves at least an ounce of coal every two hours.

Turn lights off when not needed. If a 25-watt lamp or an ordinary gas light is turned off, even for short intervals, the saving may be an ounce of coal a day for each lamp.

Discard carbon-filament lamps. Substituting a 25-watt tungsten lamp for a 16-cp. carbon-filament lamp provides a better light and saves two or three ounces of coal daily.

Attend to the lubrication of machinery. A drop of oil will often save an ounce of coal. Careful attention to the lubrication of all working parts of machinery will save many pounds of coal in the day.

Do not superheat rooms. Observing the thermometer and turning off radiators to hold the temperature below 70 deg. Fahr. reduces the load on the heating plant.

Conserve all heat and power. Keep in mind that every loss of heat or power is a loss of coal. A leak in a steam connection and a superheated office room are alike the cause of wasted coal. Keeping a heavy power unit in operation when a lighter one would carry the load wastes coal, and so does all unnecessary use of electric elevators.

Use weather stripping and storm windows. A bit of weather stripping about the door and the use of storm windows in offices, schools and all buildings that are heated will reduce the burden on the heating plant and make effective a daily saving of coal.

Discourage electric display illumination. This use of coal is not absolutely necessary. The genius for advertising which originated this excellent method of display should find temporarily other means of expression. Eliminating or forgoing an electric sign may save tons of coal a year.

These methods of saving heat, light and power are not unfamiliar. Every one, perhaps, will think of some effective means of saving which is not included in this list. The important idea to be impressed on every person is that a great need exists for saving coal and that even small savings must not be overlooked.

Saving coal is not always identical with economy to the person effecting the saving. It may be some one else's coal that is saved, or the time and expense required to effect the saving may offset the money advantage. Nevertheless, it is a patriotic duty now to save coal at any reasonable expenditure of time and material. And in the majority of cases there will be a direct or indirect advantage to the person entitled to the credit for the saving.

A voluntary, universal response to the call for saving coal

in the many small ways that present themselves every day will insure the success of the great efforts at fuel retrenchment which are now being made in the industries and by central plants.

MASSACHUSETTS BOARD ON WATER POWER CONSERVATION

State Commission Seeks Authority from Legislature to Investigate Questions Involved in Water-Power Conservation and Development

Authority to investigate the possibilities of conserving stream flow in conjunction with the Commission on Waterways and Public Lands is sought by the Massachusetts Gas and Electric Light Commission in its recommendations to the incoming Legislature. The board says:

Two of the companies under the board's supervision [the New England Power Company and Turners Falls Power & Electric Company] transmit and deliver to the industries of the Commonwealth power generated by hydroelectric developments on the Connecticut and Deerfield Rivers. The power so furnished during the present year would have required more than 450,000 tons of coal to produce.

It appeared at the hearings relative to the issue of securities that a projected stream flow conservation undertaking on the Deerfield River would increase the hydroelectric energy developed by that stream to an equivalent of over 150,000 more tons of coal. It also appeared that if the spring freshets were impounded near the principal sources of the Connecticut River and the flow of the stream equalized throughout the year, the output of the three developments on the main stream which are furnishing power to the Commonwealth might be increased over 15 per cent and more than 58,000 tons of coal saved. A similar undertaking on the Millers River would add to such saving over 8400 tons.

Steps have already been taken by the two companies mentioned to investigate the feasibility of storage basins upon certain of the tributaries of the Connecticut River in New Hampshire and Vermont. But any treatment of the full development of rivers as sources of power requires the exercise of governmental powers, and in the case of the Connecticut co-operation of the federal government, as well as of the four states which border upon the river or through which it flows. The board therefore recommends that steps be taken to investigate the feasibility and the legal and political questions involved in this project and the possibility of a similar treatment of the smaller streams whose sources are within the Commonwealth.

It is proposed to report upon this subject to the 1919 Legislature.

PATRIOTIC WORK OF THE NATIONAL DEFENSE COUNCIL

Purpose to Make Available the Best Thought and Effort of Industrial and Professional Life to Prosecute the War

A report of the Council of National Defense just made public covers the history of the council from its inception to the close of the fiscal year ended June 30, 1917. Permanent organization of the council was not effected until March 3, 1917. Director W. S. Gifford says in introduction:

In a broad sense the council and commission have sought to make available to the United States the best thought and effort of American industrial and professional life for the successful prosecution of the war. It has become a truism that no past war has been so essentially a war of the mechanic and the machine, and it is the realization of this truth that has been throughout the inspiration of the policy

pursued by the council, the commission and their subordinate bodies.

The direction of the machinery of American industry for the national defense necessarily involves the creation of an organization of great flexibility. The swift changes in strategy and rapid improvement in war machinery, attended by the equal speed with which implements of warfare are scrapped and replaced at the front, has been reflected by corresponding rapid transformation and stimulation of the industrial organization within the nations at war. These ever-changing developments have necessitated almost unprecedented flexibility in government organizations.

The history of the first three months of the war in the United States has proved no exception. Constantly recurring demands for increases in personnel and for new efforts in unexpected directions have had to be met as the war progressed. It has been the effort of the organization of the Council of National Defense to hold itself in constant readiness to meet such new demands and to shift its ground and expand its facilities in the interest of the national service. It has been in no sense a fixed institution. Its organization has been and of necessity must continue in process of evolution rapid enough to keep abreast with the rapidly changing current of the times and yet conservative enough to prevent confusion or lack of proper co-ordination and control. In a peculiar sense it has felt itself called upon to be constantly ready to "fill in the gaps" and assist the regular departments of the government in their splendid and successful effort to expand and carry the new and huge burdens thrust upon them by the country's need. Flexibility must remain the essence of the spirit with which the council carries on its work.

The National Research Council has served as a department of science and research of the Council of National Defense and in that capacity has been charged with the organization of scientific investigation bearing on the national defense and on industries affected by the war. It has co-operated extensively with foreign scientific missions to this country from the Allies, and has been represented abroad in joint work for the promotion of research service of particular value to the conduct of the war, including the submarine problem and various physical and chemical problems.

It has been the function of the committee on engineering and education to make available to the government in the most effective possible form the services of the engineering and educational professions.

The engineering committee has been appointed by different engineering groups to assist in the solution of problems of engineering policies. In a similar way,

embarrassing situation wherein the members of the present committees are apparently called upon to act both as government agents or advisers and at the same time as representatives of the industries. In dissolving the present co-operative committees of industry, which were appointed by and under the direction of the council, the action is taken only with the highest praise and thanks for their splendid and indispensable work and at the same time with the hope that representative committees of industry will be formed by the industries themselves at the earliest possible moment. Already a number of such committees have been organized. The establishment of such committees, formed so as to entitle them to speak for their entire industries, will render immediately available valuable sources of information upon which the government can draw in connection with the countless business and industrial problems attendant upon the conduct of the work necessary for the prosecution of the war.

DAYTON ENGINEERS' CLUB TO DEDICATE A NEW HOME

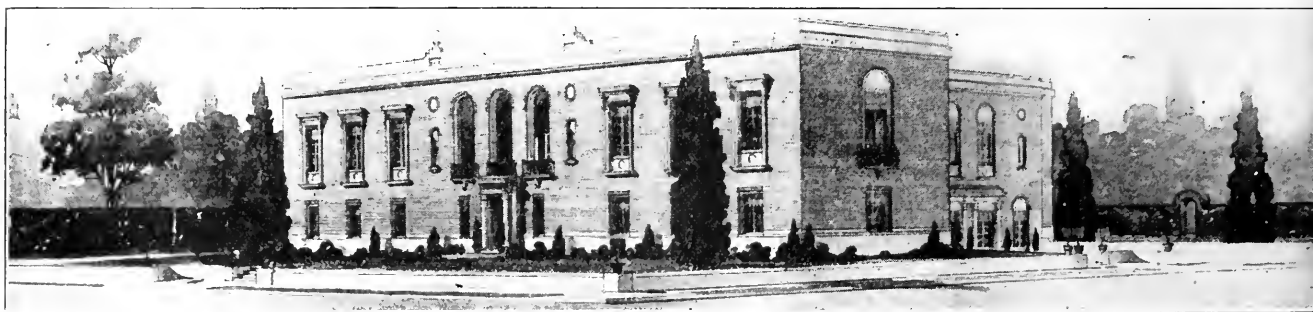
Formal Exercises to Be Held on Feb. 2 to Place Fine Structure at the Service of the Engineering Industries

The new home of the Engineers' Club of Dayton, Ohio, will be dedicated on the afternoon and evening of Feb. 2. It will be a great event in the engineering circles of the entire Miami Valley. The dedicatory exercises are expected to be of decided interest.

At present the club has about 300 members. Col. E. A. Deeds, the president, is chief of the Aircraft Production Board, and is giving his entire time to the war program. The other officers are: First vice-president, C. F. Kettering; second vice-president, Orville Wright; third vice-president, H. M. Waite; recording secretary, H. I. Schenck; treasurer, F. O. Clements; house secretary, W. E. Bingham.

The new building is at the southeast corner of Monument Avenue and Jefferson Street, facing the river.

The pioneering genius has made Dayton unique among American cities. The creative work of Wilbur and Orville Wright has been acknowledged internation-



NEW HOME OF THE ENGINEERS' CLUB OF DAYTON, OHIO

through a meeting of the heads of 187 colleges, universities and technical schools, held in Washington on May 5, the work of carrying on the national relation between the colleges and the nation was turned over to the education section. Detailed references are made to the work of the members of the various other committees.

Recently it has become feasible to discontinue the

ally, and Dayton, the birthplace of aviation, to-day has a magnificent airplane factory, one experimental flying field devoted to research and development work, the McCook experimental field of the aircraft engineering department of the United States Signal Corps, and the Wilbur Wright Field, the largest aviation training school in the world.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

New York Chapter, A. A. E.—Edmund F. Perkins, consulting engineer, Chicago, president of the American Association of Engineers, will address the New York chapter at the Hotel McAlpin on Tuesday, Jan. 15, at 8 p.m., on the subject "National Association Service for Engineers."

Schenectady Section, A. I. E. E.—John L. Harper, chief engineer Hydraulic Power Company and Cliff Electric Distributing Company of Niagara Falls, N. Y., addressed a meeting of the Schenectady Section of the A. I. E. E. on the subject of "Niagara Power or a Real Coal Shortage?" This meeting was held Jan. 4.

Minneapolis Section, A. I. E. E.—R. F. Pack, general manager of Northern States Power Company and the Minneapolis General Electric Company, was one of the speakers at the meeting of the American Institute of Electrical Engineers at Minneapolis Jan. 11. His subject was "Public Service Corporations and What They Have Done in the War."

New York Section, I. E. S.—On Jan. 10 this section held a meeting in the Engineering Societies Building to discuss the code of lighting school buildings. L. B. Marks, chairman lighting legislation committee, presented the code in abstract, and C. B. Snyder, superintendent of school buildings, Department of Education, city of New York, discussed the practical application of the code.

Vancouver Section, A. I. E. E.—The following officers were elected for the coming year by the Vancouver (B. C.) Section, A. I. E. E.: Chairman, R. F. Hayward; secretary, T. H. Crosby; executive committee, E. P. La Belle, C. N. Beebe and L. B. Philpot. At a recent meeting of this section M. L. G. Robinson presented a paper on "The Present Trend and Development of Electrical Business, with Possibilities for the Future."

Brooklyn Company Section, N. E. L. A.—The December meeting of the Brooklyn Company section of the N. E. L. A. was held in the Y. M. C. A. auditorium on Tuesday evening, Dec. 18, with the largest attendance for the year. Almet F. Jenks, presiding justice of the Appellate Division of the New York State Supreme Court, delivered an address on the world war, contrasting every-day life in Germany with our own. The competition paper entitled "Economy in Ordering Printed Forms," presented by A. O. Kohloff of the purchasing department, pointed out many important features in connection with this subject and was discussed by a number of the members present. Motion pictures and other entertainment were provided.

New York Section, A. S. M. E.—Walter Rautenstrauch addressed the New York Section of the American Society of Mechanical Engineers Jan. 8 on the subject "Relation of Manufacturing to Banking and Research."

Jovian League of New York.—Former Senator Theodore E. Burton addressed the members of the Jovian League of New York on Jan. 9. The following officers and directors were elected for the year 1918: President, James M. Wakeman, Society for Electrical Development; vice-president, George Williams, Henry L. Doherty & Company; vice-president, H. A. Pratt, Westinghouse Electric & Manufacturing Company; secretary, F. M. Feiker, editorial director ELECTRICAL WORLD and *Electrical Merchandising*; treasurer, L. L. Strauss; directors, Arthur Williams, New York Edison Company, and James R. Strong, Tucker Electric Construction Company.

Cleveland Electrical League.—E. J. Laibman of Zhitomir, Russia, spoke before the league on Jan. 3. Whether a separate peace is concluded or not, he declared that from a military standpoint Russia is out of the war for good. A new offensive would be impossible, he said, because the nation is too demoralized to become again a potent military factor. The peasants, he continued, want peace and an education. They may be in sympathy with the Bolsheviks, because the Bolsheviks are promising them things. The peasants do not realize the position in which the country is at the present time. Mr. Laibman was exiled to Siberia by the imperial government for revolutionary activities.

Ohio Electric Light Association at Dayton.—The program for the meeting of the new-business co-operations committee of the Ohio Electric Light Association, to be held Jan. 16 at Dayton, has been arranged as follows: Address of welcome, Judge E. P. Matthews, vice-president Dayton Power & Light Company; "Low-Temperature Industrial Heating," Dwight D. Miller, Society for Electrical Development, with discussion by H. J. Kuhns of Toledo, C. W. Bartlett of Schenectady, N. Y., and Wirth S. Scott of East Pittsburgh, Pa.; luncheon address by George C. Smith of Baltimore, Md., on "Industrial Surveys for Intensified Service; afternoon session—"The Uses of Electricity for the Manufacture of Chemicals," by C. A. Winder of Niagara Falls, with discussion by C. D. Carlson of Cleveland and J. C. Matthieu of Dayton; "Water Pumping by Electricity," by R. L. Yates of Dayton, with discussion by C. I. Crippen of Youngstown, F. H. Hooper of Van Wert, Ohio, and Frank B. Steele of Dayton. At the banquet Judge Roland W. Baggott, Dayton, will be toastmaster. The speakers will be J. W. Lieb of New York on "The Electrical Industry and the War"; J. M. Switzer of Dayton on "The City and the Public Utilities"; D. L. Gaskill of Greenville, C. F. Kettering of Dayton, E. R. Kelsey of Toledo, Le Warren James of Dayton and R. H. Grant of Dayton.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Chicago Sued for Electricity Bill of \$1,900,000.—The Sanitary District of Chicago has filed a suit in the municipal court to collect \$1,900,000 from the city of Chicago. The suit includes amounts for electrical construction and for electrical energy for lighting streets and the city hall. The largest item was \$1,607,486, principal and interest on construction.

Announcing Change to New Location.—The Worcester (Mass.) Electric Light Company moved recently into a new office at 11 Foster Street, Worcester. In addition to the usual announcements in the press the company is adding a sticker to about 35,000 bills mailed for the current month's service. These stickers are also available for use on packages of lamps, appliances, etc., sold from the new office.

Navy Radio to the Philippines.—Secretary of the Navy Daniels has been surprised by the receipt from Admiral Knight, commanding the Asiatic fleet, of a radio message which announced the successful completion of the chain of high power stations whose construction was authorized by the act of Aug. 22, 1912. The stations comprising this chain are Arlington, Darien, San Diego, Pearl Harbor and Cavite. The Darien station was completed about two years ago, San Diego in March of this year, and Pearl Harbor in October; and while it was known that the acceptance test of the Cavite station was under way, the Secretary was quite unprepared for a message of greeting from Admiral Knight.

French Committee Formed to Cooperate with American Electric Committee for France.—There has been formed in America, on the initiative of Capt. Gustave P. Capart of the general staff of General Pétain, a committee of which Dr. C. O. Mailloux is chairman and which has for its objects, first, to render immediate and effective assistance to the French armies and the national defense of France, and, in addition, to promote in times of peace the relations between French and American industry. As the board of management of the Union des Syndicats de l'Electricité deemed it desirable that there should be in France a corresponding committee, it decided to constitute in the body of the union a special Franco-American committee. The president of the union, G. Cordier, requested F. Meyer, managing director of the Continental Edison Company, to take the chairmanship of this new committee. In accepting this position Mr. Meyer received full power to enlarge the committee by adding to it all persons whose assistance he might deem desirable.

E. B. Craft has been appointed an assistant engineer of the Western Electric Company.

W. F. Hendry has been appointed an assistant engineer of the Western Electric Company.

E. H. Colpitts has been appointed an assistant engineer of the Western Electric Company.

J. F. Olney succeeds H. P. Harley as manager of the Ozark (Ark.) Citizens' Service Light & Power plant.

H. P. Harley, who has been manager of the Ozark (Ark.) Citizens' Service Light & Power plant, has been promoted to be manager of the district, which includes several towns.

Philip I. Robinson, superintendent of the Houghton (Mich.) County Electric Light Company, has been transferred by the Stone & Webster Management Association to the Fort Madison (Iowa) Electric Company.

W. R. Emerson, auditor of the Oklahoma Gas & Electric Company, has been selected as one of six accountants from the United States who will perfect a new system of accounting for the American Red Cross.

Earle L. Milliken has been transferred by the Stone & Webster Management Association from being manager of the Cape Breton Electric Company, Ltd., Sydney, N. S., to be general manager of the Houghton (Mich.) County Electric Light Company.

Monroe J. Frankel, chief of the office of gas and electricity, Louisville, Ky., has resigned. Previously he was in the engineering departments of Fairbanks, Morse & Company at Detroit, Mich., and Indianapolis, Ind. Mr. Frankel is a graduate of the University of Kentucky.

W. R. Thompson, formerly manager of engineering and construction for H. M. Byllesby & Company, has been promoted from captain of the 109th Regiment of Engineers, stationed at Camp Cody, Deming, N. M., to major in the same regiment. Mr. Thompson is a graduate of Pennsylvania State College with the class of 1897. For several years he was engaged in electrical engineering work with J. G. White & Company of New York and later in the engineering department of the company's London branch. He became connected with the British Westinghouse Electric & Manufacturing Company in 1903, where he gave considerable attention to problems of power-house design and heavy steam-railroad electrification. He again entered the employ of J. G. White & Company in the United States in 1906 and two years later became assistant electrical engineer for the Public Service Commission of the First District of New York, subsequently becoming acting electrical engineer. He resigned from this position to become assistant chief engineer for H. M. Byllesby & Company of Chicago, and on Jan. 1, 1913, he became manager of the engineering and construction department of this company, in which work he continued until he entered the army.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

John G. Galloway, a San Francisco consulting engineer, has been appointed a major in the United States Engineer Corps and has been called into service. Mr. Galloway was consulting engineer for the building of what is believed to be the longest single span of wire in the world, the Carquinez crossing of power lines for the Pacific Gas & Electric Company, near Benicia, Cal.

C. H. Andrews, assistant to president and chief engineer of the North Carolina Public Service Company, Greensboro, N. C., has been appointed general superintendent of the Southern Utilities Company, which corporation operates electric, gas and ice properties



C. H. ANDREWS

throughout Florida, under the management of the J. G. White Management Corporation, New York. He will assume his new duties on Jan. 1. Mr. Andrews was graduated from Purdue University, Lafayette, Ind., in 1908, receiving the degree of B. of S. in E. E. After graduation he entered the employ of the Public Service Corporation of New Jersey, serving in the meter department of that company. In 1909 he became connected with the North Carolina Public Service Company. Soon after joining this organization he was appointed superintendent of the light and power department; later on he was made departmental manager of new business; in 1911 he was promoted to the position of assistant general manager, in charge of electric, gas and street railway utilities in Greensboro and High Point, N. C., and in 1917 his position became that of assistant to the president and chief engineer. In connection with his general duties, Mr. Andrews has devoted much time with success to studying the question of rates and their application.

Alan Sullivan, secretary of the Canadian Electrical Association, has joined the Royal Flying Corps as an equipment officer.

Prof. O. J. Ferguson, head of the electrical engineering department of the University of Nebraska since 1912, has been made acting dean of the engineering college of that university because of the entrance of Dean O. V. P. Stout into active military service. Professor Ferguson is a graduate of the University of Nebraska, class of 1903, and took his master's degree in electrical engineering in 1909 at Union University, where he was professor of electrical engineering from 1905 to 1912.

L. G. Van Ness, vice-president of the Memphis Gas & Electric Company, has resigned to engage in consulting engineering work in Memphis. After being graduated from the course in electrical engineering at the University of Wisconsin in 1896, Mr. Van Ness was for three years variously engaged in machine-shop, pole-line, wiring, engine, meter and testing work in central stations. In 1899 he associated himself with the Emerson-McMillan company and occupied himself in designing and redesigning many of the electric plants under the control of the company. Conspicuous among the plants on which he worked were those of Columbus, Ohio; Madison, Wis.; San Antonio, Tex.; Montgomery, Ala.; Denver, Col.; St. Paul, Minn.; Lincoln, Neb., and a hydraulic generating and distributing system for Quebec. From purely engineering work he went into the study of cost-rate making and accounting for both electric and gas plants. For two years after this he was associated with the Laclede Gas Light Company of St. Louis and the Union Electric Light & Power Company of the same city. His work there covered a period of two years and included chiefly the revision of the accounting systems. In 1906 Mr. Van Ness went to Memphis, Tenn., to build an electric plant and system for the Merchants' Power Company of that city. He became vice-president and general manager of the company, which position he retained until the rate readjustment and consolidation of Memphis utilities some months ago, when he became vice-president of the new company. From this position he has now resigned, as stated.

Obituary

William Maher, Flushing, L. I., connected with the Long Island Railroad Company at Long Island City in the capacity of stationary engineer for forty years, died Dec. 19.

Henry A. Herrick, who built the Black Eagle dam at Great Falls in 1890, died suddenly at Butte, Mont., Dec. 14, at the age of sixty-one. Mr. Herrick had been identified with the engineering features of practically all dams built along the Missouri River by the Montana Power Company or its predecessors in the last twenty-seven years.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Discrimination in Rates.—A city ordinance providing that "water meters will be used wherever and whenever in the judgment of the board they should be attached," in the absence of any charge that the meter rate is unreasonable, will not be held unreasonable as discrimination because meter rates are charged against certain consumers and flat rates against other consumers of the same class, nor because small consumers are charged by the room and large consumers according to the quantity of water used, the Supreme Court of North Carolina held (94 S. E. 3).

Injury from Live Guy Wire.—In an action for injuries to one coming in contact with a live guy wire on an electric light pole evidence was held by the Missouri Court of Appeals, in *Faris vs. Lawrence County Water, Light & Cold Storage Company* (198 S. W. 449), to make plaintiff's contributory negligence in getting close to the pole out of curiosity, on account of the pole being afire, a question for the jury. Persons have a right to travel on streets even to satisfy curiosity, and unless it appears positively that they voluntarily and knowingly come in contact with a live wire or other dangerous agency, or have such knowledge as would suggest caution to an ordinarily prudent person, they are not guilty of contributory negligence. An electric company was prima facie negligent in allowing a dangerous current to escape to a guy wire which had no current breaker or insulator.

Liability for Injuries Received After Assurance of Safety by Foreman.—Where a telephone lineman engaged in painting poles was ordered by his foreman to paint a certain pole, at the top of which were electric power wires, under the foreman's assurance that they were "always dead until after 4 o'clock," the finding that the order given by the foreman was within the scope of his authority as superintendent, and that it was negligent, was warranted, it appearing that the wires carried a potential of 2300 volts, whereby plaintiff received a shock causing him to fall and break his leg, it was held by the Supreme Judicial Court of Massachusetts (117 N. E. 620). A notice of injury under the employers' liability law, stating that the injuries were caused by defective insulation and improper covering of wires on a telephone pole, such wires being charged at a time with an electric current which caused the employee to receive a shock whereby he fell and sustained injuries, was sufficient, without specifying the negligent order of the superintendent in pursuance of which the lineman as-

cended the pole. A notice of injury under the employers' liability law, alleging defective insulation and improper covering of wires, whereby a lineman fell from a telephone pole which he had climbed in pursuance to orders from his superintendent, was held not to be misleading as to the cause of injury.

Safety Precautions Where Wires May Come in Contact.—Where electric street railroad wires, electric light wires, telephone wires and telegraph wires cross each other those maintaining them are bound to use the highest degree of care, commensurate with the danger occasioned thereby, by the use of such appliances, devices and precautions as are practicable to prevent contact of the wires in the event that any of them should break and fall, the Supreme Court of Kansas held in *Lewis vs. Harvey* (168 P. 856).

Provisional Valuation Orders of Public Service Commission.—Provisional orders of the Public Service Commission valuing the property of and fixing rates to be charged by a public service corporation for experimental purposes, and retaining the case on its docket for future action after the result of such experiment is ascertained, are not final orders, subject to the control of the court under the Public Service Commission act, it was held by the Supreme Court of Appeals of West Virginia (94 S. E. 121). The valuation of the property of a public service corporation and prescribing rates for tolls and charges for services to be rendered are purely legislative acts, not subject to judicial review except in so far only as may be necessary to determine whether such rates are void on constitutional or other grounds.

Municipal Plant Discrimination.—Municipal corporations in operating a water plant exercise business and administrative functions rather than those strictly governmental in their nature, and in the exercise of such functions are governed largely by the rules applicable to individuals or private corporations engaged in the same business, the Supreme Court of Oklahoma held (168 P. 800). Municipal corporations operating water plants are not required to give absolute equality of service or rates, but are only required not to act arbitrarily in exercising the discretion vested in them in such matters and not to maintain a discrimination between patrons which is essentially unjust. The law against unjust discriminations rests on public policy, and it is not in violation of the public policy of the State, in the absence of specific legislation on the subject, to permit discriminations by a municipality in favor of a state institution which redounds to the intellectual, moral and commercial benefit of the general public resident in such municipality. Under the facts alleged in the instant case, it was held that the donation of water by the city of Edmond to the Central State Normal School does not constitute an unjust discrimination against a citizen, taxpayer and water consumer of the city who is required to pay a fixed rate for water used by him.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Salaries of Utility Officials.—A decision of the New York Public Service Commission, Second District, affecting the Ithaca Traction Corporation, refers thus to salaries: "In the attack which the representatives of the city have made upon the alleged extravagance of the company's operation, considerable stress has been laid upon the number and amounts of the salaries paid, the claim being that the company's salary list is unwarrantably burdensome and that a reasonable allowance for this purpose might materially affect the commission's opinion upon the question before it in the present case. We do not agree with this view. The salaries paid are not in our opinion too high." Higher fares were granted.

Quality of Service.—The Wisconsin Railroad Commission, in a decision affecting the Pulaski Light & Power Company, holds that the electric service furnished by respondent is inadequate; that the equipment is now generally sufficient, but that certain alterations and improvements are necessary; that, as regards night service, it is the standard practice to make such service available at one-half hour after sunset on clear days; that respondent should obtain one of the various tabulations worked out on substantially such basis and govern its operations accordingly; that on cloudy days conditions vary and the time of commencing service must depend upon good judgment; that in case of reasonable doubt, however, as to the necessity for lights at such times the energy should be made available, and that the alterations and improvements specified are necessary for reasonably safe and adequate service.

Development of California Properties.—The Southern Sierras Power Company and the Corona Gas & Electric Light Company have filed with the California Railroad Commission a joint application for authority for the Corona company to lend to the Southern Sierras company for six months \$33,000 from its treasury on a promissory note at 6 per cent. Both companies are practically owned by the same interests, the Southern Sierras corporation operating in Inyo, Kern, San Bernardino and Riverside Counties and the Corona in Riverside County only. They have separate offices, but the Sierras concern is planning to buy all the properties of the Corona company and other small associated companies to economize in management. The Southern Sierras company says that since April of this year it has spent or contracted for nearly \$400,000 for enlargements, and will need large further sums to complete important work.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

HEATING DEVICE STOCKS CLEANED OUT IN EAST

Extreme Cold Spell, Coupled with Acute Shortage of Coal and Other Fuels, Results in Record Demand for Radiators and Other Appliances

As far as could be learned the stock of radiators and other heating appliances in the East prior to the unexpected arrival of the unprecedented cold weather of last week was as large as it usually is at this time of year under normal conditions. Distributors, jobbers, dealers, hardware and department stores and other retailers of electrical goods in and about New York had made their usual preparations to meet what they supposed would be the customary demand. But when the intense "cold wave" of last week arrived and persisted in hanging on very much longer than any previous record, stock in these lines melted away more rapidly than even the most sanguine believed possible. Coal, oil and every other fuel that could be utilized were exceedingly scarce, and the pressure for electric radiators became acute. Many apartment houses had no coal for three or four days. The market was swept bare and not a heater could be had at any price. Orders for stock on generous lines were wired to the factories and every effort was made to rush express shipments into the city, but without avail. Freight and express were under embargo, and while the goods were in transit none arrived until practical relief came through heavier receipts of fuel expedited by official pressure on the transportation facilities.

As it stands, merchandise of the description on December delivery is now being distributed to the retail houses as rapidly as it reaches the market. During the most acute stage of the cold spell irons, percolators, grills, toasters, pads and every conceivable type of heating appliance that could contribute warmth were not only short but pretty well cleaned out. The situation is far from easy yet, and final relief is not expected by the trade in the East for a couple of weeks at least. The West seemed to be better prepared and conditions were not so strenuous.

EASTERN ELECTRICAL TRADE FEELS FREIGHT CONGESTION

Difficulties Met in Trying to Get Shipment of Motors from Middle Western Concern Expedited

So far as can be learned from leading shippers and receivers of electrical commodities, deliveries have grown worse rather than better. The situation is said to be more acute in the New York territory than at any other point in the country. The congestion of freight and that of unloaded cars causing this condition has reached the stage where drastic action has been found necessary. Secretary McAdoo, Director General of Railroads, has named the week of Jan. 14 to 21 for the unloading of cars which have for months been used by consignees here as warehouses.

As one electrical goods distributor stated, the demurrage of \$10 a day, instead of \$1 or \$2, should have been put into effect months ago. A jobber carrying one of the largest stocks in the country said deliveries are not only a sore spot, but the situation is almost unbearable. Not only is freight affected by the embargoes, but the express companies, which afforded some relief, even at a higher cost, have in some cases embargoed all but direct and incidental government business.

Shipping West to East is the most difficult to accomplish.

A Middle West manufacturer of motors, who has an important market in New York, Philadelphia and contiguous territory, says he has tried in vain for over a week to move a shipment taken from stock in the New York and Philadelphia warehouses and going South. To expedite deliveries this manufacturer has a traffic man in Cleveland, Ohio, and one in Buffalo, N. Y., who follow shipments. When the train starts, not only is its number taken, but also that of the car containing the merchandise and that of the engine. In addition, the engineer's name and personal appearance are noted. This information is wired to the man ahead, who in turn is on watch, and so it is followed to destination. This factory's deliveries are behind two months, mainly owing to this congestion of transportation facilities. As yet government railroad control has made no perceptible improvement.

SITUATION TO BE MET IN STOCK REPLENISHMENT

Generally Felt that Orders for Merchandise Should Be Placed Early—Fears Concerning Non-Essentials Crop Up

With a reported tendency to economize in buying, the various interests engaged in the manufacture and distribution of electrical goods were called upon by the ELECTRICAL WORLD to verify the statement, so far as they were concerned. They were also asked whether there would be any trouble, hesitancy or unusual delay in replenishing the stocks of jobbers and dealers in staples. The firms approached, of unquestioned standing and influence in the trade, were found to hold diverse views. It was generally agreed, however, that orders should be placed early if stocks of merchandise were to be replenished and maintained at standard strength and levels.

No disposition toward a pessimistic outlook was voiced. On the contrary, buying, in some instances exceeding expectations, was generally characterized by more conservatism and discrimination. The volume of trade in electrical staples and specialties was well maintained and both manufacturers and sellers were preparing for a busy season. At the present time the larger jobbers appear to be carrying strong stocks and fortifying them at every possible chance, owing to the uncertainty of deliveries. Smaller concerns are spoken of as already feeling the pinch and are said to have been calling on the others to help them out by "borrowing" to relieve the immediate pressure of order filling for dealers and general stores. It is stated that establishments of this caliber will encounter more or less trouble in the replenishment of stocks. Other lines of business are in the same predicament. For instance, on lighting fixtures, with the finished articles following the fluctuations of the metal market in price, it is believed that not only will the demand show a curtailment, but that it will be difficult to get goods. Manufacturers are finding it by no means easy to obtain material; hence they are taking no speculative chances with buyers, whether jobbers, dealers or contractors.

Wire and cables are short in this market, and when it comes to replenishing stock there is a question of deliveries and dependence upon the manufacturers. Some of them just now are described by the distributing trade particularly as efficient and therefore will be prepared to replenish stocks, while others, working around in circles, are an uncertain quantity when it comes to filling and shipping orders in a given time. The avenues of distribution are also seriously considering the probability of certain lines being designated as non-essentials and are acting accordingly when placing orders.

RULING ON GOODS
FOR USE IN ONTARIO

All Electrical Equipment Must After April 1 Next
Meet with Approval of the Hydro-Electric
Power Commission of That Province

The Hydro-Electric Power Commission of Ontario has, under date of Jan. 1, sent out the following notice regarding the sale of electrical products in the Province of Ontario:

"Pursuant to the Power Commission act and amendments thereto, and the rules and regulations of the Hydro-Electric Power Commission covering the design and construction of electrical machinery, apparatus, appliances, devices, material and equipment for use in the generation, transmission, distribution or use of electric power or energy in the Province of Ontario, in connection with any electrical installation or wiring for electric light, heat or power, where the electric pressure delivered to or from the same exceeds 10 volts, manufacturers of, jobbers, agents and dealers in electrical machinery, apparatus, appliances, devices, material and equipment, and others interested, are hereby notified that the commission orders that on and after three months from date of this notice no such electrical machinery, apparatus, appliances, devices, material or equipment used, or to be used, as above may be used or disposed of in the Province of Ontario unless and until the design and construction of same has been submitted to the Hydro-Electric Power Commission of Ontario and approval of such has formally been obtained."

METAL MARKET SITUATION

Copper Buying Sharply Reduced by Lesser Demand—
Ample Supply—Tin Scarce and Lead Advancing

An ample supply of copper—at the rate of 50,000,000 lb. per month—is now estimated to be guaranteed for industrial or commercial requirements during the first half of 1918. The demand for this purpose, however, has fallen off sharply in the last six or eight months. An authority states that the difficulty of securing funds to finance power and lighting plant extensions and similar enterprises is held responsible for the smaller buying of copper other than for government uses. This undoubtedly had its influence on the price for base wire which governs the quotations on the various trade commodities. Wire or cable is in a weak position and slightly lower. Rubber-covered wire is a shade off in price also. Solid wire can be shipped from stock, but stranded wire is behind from three weeks to three months on delivery, dependent in large measure upon the varying manufacturing efficiency of the respective individual producers.

Lead is again advancing, but tin, with none offering even at the high figure nominally quoted, is still scarce. It is expected that with the official restrictions placed on the export of Straits tin there will be none received here before the beginning of next May.

NEW YORK METAL MARKET PRICES

	Dec. 31	Jan. 7
	£ s d	£ s d
Copper:		
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	27.00*	27.00*
Lead, trust price	6.25	6.50
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.82½ to 7.92½	7.82½ to 7.92½
Tin, Straits	85.00†	85.00†
Aluminum, 98 to 99 per cent.	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire	22.00 to 22.50	22.00 to 22.50
Brass, heavy	14.00 to 14.50	14.00 to 14.50
Brass, light	10.00 to 10.50	10.00 to 10.50
Lead, heavy	5.75 to 6.00	6.00 to 6.12½
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal. †None offering.

THE WEEK
IN TRADE

ACTIVITY is the keynote of the manufacturing, distributing and selling branches of the electrical merchandise field. Where shipbuilding and other governmental work is being developed and carried forward on a great scale the buying of heavy or large electrical equipment is notable. In staple lines ordering since the opening of the year is reported as showing no marked curtailment; when it has occurred conservatism in buying is responsible for the reduction. Conduit pipe and line material are stated to be in a precarious position for lack of deliveries. The sale of farm lighting sets, storage batteries, fans, lamps, etc., is developing optimistically.

No specific complaints are heard regarding collections. Not a few reports say they are unusually prompt, while others declare they are fair. Credit restrictions continue to engage the attention of all sections of the trade.

NEW YORK

Notwithstanding the difficulty of securing sufficient labor—skilled and unskilled—manufacturing activities are not appreciably reduced, if they do not continue unabated. With the business outlook rather obscure and likely to continue uncertain in some lines, there is still a disposition on the part of jobbers and dealers to operate with caution. Earnings have been unprecedented. Building operations continue to be quiet. Government requirements remain the dominating influence. The freight congestion is in a particularly serious situation, although the government's action in reducing passenger traffic will undoubtedly have a beneficial effect.

Collections are variously spoken of as slow, fair and prompt, depending greatly upon the vigorous methods of the creditors. Credits are drawn more closely than ever.

RADIATORS.—An acute shortage of radiators and all heating appliances, amounting to practically a bare market, during the recent cold weather of last week was a cause of embarrassment to distributors, jobbers, dealers and the department stores in this district.

LIGHTING FIXTURES.—Stock goods are moving slowly, as has been noted from time to time, on account of flat building conditions. Fixtures made to order are, if possible, in a weaker position, as their sale is limited to special purposes, with an outlook for even a smaller demand, as reported by leaders in the line.

LINE MATERIAL.—Conditions are being very much affected by the scarcity of material. Shipments held up by embargoes east of Pittsburgh are a cause of anxiety on the part of distributors. An order for locust pins placed early in June last has not been delivered yet. An acute shortage is in sight. Yellow-pine cross-arms are also in bad shape. Of three cars ordered six months ago one was received here; the others are "somewhere" in the South in transit. Fir arms are hard to get, as the lumber is being requisitioned by the government for aeroplanes and ships.

COLLECTIONS AND CREDITS.—Generally speaking collections, when energetically looked after, are returning good results. Over-trading is evident and steps are under way to check it. The day of free credit accommodation is gradually passing away hereabouts. Leading jobbing houses are not reducing their efforts toward a more general introduction of trade acceptances in place of open book accounts. Dealers in this section are inclined to regard the innovation askance, but a brief and clear explanation of their financial and credit advantages dissipates this prejudice. An amended or new form of trade acceptance as adopted by the Federal Reserve banks, which supersedes all other forms used heretofore in the trade, is announced.

LAMP CORD.—A scarcity is reported on silk-covered lamp cord. Prices are at the apex, in the view of the jobbing houses, and no further advances are anticipated.

DRY BATTERIES.—Labor conditions and poor deliveries are interfering with the free movement of dry batteries. Stocks are none too strong.

PORCELAIN.—Goods in this line, with the strikes at the factories adjusted, are in better supply and the situation is greatly improved, but yet not up to normal.

LAMPS.—The position of lamps, with the exception of a few types, is much better than formerly. Orders under the new price schedule, effective Jan. 1, are being booked on a larger scale than before. Jobbers are making their assortments broader and along lines more representative for current demands.

BELLS AND GONGS.—The United States Shipping Board Emergency Fleet Corporation is requesting bids this week for 300 lots of call-bell materials. In all, about 3000 2½-in. vibrating bells for use on 10 volts are called for and also 900 6-in. and 300 8-in. vibrating gongs.

CHICAGO

Nothing but optimism over the outlook for 1918 is expressed by the commercial branches of the industry in the Middle West. The last week has been quiet, some companies being still engaged in taking stock and holding sales conferences. At these conferences manufacturers have held out the opinion that, while trade may slow up in certain branches of the industry, it will go ahead at increasing speed in others. The industrial outlook continues bright.

Several inquiries indicating a good volume of business have been received from railroads in the last week. There is some question in the minds of jobbers, however, as to whether or not the government's taking over the railroads will have any effect upon the buying of railroad maintenance supplies. As yet there is no information at hand which would indicate that a change will be made.

Inventories are developing that some jobbers are carrying stocks which are actually considerably larger in volume than those carried in the end of 1916. The statement with regard to this condition is that the railroad situation makes this necessary in order for the jobbers to deliver the goods. Many big shipments are going out of jobbers' stocks these days by express.

WIRE.—Manufacturers have brought their prices down to a 30-cent base. Certain jobbers within the next week will reduce their prices on rubber-covered wire and weather-proof wire to a 30-cent base. Lamp cord is already on the 30-cent base.

MINE SUPPLIES.—Trolley hangers, signaling systems and the like are being bought quite freely by mines in the Northwest. Traveling salesmen in from that territory report unusually successful seasons among the mining companies, but decreasing business from central stations.

CONDUITS.—The government is still taking such large quantities of conduit that some Chicago jobbers have not been able to replenish stock.

FARM LIGHTING SETS.—The salesmen engaged in selling farm lighting plants report that the soft condition of corn throughout the corn belt is responsible for the loss of much of their farm-lighting plant business. While the farmers are prosperous, they are not as prosperous as they expected to be on account of the fact that the elevators cannot store the soft corn, and the farmers hence cannot get their money out of it until it either dries out or is sold in the local community for feeding stock.

AUTOMOBILE SUPPLIES.—While the automobile outlook may be curtailed in the coming year, the accessory and repair market looks especially bright, since it will be necessary for present car owners to use their old cars, which otherwise they might have discarded for new ones. Using old cars means buying more repair equipment. A good season is therefore expected in this branch of the trade.

PORTABLES.—Floor lamps and silk shades were reduced in price from 25 to 33 1/3 per cent immediately following Christmas in an attempt to clear out stock that had been on the floor for some time. The sales were quite successful.

BOSTON

Business continues in fair volume, though a slight falling off is reported during the period of analyzing last year's conditions and results. Inquiries are coming in and recent price advances in fans and lamps seem to be no deterrent to prospective purchasers. The lamp situation is greatly improved and jobbers are well stocked. The coming of longer days will soon be a real factor in easing the lamp situation still further, combined with the federal "lightless night" program. Jobbers report improved deliveries along many lines; manufacturing facilities are being rapidly brought up to meet present demands and the local stocks of motors are better than for some time. Fan price advances have not yet been passed along to the retail trade and resale contracts are yet to be received by jobbers.

Government demands are very active. One Boston jobber has sold a lamp order to Halifax as a result of the explosion in December. Central stations are pursuing a very conservative policy regarding appliance purchases. Pole-line material is now available at Boston in substantial quantities. Labor conditions are unusually free from disturbance, all danger of a telephone strike having passed. Textile mills are very active. As yet the expected new business from the railroads under government control fails to appear, but it is bound to be a factor in this year's sales. Collections are still a little slow, except where closely followed.

APPLIANCES.—Jobbers are still conservative as to the 1918 outlook, but optimistic reports are in hand respecting the prospects of labor-saving devices, especially irons and washing machines. Industrial heating appliances are in considerable demand. One jobber sold 700 washing machines in 1916, his first year handling these.

LAMPS.—Stocks are much larger and more varied. A 10 per cent advance took place Jan. 1, but this is likely to cause little falling off in the volume of trade. The prospect is for a further accumulation of stocks despite heavy government orders. Jobbers are not yet being supplied on a maximum scale, but one house which recently became agent for a large manufacturer received a heavy initial stock in excess of the normal business allowed under present conditions.

POLE-LINE MATERIAL.—A large jobber specializing in this line reports his stock in ample volume, prices remaining steady and industrial business good. The central-station outlook is for a quiet spring on new construction, but some interconnection of lines and plants should result from the recommendation of the Massachusetts Gas and Electric Light Commission to the Legislature for greater inter-system efficiency.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are very active, with considerable government business and keen competition. A delivery of ten days in a drop-frame type of truck was offered the Navy Department last week. Manufacturers are developing this field intensively and the outlook is excellent for the new year.

ATLANTA

Business in general is considerably off this week as compared with the pre-holiday period. New Year's Day falling on Tuesday, thus breaking into the week, combined with a post-inventory lethargy, has tended to slow up orders. But representatives of the various manufacturers and jobbers at this point have begun to cover their territories and business is expected to be equal to, if not greater than, what it was in the last few months of 1917.

The shipbuilding program seems to hold the center of the business activity at this time. The Tennessee Coal & Iron Company's new shipyards near Mobile, Ala., incorporated by the Chickasaw Shipbuilding Company, is one of many instances of the activity in this industry. Speculation is rife regarding Henry Ford's trip South this week in the interest of the government and the location of his large steel shipbuilding plant. With the freight situation growing worse each day at the Eastern ports, it is expected that the facilities of the Southeastern ports will receive more consideration in the shipbuilding program.

Motor manufacturers have received specifications this week covering the electrification of the Saxon Mills and Spartan Mills Nos. 1 and 2, Spartanburg, S. C. Bids on the former mill are to cover 1500 hp. individual and group drive, and those on the latter 4000 hp. group drive. J. E. Serrine & Company, Greenville, S. C., are the engineers. Power will be supplied by the Blue Ridge Power Company, Spartanburg.

The Unity Cotton Mills, Lagrange, Ga., contemplate the purchase of 400 hp. individual motor drive, securing energy from the Columbus Power Company, Columbus, Ga. Specifications covering wiring and motor installation of approximately 4000 hp. for the Langley Mills, Langley, S. C., have been sent out by C. R. Makepeace, engineer, Providence, R. I.

Steam turbine sales for this section were given quite a boost recently by the Emergency Fleet Corporation's purchases to the extent of \$1,000,000, covering equipment for ship propulsion.

A few manufacturers and jobbers report a slowing up in collections from municipalities. The theory is advanced that this condition is due to the fact that these municipalities are diverting a large amount of current funds toward abnormal fuel costs. The continued cold spell has tended to increase further the difficulties of the various public utilities depending on coal for fuel.

MOTORS.—The demand for the standard three-phase type has slackened. This is, no doubt, due to a number of causes, such as priority investments, scarcity of fuel, lack of available water power and increasing length of shipment. A number of substantial orders have been placed recently and some big business is in sight, but it is not expected that the pressure on this line will be so great for some time as it was during June, July and August, 1917. There is practically nothing available in local stocks. Prices firm.

FLOODLIGHTING.—Shipbuilding plant and yard construction, together with munition plants and other industries working on war materials, has stimulated the demand for all types of light projection in the Southeast, with good prospects for continued activity in this line. Lamps rated at 200, 400 and 1000 watts are in great demand, the 400-watt size being the most popular.

FANS.—Jobbers and dealers are placing more substantial orders for fans at this time than they did last year, as they are afraid that fans may be put on the luxury or non-essential list later on.

SEATTLE

Staple lines, mainly equipment for ships under construction, are selling about the same as for the past month at peak prices. Wholesalers state that the past year's business was far better than anticipated and are looking forward to still greater activity during 1918. The big increase in retail business last year was due to heavy buying by shipyard workers. This class of buying has increased enormously. Wholesalers state that without a doubt industrial business will hold up and increase in volume during the year in spite of prices considerably higher than last year at this time.

Stocks are not in quite so good shape as last year at this date. Heavy orders are being placed on account of the anticipated difficulty of getting materials to the coast due to railroad congestion, as well as in consideration of the list of non-essentials which dealers expect will be very materially increased within the next few months. The main stock shortages are conduit, particularly black and the $\frac{3}{4}$ -in. size, which is used extensively by the government. The lamp shortage still exists and, if possible, is worse than heretofore reported. The movement of wire in all sizes is about the same, with prices remaining firm. Securing of wire stock is spasmodic, although stocks are in fair shape. Motors are selling satisfactorily in both large and small sizes, with large orders for new mills or shipbuilding plants coming intermittently.

The volume of repair work on small and medium-sized vessels in Puget Sound harbors is gaining steadily and will continue until about March 1. Electrical dealers are realizing a nice business from this source. Owners of repair

yards state that the volume is running far ahead of former records. Motors, wire and lamps are being bought for that purpose.

The transfer of all wooden-ship contracts from the Southern pine district to the West Coast fir territory because of speedy delivery is expected by West Coast lumbermen. The establishment of a central purchasing office for standard commodities used in construction of wooden ships will be suggested to the United States Shipping Board by the Washington wooden-ship builders. Shipbuilders are desirous of having the government take over the assembling and distribution of materials used in construction. The Seattle Metal Trades Council, representing 15,000 shipyard workers, recently voted to request the United States Shipping Board to reopen the shipyard wage scale award made last fall and authorize an upward revision of shipyard wages in the Puget Sound district on the ground that the rise in cost of living since Aug. 1 justifies corresponding increase in wages. During the week plans were announced for the establishment of a steel shipbuilding plant in Portland, a machinery installation plant in Aberdeen, and the first unit of the steel plant in Seattle to be equipped with electric furnace and electric machinery. Building is showing no signs of renewed activity with exception of orders for additional structures at Camp Lewis, the Vancouver barracks and the Puget Sound forts.

Relief of congested conditions of the Puget Sound terminals is expected to result speedily from the appointment of a joint committee of railway and steamship officials to devise a solution of the problem. Federalization of railroad lines will lead, it is believed, to an early settlement of terminal problems and is certain to result in an issuance of an order to abandon intraterminal switching. Transcontinental lines are striving to reorganize service, which was disrupted during the past ten days by floods. Work of repairing and rebuilding washed-out bridges in mountain divisions particularly is being rushed under difficulties. Collections fair.

SAN FRANCISCO

Government orders are probably of first importance in point of volume in the San Francisco field just now, even excluding the requirements of the Shipping Board. Construction is under way at the naval training stations, navy yards, military encampments and fortifications, and electrical materials constitute a considerable part of the orders placed for such work.

The time required for Eastern freight deliveries has jumped from seventeen days, which was the average a month or six weeks ago, to thirty to forty days, which is the time in which shipments are now arriving. However, government control of railroads is confidently expected to improve freight shipments.

The California Railroad Commission has decided that government railroad control will not affect the applications for rate increases which electric railways have filed. This news has strengthened electric railway securities, and, with the freight business these lines are developing, the prospects in this field are much better than they have been.

SMALL MOTORS AND TRANSFORMERS.—There is an outlook for a heavy demand in the agricultural field. Stocks are improving in small sizes. About eight months' time is generally desired for motors of more than 50 hp., and about four months on sizes of more than 15 hp. On emergency calls, however, the leading manufacturers do better.

STORAGE BATTERIES.—The demand for automobile storage batteries continues very heavy, but with improved facilities for assembly in San Francisco this demand is being handled satisfactorily. Battery orders for the United States Shipping Board continue heavy, and in recent months the demand from firms which assemble motor trucks on the Pacific Coast has been steadily increasing. The manufacture of farm tractors also calls for an increasing supply.

FARM LIGHTING SETS.—With agricultural district prosperity the attention to farm lighting sets has been renewed, and one of the leading manufacturers reports having sold more equipment of this sort in the last two months than has been placed in the two years previous.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must

increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.&S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil.....	+10% to \$61.00
Coil to 1000 ft.....	5% to \$59.17
	No. 12 Solid
Less than coil.....	+10% to \$71.00
Coil to 1000 ft.....	—10% to \$68.87

Twin-Conductor

	No. 14 Solid
Less than coil.....	List to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
	No. 12 Solid
Less than coil.....	List to \$135.00
Coil to 1000 ft.....	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil.....	List +10%
Coil to 1000 ft.....	List —10%
	No. 12 Solid
Less than coil.....	+10%
Coil to 1000 ft.....	—10%

Twin-Conductor

	No. 14 Solid
Less than coil.....	List +10%
Coil to 1000 ft.....	List —10%
	No. 12 Solid
Less than coil.....	+10%
Coil to 1000 ft.....	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List to 10%
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	20%
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

	No. 6 Regular	No. 6 Ignitor
Each Net		
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.295

CHICAGO

	No. 6 Regular	No. 6 Ignitor
Each Net		
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175	.3275
Barrel lots.....	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/4-in. s. strp.....	Net to \$75.00 —12% to \$69.75	
3/4-in. d. strp.....	10% to 70.00 —9% to 72.00	
1 1/2-in. s. strp.....	List to 100.00 —12% to 93.00	
1 1/2-in. d. strp.....	+10% to 100.00 —9% to 96.00	

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/4-in. single strip.....	\$75.00	\$63.75
3/4-in. double strip.....	78.25-78.75	71.25
1 1/2-in. single strip.....	100.00	85.00
1 1/2-in. double strip.....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	2.....	.47
5/8.....	.15	2 1/4.....	.55
3/4.....	.18	2 1/2.....	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$25.00-\$55.00	\$20.50-\$24.75	\$20.00-\$22.00
1/4-in.....	\$28.00-\$60.00	\$22.50-27.00	\$22.00-\$24.00

NET PER 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	Net to..\$55.00	\$25.00-\$37.50	\$22.50-\$24.75
1/4-in.....	Net to..\$60.00	\$27.00-\$30.00	\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

	List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	4% to 6%	7% to 9%
2500 to 5000 lb.....	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	1.3% to 3.7%	4.3% to 6.7%
2500-5000 lb.....	3.3% to 5.7%	6.3% to 8.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	.25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	.30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50
	600-Volt		
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	.28%
1/5 to std. pkg.....	.38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	.28%
1/5 to std. pkg.....	.38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.	100	\$0.30
60-watt—B.	100	.35
100-watt—B.	24	.70
75-watt—C.	50	.70
100-watt—C.	24	1.10
200-watt—C.	24	2.20
300-watt—C.	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4 1/4 in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$23.98 to \$31.00
Coil to 1000 ft.	\$25.82 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$35.60
Coil to 1000 ft.	22.30 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25
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OUTLET BOXES

	List, per 100
Nos.	
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, AX, 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2.	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%-37%	20% 32%
\$10.00 to \$50.00 list.	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to \$20.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N.C.			

	Std. Pkg.	List
Less than 1/5 std. pkg.		
1/5 to std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.			

	Std. Pkg.	List
Less than 1/5 std. pkg.		
1/5 to std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/8-in. cap key and push sockets	500	\$0.32
1/8-in. cap keyless socket.	500	.30
1/8-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	14%
1/5 to std. pkg.	30%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

	High Grade:	
30-amp. S. P. S. T.	\$0.80	
60-amp. S. P. S. T.	1.20	
100-amp. S. P. S. T.	2.25	
200-amp. S. P. S. T.	3.48	
300-amp. S. P. S. T.	5.34	
30-amp. D. P. S. T.	1.20	
60-amp. D. P. S. T.	1.78	
100-amp. D. P. S. T.	3.33	
200-amp. D. P. S. T.	5.20	
300-amp. D. P. S. T.	8.00	
30-amp. 3 P. S. T.	1.80	
60-amp. 3 P. S. T.	2.63	
100-amp. 3 P. S. T.	5.08	
200-amp. 3 P. S. T.	7.80	
300-amp. 3 P. S. T.	12.00	

	Low Grade:	
30-amp. S. P. S. T.	0.42	
60-amp. S. P. S. T.	0.74	
100-amp. S. P. S. T.	1.50	
200-amp. S. P. S. T.	2.70	
30-amp. D. P. S. T.	0.68	
60-amp. D. P. S. T.	1.22	
100-amp. D. P. S. T.	2.50	
200-amp. D. P. S. T.	4.50	
30-amp. 3 P. S. T.	1.02	
60-amp. 3 P. S. T.	1.84	
100-amp. 3 P. S. T.	3.76	
200-amp. 3 P. S. T.	6.76	

DISCOUNT—NEW YORK

	High Grade	
Less than \$10 list.	List to + 5%	
\$10 to \$25 list.	11%	
\$25 to \$50 net.	14% to 15%	

	Low Grade	
Less than \$10 list.	5% to 10%	
\$10 to \$25 list.	16%	
\$25 to \$50 list.	24% to 25%	

DISCOUNT—CHICAGO

	High Grade	
Less than \$10 list.	+ 5%	
\$10 to \$25 list.	10%	
\$25 to \$50 list.	14%	

	Low Grade	
Less than \$10 list.	5%	
\$10 to \$25 list.	16%	
\$25 to \$50 list.	24%	

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

	Union and Similar—	List Each
No. 155.		\$0.34
No. 160.		.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List	List to + 10%
\$2.00 to \$10.00 list	10% to 20%	5% to 10%
\$10.00 to \$50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25%	15% to 20%
\$2.00 to \$10.00 list	25%	20%
\$10.00 to \$50.00 list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	\$5.00 to \$7.50
Discount	25% to 30%

CHICAGO

List price	\$5.50 to \$6.00
Discount	30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net.
No. 18, less than full spools.	\$0.44 1/4 to \$0.49
No. 18, full spools.	0.43 1/4 to 0.45

CHICAGO

	Per Lb. Net.
No. 18, less than full spools.	\$0.64 to \$0.65
No. 18, full spools	0.54 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.			
11.	\$15.00-\$18.00	\$13.00-\$14.00	\$11.25-\$12.00
12.	23.25-27.09	21.30-23.22	19.35-20.85
10.	32.40-37.80	29.70-32.40	27.00
8.	45.70-53.34	41.90-45.72	38.00
6.	72.40-84.42	66.35-72.40	60.30

CHICAGO

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No.			
14.	\$18.00	\$13.50	\$12.00
12.	25.33-27.79	23.82-25.33	19.85-20.40
10.	33.24-35.04	30.03-30.47	27.70-28.23
8.	47.04-48.97	41.98-43.12	39.20-39.42
6.	66.46-68.25	62.05-62.43	55.85-56.39

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$35.25 to \$39.25
25 to 50 lb.	35.25 to
50 to 100 lb.	34.25 to 35.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$40.00 to \$40.35
25 to 50 lb.	39.00 to 39.35
50 to 100 lb.	38.00 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements
in Manufacturers' Products Used in
the Electrical Field

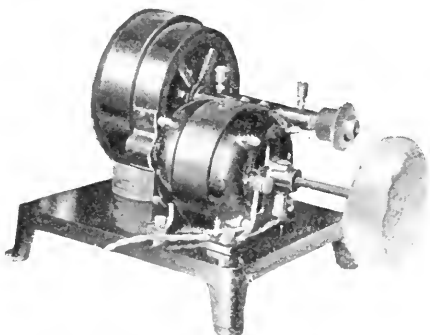
Renewable Cartridge Fuse

The Trico Fuse & Manufacturing Company of Milwaukee, Wis., points out seventeen superior features for its renewable cartridge fuses. Several of the claims made follow. To renew or inspect these fuses in the ferrule type end screws and caps are removed, and in the knife-blade type one cap only is removed. The renewals are powder-filled and carry starting or momentary overloads, yet positively protect apparatus from prolonged overload, it is claimed. No blackening or burning of contacts is had, as the powder smothers the arc. The knife blades and terminals are self-aligning, which insures perfect contact with clips, eliminating blow-outs due to terminal heating. In the ferrule type the cap is screwed over the fiber shell to terminals of renewal cartridge, then secured with a heavy brass screw. In the knife-blade type the renewal elements have solid copper terminals securely bolted to blades, making perfect copper-to-copper contact and doing away with oxidized and burned-out renewal elements due to heating or contact bolts.

Motor-Operated Polishing Machine

The Ernst Koppen organization of New York City has developed a motor-operated knife-cleaning and silver-buffing machine. According to the motor supplied, it can be used on circuits of 110 volts or 220 volts, direct current, or on 60 cycles, alternating current of 110 volts or 220 volts.

The complete device consists of a pair of patented cleaning or polishing brush disks and a fractional-horse-power motor made by the General Elec-



KNIFE-CLEANING AND SILVER-BUFFING MACHINE

tric Company, which drives the disks through gears and besides has a buffing-shaft extension for the buffing of light silverware or rinsing of teapots, etc.

The knife cleaning takes place between the brush disks in the inclosed drum on the left of the motor, and the cleaning or polishing brush disks will, it is claimed, serve several hundred thousand knife blades without renewal, which is done at a low cost. The butt of the knife handle is polished by the special attachment at the right end of the back-gear shaft.

Electric Cleaner with Few Parts

The "America" vacuum cleaner, which is just being placed upon the market by the Wise-McClung Manufacturing Company of New Philadelphia, Ohio, is said by the manufacturer to have fewer parts than any other electric cleaner. A number of distinctive features are claimed for this appliance, among them a patented floor brush the design of which permits sewing-room litter, threads, etc., to pass through a center vent direct to the dust bag, thus



EQUIPPED WITH PATENTED FLOOR BRUSH

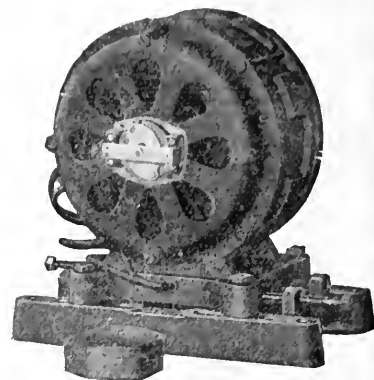
leaving the brushes always free from accumulation. A positive catch for raising and lowering the nozzle can be adjusted by the tip of the operator's shoe, as can also the patented electric control switch. It is made under the Kenney patent.

Insulating Material

A material which is known as "leatheroid" and comes in sheets of various thicknesses for use in place of fiber is now made by the Leatheroid Manufacturing Company, 43 West Sixteenth Street, New York City. This material is made in different colors, including black, reddish tan and gray. According to tests made by the Electrical Testing Laboratories, New York City, the dielectric strength of this material is about 350 volts per mil thickness. It is now being used by a number of large manufacturing companies as an insulating material.

Alternating-Current Motors

The St. Louis Electrical Works of St. Louis, Mo., have just finished complete development of a full line of alternating-current motors, single-phase motors from $\frac{1}{4}$ hp. to 2 hp. and polyphase motors from $\frac{1}{2}$ hp. to 10 hp.



EQUIPPED WITH CENTRIFUGAL STARTING DEVICE

These motors are for a frequency of 60 cycles and a speed of 1750 r.p.m. A speed of 1200 r.p.m. can be furnished in the two-phase and three-phase motors. Any of the frame sizes can be furnished for frequencies of 50, 40, 30 and 25 cycles.

The frame construction is of the skeleton type and so put together as to give excellent ventilation to both the stator and rotor, and the design has been so worked out that the frames are interchangeable for both the single-phase and the polyphase motors. With the use of this special winding and the proportion of the ratio of the rotor to the stator very low iron losses take place.

Ball bearings have been adopted exclusively for these motors. The oiling arrangement is such that all oil that gets to the bearing has to filter through a felt washer that is used in inclosing this bearing. A ball bearing oversized in comparison to that recommended by ball-bearing manufacturers is used at the pulley end of these motors. The rotor construction is such that it acts as a fan for the stator, and this fanning is done by the rotor bars, which extend out.

In the single-phase motors the split-phase winding is used in starting and on all sizes up to and including $\frac{1}{2}$ hp. A centrifugal starting device is furnished. This centrifugal starting arrangement can also be furnished on larger sizes if specified by the purchaser; otherwise a double-throw starting switch is furnished. This centrifugal starting switch is mounted outside the motor on the end plate and rotor shaft. It is completely inclosed

and gives the motor all the features of a completely inclosed motor, still allowing ventilation at the ends. Inside of the end plates of the single-phase motor there is a simple squirrel-cage rotor. This design gives this single-phase motor all the simple features of the ordinary squirrel-cage, two-phase or three-phase motors.

This starting device is so constructed that in breaking the contact which cuts out the starting winding it does it with a snap. The quick break eliminates chattering or the burning of the contact points by arcing. The points used for making and breaking contact are tungsten, which assures minimum wear. The 5-hp., 7½-hp. and 10-hp. motors are furnished with leads brought out so that the motors can be started by the Y-delta starting arrangement if desired. The bringing out of these leads also permits the motor to be connected either for 110 or 220 volts.

Bell-Ringing Transformer

An improved bell-ringing transformer is announced by the Packard Electric Company of Warren, Ohio. The former type made by this company had a brass-bolted two-piece case with lugs projecting from the top and two lower sides, and these have been eliminated by making the heavy porcelain case in one piece. This results in a neater, more compact instrument—the only projecting parts being the bell-wire binding posts and two small slotted flanges on the base to receive the screws by which the instrument is secured in place.

The electrical element is inserted in the case through an opening in the base and then completely covered with a fine grade of sealing compound, thus forming the unit into practically one solid piece. The leads are marked in raised letters on the adjacent porcelain, insuring against any possible mistake in making connections.

The instrument is so made that a dead short circuit on the secondary or bell side for an indefinite length of time will pull less than 15 watts from the 110-volt service wires. The cases are finished in blue with a high glaze which renders the unit attractive to the eye and assists materially in making sales.

Box Connector

Box connectors that are easy to apply and that hold conduit tightly are made by S. R. Fralick & Company, 15 South Clinton Street, Chicago. It is



HOLDS CONDUIT TIGHTLY

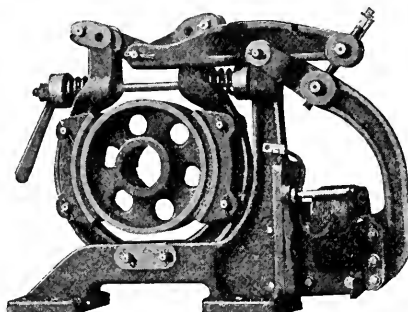
claimed that there is no danger of the conduits pulling out when these connectors are used. The accompanying illustration clearly shows how this

connector is applied and how it holds the conduit. The screw, it is said, eliminates the danger of the conduit pulling out.

Magnetic Brakes

The principle of the type of magnet which has been so successfully incorporated in the design of magnetic controllers by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has been employed by the company in a new design of magnetic brakes just developed for use with mill, crane and hoist motors. The use of a clapper-type magnet eliminates all moving parts within the coil and the consequent wear, sticking or damage to insulation. The modified and improved type A alternating-current brake with which the trade is already familiar and the new type B direct-current brake are similar in operation and have common parts throughout except for the armature lever and magnet.

These brakes are characterized by the quickness of their operation. They respond almost instantly, "releasing" when the power is applied and "setting"



PARTS OF BRAKE ARE READILY ACCESSIBLE

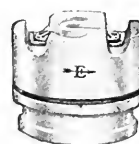
when the power is cut off. This is due to the design of the operating magnet, which gives high initial pull and a very small distance of travel, ¼ in. to 1 in. (6 cm. to 2.5 cm.).

Their operation is similar. When voltage is impressed on the motor the magnet is energized and the magnet armature lever overcomes the pressure of the compression springs through a toggle and releases the brake-shoe grip upon the brake wheel. While the magnet remains unenergized the brake wheel is allowed to rotate freely. As soon as the current is shut off from the motor the brake magnet releases and the compression springs force the shoes against the brake wheel and bring the motor quickly and smoothly to rest without shock or jar. The compression exerted by the springs can be easily adjusted so that any holding or retarding torque up to the full capacity of the brake can be obtained for equal braking effort for both directions of rotation. Simple means for making adjustment for shoe wear are provided.

In case adjustments for shoe wear should be neglected, a safety feature has been introduced so that the brake does not fail to hold the load but the magnet will not release the grip on the brake wheel. This insures proper brake operation and the elimination of accidents due to the brake wheel slipping.

Outlet-Box Receptacle

The Arrow Electric Company of Hartford, Conn., has just placed on the market an outlet-box receptacle with a removable porcelain ring grooved for shade holder. This shade-holder



EQUIPPED WITH A REMOVABLE GROOVED PORCELAIN RING

groove is the new feature of the device, as the receptacle base is nothing more than the standard short type of sign and outlet-box receptacle which has been on the market for a number of years. The ring is threaded sufficiently to support a considerable weight, and it can be fitted to bases, for ordinary cleat wiring, for weatherproof work and for concealed terminals.

Adjustable Light Fixtures

Fixtures that consist of a ball-and-socket arrangement to be secured to the ceiling and a steel rod provided with brass sliding or extension tube which can be drawn out or pushed back over the rod at will are made by the Peter Forg Manufacturing Company of Somerville, Mass. It is pointed out that the ball-and-socket arrangement permits the fixture to be at once adjusted to any desired position. The lower end of the sliding tube is provided with a ball-and-socket clamp, to which the lamp can be readily attached and which permits the lamp to be turned to any desired angle. On this fixture the upper part of the wire is coiled around the rod, and as the lamp is drawn down the coil is extended, the cup at the bottom of the coil pushing the wire back to a close coil as the lamp is raised.

Motor-Operated Vegetable Washer

The American Machinery Company of Philadelphia has developed motor-operating machines for simultaneously paring and washing all hard-root vegetables. These machines are extensively used by the United States government in the navy and all governmental institutions. They remove the outer skin of the vegetables and turn them out ready for cooking.

The machines are made in a variety of sizes suitable for use in restaurants, hotels, hospitals and institutions of various kinds. Power for the machine is obtained from fractional-horsepower motors manufactured by the General Electric Company. The motors are inclosed and are moisture and dust proof, furnished either in direct current or alternating current to meet the service conditions. These motors are regular equipment for these machines.

Trade Notes

HESS & SON, Philadelphia, owing to need of increased manufacturing facilities, have removed from 1031-1033 Chestnut Street to 1302-1304 Filbert Street.

C. P. COLEMAN was elected president of the Worthington Pump & Machinery Company of New York City at a meeting of the board of directors on Dec. 31, 1917.

JOHN N. TIMBERLAKE resigned as power apparatus sales engineer of the Northern Electric Company on his appointment as Montreal (Canada) district sales manager of R. E. T. Fringle, Ltd.

THE MENOMINEE ELECTRIC MANUFACTURING COMPANY, Menominee, Mich., has moved its office and stockroom from 30 Church Street to 150-152 Chambers Street. The change was made Jan. 1.

THE WESTERN ELECTRIC COMPANY of New York City has leased the eight-story building at 152 to 156 West Thirty-sixth Street for a term of years. The building is to be used for a warehouse.

H. H. HONDE, sales manager of the Electric Railway Manufacturers' Supply Company, has resigned to become associated with the North Coast Electric Supply at Seattle, Wash., of which Harry Byrne is manager.

PERCY E. WRIGHT, consulting mechanical engineer of Seattle, Wash., has taken the management of the Jeffery Manufacturing Company of Columbus, Ohio, for the Northwest and opened offices in the L. C. Smith Building, Seattle.

THE NEW YORK CITY BETTER HOMES EXPOSITION will be held in the Grand Central Palace, New York City, from May 18 to 25, inclusive, under the management of Louis W. Buckley. The floor space to be occupied equals 100,000 sq. ft.

L. W. SHIRLEY, formerly general sales manager for the Link Belt Company of Chicago, is now stationed in Seattle, Wash., as secretary and manager of the Washington Corporation of the Link Belt Company, with plant and offices at 574-576 First Avenue South.

C. G. COX has been transferred as district manager of the McIntosh & Seymour Corporation from St. Louis, Mo., to San Francisco, Cal. The St. Louis office is discontinued. Mr. Powelson, who formerly represented the company in San Francisco, is no longer connected with it.

THE WAR TRADE BOARD, Washington, D. C., has issued bulletin No. 1, containing the complete text of the trading-with-the-enemy act, approved by the President Oct. 6, 1917, and also a full list of the enemy trading list, with the index of the names by countries. Notes on the list are also embodied.

D. GLEISEN, manager of the industrial bearings division of the Hyatt Roller Bearing Company, Newark, N. J., is a mechanical engineer, a graduate of Stevens Institute, and has been connected with the Hyatt company for the last six years. He was formerly assistant manager of the company in charge of bushings sales.

THE CREDIT ASSOCIATION OF THE BUILDING TRADES of New York City has distributed a pamphlet entitled "The Present Trouble with the Building Trades." It relates the causes of the present unsatisfactory conditions in that line of business. The remedy suggested is co-operation between all interests concerned.

JAMES MOREY, formerly representing the Multi Refillable Fuse Company of Chicago, recently absorbed by the Chicago Fuse Company, has become connected with Hathaway & Knott, Inc., electrical merchandise, New York City. Mr. Morey, whose appointment became effective Jan. 2, will travel the Southern territory and Pennsylvania.

NIXON & KIMMEL, electrical engineers and contractors of Spokane, Wash., have been appointed distributors for the Edison storage batteries and Edison farm lighting plants for all territory east of the Cascade Mountains in Washington, and all of Idaho and the western part of Montana. They are also distributors of the Robbins & Myers motors, etc., the Sangamo meters and the Maloney transformers. Nixon & Kimmel have been in Spokane for twenty years.

GARNETT, YOUNG & COMPANY, San Francisco, Cal., announce their succession to the business of the Telephone-Electric Equipment Company, which will be conducted without interruption at San Francisco, Los Angeles, Seattle and Portland,

there being no change in the address of the respective offices. The personnel of the management and sales staff is exactly the same as in the old company, while the character and policy of the business holds without modification.

THE TELEPHONE-ELECTRIC EQUIPMENT COMPANY, San Francisco, Cal., is exclusive Pacific Coast sales agent for the following manufacturers: American Electric Works, Chicago Pump Company, Hart & Hegeman Manufacturing Company, Harvey Hubbell, Inc., Holtzer Cabot Electric Company, National Metal Molding Company, H. T. Pulste Company, Pratt Chuck Company, Shuplex Wire & Cable Company and the Stromberg-Carlson Telephone Manufacturing Company.

FRANK J. POLEY, manager of the mining section of the industrial department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has taken a position as manager of the mining and traction department of the Edison Storage Battery Company, Orange, N. J. Mr. Poley, who is a graduate of Pratt Institute, Brooklyn, N. Y., has been with the Westinghouse company for twelve years, commencing with the service department in New York City and later being transferred to East Pittsburgh.

FRANK W. HALL has been appointed commercial manager of the Sprague Electric Works of the General Electric Company, New York City. With the exception of a short period Mr. Hall has been connected with the Sprague Works continuously for twenty-two years in various engineering and sales capacities, and for the three years prior to his present appointment occupied the position of sales manager. D. C. Durland, former executive head of the Sprague Electric Works, has resigned to accept the presidency of the Mitchell Motors Company, Inc.

SWISS COMMERCIAL LAWS. — The Swiss commercial laws are analyzed in a new report of the Bureau of Foreign and Domestic Commerce, Washington, D. C., entitled "Commercial Laws of Switzerland," Special Agents' Series No. 150. The bulletin has been prepared primarily for American business men who have dealings in Switzerland, special attention being given to the jurisdiction of the several courts and to partnerships and corporations, powers of attorney, collection of debts, attachment, bankruptcy laws and laws relating to trusts and unfair competition. It is the work of Commercial Agent Archibald J. Wolfe, supplemented by Robert P. Shick of the Philadelphia bar and Phanor James Eder of the New York bar. Copies can be obtained for 10 cents.

New Incorporations

THE KINCANNON SILENT TRANSMISSION COMPANY of Boschob, Wis., has been incorporated with a capital stock of \$3,200 by J. J. Blaine, George C. Kincannon and others.

THE PYRINOL FLASHLIGHT COMPANY of New York, N. Y., has been incorporated with a capital stock of \$25,000 by F. Dameric, S. Goodman and N. F. Lefkadtis, 140 Liberty Street, New York City.

THE AUSTRALIAN GENERAL RAILWAY SIGNAL COMPANY of Gates, N. Y., has been chartered with a capital stock of \$10,000 by J. S. Fitch, H. Satterlee and L. A. Plumb of Rochester. The company proposes to manufacture railway signals, etc.

THE STANDARD ELECTRIC MANUFACTURING COMPANY of Jersey City, N. J., has been incorporated by Jules E. Brand, H. A. Black and Walter J. Hilton of Jersey City. The company is capitalized at \$200,000 and proposes to manufacture electrical appliances of all kinds.

THE EUGENE F. PHILLIPS ELECTRICAL WORKS, Ltd., of Montreal, Que., has been incorporated by Frank B. Common, Francis G. Bush, George R. Drennan and others. The company is capitalized at \$4,000,000 and proposes to manufacture hydraulic and compressed-air machinery, devices, etc.

THE BRECO ELECTRIC COMPANY of Toledo, Ohio, has been incorporated by M. G. Lang and H. A. Stafford of the E. Pauck Machine Company. The company is capitalized at \$50,000 and proposes to manufacture electric machines for charging storage batteries. The company, it is stated, holds valuable patents on several electrical appliances for automobile equipment, which will be manufactured later on. The office of the company is located at 206 Huron Street.

Trade Publications

BOX CONNECTOR. S. R. Fradlek & Company of Chicago have issued a leaflet descriptive of "Kwikon" box connections.

COAL CONVEYOR. — The Godfrey coal conveyor is illustrated and described in a circular prepared by John F. Godfrey of Elkhart, Ind.

ELECTRIC SOLDERING IRON. — The Dover Manufacturing Company of Dover, Ohio, has issued a folder descriptive of its garage special electric soldering iron.

WATER-COOLING SYSTEM. — Cooling water with sprays is the subject of bulletin No. 71 prepared by the American Spray Company, 26 Cortlandt Street, New York City.

PLUGS AND RECEPTACLES. — Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared a leaflet descriptive of Hubbell interchangeable attachment plugs and T-slot receptacles.

CONDENSERS. — Bulletin No. 50, descriptive of the Rees rotorho patent rotary jet condensers, has been prepared by the Manistee Iron Works Company of Manistee, Mich.

WATT-HOUR METERS. — The General Electric Company of Schenectady, N. Y., has published an erratum to accompany bulletin No. 14,201A, on single-phase watt-hour meters.

INCLOSED FUSES. — "Union" renewable inclosed fuses for 250 volts and 600 volts are described in a leaflet prepared by the Chicago Fuse Manufacturing Company of Chicago and New York.

MILITARY CAMPS OF OUR ALLIES. — The Consolidated Expanded Metal Companies of Braddock, Pa., is distributing a book with this subject which has been copied from a pamphlet issued by the Expanded Metal Company, Ltd., of England.

FIXTURE SOCKETS. — The Wirt Company of Philadelphia, Pa., has published a leaflet entitled "Thrifty in Sugar Coats." This leaflet gives information on the various uses of the "Dim-A-Lite" and tests made by the Bureau of Standards on how this device saves electricity.

ELECTRIC WELDING. — The Wilson Welder & Metals Company, Inc., of New York City has prepared its catalog No. 2, on electric welding. This book includes information on the development of the Wilson system, specifications of equipment, portable equipment, size, weight and use of electrodes and schedule of equipment, table of economies, physical tests of welded joints, economy and operation, etc.

DEALERS' CATALOG. — A catalog confined entirely to electric socket and other appliances which may be sold over the counter to consumers has been prepared by the Mohawk Electrical Supply Company of Syracuse, N. Y. It is said that when this catalog was prepared the Goodwin movement of co-operation between the different classes of electrical business, especially that between jobber and contractor-dealers, was in mind. This catalog contains 120 pages.

MANUFACTURE OF IRON AND STEEL. — The Youngstown Sheet & Tube Company, Youngstown, Ohio, has issued an attractive calendar for 1918. It is featured by twelve large two-color illustrations of as many different operations in the manufacture of iron and steel. The plates were made from photographs taken in the works of the company and are both handsome and instructive. The calendar will be sent to any address on receipt of 4 cents in stamps to pay cost of mailing.

FIREBRICK. — Under the title "How Any One Can Make a Jointless, Gas-Tight Furnace Lining," the Betson Plastic Fire Brick Company of Rome, N. Y., has published a sixteen-page illustrated folder showing how the "plastic firebrick" made by it is used in forming one-piece linings for steam-boiler furnaces. The old lining of firebricks or blocks is first removed and the plastic material is then placed in the form of chunks, consolidated with a mallet and smoothed with a trowel, occupying the same thickness as the old lining. The special mechanical process used in the preparation of this material is said to eliminate expansion and contraction with temperature changes, so that not only side walls but also door arches, rear arches and arches for Dutch ovens and other forms of furnace can be formed as solid monolithic structures. After the material has been dried and set by a slow fire for four or five hours the furnace can be put into full service. No molds or special forms are used. The same material is used for baffles in water-tube boilers.

New England States

MANCHESTER, N. H.—The Public Service Commission has authorized the Manchester Traction, Light & Power Company to issue \$340,000 in bonds and coupon notes to an amount not exceeding \$1,500,000, the proceeds to be used for defraying the cost of new construction, most of which is required for a dam now under construction at Gregg's Falls.

HARWICH, MASS.—The Buzzards Bay Electric Light Company of Falmouth has been granted permission to erect transmission lines in Harwich to enable it to supply electricity to the government aviation plant at Chatham.

HAVERHILL, MASS.—The Haverhill Electric Company is installing a 5000-kw. Westinghouse turbine. J. E. Frank is superintendent.

HUDSON, MASS.—The town officials are planning the installation of a 600-kw. turbine with condenser and an additional boiler in the municipal electric-light plant. George A. Brothers is manager.

IPSWICH, MASS.—The Newburyport (Mass.) Gas & Electric Company has petitioned the selectmen for permission to erect its electric transmission line across certain streets in Ipswich in order to supply electricity to Ipswich Mills.

PALMER, MASS.—The Wright Wire Company is contemplating the construction of a rolling mill in Palmer, to have a daily capacity of 200 tons of steel. The company has purchased the Stephen Jones property on the west side of the Quabog River, on which the proposed plant will be erected. The plans provide for the construction of a power house a short distance down the river, where 9000 hp. will be generated. George M. Wright of Worcester is president of the company.

WEBSTER, MASS.—Work has been started by the Webster & Southbridge Gas & Electric Company on an addition to its plant in Webster to provide space for five new boilers of 400 hp. each, together with coal-handling and conveying machinery. Overhead bunkers will be built.

BLOOMFIELD, CONN.—The Board of Selectmen is considering extensions to the electric street-lighting system. The service is supplied by the Hartford (Conn.) Electric Light Company.

NEW HAVEN, CONN.—The Public Utilities Commission has given its approval to the petition of the Connecticut Company to erect electric transmission lines in New Haven and North Haven.

NEW HAVEN, CONN.—The Rock River Company, which is developing the water power of the Naugatuck Valley, at an estimated cost of between \$4,000,000 and \$5,000,000, expects to have the dam built near Stevenson and the water power developed by the latter part of 1918. J. Henry Roraback, attorney for the company, has consulted with Charles J. Bennett, highway commissioner, on the project to build a State highway to take the place of the road that is to be eliminated in connection with the construction of the proposed dam near Stevenson.

NORWICH, CONN.—The Eastern Connecticut Power Company has purchased the Warner property at Trading Cove. The use to which it is to be put has not been made public.

TORRINGTON, CONN.—The proposal to construct three reservoirs, near Torrington, to cost about \$1,300,000, is reported to be under consideration. C. H. Preston, Jr., of Waterbury is engineer.

WALLINGFORD, CONN.—The installation of an additional 250-hp. Porcupine boiler, with piping, etc., at the municipal electric-light plant is under consideration. A. L. Pierce is manager.

Middle Atlantic States

BORDER CITY, N. Y.—The Empire Gas & Electric Company has taken over the plant and holdings of the Empire Coke Company. The latter company furnishes gas to the former company, which supplies the cities of Auburn and Geneva and the towns of Waterloo, Seneca Falls and Lyons.

BROOKLYN, N. Y.—Plans have been filed by the E. W. Bliss Company for the erection of a large factory in Fifty-third Street near First Avenue, South Brooklyn. The new building will be 380 ft. by 200 ft., seven stories high, and will cost about \$1,400,000.

BUFFALO, N. Y.—The report of Bernard J. McConnell, fire chief, submitted to the City Council, giving an estimate of placing the wires of the fire and police departments underground in various sections of the city,

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

places the cost at about \$40,000. If it should be decided to place the wires in Genesee Street, from Jefferson to Bailey, underground, the additional cost is estimated at \$20,000.

CITY ISLAND, N. Y.—Plans are being prepared by the Kyle & Purdy Shipbuilding Company, Fordham Street, for the construction of a one-story power house.

IRVINE, N. Y.—Work has begun on the construction of a new power house for the National Forge & Tool Company in Irvine. When completed the plant will furnish electricity for lamps and motors in the village as well as to operate the works of the company.

NEW YORK, N. Y.—The capital stock of the Electric Reduction Company, 50 East Forty-first Street, has been increased from \$100,000 to \$500,000, to provide for extensions and improvements.

NEW YORK, N. Y.—The contract for the installation of a vacuum cleaner system in the Hotel Commonwealth has been awarded to the Spencer Turbine Cleaner Company of Hartford, Conn. The work consists of a central plant in the basement, with piping extensions to several hundred stations.

NIAGARA FALLS, N. Y.—The Prospect Electric Company of Niagara Falls has secured contracts for the electrical installations at the large plants of the National Electrolytic Company and the Niagara Alkali Company of Niagara Falls.

NORTH TONAWANDA, N. Y.—The capital stock of the Tonawanda Power Company has been increased from \$250,000 to \$750,000.

ROCHESTER, N. Y.—Notice has been filed by the Rochester Railway & Light Company of an increase in capital stock from \$10,250,000 to \$17,250,000 for expansion.

SALAMANCA, N. Y.—Contract has been awarded by the Board of Water, Light and Power Commissioners to G. F. Miller & Son, 58 East Elm Street, for the construction of an addition to the municipal electric-lighting plant.

JAMESBURG, N. J.—Plans are being prepared by F. H. Bent, State House, Trenton, for the installation of a new heating system to cost about \$5,000 at the New Jersey State Home for Boys.

NEWARK, N. J.—Plans have been prepared by the Butterworth-Judson Company, Avenue R, for the erection of a new one-story power house, about 85 ft. by 95 ft., at its works on Roanoke Avenue, to cost about \$24,000.

NEWARK, N. J.—Plans are being considered by the Public Service Railway Company for extending its electric railway system from Newark to Port Newark, via Avenue R, to reach the large shipbuilding plants at the latter place.

CHESTER, PA.—The Philadelphia (Pa.) Electric Company, it is reported, because of war conditions, has abandoned temporarily the construction of its proposed power plant at Beach and Palmer Streets, the preliminary work for which was started last fall.

CONNELLSVILLE, PA.—The West Penn Power Company of Conneltsville has filed petitions with the Public Service Commission asking for approval of franchises and contracts with the boroughs of Carmichaels, Bentleyville, North Irwin, Clarksburg, Jefferson and Rice Landing, covering the construction of electric-lighting systems and electric-lighting contracts in the above boroughs.

FRANKFORD, PA.—Contracts will soon be awarded for the construction of an artillery range firing house, power house and bomb-proof building at the Frankford Arsenal for the United States government. Lowest bid was submitted by William R. Dougherty.

HARRISBURG, PA.—The City Council, in its annual budget for the year, has made a requisition for an appropriation of \$63,833 for electric street-lighting for a section of the city.

HARRISBURG, PA.—An ordinance has been adopted by the City Council, providing for the consolidation of the lighting, police and fire-alarm bureaus into one department, to be known as the City Electrical Bureau, and which will be in charge of Clark E. Diehl, city electrician.

HAZLETON, PA.—One of the large turbo-generators in the plant of the Harwood Electric Company was recently damaged by fire, causing a loss of about \$25,000.

LANCASTER, PA.—Notice has been filed by the Edison Electric Company with the Public Service Commission of an issue of \$75,000 in capital stock, the proceeds to be used in part payment for the acquirement of the property of the Akron Electric Light & Power Company.

MANAYUNK, PA.—Plans have been filed by the Glen Willow Ice Manufacturing Company, 3517 Main Street, for the construction of a power house, 35 ft. by 75 ft. Contract has been awarded to the Brown Construction Company, 4600 Main Street, for construction of building.

NEW BRIGHTON, PA.—The Borough Council has awarded the Beaver County Light Company a contract for lighting the streets of the borough for a period of three years.

PHILADELPHIA, PA.—The United States government is planning the erection of a one-story power house at the Frankford Arsenal, Philadelphia.

PHILADELPHIA, PA.—Plans have been prepared for alterations and improvements in the administration building of the Bell Telephone Company at Eleventh and Filbert Streets.

PHILADELPHIA, PA.—Contract has been awarded by F. A. Poth & Sons, Thirty-first and Jefferson Streets, to Charles Casper, Horner Building, for the construction of an addition to boiler house, to cost about \$18,000.

READING, PA.—Notice has been filed with the Public Service Commission by the Metropolitan Edison Company of an issue in capital stock of \$316,300, the proceeds to be used for extensions, improvements, etc.

WEST CHESTER, PA.—The Philadelphia Suburban Gas & Electric Company, which has a large electric plant on the Schuylkill River at Crombie, it is reported, is contemplating the erection of an electric transmission line from that place to Coatesville for the purpose of connecting its plant with the power plant of the Chester Valley Electric Company, to be used in case of emergencies. West Chester, Phoenixville and Pottstown are already connected. The Lenape plant is connected by a high-tension line with the Chester Valley Company's plant at Coatesville.

INDIAN HEAD, MD.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Austin Company, Bulletin Building, Philadelphia, Pa., for the construction of an addition to power house, 40 ft. by 60 ft., with other building, 30 ft. by 100 ft., at the naval proving ground at Indian Head, to cost about \$40,000; also pulping and poaching house, 60 ft. by 200 ft., with monitor and two blending towers, 38 ft. by 35 ft., and 123 ft. by 35 ft.

RIISING SUN, MD.—Bonds to the amount of \$8,000 have been sold, the proceeds to be used for improvements to the municipal electric-lighting plant.

CHARLESTON, W. VA.—The West Virginia Water & Electric Company, it is reported, is considering an increase in its capitalization to provide for expansion.

RICHMOND, VA.—Plans are being prepared for a tobacco factory for the Allen & Ginter Tobacco Company, a branch of Liggett & Myers Tobacco Company of St. Louis, Mo. The proposed building will be six stories high, main frontage 86 ft. by 286 ft.; two wings, 86 ft. by 152 ft. and 86 ft. by 109 ft. respectively, forming U-shaped building with boiler house and engine room in the rear. Automatic conveyors to deliver coal to overhead bumpers, automatic sprinkler system and four electric elevators will be installed.

WASHINGTON, D. C.—The Secretary of the Interior recently recommended and the President has approved, the inclusion within a power site reserve of about 196 acres of public land in the Big Sandy River Basin, Ore., in order that this land may be used in connection with the development of power, but not for other purposes. The land recommended for withdrawal is located near or adjacent to Big Sandy River below the mouth of Salmon River. A tract within the Eldorado National Forest, Cal., for power site purposes has also been recommended by the Secretary of the Interior and approved by the President.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 1646—miscellaneous single and two-conductor lighting and power cable and wire, and interior communication cable. New York, N. Y., Schedule 1647—miscellaneous rubber-covered duplex wire; Schedule 1649—miscel-

laneous twin conductor, plain and leaded and armored wire. South Charleston, W. Va., Schedule 1641, miscellaneous wet tool and power vibrating device drill grinders, Mare Island, Cal., Schedule 1639, 100,000 ft. plain bell wire. Application for proposed blanks should designate the schedule desired by number.

North Central States

AKRON, OHIO. Plans are being prepared by William C. Owne & Company of Cleveland, engineers, for the construction of a factory and power plant for the Akron Billwell Tire & Rubber Company of Akron.

CLEVELAND, OHIO.—The Elliott Electric Company, manufacturer of electrical devices, contemplates the erection of an addition to its plant.

CLEVELAND, OHIO.—The Canada Gas & Electric Corporation, recently incorporated under the laws of Delaware, with a capital stock of \$2,500,000, with headquarters in Cleveland, will open many branches in the principal cities throughout Canada. A branch has already been established in Brandon, Man. The company is contemplating the construction of many plants and all business will be transacted through the headquarters at Cleveland. Electric equipment, wire, generators, transmitters, etc., will be required. Cyrus S. Eaton, Cuyahoga Building, Cleveland, is president.

MONROEVILLE, OHIO.—Connections have been made with the Lake Shore Electric Shore service and the new lighting system was put in operation recently and a 24-hour service established. The municipal plant will be held in readiness for use in case of emergencies. Connections will be made next summer with both the east and west end power plants of the electric company.

OWENSBORO, KY.—Preparations are being made by the Owensboro Home Telephone & Telegraph Company for improvements to its system, including the installation of a new switchboard, etc., to cost about \$50,000. Contracts have been awarded for the work.

UZ, KY.—The West Virginia & Kentucky Coal Company, it is reported, would like to receive prices on copper wire, hangers and bonds. Thomas P. Jones of Uz is manager.

INDIANAPOLIS, IND.—The William A. Corroa Electric Company, a Missouri corporation, has been granted a charter to do an electrical contracting business in Indiana. C. E. Crowley of East Chicago, Ind., is named as agent.

KENDALVILLE, IND.—Improvements are being made to the water-works system, including the construction of a 500,000-gal. reservoir (completed) and the installation of three motor-driven centrifugal pumps, already contracted for and to be installed in April. S. E. Dickinson is superintendent.

PIERCETON, IND.—Plans are being considered to secure electricity from Winton, 7 miles west of Piercet, in the spring, to operate the municipal electric-lighting system. About 65 hp. in motors have been installed during the last year. J. R. Winsley is superintendent.

CENTRALIA, ILL.—The Southern Illinois Light & Power Company of Hillsboro has taken over the utility plants in Centralia and, it is said, will make this city a distributing center for various systems controlled by the company. The plants which will be controlled from Centralia are at Mount Vernon, Du Quoin, Chester, Sparta, Collinsville, Litchfield, Hillsboro and Nashville.

KEWANEE, ILL.—The City Council has awarded the contract for wiring the new water-works plant to Messrs. Smith and May.

MURPHYSBORO, ILL.—Application has been filed with the Public Utilities Commission by the Murphysboro & Southern Illinois Railway Company for permission to issue \$63,000 in capital stock and \$250,000 in bonds. The company is constructing a railway between Murphysboro and Carbondale, and the new capital is desired to extend the car line from Carbondale to Carterville or to Herrin.

ROCKFORD, ILL.—The Rockford Electric Company is equipping its former power plant at the corner of Wyman and Chestnut Streets as an auxiliary heating station.

MINNEAPOLIS, MINN.—Plans have been announced for the reconstruction of the Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company's railway from the Minneapolis terminal at Seventh Street and Third Avenue, N., to Northfield and Faribault, to cost approximately

\$750,000. If the plans go through the road will be equipped for electrified operation for freight and heavy traffic as well as for passenger traffic. C. T. Hainboer, who was receiver for the railroad, is in charge of the proposed plan.

ST. PAUL, MINN.—The Twin City Rapid Transit Company of Minneapolis is erecting an automatic substation at Concord and Isabel Streets, St. Paul. The new station will have an output of 2000 hp.

EDDYVILLE, IOWA.—An election will be called within 60 days to vote on the proposal to issue \$10,000 in bonds for improvements to the municipal electric-light plant. It is proposed to change the system from direct current to alternating current. A Lieberman is manager.

GRUNDY CENTER, IOWA.—The Grundy Center Electric Company is erecting about 5 miles of electric transmission lines to supply electricity in the farming districts. J. B. Calderwood is owner and manager.

SUMNER, IOWA.—The erection of an electric transmission line between Sumner and Tripoli is reported to be under consideration.

GREGORY LANDING, MO.—The Gregory Drainage District is contemplating the construction of a pumping station, to cost about \$75,000. The Edmund T. Perkins Engineering Company of Quincy, Ill., is engineer.

KANSAS CITY, MO.—The Southwestern Bell Telephone Company has awarded the general contract to the Swenson Construction Company, Shubert Theater Building, for construction of a new telephone building 14 stories and basement, at the corner of Eleventh and Oak Streets, to cost about \$800,000.

KANSAS CITY, MO.—The city officials have authorized R. E. McDonnell, of the engineering firm of Burns & McDonnell, and Burton Lowther, chief engineer of the water department, to make surveys to establish the first unit of a municipal electric-light plant in conjunction with the Turkey Creek pumping station of the water works system. It is proposed to install a plant at the Turkey Creek station to provide electricity for that district bounded by Twelfth and Thirty-fifth Streets, from Main Street to the State Line.

OREGON, MO.—The City Council is considering the purchase of electricity to operate the municipal electric-lighting system from the St. Joseph Transmission Company for a period of ten years.

ST. LOUIS, MO.—F. C. Adams of St. Louis has been appointed chairman of the committee representing the electrical interests of St. Louis on the board of a permanent organization which has been formed to urge the advantages which this city possesses as a center for the manufacture of materials for the government which will be needed in the prosecution of the war.

BELFIELD, N. D.—The City Council is considering the purchase of the Chrysler Light & Power Company, to be owned and operated by the municipality.

BLOOMFIELD, NEB.—The Nebraska Electric Company of Cedar Rapids, Iowa, has been granted permission by the State Railway Commission to erect an electric transmission line between Bloomfield and Hartington. The company operates electric plants at both towns and desires to connect them for commercial purposes. This, it is understood, is the beginning of a transmission system to cover most of northeastern Nebraska.

OMAHA, NEB.—The City Council has decided to install an ornamental lighting system on Leavenworth Street, from Sixteenth Street to Park Avenue. Lamps similar to those on Farnam Street will be used.

CHANUTE, KAN.—Contracts have been awarded by the Commissioners of Public Utilities for improvements to the municipal electric-light plant as follows: For building to George A. Copley of Chanute, at \$4,440, and to the Merkle Machinery Company, Inter-State Building, Mo., for boilers and machinery, at \$19,900.

MACKSVILLE, KAN.—The local electric light plant, it is reported, was recently damaged by fire.

WICHITA, KAN.—Bids will be received by the Wesley Hospital Commission, care of O. A. Rorabaugh, chairman of building commission, Wichita, until Jan. 15 for construction of hospital building, five stories and basement, 236 ft. by 44 ft., with wings, 44 ft. by 16 ft., and 58 ft. by 44 ft., including steam heating, plumbing, electric wiring, telephone system, silent call system, ventilating fans, vacuum cleaner, freight and passenger elevators, etc. The cost of the first unit is estimated at \$250,000. Richards, McCarty & Bulford, Columbus, Ohio, are architects. A. H. Kagy, 402 Sedgwick Block, is local manager.

Southern States

LEXINGTON, N. C.—The Columbia Power Company has filed an amendment to its charter increasing its capital stock to \$250,000. Dermitt Shemwell is president.

SOUTHERN PINES, N. C.—John T. Patrick of Southern Pines, it is reported, is in the market for electrical machinery (second-hand) for a water-power development of from 25 to 50 hp.

ATLANTA, GA.—Plans have been adopted by the City Council for the installation of an electric generating plant at the city crematory, to cost about \$75,000. The Georgia Railway & Power Company has agreed to purchase all electrical energy generated at the plant, paying for it at the same rate that the city now pays the company for electricity for lighting and power purposes.

PORT WENTWORTH, GA.—Plans have been prepared by Sprout, Waldron & Company of Muncy, Pa., for the construction of a meal mill and grain elevator for the Port Wentworth Mill & Elevator Company, recently organized. Fred C. Beckham is manager.

GAINESVILLE, GA.—The Southern Bell Telephone & Telegraph Company has awarded contract to A. J. Krebs & Son of Atlanta, for construction of new exchange building in Gainesville. The company also plans to change all stations to drop system and place overhead wires in the business district underground. The cost of the improvements is estimated at \$50,000.

JACKSONVILLE, FLA.—The Jacksonville Traction Company has been granted a franchise by the County Commissioners to construct a car line from Ortega to Camp.

MEMPHIS, TENN.—The Memphis Gas & Electric Company has purchased 1100 acres of coal lands at Mannington, Christian County, with two mines already developed, which it will operate to obtain its coal supply.

FLORENCE, ALA.—Contract has been awarded by the Ammonium Nitrate Air Nitrates Corporation, controlled by the United States government, for designing and constructing manufacturing buildings, workmen's houses, streets, sewers for a complete plant, excepting power plant, for the manufacture of ammonium nitrate, near Muscle Shoals, to the Westinghouse, Church, Kerr Company, 37 Wall Street, New York, N. Y. J. W. Young of New York, N. Y., is superintendent of construction at Florence; F. E. Caldwell of New York, N. Y., is resident engineer at Florence.

MOBILE, ALA.—The Mobile Electric Company is planning to erect an electric transmission line (5 miles long) to supply electricity to the plant of the Chickasaw Shipbuilding Company, now under construction.

MOBILE, ALA.—The Mobile & Ohio Railroad Company is contemplating improvements to grain elevator and pier on which it is located, involving an expenditure of about \$115,000. The proposed work will include reconstruction of a 250,000-bushel grain elevator, which has been out of commission 10 years; replacing steam power with electrically-operated machinery, building 600 ft. of overhead conveyor in order to convey grain to ships. R. C. Stone Engineering Company, Merchants' Exchange Building, St. Louis, Mo., will have charge of installation of elevator machinery. B. A. Wood, chief engineer of maintenance of ways and structures of the company, will have charge of the proposed improvements.

ONEONTA, ALA.—The plant and holdings of the Oneonta Utility, Water & Light Company have been purchased by the Alabama Water Company. The new owners, it is stated, will install new pumps, mains and fire hydrants at once.

GULFPORT, MISS.—The local power house of the Gulfport & Mississippi Traction Company, which supplies electricity in Gulfport, Ocean Springs, Pass Christian, Hattiesboro and Biloxi, was recently badly damaged. The plant had been idle for some days owing to a strike.

MAGEE, MISS.—Contract has been awarded to the Inglenook Construction Company of Birmingham, Ala., for the construction of buildings for nurses' home, servants' building, power house and cold-storage plant at the Mississippi State Tubercular Sanatorium. B. Price, 518 Empire Building, Birmingham, Ala., is architect. For information address Dr. Henry Boswell, at Magee.

BARATARIA, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department Washington, D. C., until Jan. 21 for constructing two 125-ft. steel towers on concrete and timber pile foundations, one 12,000-gal. water tank, dormitory and receiving buildings with equip-

ment and water, electric-light and power and sewerage systems at the Naval Radio station at Barataria Bay, La. Drawings and specifications (No. 2686) may be obtained upon application to the above bureau or to the commandant of the naval station, New Orleans.

THIBODAUX, LA.—The Southern Traction & Utilities Company, it is reported, is planning to construct an electric railway from Donaldson to Bayou Lafourche, a distance of 56 miles. Practically all of the right of way has been secured. C. C. Barton of Albemarle is president of the company.

BRISTOW, OKLA.—The City Council is considering taking over the local electric-light plant, to be owned and operated by the municipality. The price, it is understood, is placed at \$25,000.

CHANDLER, OKLA.—The Chandler Electric Company, it is reported, is contemplating the construction of a new power house and installation of new equipment.

HOOKER, OKLA.—The electrical apparatus in the municipal electric-light plant was recently destroyed by fire, causing a loss of about \$22,000. There was no insurance and the city will have to issue bonds to install a new plant.

MIAMI, OKLA.—Plans are being considered by the Bilharz Mining Company for the construction of a central electric power plant to supply energy for plants 1, 2 and 3.

SAPULPA, OKLA.—The board of education has awarded the general contract to the Manhattan Construction Company of Muskogee for construction of high school building at \$179,872. Contract for heating and electric wiring has not yet been placed.

SEMINOLE, OKLA.—At an election held recently bonds to the amount of \$5,000 were voted for the installation of an electric-light plant.

BURNET, TEX.—The power house at the mine of the Southwestern Graphite Mine was recently destroyed by fire, causing a loss of about \$6,000.

McALLEN, TEX.—The Rio Grande Public Service Corporation contemplates extensive improvements to its local plant, involving an expenditure of about \$40,000. R. F. McCord is manager.

ORANGE, TEX.—The Orange (Tex.) County Irrigation Canal Company is contemplating the installation of a new pumping plant, to cost about \$25,000.

SABINAL, TEX.—The electric plant and ice factory of the Sabinal Light & Ice Company has been purchased by R. T. Robinson of San Antonio. The new owner, it is understood, will enlarge the plant and make other improvements to the property.

SAN BENITO, TEX.—The Commonwealth Electric Light & Water Company is planning to enlarge its power house and will install a new 100-hp. engine and other equipment in its plant.

SAN MARCOS, TEX.—Bids will be received until Jan. 14 by A. C. Goeth, of Austin, president of the State Normal School Board of Regents, Austin, for the construction of buildings, including heating, plumbing and wiring, for the Southwest Texas State Normal School at San Marcos and Sam Houston State Normal School at Huntsville. C. H. Page & Brothers of Austin are architects for the school at San Marcos, and Endress & Watkins, Austin and Houston, are architects for the school at Huntsville.

Pacific and Mountain States

SEATTLE, WASH.—The City Council has authorized the erection of a substation for the Light Department on B 166 Gilman Park Addition, and appropriated \$20,000 for same.

SEATTLE, WASH.—An ordinance has been introduced in the City Council directing the Board of Public Works to purchase the railway and equipment of the Loyal Railway Company, to be operated as a part of the municipal street car system. Harry Whitney Treat, owner of the Loyal Heights line, has agreed to sell the property for \$40,000.

SHELTON, WASH.—The Commissioners of Mason County have granted the Shelton Light & Power Company a franchise to erect and operate electric transmission lines over the highways of Mason County.

SPOKANE, WASH.—Plans have been prepared by the Washington Water Power Company for extending its electric transmission line into Coeur d'Alene. The company is planning to issue \$2,800,000 in notes, of which \$640,000 will be used for extensions and improvements and the remainder for refunding purposes.

TACOMA, WASH.—Plans are being considered for placing the electric wires of the Municipal Electric Light Department underground, for which estimates of cost are being prepared.

BANDON, ORE.—Contract has been awarded by the Glenisch & Joplin Condensed Milk Company of Portland to the Northwest Process Company of Portland for the construction of a milk condensing plant in Bandon, to cost about \$100,000. The building, 106 ft. by 240 ft., two stories, will be located on the water front with a detached power house, 40 ft. by 60 ft.

BYRON, CAL.—Improvements are being made by the Sierras & San Francisco Power Company of San Francisco, which supplies electricity in this district, involving an expenditure of \$25,000, to meet the demands for electrical service for irrigation and other purposes. The work will include the erection of a 17,000-volt transmission line from pumping plant No. 1 of the Byron-Bethany system to plant No. 4, near the Brentwood border, a distance of about 12 miles. Later the local distribution lines in Byron and Brentwood will be rebuilt.

CHICO, CAL.—The City Council is considering a proposal submitted by the Northern California Power Company for lighting the streets of the city for a period of four years. The company agrees to furnish electricity to maintain the entire system at \$275 per month. The contract provides for larger lamps in the residence districts, the cost of which has not yet been determined, and which the city will bear.

CORONA, CAL.—The Southern Sierras Power Company, which operates in Inyo, Kern, San Bernardino and Riverside Counties, is planning to take over the property and holdings of the Corona Gas & Electric Light Company, which operates in Riverside County. Both companies are practically owned by the same interests.

EUREKA, CAL.—The Rolph Shipbuilding Company has taken over the Bendixson ship timber mill, which it proposes to enlarge and equip for electric motor drive. Electrical service is supplied by the Western States Gas & Electric Company, which is installing a larger transformer at the yards of the company.

HANFORD, CAL.—The city trustees have entered into a contract with the H. G. Lacey Company for service for the downtown electric-lighting district for a period of two years, at \$11,400.

LA GRANGE, CAL.—The Railroad Commission has authorized the Sierra & San Francisco Power Company to use \$13,670 from the sale of its \$1,000,000 bond issue for additions and improvements to the La Grange division of the Yosemite Power Company, recently purchased by the company.

OAKLAND, CAL.—The Commission Merchants' Protective Association has petitioned the City Council for the installation of additional street lamps on lower Franklin Street.

OAKLAND, CAL.—The Kings Electric Company, Oakland Bank of Savings Building, has been awarded contract for electrical work in public library building at Fifty-sixth Street and San Pablo Avenue, at \$1,955; also for public library building at Fifty-second Street and Telegraph Avenue, at \$1,955.

PALO ALTO, CAL.—The City Council has decided to call a special election to vote on the proposal to issue \$66,000 in bonds for the purchase of a Diesel engine and electric generator for the municipal electric-light plant.

RIVERSIDE, CAL.—The National Ice Company, it is understood, is contemplating using electricity instead of water power to operate its plant.

RIVERSIDE, CAL.—The Board of Public Utilities Commission has decided to offer for sale to the Southern California Edison Company all the city pole line north of the city limits, provided it will move the point of delivery from Palm and Mount Vernon Avenues in San Bernardino County to the Riverside city limits on La Cadena drive. If the sale is not consummated a rental agreement may be made whereby the Edison company will secure the use of the poles for an extension of its transmission lines to the city limits.

SAN BERNARDINO, CAL.—Extensive improvements are contemplated by the Atchison, Topeka & Santa Fe Railroad Company at its local works which include the construction of a new blacksmith shop, an electric power plant and subway. The cost of the electric plant and blacksmith shop is estimated at \$240,000.

SALT LAKE CITY, UTAH.—A permit has been granted the Latter Day Saints Church to erect a power plant, to cost about \$30,000.

SALT LAKE CITY, UTAH.—An agreement subject to the approval of the State Public Utilities Commission is to be entered into between the Commissioners of Salt Lake County, the Utah Power & Light Company and the Progress Company for lighting the public roads and streets of the county with electricity for a period of 20 years. Under the terms of the contract the company is to furnish a minimum of 400 lamps.

LIBERTY, ARIZ.—The mining company at Liberty, it is reported, contemplates the installation of electric lighting, water and sewer systems for the proposed town near the mine. Lescher & Kibbey of Phoenix are engineers.

CASPER, WYO.—The electric plant of the Natrona Power Company was recently destroyed by fire, causing a loss of about \$150,000.

CARSON CITY, NEV.—The Board of City Trustees is considering extending the street-lighting system throughout the city. The Truckee River General Electric Company of Reno furnishes electrical service in Carson City.

RATON, N. M.—The Superior Coal Company of Raton, it is reported, is in the market for a second-hand storage battery locomotive, 36-in. gage, with 12 nickel-iron batteries, preferably Jeffrey make.

SILVER CITY, N. M.—The large Diesel engine in the plant of the Silver City Power Company was recently damaged by an explosion, causing a loss of about \$10,000.

Canada

BASSANO, ALTA.—The purchase of an electrically driven pumping unit, to cost about \$2,000, is under consideration by the Water Works Department. George W. Murtagh is engineer.

NELSON, B. C.—Application has been made to the council by the Kootenay General Hospital for the installation of an electric-lighting system, to cost about \$1,180.

VANCOUVER, B. C.—The British Columbia Telephone Company is planning to lay another submarine cable across False Creek, work on which will soon begin.

VANCOUVER, B. C.—An electric-lighting plant, it is understood, will be installed at the shipbuilding yards of J. J. Coughlan & Sons; also 12 electrically operated cranes.

BARTON TOWNSHIP, ONT.—The township of Barton is considering the purchase of electrical equipment, to cost about \$55,000.

GALT, ONT.—A by-law has been passed by the ratepayers appropriating \$45,000 to pay for extension to municipal hydroelectric system.

MERRICKVILLE, ONT.—The Rideau Power Company has authorized the Hydro-Electric Power Commission of Ontario to prepare plans and purchase the necessary equipment for high-tension service for its power house in order to supply power to the commission.

RENFREW, ONT.—The International Molybdenum Company is planning to remove its plant from Orillia to Renfrew. Power for operating the plant will be secured from the Calabogie Light & Power Company.

TORONTO, ONT.—The Hydro-Electric Power Commission, it is reported, is planning to build a third tunnel at the plant of the Ontario Power Company (the plant purchased by the Hydro-Electric Commission), which it is expected will develop an additional 50,000 hp., to be utilized by plants manufacturing munitions for the war. Work, it is understood, will begin at once and will be completed within a few months. The cost is estimated from \$1,500,000 to \$2,000,000.

WELLINGTON, ONT.—The Town Council is considering an issue of \$10,000 in debentures for the purpose of purchasing the local electric-lighting system and remodeling it. The Niles estate, owner of the distributing system, has agreed to sell it to the town for \$3,000.

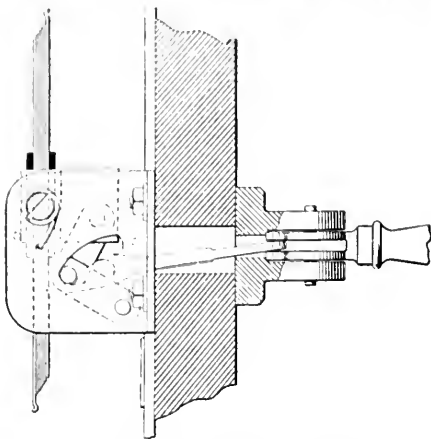
WHITBY, ONT.—Work has begun in Whitby on a track from the station on the Grand Trunk main line to the military hospital on the lake front. This road will be the initial unit of street railway system in Whitby, authorized by a vote of the municipality in adopting the Hydro radial proposal from Toronto to Whitby.

VALLEYFIELD, QUE.—The Montreal Cottons, Ltd., it is understood, will rebuild its power plant, recently destroyed by fire, at once, causing a loss of about \$100,000. The plant had a generating capacity of 4300 hp.

(Issued Dec. 18, 1917)

1,250,129. INCANDESCENT ELECTRIC LAMP SOCKET. Carl H. Russell, Syracuse, N. Y. App. filed June 22, 1911. Comprises, generally, a base having two sections, one of the sections being formed with a recess opening through the end face thereof opposed to the other section, and such other section serving as a closure for the recess, wire terminals and lamp-contact terminals carried by the base, a switch being placed in the recess.

1,250,110. PROCESS FOR LOOSENING THE SKINS OF TOMATOES AND THE LIKE; William H. Chapman, Portland, Me. App. filed April 25, 1917. A comb conductor charged with high-voltage alternating



1,250,324.—Electrical Switch Instrumentality.

electricity is located adjacent to the tomato and the apparatus is so formed and manipulated that all portions of the skin are presented to the discharging points.

1,250,142. BUFFER FOR RAILWAY CARS; Samuel S. Cole, Cokeburg, Pa. App. filed May 8, 1917. Improvements.

1,250,146. ELECTROLYTIC APPARATUS; John Coulson, Wilkinsburg, Pa. App. filed Jan. 6, 1917. Improvements.

1,250,152. AUTOMATIC SWITCH; Carl W. Eisenmann, Nebraska City, Neb. App. filed April 5, 1916. For use in connection with storage-battery systems.

1,250,164. SYNCHRONOUS-BOOSTER ROTARY CONVERTER; Floyd T. Hague, Pittsburgh, Pa. App. filed Nov. 12, 1915. Provides means for the exact regulation of the commutating field in order to insure effective commutation under all conditions of load.

1,250,175. JUMPER CABLE TAP; Albert F. Hills, Syracuse, N. Y. App. filed June 19, 1911. Comprises, generally, a body, a fixed jaw carried by the body, and a spring-pressed jaw movable toward and from the fixed jaw.

1,250,188. ENGINE-STARTING SYSTEM; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed Sept. 13, 1913. Improvements.

1,250,192. TELEPHONE REPEATING INSTRUMENT; Charles D. Lanning, Boston, Mass. App. filed Jan. 21, 1901. Improvements.

1,250,210. FLUID-PRESSURE-CONTROLLED SWITCH; Harry Y. Norwood and Fred K. Taylor, Rochester, N. Y. App. filed May 20, 1915. Improvements.

1,250,211. CONTROL SYSTEM; Stanley G. Nottage, Wilkinsburg, Pa. App. filed Oct. 9, 1915. For dynamo-electric machines.

1,250,231. ELECTRICALLY PROPELLED VEHICLE; Theodore H. Schoff, Pittsburgh, Pa. App. filed May 3, 1915. Improvements.

1,250,243. SYSTEM OF DISTRIBUTION; Norman W. Storer, Pittsburgh, Pa. App. filed April 4, 1914. Means for supplying a suitably low voltage to a receiving circuit from a supply circuit of relatively high voltage.

1,250,250. HIGHWAY SIGNALING APPARATUS FOR RAILROAD SERVICE; Eugene W. Vogel, Oak Park, Ill. App. filed June 5, 1914. Grade crossings.

1,250,286. ELECTROLYTIC APPARATUS; John Coulson, Wilkinsburg, Pa. App. filed Jan. 6, 1917. Means for forming each set of plates composing such apparatus from a single set of film-forming material.

1,250,290. CONTROL MECHANISM FOR PREVENTING EXCESSIVE SPEED OF MOTOR

Record of Electrical Patents

Notes on United States Patents

VEHICLES; Richard A. Dunern, Adelaide, South Australia, Australia. App. filed Dec. 28, 1915. Improvements.

1,250,302. ELECTRIC LIGHT CONTROLLER; Raphael A. Granquist, West Duluth, Minn. App. filed April 8, 1914. The apparatus is constructed in such a manner as to permit of its being housed in the canopies of the fixtures so as to be concealed from view and yet ready of access should repairs be necessary.

1,250,324. ELECTRICAL SWITCH INSTRUMENTALITY; Hubert F. Krantz, Brooklyn, N. Y. App. filed March 13, 1915. Creates a compact few-part switch-moving mechanism conducive to a greatly simplified panelboard arrangement.

1,250,342. RECEPTACLE FOR ELECTRIC LAMPS; Axel V. Olson, San Francisco, Cal. App. filed July 8, 1914. Sign receptacle.

1,250,387. ELECTRIC INSULATOR; Percy H. Thomas, Upper Montclair, N. J. App. filed May 16, 1913. Insulator is of the suspension type and is adapted to extra-high-tension service.

1,250,401. ELECTRIC HAMMER; Alex. Wendelburg, New York, N. Y. App. filed July 28, 1914. Improvements.

1,250,467. PIPE CLAMP; Frederick I. Johnson, Warren, R. I. App. filed Feb. 1, 1917. For grounding or bonding electric wires.

1,250,501. ELECTRIC SWITCH; Clarence D. Platt, Bridgeport, Conn. App. filed Aug. 2, 1916. Improved.

1,250,502. COMBINATION ELECTRIC SWITCH; John E. Powers, Pike, N. Y. App. filed Jan. 8, 1917. For use in connection with automobiles or other vehicles.

1,250,536. ELECTRIC DISTRIBUTING SYSTEM; William L. Waters, Milwaukee, Wis. App. filed May 25, 1914. Improvements.

1,250,708. EMERGENCY STOP FOR ELECTRICALLY DRIVEN APPARATUS; Caswell D. Swett, Redwood City, Cal. App. filed April 5, 1916. Improvements.

1,250,716. HOLDER FOR TELEPHONE RECEIVERS; Katherine G. Townsend, New York, N. Y. App. filed Jan. 27, 1917. Low-cost device.

1,250,718. DYNAMO-ELECTRIC MACHINE; William A. Turbayne, Niagara Falls, N. Y. App. filed Dec. 24, 1912. Adapted for efficient operation as a motor where great variations in speed are desired.

1,250,719. VARIABLE-SPEED MOTOR; William A. Turbayne, Niagara Falls, N. Y. App. filed Dec. 31, 1912. Improved means for reducing the effects of armature reaction at high speed.

1,250,720. STARTING AND LIGHTING SYSTEM; William A. Turbayne, Niagara Falls, N. Y. App. filed Dec. 26, 1912. Close inherent regulation is obtained.

1,250,731. X-RAY SYSTEM; Harry F. Waite, New York, N. Y. App. filed March 22, 1917. Hot cathode is employed.

1,250,743. ELECTRICALLY PROTECTED HOLDER FOR POCKETBOOKS AND SIMILAR ARTICLES; John P. Williams, New York, N. Y. App. filed July 28, 1915. Improved.

1,250,746. TIME-LIMIT TRIPPING MECHANISM; George Wolff, Berlin, Germany. App. filed Jan. 21, 1914. Improvements.

1,250,752. APPARATUS FOR PRODUCING AN ELECTROMOTIVE FORCE FOR SPECIAL WAVE FORM; Ernest F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 22, 1914. Improvements.

1,250,754. ELECTRIC-CIRCUIT CONTROLLER; Johan M. Andersen, Boston, Mass. App. filed April 29, 1914. Means for locking the movable member of the switch in its closed position, so as to prevent accidental opening of the switch.

1,250,757. ELECTRODE USED IN THE ELECTROLYTIC PROCESS OF REFINING METALS; Frank L. Antisell, Perth Amboy, N. J. App. filed Feb. 8, 1913. Improvements in anodes and cathodes used in the multiple system in the electrolytic process of refining copper and other metals.

1,250,769. SIGNALING SYSTEM; Clarence E. Beach, Binghamton, N. Y. App. filed

Dec. 18, 1916. May be employed as combination fire-alarm and police signaling systems, as combination watchman's time detector and fire-alarm systems, as combination watchman's time detector, fire-alarm and police call systems, and as combination fire dismissal and fire-alarm systems adapted for use in factories and buildings where many persons congregate.

1,250,782. ELECTRIC CLOCK; John G. Blessing, Chicago, Ill. App. filed April 2, 1917. Ratchet mechanism and electric switch are simplified.

1,250,804. SELECTIVE SIGNALING SYSTEM; Leslie E. Coon, Chatham, N. J. App. filed June 18, 1917. Provides means whereby an audible signal, such as a single-stroke bell, may be operated at all stations simultaneously and in consonance with impulses from an extraneous source, such as time signals over a telegraph line.

1,250,806. TIME-LIMIT RELAY; James R. Craighead, Schenectady, N. Y. App. filed Sept. 2, 1914. Improvements.

1,250,815. INCANDESCENT LAMP; Frank M. Dorsey, Cleveland, Ohio. App. filed Feb. 5, 1914. Tungsten or like metal.

1,250,834. CURRENT REGULATOR; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed June 21, 1912. Relates to constant-current regulators and to systems of distribution embodying the same.

1,250,835. ELECTRICAL DISTRIBUTING SYSTEM; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed June 21, 1912. Special relation to alternating-current rectifying systems comprising constant-current regulators.

1,250,854. ELECTRICAL REGISTERING SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed June 29, 1916. Telephone.

1,250,856. ELECTRIC SOLDERING IRON; James T. Griffin, Oak Park, Ill. App. filed Jan. 3, 1916. Separable parts.

1,250,870. MAGNETO-DYNAMO UNIT; Otto Heins, New York, N. Y. App. filed Aug. 12, 1915. Improvements.

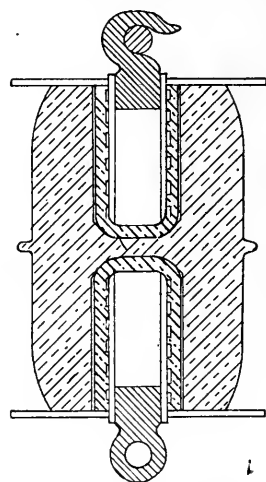
1,250,879. METHOD OF AND APPARATUS FOR FRACTIONATING HYDROCARBONS; Leon E. Hirt, Los Angeles, Cal. App. filed Oct. 21, 1916. Simple and highly effective manner.

1,250,885. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Carl A. W. Hultman, Stockholm, Sweden. App. filed March 15, 1915. Improvements.

1,250,904. CIRCUIT BREAKER; Bennett M. Leece, Cleveland, Ohio. App. filed Aug. 23, 1916. Adapted for use with ignition systems.

1,250,906. CONTROL SYSTEM FOR ELECTRIC MOTORS; Jesse J. Linebaugh, Schenectady, N. Y. App. filed July 30, 1914. Improvements.

1,250,921. TELEPHONE APPARATUS; Harold T. Martin, New York, N. Y. App. filed July 28, 1914. Provision of convenient means in connection with the device for



1,250,387—Electric Insulator

readily connecting a plurality of instruments in circuit with the conductors of the reel.

(Issued Dec. 25, 1917)

14,416. (Reissue). FUSE DEVICE; Edmund O. Schweitzer and Alfred Herz, Chicago, Ill. App. filed April 3, 1907. Prevents arcing upon the operation of the fuse and thereby permits the use of fuses on currents of high potential with perfect safety.

Electrical World

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The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Volume 71

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Number 3

The Urgent Need for Coal

COMMON experience throughout the eastern and central sections of the country with reference to the coal problem is such as to indicate that the solution of the task calls for large statesmanship in Washington. In all directions we are urged to curtail, even to check, industries, if necessary to save fuel. The disposition is to suppress. Every news item breathes of drastic measures. Nowhere is there a ray of hope for better conditions. We get promises, conferences and priority orders, but little relief. Notwithstanding the testimony of the soft-coal producers and the added assurances from miners themselves that the present coal shortage is inexcusable so far as they are concerned, no one apparently has taken steps to do what seems most vital—increase the production of coal to a point commensurate with present demands. It is admitted that the solution of the immediate problem rests primarily with the railroads. Given sufficient cars, the miners and operators promise to supply the coal. Under the government control, hundreds of passenger trains have been taken off to make room for freight movement, and with what result every traveling man and shipper knows. The congestion remains. The public will endure from the government what it would not tolerate for one moment from the railroad companies. Power to remedy conditions is not lacking—the government has it all; but we are still looking for the man with vision and foresight to apply that power—for the Moses who is to lead us out of this wilderness. Surely there are men big enough, patriotic enough and willing enough to take charge of the whole question of coal production, transportation and distribution and co-ordinate this work effectively. The task demands the best brains available and the country will not be satisfied with less. Action is also necessary. We have dallied too long with a serious situation.

The Close of the Eighth Crusade

ON Dec. 10 last the official entry of the British and allied forces into Jerusalem was witnessed by the inhabitants. The procession is stated by General Allenby to have been entirely on foot, after the manner appropriate to pilgrims at the gates of the tomb of Christ. Seven centuries have elapsed since the previous crusade, and this last, or eighth, crusade differs from all its predecessors by having had its base in Egypt. The desert of Sinai, which separates Palestine from the Nile delta, has been heretofore passable only to caravans or relatively small bodies of men, owing

to the difficulties of water supply and transport. But in this case it was conquered by engineering. A broad-gage railroad line was laid over the desert for a distance of some 250 kilometers, and an American pipe line is stated to have been installed to carry water from the Nile to the troops as they advanced. Scouting and reconnaissance were carried on by means of airplanes in radio communication with the advancing line. The eighth crusade succeeded not merely by valor and military skill, but also by the aid of engineering, with electricity taking its share.

Emergency Plants for France

THE coal crisis is world-wide and has already involved the mechanism of production to a serious extent. More than that, the labor required in mining and transportation is so very grave a matter in regions where man power is already short that the suggestions of Messrs. Clogher and Hammel in our current issue must be taken very seriously not only as regards France but in our own country as well. The situation in France is the more acute, but even here the quick development of considerable amounts of electric power is a step which should be taken at the earliest possible moment to help out in the present crisis.

France is in a specially bad way because coal has to be imported in large quantities under great difficulties, and its distribution puts added strain on transportation facilities already overtaxed in the conduct of the war. France has, however, a very large amount of water power, not generally in large blocks, but scattered rather widely over the central and eastern parts of the country, where it is within striking distance not only of industrial centers but even of the fighting front by modern methods of power transmission. There are a few great French projects like that for supplying Paris from the falls of the Rhone, but they are less quickly and easily developed than some of the minor ones. We need, too, in France liberal supplies of power for the necessary work back of our lines.

The suggestion of Messrs. Clogher and Hammel is an eminently workmanlike and sensible one. Experience in this country has taught that outdoor power stations and switching stations constitute now good conservative practice, and this is doubly true in the climate of France. Talk with a French or Swiss engineer of our extraordinary precautions against sleet, and he will stare at you open-eyed, wondering at the misfortunes which assail his American colleagues. Moreover, it is an indisputable fact that structures of elaborate and dignified architectural character are not in the

slightest degree necessary to house waterwheels and dynamo. They may prove impressive to the bondholder, but do not add to the effectiveness of the system. The proposition before us, therefore, is for the construction of hydroelectric units of as nearly standard type as practicable and their rapid installation, wherever feasible, to back up the industrial needs of the fighting fronts. There is nothing in the least impracticable about the idea.

The French government is probably in possession at the present moment of rather full details regarding a very considerable proportion of the water powers in France, including some of those whose development has already been studied. The efficient utilization of these would depend on the selection of such as make the least demands in the matter of time of constructing the hydraulic works, beginning operations at once, and concurrently starting production of hydroelectric units, transformers and line wires in this country. Much of the minor line material could undoubtedly be purchased in France, Switzerland or Italy more easily than it could be shipped from here. As is pointed out in the article, the delivery of the material does not make any great demand on tonnage and saves a large amount of continuous coal supply. Further, after the war is over, all these plants will prove serviceable in rebuilding the shattered industries of France, for which power will be sorely needed.

As regards the present power-plant requirement of the American army in France, we could well be undertaking it now by prompt co-operation of our own government with the French, and there are enough American engineers already on the ground to lay out and superintend the execution of the work. The distances to be covered are nothing serious from the American standpoint, and much of the construction would prove to be of permanent value. An obvious corollary of this proposition is that such plants should be thrust into service wherever possible in our own country. In this particular the lessons of the coal shortage may prove to be valuable ones. It is not often appreciated how much fuel hydroelectric plants save.

Power Requirements for Traveling Cranes

STILL another of Professor Clewell's excellent papers examines in considerable detail the special requirements of motor equipment for the traveling cranes in which it is so widely used. The electric crane needs no commendation here. It has become practically standard for all permanent work and for much temporary work. As its use has become more familiar the motor drive has been more and more refined. The things most imperative in its organization are unusual mechanical strength, accurate speed control and reliability. These have led to the development of many highly specialized devices, which Professor Clewell considers, and have resulted in apparatus which has proved exceedingly successful from every standpoint. One particular point in design to which attention should be directed is the question of efficient co-ordination between the speed and the requirements of the particular work for which the crane is designed. Here more than anywhere else is the finesse of the engineer needed in planning a successful crane equipment.

The New Bill Dealing with Water Power

A PROPOS of the dire need of increase in the development of electric power to meet our fuel difficulties, attention should be called to the administration bill concerned with this matter which will soon come before Congress. Its provisions are in no respect worse and in some respects better than those of several previous bills which have failed of passage. The present scheme provides for the institution of a federal power commission composed of the Secretaries of War, the Interior and Agriculture. To them will be given rather plenary authority over the public lands and navigable streams. The development of the bill follows somewhat the lines of those of the preceding Ferris and Shields bills. It differs from them somewhat in the disposition of the receipts obtained from power licenses, in that all these go to the Treasury of the United States, with provision for the proceeds being used in specified portions for the service of the national forests, public lands and navigable streams.

As respects the service and charges of the licensee companies, they are to be regulated in all interstate relations, and in states having no public commission charged with similar work directly by the federal water power commission. The states having commissions, of course, retain jurisdiction over the service and charges wholly within their own territory. The most important part of the bill, as of others, lies in the matter of charges and the regulations concerning the tenure of the privilege. Under the present proposal the license charges must be not less than 10 cents per horsepower per annum without any maximum fixed and for a period not exceeding fifty years. At the end of the license period the United States may take over the entire development upon a suitable payment therefor, or it may issue a new license either to the old or a new licensee on such terms as may then seem equitable. Now it is just at this point that the success of the bill may be made or broken. The expenditures put upon such a property in a license term of fifty years involve the building up of a business and interconnections probably of a very intricate kind, with other plants and powers both on the public domain and on private lands. It is not clear from the present proposals on what basis the government will be at liberty to take over part or the whole of the resulting business. The present provisions would include payment for severance damage, which seems to be a more reasonable provision than has heretofore appeared.

After all, the success of this or any other water-power bill in developing water powers must in the last resort depend on the temper and policy of the government regarding private property at the end of a long but somewhat indeterminate period. If the licenses hold for fifty years, there is reasonable opportunity for making financial provisions which will take care of this element of doubt. If a policy of relatively short-term licenses should be inaugurated, the financial side of the matter would be left hung up in the air. It would be better to assure licenses for a minimum period long enough to allow the enterprise to be properly and profitably developed, and there seems no good reason why the fifty-year term should not be regularly specified, considering the large powers which lie with the com-

mission in the way of regulating service and charges. The uncertain factors in any short-term development must necessarily be reflected in the price paid for power. The present bill provides a complete defence for the consumer, and therefore there would seem to be no reasonable excuse for shortening the term of the license, and there might be good reason for lengthening it. The chief need is to pass speedily the best available regulations, under our existing limitations of knowledge of the future, to encourage speedy development of all the available powers. We need them sorely, and every bit of delay adds to the gravity of the situation. A liberal policy toward the investor will hasten the construction of much needed works; an illiberal one which leaves his future in grave uncertainty will simply serve to cause further delay.

Inherent Voltage Regulation of Direct-Current Units

A DIRECT-CURRENT generator unit may consist of the electric generator and its prime mover, say a steam turbine. Such a unit, when supplied with steam of definite pressure and quality at the throttle, will deliver current at a rated voltage. If the throttle is left open and the field rheostat of the generator is untouched, the delivered voltage will vary in a definite manner as the load is applied to the generator. If the machine is a shunt generator, the voltage may be expected to fall very appreciably as the load comes on. This is partly due to the fall in speed of the prime mover, and partly due to the IR drop in the generator armature, as well as to the reduced generator-field excitation.

In numerous cases where the unit is supplied by one and the same manufacturer the total inherent voltage drop under load can be estimated in advance from previously acquired data concerning the prime mover and the generator; so that the specifications for inherent voltage regulation in the unit seldom produce difficulty when the unit is tested before delivery. When, however, one manufacturer supplies the prime mover and another manufacturer supplies the generator, there is an obvious opportunity for disagreement between the two and the purchaser in case the inherent voltage regulation of the unit does not come up to the limits stated in the specifications.

In the case of a compound-wound generator the difficulties involved are much less, partly because the inherent voltage regulation is much better than in a shunt machine and partly because the field excitation at constant speed may be almost independent of the load, so that the correction for change in driving speed may be much smaller and easier to determine.

This question of resolving the inherent regulation of a unit into the proper proportion assignable respec-

tively to the prime mover and to the generator is discussed this week in an article by W. B. Kouwenhoven. A simple technique and procedure are outlined for the case of a compound-wound generator. These call for the experimental determination of two characteristics of the unit—namely, voltage-load characteristic at constant steam pressure and the voltage-speed characteristic at no load and with adjusted steam pressure. From these two series of observations the voltage-load characteristic of the compound-wound generator for constant speed can ordinarily be inferred within satisfactory limits of precision.

The corresponding problem in relation to a shunt generator is much more complicated, as the article points out. In practice there is first the influence of change in speed on the delivered voltage at no load for constant field excitation. Second, there is the effect of change in temperature on the shunt-field circuit influencing the terminal voltage. Third, there is the effect of IR drop in the generator armature on the terminal voltage. Fourthly, there are the effect of change of voltage on the shunt-field excitation and its influence on the generated emf. The article offers no solution for this more difficult case. A solution has, however, been claimed by some engineers, although it is complicated and open to some uncertainty.

The Power Factor of Three-Phase Systems

THE power factor, or ratio of the active to the apparent power, in any single-phase alternating-current circuit considered as carrying substantially only the fundamental frequency is readily obtained from the readings of a voltmeter, ammeter and wattmeter connected to the circuit, or it may be obtained directly from the dial of a power-factor-indicating instrument joined to the circuit. In the case of a three-phase system, however, it is rare to find a power-factor indicator installed for the system, but the system power factor can be readily computed from the voltages on two sides of the system, the current strengths in two lines, and the readings of two wattmeters, one on each side. The computation is almost as easy for an unbalanced three-phase system as for a strictly balanced three-phase system.

E. G. Barrington develops this week a method for evaluating the power factor of a three-phase system when a polyphase wattmeter is employed. The method is shown to be applicable either to three-wire or four-wire three-phase systems. The method is evidently readily applied in the case of a balanced three-phase system. When the system is unbalanced modifications are described for making the necessary corrections, but the procedure takes considerably more time and is not as simple in application.

IN NEXT week's issue of the ELECTRICAL WORLD further attention will be given to the coal situation, which is of increasing seriousness and calls for the best thought and most careful management ever demanded by any exigency in the industry. The next installment of Professor Cléwell's article will contain a discussion of the motor and control

The Coming Issues

requirements for blowers, fan and air-compressor service. A rather technical article dwelling on the effect of color, thickness and temperature on the electrical properties of vulcanized fiber will also be presented on Jan. 26. Interest attaches to the results which will be given next week of somewhat unusual tests on electric range efficiencies.



Facing the Fact of Coal Shortage

Conditions of Supply Remain Very Serious for Central-Station Companies—
How They Have Worked to Get Coal Enough to Provide a
Reserve Supply—Cost High, Quality Poor

COAL supply conditions became increasingly serious as 1917 drew to a close; and in the opening month of the new year they are not only no better, they call for all the ingenuity of private and government agencies in order that the service of electric central stations may not be disrupted.

Contrary to precedent and cherished tradition of the central-station industry, service has been interrupted in many communities. To the extent that this is attributable to war needs and the urgent priority to which they are entitled, the industry has no ground for complaint; to the extent to which coal shortage is due to lax production methods or faulty distribution the industry passes criticism, not for the sake of complaining, but so that the conditions may be remedied as well as possible.

For a year the *ELECTRICAL WORLD* has consistently warned its readers of the dangers of coal shortage. It has advised forehandedness in accumulation of reserve supplies, has urged the study and introduction of economical boiler-room practices, has counseled quick and willing co-operation with efforts of the Fuel Administration to conserve power and coal. The object of the present article is to show how the companies operating steam stations using coal as fuel view the situation at present, what specific steps they have taken to lessen the strain of conditions, how they think improvement can be assured. The information published is based on a country-wide inquiry.

THE PROBLEMS OF COST, QUALITY AND SUPPLY

In general the companies have tried to meet these by furthering boiler-room efficiency, by looking more carefully into contracts for purchase of coal, by the purchase of mines in some cases and, so far as cost is concerned, by increasing rates for energy to large power users. In notable exceptions rates have not been increased.

An illustration of an analysis of boiler-room conditions which proved successful follows:

It was apparent during the latter part of 1916 that the demand for coal would be unusual, and in an endeavor to increase the general over-all efficiency of our production plants it was ascertained from a study of the log sheets that the greatest gain in economy would be in the boiler room. Previous to October the evaporation of one of our large boiler plants was averaging about the equivalent of 7 lb. (3.1 kg.), which gave a boiler efficiency in the neighborhood of 50 per cent. With this information we decided to make a thorough study of the boiler-room conditions and to conduct the necessary tests in order to ascertain the causes contributing to this lower efficiency. This study involved the handling of fires, draft conditions, gases, etc. We equipped all of our boilers with steam-flow meters and found that some boilers were carrying an average load of only 68 per cent of rating. This condition we found was caused by draft loss, settings, soot accumulation, etc. Capacity tests were run, and the best performance showed that only about rating could be got out of the boilers in the way they were operating and when they were entirely free from soot. These studies were conducted at a considerable expense, but we were able to increase the over-all efficiency of our plant by approximately 50 per cent.

We are not satisfied by any means that we have reached the maximum of the plant, but are continuing our studies from day to day, and the results justify a continuation of the expense involved. Coal clauses have been added to all large contracts and enforced.

Many companies installed coal-handling apparatus in order to be able to store even a greater reserve supply than under ordinary conditions, although subsequent events showed the impossibility of accumulating the amount of fuel desired. One company operating a relatively small plant spent \$5,000 on coal-handling apparatus.

One of the greatest difficulties, about which widespread complaint is made, lies in poor quality. Typical comments on this condition follow:

Owing to our inability to get our regular run of coal, we have to take all grades and kinds of coal; consequently our operating conditions are not at all satisfactory. Our economy has been poor, and it is impossible to adjust our fire-room conditions for a very fine slack coal and then in the next half-hour have lump coal.

The quality of coal which we ordinarily obtain averages

about 13,500 B.t.u., with about 9 per cent ash. Owing to the difficulty of obtaining an adequate amount of coal, we have been compelled to burn all kinds down to that running as low as 9600 B.t.u. and as high in ash as 34 per cent.

Where coal has been purchased on the market we have not found it possible to control the quality, which is wretched.

In anticipation of serious coal shortage many companies planned to store extraordinarily large reserve supplies, while others, as stated in previous issues of the *ELECTRICAL WORLD*, bought coal mines or an interest therein so as to strengthen their control at the source. Most of the companies found it impossible to store coal in adequate quantities. One company, for instance, reports having "only about 15 per cent of that stock ahead of us which would insure against a shutdown resulting from a long period of inclement weather with the consequent delay in freight movement."

Another company, in which complete shutdown had just been threatened, writes that the Fuel Administra-

ENFORCED ABANDONMENT OF THE HISTORIC PRACTICE

Publication of this survey of the coal situation coincides with the most acute crisis, due to coal shortage, in electric central-station history.

The practice of storing adequate reserve supplies of coal to guard against the danger of mine or railroad strike or interruption of operation from any other cause has grown with the years. Its wisdom, tested time and again, has given the public continued service in past years. A less forehanded policy would have been followed by curtailed service or complete cessation of operation, with the result of public inconvenience and distress.

It is greatly to be regretted that events have prevented the companies from carrying out their time-honored, justified policy of maintaining adequate storage piles at generating stations.

When normal times are here again this policy will be re-established more firmly than ever. It is a necessary and effective safeguard.

tion has thought it wise, in effect, "to clear out our stock piles and put us on a hand-to-mouth basis, thereby wiping out our own plans and provisions for the winter."

The purchase of an interest in a coal mine gave one company sufficient coal to take care of requirements, although car shortage brought anxiety several times. However, there has been a considerable advance in the cost of coal to this company.

"Considering the expense other companies are having on account of the high price of coal," says this company, "we are of the opinion that the purchase of our interest in the mine has materially assisted us in this trouble."

A holding company which followed the policy of buying coal mines where the consumption of coal by the operating utility warranted it says: "We have been able to mine this coal at a considerably lower figure than the price fixed by the administration."

Experiences on the question of price vary widely be-

cause of the radical differences in coal-producing conditions and costs in the country. Increased cost, however, is the burden of the complaint. Comment on this point follows:

We formerly paid 85 cents per ton for coal at the mines, but we are now paying the government price of \$2.85, plus 15 per cent for brokerage, with a possibility of paying 45 cents in addition if the miners get the increase for which they are asking.

I had occasion to collect some information with reference to effect on operating conditions, and my recollection is that before the present prices were established by the government the average increase in coal cost of the various companies with which I corresponded was about 145 per cent and the average increase in the operating cost was about 45 per cent.

Are buying coal at the market price, which is about 300 per cent more than it was two years ago.

We were fortunate enough to have made a contract for two years' supply of coal and have received the bulk of our coal under this contract, although we were forced to cancel it so far as price was concerned and pay practically the government price.

RAISING RATES TO MEET INCREASED COST OF FUEL

Many companies have raised rates to offset in part the increased cost of fuel, or plan to take this step. Some have not raised rates and do not expect to do so. One executive writes:

"We feel it a part of our patriotic duty not to raise our rates unless absolutely necessary. The new wholesale contracts that we have made carry a coal clause. These clauses, however, barely pay for the increased cost of coal, without considering other items."

The attitude of companies generally in trying to protect themselves by increasing rates is shown by the following statements:

The problems raised by increased cost of coal during 1917 came upon us so quickly that it was impossible to provide adequate additional revenue against them in time to have much effect upon the earnings for 1917. We have done something in the way of securing increased wholesale power rates, but not on all of our properties and have been able to do very little except get started in other directions.

We are endeavoring to meet, although it has not yet been accomplished, the increased costs of coal due to bonus which we have been obliged to pay in order to get the necessary supply, although under contract until 1921, by increasing rates. If we can obtain sufficient increases to offset the increased costs, we are perfectly satisfied. At this writing this has not been accomplished, and probably will not be accomplished for another sixty days.

Surcharges on power and steam-heating rates will yield approximately 45 per cent of our increased coal cost.

[A continuation of this article, to be published next week, will deal with other vital phases of the critical coal situation.]

Japan's Electrical Industries

The Department of Communications of Japan has published the following statement of the condition of the electrical industry in that country at the end of July, 1917: Plants supplying energy, 568 companies with \$160,796,063 capital; electric railways, forty-two companies, \$21,706,985 capital; engaged in both branches, forty-eight companies, \$148,482,339 capital. Compared with the figures for the corresponding period last year there is an increase in the number of enterprises of thirty-five, with an aggregate capital of \$17,892,057.

A Solution for an Acceptance-Test Problem

Simple Method of Correcting Generator-Unit Load-Characteristic Curve for Variations in Speed—Of Entire Accuracy When the Magnetic Circuit Is Highly Saturated

BY W. B. KOUWENHOVEN

Associate in Electrical Engineering, Johns Hopkins University

SYNOPSIS.—From experimental results the conclusion is drawn that there is no simple method for correcting the generator-unit characteristics of shunt generators for variations in speed unless the iron is highly saturated. In the case of compound generators the results show that there is a simple method for correcting the generator-unit characteristic for variations in speed. This method gives the true load characteristic of the generator within a plus and minus variation of about 1 per cent for ordinary machines. This method may also be used to determine a generator-unit load characteristic from the true generator characteristic of a given generator when that generator is combined with a prime mover whose speed variation with load is known.

AS THE load on a prime mover increases its speed falls so that the resulting regulation of a generator connected thereto is not the true generator regulation but a combination of the speed regulation of the prime mover and the voltage regulation of the generator. A question therefore arises sometimes when the generator and prime mover are purchased from different concerns whether the generator gives the regulation called for in the specifications* or some other value.

Such a case having been brought to the writer's attention, he undertook the problem of determining from the load characteristics of the generator unit the true load characteristics of the generator. The load characteristics of shunt and compound generators were studied both theoretically and experimentally. The ex-

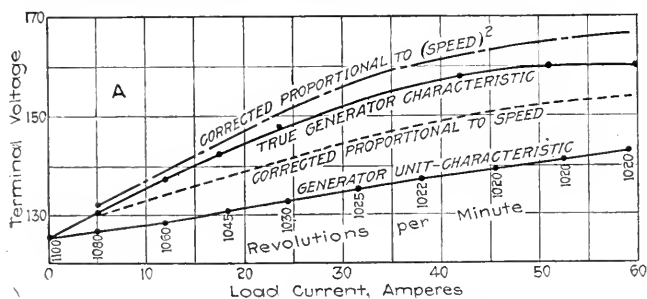


FIG. 1—CHARACTERISTICS OF GENERATOR CORRECTED FOR SPEED VARIATIONS

The lower curve is the load characteristic belonging to a generator unit. The figures 1100, 1080, etc., refer to the speed of the set at which the readings were taken. The upper full-line curve is the true generator-load characteristic taken at a constant speed of 1100 r.p.m. The broken-line curve shows the characteristic that is obtained when the generator-unit characteristic is corrected according to the ratio $(n_1/n_2)^2$ and the dotted-line curve is the characteristic that is obtained when the generator-unit characteristic is corrected proportional to the ratio n_1/n_2 . It is evident that the true characteristic of the generator lies between these two corrected curves, and that neither of the above speed corrections gives a method by which the true characteristic or regulation can be determined from the generator unit characteristic or regulation.

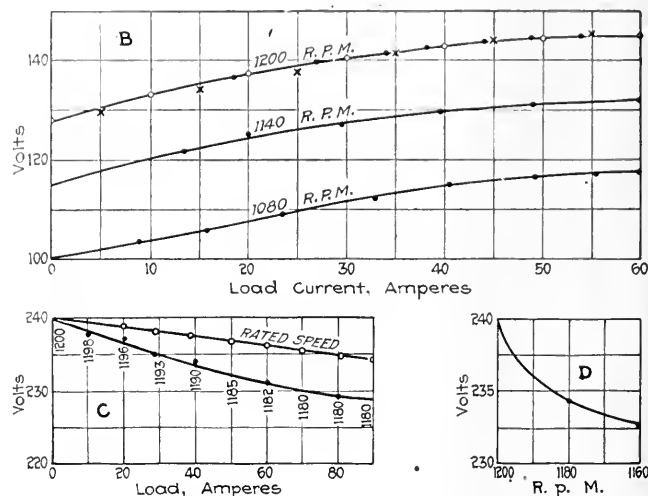
perimental work was performed in the laboratories of the electrical department of Johns Hopkins University.

THEORETICAL ANALYSIS OF REGULATION

At rated speed and no load the emf. induced in a direct-current generator is given by the relation

$$E = k_1 n \Phi,$$

where E is the induced electromotive force, n the revolutions per minute, Φ the flux per pole and k_1 a constant whose value depends upon the number of armature con-



FIGS. 2 AND 3—LOAD CHARACTERISTICS OF TWO COMPOUND GENERATORS, THE LATTER CORRECTED FOR SPEED

ductors connected in series, the number of poles and numerical constants.

Since the flux per pole is proportional to the mmf. divided by the reluctance, and the mmf. depends upon the number of ampere turns that there are in the field circuit, $\Phi = k_2 (i_f/R)$, where i_f is the field current in amperes, R the reluctance and k_2 a constant. Substituting the value of Φ in the equation for the induced voltage, $E = Cn(i_f/R)$, where C is a new constant which equals the product of k_1 and k_2 .

The field current i_f is found by dividing the terminal voltage by the resistance of the shunt-field circuit. But at no load the terminal and induced voltages are practically equal and therefore the field current is directly proportional to the induced voltage E . Assuming there is no load on the generator and that at n_1 revolutions per minute the induced voltage is E_1 , then at a lower speed of n_2 revolutions the induced voltage E_2 would be less by the ratio n_1/n_2 , provided the field current was maintained constant. But in an actual machine, where the resistance of the shunt-field circuit is constant, the drop to E_2 volts would cause a proportional drop in the field current i_f . If the flux were directly proportional to i_f , the value of E_2 would be expected to be less than E_1 by the ratio of $(n_1/n_2)^2$.

However, the flux is not proportional to the field current because the reluctance of the iron is not constant. The reluctance decreases as the flux decreases, and the flux does not decrease as rapidly as the field current decreases. Therefore, the resultant change in induced voltage for a fall of speed to n_2 revolutions will

*A. I. E. E. Standardization Rules, Article 571.

be less than that given by the ratio $(n_1/n_2)^2$ and greater than that given by the ratio n_1/n_2 (see Fig. 1).

No simple method was found for correcting shunt generator characteristics for variations in speed unless the flux saturation of the iron was high (see Fig. 2). At high values of the saturation it was found possible to correct† the generator-unit characteristic-load characteristic by adding to it an ordinate that was equal to the drop in voltage between the no-load voltage at rated speed and the no-load voltage at the lower speed for which the correction was desired.

In securing the data for Fig. 2 the shunt excitation only was used, and load curves were taken for 200, 141 and 100-volt values of no-load voltage. The resulting characteristics are the curves A, B and C. The speed was maintained constant at rated speed throughout each run. Then, in order to investigate the effect of a change in speed, another set of curves was taken. In this second set the voltage was adjusted to the corresponding no-load voltage at rated speed, i. e., 200 volts; the speed was allowed to drop 10 per cent to 1080 r.p.m., and a new characteristic was found during which the speed was held constant at 1080 r.p.m. The corresponding characteristics are given by the A', B' and C' curves respectively.

Compound-generator characteristics were also studied graphically, using Arnold's methods. The analysis indicated that the method of adding to the generator-unit characteristic an ordinate which is equal to the difference in voltage between the no-load voltage at rated speed and the no-load voltage at the lower speed for which the correction is to be made will give good results and is furthermore simple in application. In order to test the correctness of this theoretical conclusion a number of compound generators were tested. As in the case of the shunt generator, load characteristics were taken at different speeds, the resistance of the field circuit remaining unchanged throughout. These points determined by the graphical method were found to lie almost entirely upon the true characteristic curves of the generators, their maximum plus and minus deviation being less than 1 per cent.

The success obtained with this method of correcting for speed variations led to a further study of other compound generators. In all of these tests the true load characteristic of the generator was obtained at constant rated speed. Then a load characteristic of the generator unit was obtained. In each case the set started at rated speed and the terminal voltage was measured as the load was applied, the speed being allowed to fall in accordance with the inherent speed characteristics of the prime mover. The load was removed and then at no load and rated voltage, or at the voltage for which the true-load characteristic was determined, a third curve, which will be called the no-load-voltage-speed characteristic, was taken by simply allowing the speed of the prime mover to drop and noting the armature voltage for various values of speed. The resistance of the field circuit was maintained constant throughout the entire run. The load characteristic of the generator unit was then corrected for speed variations by adding to it a correction obtained from the no-load-voltage-speed characteristic for the given reading (Fig. 3).

The calculated load characteristics checked very closely with the true generator load characteristics and indicated that the correction is independent of the saturation and speed at which the characteristics are desired over a considerable range.

APPLICATION OF THE METHOD

A method of actually securing the data necessary for determining the regulation is as follows: Starting at no load, rated voltage and rated speed, take the necessary data for plotting the load characteristic of the generator unit, noting the speed at which each reading is taken. Remove the load and, starting again at rated voltage and rated speed, throttle the prime mover and reduce the speed throughout the same range of speed as was found when determining the load characteristic,

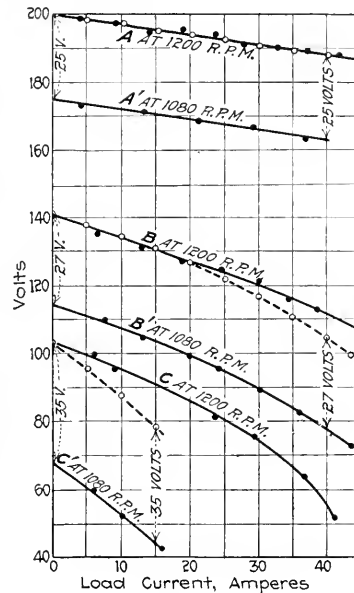


FIG. 4—MEASURED AND CORRECTED CHARACTERISTICS OF SHUNT GENERATOR, SHOWING AGREEMENT AT HIGH SATURATION

noting the no-load voltage at various values of the speed. Plot the generator-unit characteristic, marking at each point the corresponding speed and the no-load voltage-speed characteristic of the unit.

For a given point on the generator-unit characteristic determine the correction as follows: From the no-load voltage speed curve determine the difference in volts between the voltage at rated speed and the voltage at the speed corresponding to the given point. Add this difference to the ordinate of the generator-unit characteristic at

the given point and the corrected point will lie on the true generator characteristic curve of the machine.

Proceed in a similar manner to correct the other points on the generator-unit characteristic. Draw the curve through the corrected points and the result will be the true generator load characteristic. From this curve the true regulation of the generator can be found.

Not only can the true load characteristic of the generator be obtained from the generator-unit characteristic by this method, but it may also be applied in the reverse direction and the generator-unit characteristic determined from the true load characteristic of the generator. If the load characteristic at constant speed and the voltage-speed characteristic of a given generator are known, it is possible to predetermine, by the use of this method, the load characteristic that will be obtained when the generator is combined with a prime mover whose speed variation with load is known. In such a case the proper ordinate for a given drop in speed below rated speed is determined from the voltage-speed characteristic curve, and this ordinate is subtracted from the true load characteristic of the generator. The resulting curve is the load characteristic curve of the prime mover and generator combined.

†E. Arnold, in "Die Gleichstrom Maschine," Vol. 1, p. 606.

Obtaining Power Factor by Use of Wattmeter

Explanation of the Manner in Which, by Making Simple Change in Connections of Polyphase Wattmeter, Power Factor on Three-Phase Circuits May Be Readily Obtained

BY E. G. BARRINGTON

Toronto Hydroelectric Commission

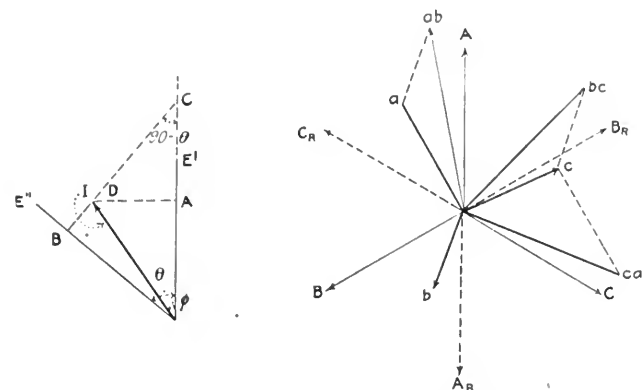
ALTHOUGH several methods have been proposed for obtaining the power factor on three-phase circuits, most of them prove to be incorrect when the phases are unbalanced, which is usually the case to a greater or less extent on all commercial circuits. By means of the following method the power factor of any

OA is equal to R'/E' and OB equal to R''/E'' . If, however, E' and E'' are equal, R' and R'' are proportional to these values and may be substituted for OA and OB in the above formula.

Referring to Fig. 2, in which the voltages of a three-phase system are represented by A , B and C and the currents by a , b and c , the current in the three lines will be ab , bc and ca . The currents ab and bc are considered as flowing through elements R and L of a polyphase wattmeter, in which case voltage A will be connected to element R and voltage C to element L .

By reversing voltages C and B (in which case they will be represented by C_r and B_r) and connecting them, instead of voltages A and C , to elements R and L respectively, a reading proportional to the components of currents ab and bc in phase with voltages lagging 60 deg. behind voltages A and C will be obtained. From this reading it is possible to find the total reactive volt-amperes and the tangent of the angle of phase difference by means of the preceding formula. This reading will be positive for any value of this angle between 30 deg. lead and 90 deg. lag.

For values between 30 deg. lead and 90 deg. lead it will be necessary to use the voltages B_r and A_r in order that the angle between the voltages may remain 60 deg. and so the same formula may apply. These voltages may also be used for any angle between 30 deg. lead and 30 deg. lag, making the total range with the lagging voltages from 30 deg. lag to 90 deg. lag, and with the leading voltages 30 deg. lag to 90 deg. lead. In the ma-



FIGS. 1 AND 2—VECTORIAL RELATIONS EMPLOYED IN DEVELOPING METHOD OF OBTAINING POWER FACTOR BY WATTMETER

three-phase circuit, three-wire or four-wire, on which the voltages are balanced may be obtained from the indications of a polyphase wattmeter when a simple change is made in the connections of the potential coils. It may also be used when the voltages are unbalanced, but in this case it is necessary to take additional readings, as will be explained later.

DEMONSTRATION OF THEORY

The principle upon which this method is based may be demonstrated as follows: Let I and E' (Fig. 1) represent the voltage and current of an alternating-current circuit in which I lags behind E' by the angle ϕ . The reactive component of I may be obtained if the component of I in phase with E' and also another voltage of known phase difference from E' is known. Let E'' represent a voltage θ degrees behind E' . Then OA and OB are the components of I in phase with E' and E'' respectively, and AD is the reactive component. Draw BC perpendicular to E'' to meet E' at C .

Then $OC = OB/\cos \theta$.

$OB/\cos \theta - OA = AC$.

But $AC \tan (90 - \theta) = AD$.

Therefore $[(OB/\cos \theta) - OA] \tan (90 - \theta) = \text{reactive component of } I$.

$$\text{And } \tan \phi = \frac{[(OB/\cos \theta) - OA] \tan (90 - \theta)}{OA}$$

The components OA and OB may be obtained from the readings of a wattmeter to which the current I is connected and the voltages E' and E'' are applied in turn. Calling the first reading R' and the second R'' ,

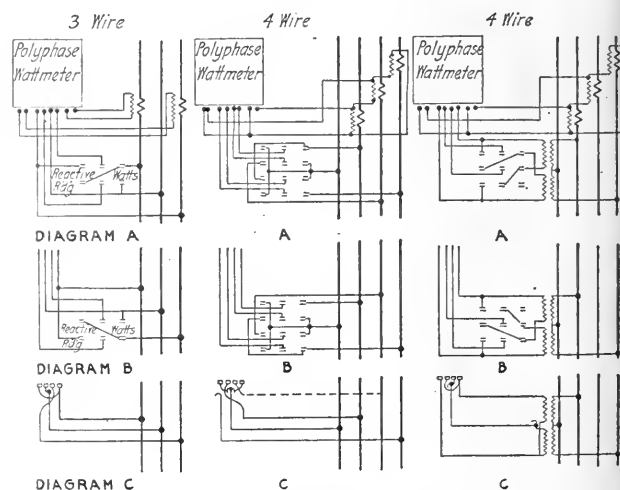


FIG. 3—CONNECTIONS NECESSARY FOR MAKING READINGS

jority of cases at least the power factor of a given circuit does not vary over these limits. However, if this is not the case, an additional double-throw switch will enable either set of voltages to be connected to the meter.

By means of this change in connections the two values required for the formula are obtained, the angle θ being

60 deg. The formula may now be written in a much simpler form, thus:

$$\frac{[(R''/\cos 60) - R'] \tan 30}{R'} = \frac{2R'' - R'}{\sqrt{3}k}$$

CONNECTIONS NECESSARY FOR MAKING READINGS

The connections which will give the required voltages under different conditions are as shown in the accompanying diagrams (Fig. 3), which give the connections for both leading and lagging voltages. It is impossible to tell which will result in leading voltages and which in lagging voltages, as this depends on the direction of phase rotation, which is not generally known. The correct one may easily be found, however, by trying out each connection and using the one that gives a positive reading, or the highest positive reading if both are positive, which will be the case if the power factor is above 87.7 per cent.

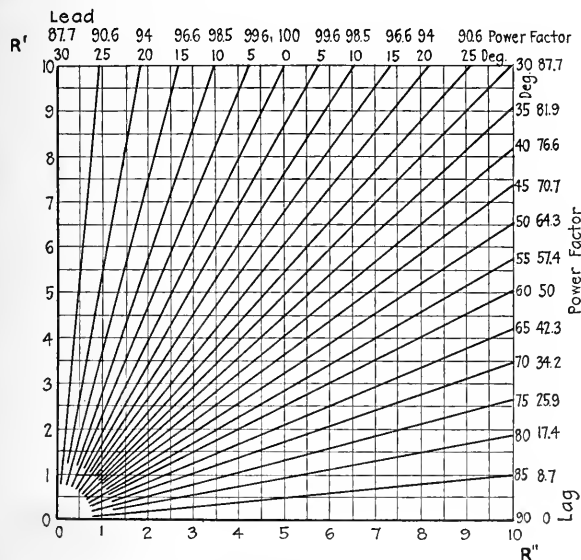


FIG. 4—VALUE OF POWER FACTOR FOR DIFFERENT VALUES OF R' AND R''

As a check on the connections it may be noted that a decrease in the power factor will cause a decreased reading on the meter with a given load in watts. Also, that at 100 per cent power factor the reactive meter will read 50 per cent of the reading of the wattmeter. At other power factors the ratio will be as follows:

Power Factor, per Cent	Ratio Watts to Reactive Reading
87.7	1:1
50	1:2

In case both connections give a positive reading, one reading will, when applied to the formula, result in a negative angle, thus indicating that leading voltages are being used with a lagging current or vice versa. By means of the accompanying chart (Fig. 4) the power factor may be read without the use of the formula. The scales R' and R'' in the chart may, of course, be changed to correspond with the scale of the meter. In case the chart is used with a leading power factor it is necessary to interchange the two words "lead" and "lag."

A useful and easily remembered method of temporarily changing the connections of a three-wire meter is shown in diagram C of Fig. 3. This change is most easily made at the meter terminals as follows: Disconnect the line wire on one element and the common wire on the other element; connect the disconnected line wire

of the one element to free terminal of the other; connect the two line terminals together, the position of the voltages obtained with reference to the original voltages depending upon which element the line wire is disconnected from. The connection for four-wire meters cannot usually be so readily changed, since for meters operating at line voltage it is necessary to carry an additional wire from the meter to the line, while with transformer meters the two transformers are usually connected to a common line. In this case it is necessary to open this connection. The required changes are, however, shown in the diagrams.

MODIFICATIONS NECESSARY WHEN VOLTAGES ARE UNBALANCED

While the formula in its simpler form is strictly correct only when the voltages are balanced, the amount of unbalance usually found on commercial circuits is not enough to affect seriously the result. The errors introduced may, however, if necessary, be corrected; but inasmuch as the value and phase difference of the voltages on each element will not be equal under these conditions, it is necessary to treat each element separately as follows:

With the potential circuit of one element open and a voltmeter connected across the potential terminals of the other, take readings on the wattmeter and voltmeter with the meter connected for both watts and reactive reading; then change over to the other element and take readings as before. Call the wattmeter readings V' and V'' . It will be found that two of the four voltmeter readings obtained will be equal since they have been taken on the same phase. By constructing a triangle with sides proportional to these values the angles between any two voltages may be measured. The value of the reactive volt-amperes for each element may then be found from the following formula:

$$\tan (90 - \theta) \left[\frac{R'' \times V'}{V'' \cos \theta} - R' \right],$$

θ being the angle between the voltages V' and V'' .

For four-wire meters operating at line voltage the formula is as follows:

$$0.577 \left[\frac{2R'' \times V'}{V''} - R' \right].$$

The algebraic sum of the reactive volt-amperes obtained for each element divided by the total watts will give the tangent of the angle of lead or lag.

Pacific Coast Company to Use Sawmill Waste for Fuel

Announcement has just been made in San Francisco that the Northwestern Electric Company of Portland, Ore., has contracted for construction of a 15,000-hp. steam generating station which will use sawmill refuse for fuel. This refuse consists of bark, splinters, short ends, slabs and sawdust, etc., which the lumber trade terms "hog fuel," and which has a very low value at the mill. It is understood that recent development of shipbuilding activity in Portland has created an increased power demand which is taxing the capacity of the system to the limit. The use of the new fuel will be a war measure in coal and oil conservation at the same time that it is expected to prove very economical.

Helping France to Help Herself

Hydroelectric Power Can Supplant Her Coal Supply Better than It Can Be Done by More Ships, and American Emergency Construction Can Provide Such Plants in from Six to Nine Months

BY ALEXANDER C. CLOGHER AND VICTOR F. HAMMEL

The object of the electric organization of the army is to distribute light and motive power as near as possible to the firing line by applying the established methods of the industry. Electric lighting of a general nature is the thing which next to nourishment contributes the most to maintain the morale of the men. Moreover, the use of electrical energy in the territory occupied by the armies increases the product of manual labor in multiple forms, a consideration not negligible in a war of attrition such as that we are waging.—Capt. Gustave P. Capart of the French Army, *ELECTRICAL WORLD*, Nov. 3, 1917.

EVERY man that we send to France, whether for the firing line or behind it, will necessitate the manufacture of additional electric power for min-

istering to his needs and comforts. The shops for repairing our rifles and guns will probably be larger than most of the munition plants in this country. These shops must be run by electric power. Most of the electricity generated in France is derived from coal. As France has no coal to spare, we must either make use of some of our ships for transporting our fuel for producing this power or obtain the power from other sources.

Electricity is produced from two sources, viz., fuel, either coal or oil, and water power. France

has no oil, an inadequate supply of coal but a large amount of undeveloped water power, a latent force which should be utilized for supplying the mechanical power so necessary in the prosecution of modern warfare.

It is well known that there is a great scarcity of coal in France, but it is probably not generally realized that a large part of the coal which is available from the French mines must be used for the manufacture of electric power for the use of the army, navy, munition

industries and, lastly, for the absolute necessities of commercial life. These demands on the scant fuel supply have raised the price of coal to a point where it is practically out of the question to use it for heating dwellings. This lack of heat has caused a great deal of suffering among the French people, and any measures which might be taken to relieve our ships from the duty of transporting fuel for our fighting forces could also be utilized to relieve the coal famine in that country.

The only practicable method remaining for relieving the coal shortage in France, other than providing more ships for the transportation of coal and oil, is to utilize some of the undeveloped water power now going to

waste in that country. It is possible for the United States to render signal aid to France in the development of this power, because of the large amount of capital required.

Conservatism has prevented the most progressive development in the use of electricity in the countries of Europe, just as it has held it back in the northeastern part of the United States. In this country we have our most complete and economical electric systems for the generation, transmission and distribution of electric power in the West and the South. Here we

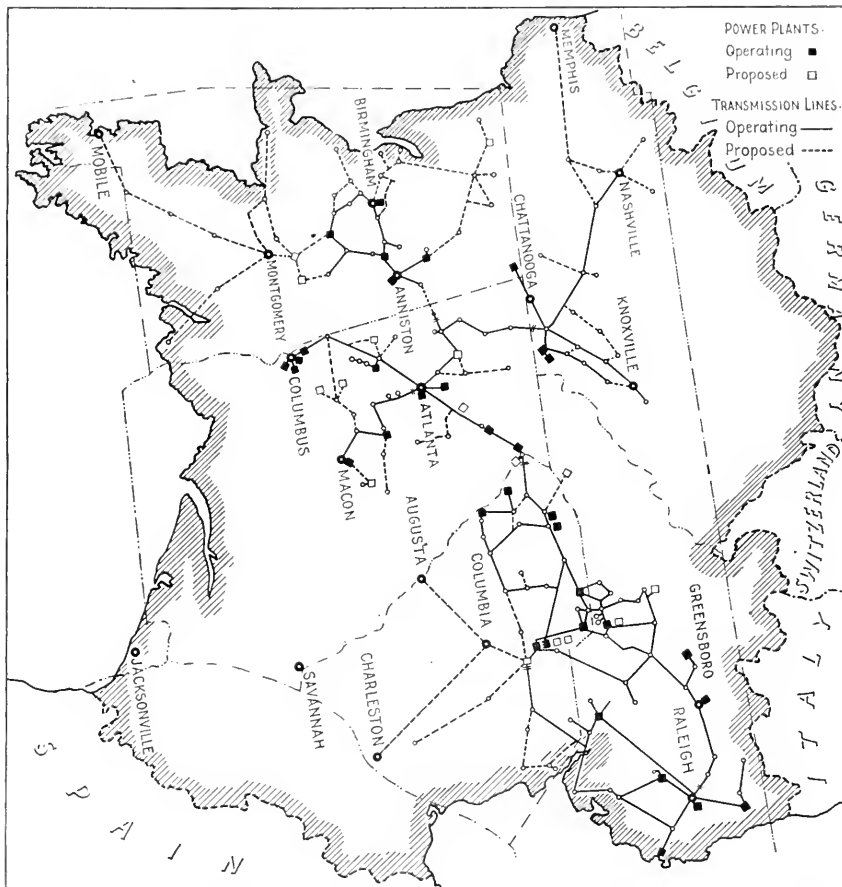


FIG. 1—INTERCONNECTED TRANSMISSION SYSTEMS OF THE SOUTH SUPERIMPOSED UPON THE MAP OF FRANCE

find a number of public utility companies serving territories as large as Switzerland from an interconnected transmission system. These companies generate, most economically, practically all of the power used by their respective communities in a few modern steam plants or in a number of hydroelectric plants.

Although there are many excellent examples of modern hydroelectric developments in France and Switzerland, it is probable that American engineers could more clearly see the potentialities for the complete develop-

ment and use of all of the hydroelectric resources in those countries. American practice proves that it would be possible to develop all of the available water power on a range of mountains in France and to distribute it throughout several provinces, whereas present developments in that country generally consist of the power available on a stream distributed to a few nearby towns and villages.

THE PROBLEM OF SHIPS

It would be unfortunate if our government did not awaken to the possibilities of this idea, which to the authors seem to be as effective a method for relieving the shipping shortage as the construction of more ships. The same amount of money would be required to build two 5000-ton steel vessels as would be required to build a 10,000-hp. hydroelectric or steam-electric power plant in France. Two such ships could easily

but for 100,000 hp., and it would release, not two ships, but twenty or more large-sized freight-carrying vessels.

If there were undeveloped power sites near our army base, the simplest solution of the army power problem would be for it to lease or purchase these power sites, develop whatever hydroelectric power it might need for its own use, and in this way avoid the necessity of using ships for transporting coal for steam-power plants which might otherwise have to be built.

LONG TRANSMISSION LINES

The topography of France, however, does not lend itself to so simple a solution of the problem. Most of the available water-power sites are situated in the extreme eastern and southern parts of France, and those nearest to our army's operations are of the type which require the longest time for construction. At first

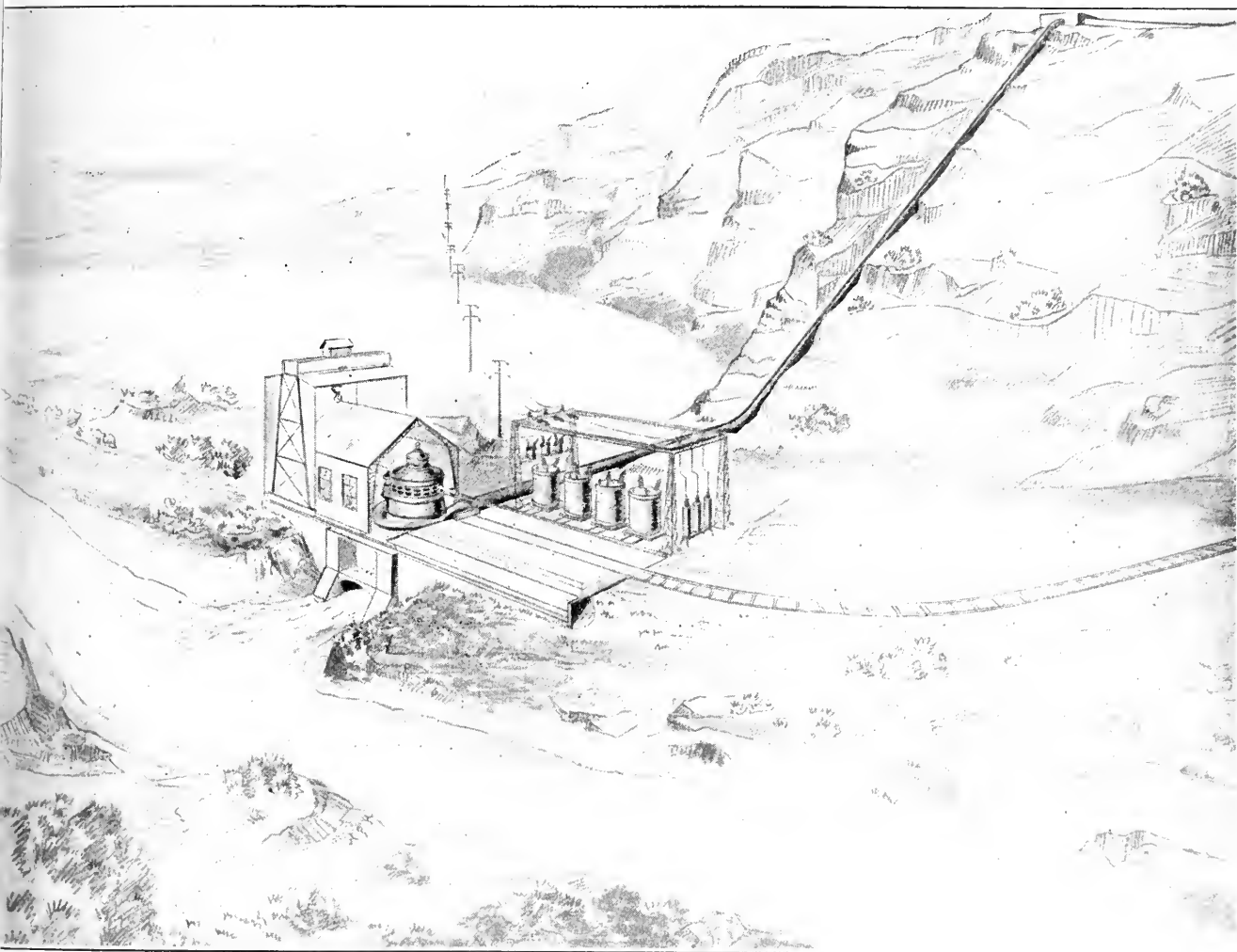


FIG. 2—PLANTS OF THIS TYPE OF FROM 1000 HP. TO 15,000 HP. CAPACITY WILL HELP SOLVE THE COAL PROBLEM IN FRANCE AND RELEASE COAL-CARRYING SHIPS FOR OTHER SERVICE

transport all of the material required for construction in either case. On completion, the steam plant would require the continuous service of both vessels for supplying it with coal, in addition to the men and transportation facilities required in this country for mining and delivering the coal to the seaboard. The hydroelectric plant, when completed, would require the services of fewer than half a dozen men. This is indeed true conservation of man power and of natural mineral resources. It could be done not only for 10,000 hp.,

glance the transmission of water power from the Alps and Pyrenees for our army base seems out of the question because of the distance. When one considers, however, that coal in France is worth \$60 to \$70 per ton, the transmission of hydroelectric power 400 miles or even 500 miles (650 km. to 800 km.) might not only be economical but it might be desirable in any event in our conduct of the war, if it would make more ships available for transporting other supplies.

The solution of the problem might be an indirect one,

and our army might secure its coal by releasing the coal now used for producing commercial power in western France. We might provide hydroelectric developments for supplying this commercial power.

In localities where all of the available hydroelectric power is developed in small independent units there is certain to be an excessive waste of energy. It is impossible to make the demand for power from each

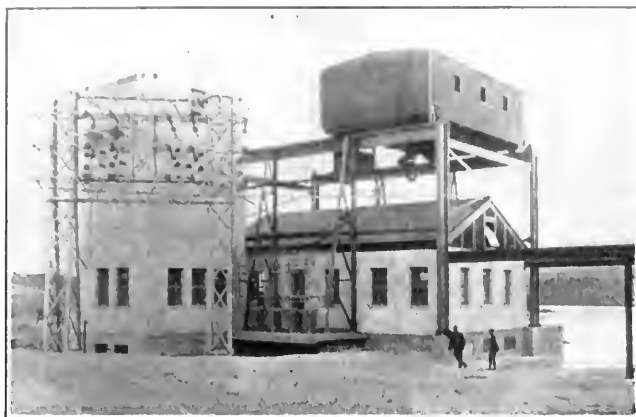


FIG. 3—A 10,500-HP. HYDROELECTRIC UNIT IS HOUSED HERE; THE ROOF ROLLS ASIDE SO THAT THE ELECTRIC CRANE OVERHEAD CAN LIFT THE HEAVY MACHINERY

small market conform to the supply of water available at its respective small power plant or plants. Some plants have large storage available which can be used to make the output uniform from a large number of plants which may have a great variation and no storage. One of our public utilities in the Rocky Mountains, using the power generated on about twenty-five streams, is able to provide a uniform production of power even in the driest year, on account of the large amount of storage it has on one stream only. This company's plants and customers are scattered over a territory larger than Switzerland, and 70 per cent of its production is transmitted 140 miles (225 km.) to its market.

GOVERNMENT AID NECESSARY

If it would be possible to secure from the French government rights which would insure the quick possession of the undeveloped water-power sites in France, efficient plants might be constructed and completed just as quickly as steam-power plants which the American Expeditionary Force would have to erect in order to carry on its operations.

Such development would require a tremendous outlay of money and could not be undertaken privately without a government subsidy. It might be accomplished by a federal corporation similar to our Emergency Ship Corporation. Such an undertaking would of necessity move slowly, and undoubtedly the greatest success (because the quickest) could be attained by making the project one of the auxiliary operations of our army.

Under the conditions it would appear that the most effective way to expedite victory over the enemy would be the emergency construction of water-power plants. It is not a question of conservation but the urgent need of the moment that should determine the action to be taken.

American practice is particularly well adapted to emergency construction. A great deal of our hydroelectric development has been done in the rough, mountain-

ous and sparsely settled country west of the Mississippi Valley, where the power was desired quickly for mining purposes, or for some town or city far from the power site. Consequently, methods of expediency were used which have been impossible in older and more settled communities.

EXAMPLES OF AMERICAN ENGINEERING GENIUS

The American engineer has often been told to secure results quickly and to expend the minimum amount of money. He often made mistakes, which many plants in existence to-day attest, but he has developed designs and types of construction which will admit of the quickest possible construction. To realize what has been accomplished one need only review our Western developments, with their successful outdoor equipment and elimination of large power houses. Comparatively, these are simplified structures, and incidentally enormous strides have been made in the time required for construction.

To illustrate the adaptation of such construction to emergency development, note the sketch of a 7500-hp. one-unit installation. This general idea could be used for a very wide range of water-power sites of from 1 hp. to 15,000 hp. in size. In this type of development the water is diverted by a small, low dam and conducted along the stream bank in a wooden pipe or flume, or in a concrete-lined canal. All the equipment is of simple character, which could be manufactured and assembled in America and set up in France, and be in operation in less than sixty days after its receipt at the site. The concrete work is of the simplest nature, and could be completed before the arrival of the machinery.

The gantry crane and the small steel building run on separate tracks, and both can be erected off to one side before the foundations are completed. It should be noted that with such a scheme no time is required to build a massive power house before the erection of the vital machinery can commence. The average American

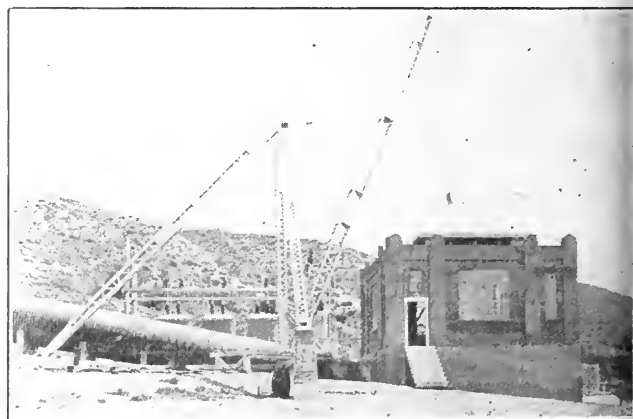


FIG. 4—AN ATTENDANTLESS 2000-HP. STATION AT WHICH NOTHING IS INSIDE THE BUILDING EXCEPT THE WATERWHEEL AND GENERATOR

layman, and even many engineers, when thinking of power stations have in mind the esthetic structures seen on the large rivers in the Eastern States and the expensive steam plants in our large cities, all of them large structures and imitating in various degrees the architecture of almost every conceivable type of monumental building, from prisons to libraries.

European engineers are more prone to build such

monuments. In their densely populated countries they have always been required to erect imposing structures with infinite devotion to detail, that the developments might harmonize with the surroundings. After the war the emergency plants could be reconstructed and imposing superstructures might be erected over them to cover them up. It is questionable, however, if this could ever be done once the custom of placing this type of machinery outdoors were established.

Such a station could be operated individually or by tying in by transmission lines with a number of similar plants. Ten of these small single-unit plants connected together with transmission lines would give more reliable service than one large station containing ten generating units. A development of this type would be made to deliver power surely within a period of six months from the day of inception and selection of the

imperatively necessary that the consideration of the full use of the water power of the country and also the consideration of the systematic and yet economical development of such of the natural resources of the country as are still under the control of the federal government should be resumed and affirmatively and constructively dealt with at the earliest possible moment. The pressing need of such legislation is daily becoming more obvious."

Making Reports for the Income Tax

Income-tax experts are to be sent to every county seat and other cities and towns to meet the people and explain the provisions of the new federal income-tax law. Returns must be made by March 1. The government recognizes that many persons will have a good

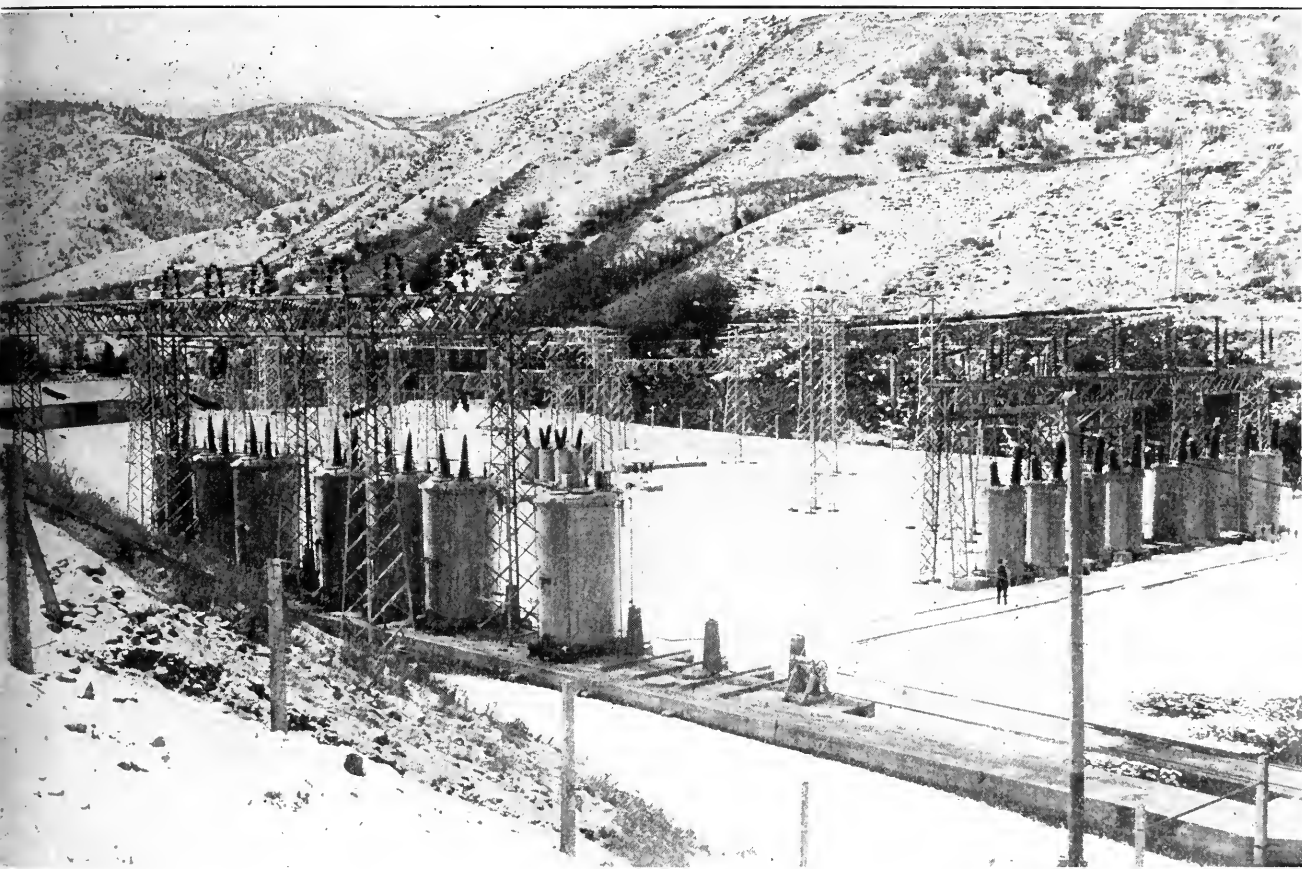


FIG. 5—NO BUILDINGS ARE REQUIRED FOR MODERN 130,000-VOLT ELECTRICAL EQUIPMENT

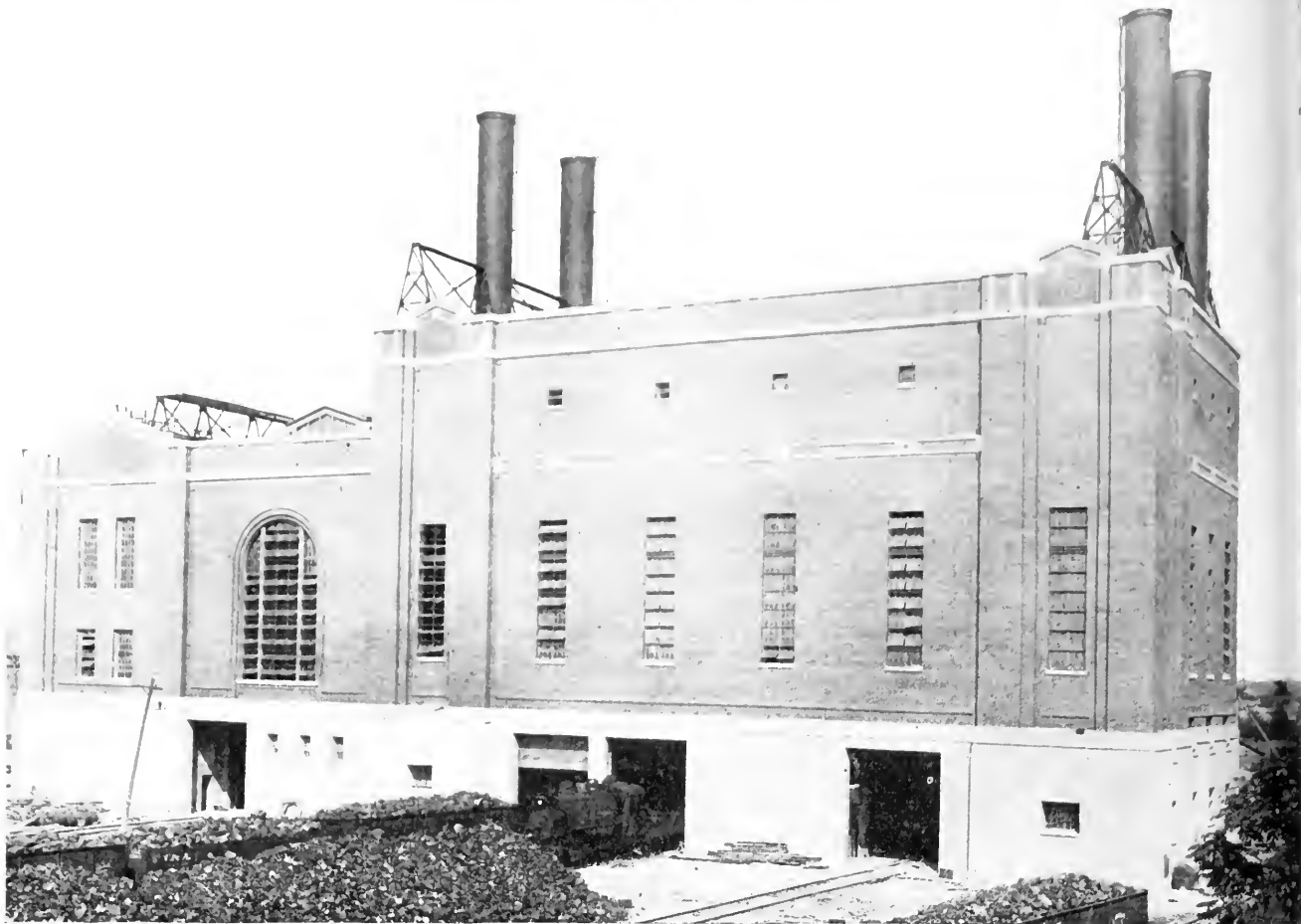
power site. Hydraulic-equipment manufacturers in America have wonderful facilities, which are not being utilized to the best advantage because of the lack of this kind of construction.

It is hoped that we shall not be dilatory in grasping this wonderful opportunity to help France. Had Switzerland started developing extensively her abundant water power at the beginning of the war she would not have been forced to tie herself, perhaps irrevocably, to German control. Recently she was forced into very unfavorable trade agreements in return for coal that she could not obtain elsewhere.

America has tarried too long over conservation policies at home. Cognizance of this has been taken by President Wilson, and has called forth this admirable warning to Congress in his address of Dec. 4: "It is

deal of difficulty in filling out income-tax forms and that taxpayers resident at points where collectors' offices are not easily accessible find it hard to get proper instruction in the law.

Every married person living with wife or husband and having a net income of \$2,000 or more, and every unmarried person not the head of a family and having a net income of \$1,000 or more, for the year 1917, must make a return of income on the form prescribed by the law. Very many people assume that if an income-tax form is not sent or a government officer does not call, they are relieved from making a report. This is decidedly an error. The taxpayer has to go to the government, and if he doesn't go within the time prescribed he is a violator of the law and the government will go to him with its penalties.



Joliet Plant a Step Toward Higher Steam Pressures

Features of Boilers, Piping and Economizers in New Joliet Plant of Northern Illinois Company, with Arrangements for Handling Coal and Supplying Feed Water

COMPLETION of the first unit of the newest power house of the Public Service Company of Northern Illinois, situated near Joliet, Ill., marks another distinct step in the advance in power-plant engineering. A pressure of 325 lb. (22.8 kg. per sq. cm.) will be developed in the boilers at the Joliet station, and pressures around 300 lb. (21.1 kg.) will be used in the turbines. One 10,000-kw. (12,500-kva.), 12,000-volt machine is already in operation and another of the same size is being erected. This high-pressure practice, of course, makes possible a higher over-all plant efficiency by increasing the upper limits of the thermal cycle. Just what the exact extent of the gain in efficiency will be on account of adopting this practice will not be definitely known until the plant has been run under operating conditions.

The station was built on a carefully chosen site, on which it can be extended in unit sections to an ultimate rating of 60,000 kw. or more. While it is very far from the geographical center of the territory served, it is in reality very near to the electrical-load center of the present system. Moreover, the present tendency of industrial growth seems to indicate a more rapid development between Chicago and Joliet than south and west of the latter city. An adequate supply of good water and fuel is available, the former from the Desplaines River, which is constantly fed from Lake

Michigan, while coal can be received from Illinois and Indiana over either of two trunk-line railroads.

The general arrangement of the apparatus in the plant is not radically different from that in other modern stations. The boiler room, turbine room and switch house are all on one level. The present installation of two 10,000-kw. horizontal generators and the probable future installation of two larger similar machines are laid out in a single line end to end. The three boilers are arranged in the usual fashion along both sides of a firing aisle. The electrical installation is practically that which is standard for supplying 12,000-volt energy for industries near the station and 33,000-volt energy for transmission.

SOME OF THE FEATURES OF THE PLANT

Although the boilers are of the standard B. & W. cross-drum type, they are built to withstand higher than the usual pressures. The plates in the boiler drum are 15 16 in. (3.33 cm.) thick, the longitudinal seam being a butt and double-cover strap quadruple-riveted joint. The heads are secured by two rows of rivets. Tubes of No. 7 gage as compared to No. 10 for 200-lb. (14.1-kg.) pressure are used. All high-pressure steam piping is extra heavy and of relatively small diameter owing to the density of the steam. The length of straight runs has been limited, and numerous long-

radius bends are employed to provide for expansion. All fittings are of steel, the manifolds used in connection with the boiler leads having been cast and the smaller fittings forged. On pipes above 4 in. (10.2 cm.) diameter a special bolted joint with a welded seal at the periphery is used.

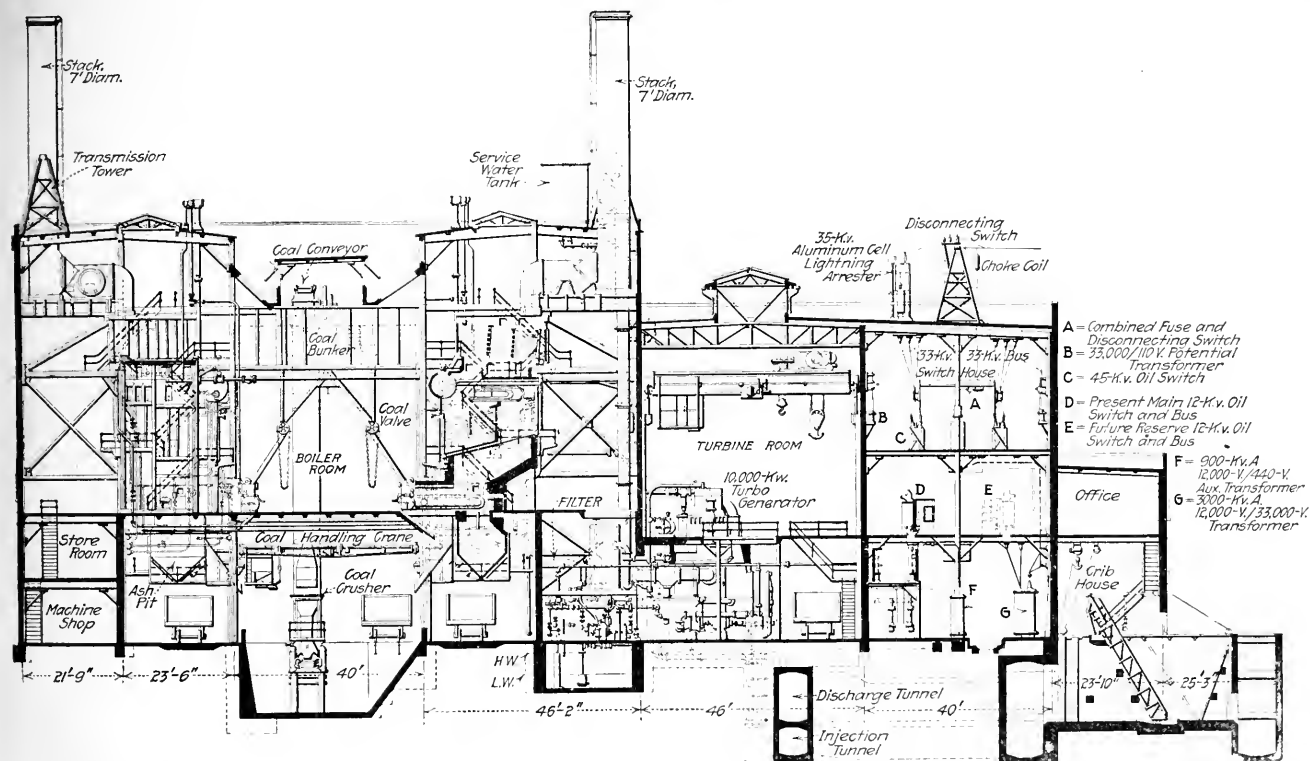
A notable feature of the steam equipment is the individual all-steel horizontal-tube economizers, the first of their kind in this country. Each economizer is placed above and integral with the boiler, with no dampers between, so that the gases pass directly from one to the other. The economizer is really a part or stage of the boiler. Furnace gases pass from the economizer at such low temperatures as to permit unlined steel stacks.

Another feature of the plant is a basement entirely above ground, the main operating floor being the second story of the building. This construction was employed as the plant is in an old stone quarry, which would have made excavation costly. Moreover, the construction gives head room for coal and ash cars to operate at the ground level and eliminates ash-handling equipment. There is gravity flow for the coal from the overhead coal bunker to the stokers and for the ashes from the stokers to the railway car waiting to receive ashes directly from the hoppers under the stokers.

Outside of stoker engines held as reserves for motor drives, there is no reciprocating machinery in the station. All pumps are of the motor-driven centrifugal

two cross-drum water-tube boilers, each having 9919 sq. ft. (970.8 sq. m.) of steam-making surface, a built-in superheater with 3100 sq. ft. (288 sq. m.) and an economizer containing 6730 sq. ft. (625 sq. m.) of surface. There are now three boilers in the plant, but when the second generating unit is installed another boiler will be added. With a good grade of Illinois coal it is the intention to use three boilers to carry the two generating units, leaving one boiler in reserve. Under this arrangement there will be 1.49 sq. ft. (0.1386 sq. m.) of active steam-making surface per kilowatt of generating capacity, or on the basis of 10 sq. ft. (0.92 sq. m.) 1 boiler-hp. will serve 7.67 kw. This does not take into account the economizer, which is really the first stage of the boiler. Each boiler, with its steel casing, masonry setting and retreating back, covers at the floor line an area of 294 sq. ft. (27.3 sq. m.), or 0.296 sq. ft. (0.022 sq. m.) per horsepower (10 sq. ft.) of rating. Including the overhang and the space occupied by the stokers, the floor space covered is 585 sq. ft. (54.3 sq. m.), or 0.59 sq. ft. (0.055 sq. m.) per horsepower. From the boiler-room floor to the top of the economizer the height is 42 ft. (12.8 m.).

Two chain grates are placed side by side in a common furnace, each being 8 ft. (2.4 m.) wide, 14.5 ft. (4.4 m.) long and containing 116 sq. ft. (35.15 m.) of active grate area. The ratio of the total grate area to the steam-making surface is one to forty-three. The stokers are motor-driven through reduction gears and belts,



RELATIVE POSITIONS OF PLANT APPARATUS AND ARRANGEMENTS FOR DISPOSING OF ASHES AT GROUND LEVEL

type with the exception of the boiler feed and one service pump operated by turbines. Provision is made to bleed steam if desirable under thermostatic control from the fourth stage of the main turbine. Another innovation is to utilize the condenser for drawing boiler make-up from the fresh water reservoir. The water enters the condenser and is passed to the heater in the usual way by the condensate pump.

For each 10,000-kw. generating unit there will be

with vertical engines in reserve. The general design of the setting and the positions of the economizer and induced-draft motor-driven fan are shown in the plan. Rising 65 ft. (19.8 m.) above the fan or 125 ft. (38.1 m.) above the grate is an individual self-supporting steel stack 7 ft. (2.13 m.) in diameter. Owing to the low temperature of the flue gases leaving the economizer (350 deg. Fahr.) the stack is unlined. The inner surface is lined with a heavy asphaltic paint.

Being the first of its kind in this country, the economizer is of special interest. The construction is similar to that of a B. & W. boiler, except that no drums are used. The headers are of wrought steel and the tubes are 4 in. (10.2 cm.) in diameter, $\frac{1}{4}$ in. (0.63 cm.) thick and 16 ft. (4.8 m.) long, of drawn steel. As low temperatures are expected, the tubes are galvanized inside and out to guard against corrosion. The economizer is vertically baffled for three passes, the gases from the boiler entering at the front and from the third pass rising vertically through the induced-draft fan to the stack. The fan has capacity to handle 75,000 cu. ft. (2100 cu. m.) per minute of gas at 350 deg. Fahr. At this rating the power required is 94 hp.

To give plenty of reserve capacity for contingencies and to reduce upkeep to a minimum, a 150-hp. motor was installed. In general, this policy of using large motors for the work has been adopted throughout the station.

Water to the economizer enters at the bottom of the rear header and passes through 396 tubes, leaving at the top of the front header. The relative flow of gas and water is thus counter-current.

Further information regarding the details of construction required by increased steam pressure, as well as features of the electrical part of the station, will be presented in a subsequent issue of the ELECTRICAL WORLD.

Motors and Control for Traveling Cranes

Types of Electrical Equipment Found Suitable with Different Cranes, Current Demand During Typical Operations, and Factors in the Effective Handling of Cranes

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—This article, the eleventh of a series on motor and control applications, contains a discussion of the suitability of variable-speed motors for traveling cranes. Reference is made to the various types of cranes in use, the types of motors commonly employed, the current required by the various motors under operating conditions, and the type of control for such equipment. In connection with control, various methods of braking are explained and a series of simplified wiring diagrams is used to show the typical schemes of connections for hoisting and lowering the load where dynamic braking is included in the control equipment. Reference is also made to the importance of the gearing between the driving motor and the crane bridge itself as a factor in the effective handling of the crane, and to the use of limit switches as a safety factor in hoisting.

THE term "traveling crane" includes several types, as follows: (a) The standard electric overhead traveling crane, where the crane travels upon an overhead framework or structure. In this type three

motors are usually required, one of which operates the hoisting device, a second moves the crane as a whole along the runway up and down the factory aisle, and a third moves the "trolley" back and forth along the crane girders. The hoisting equipment is mounted on the "trolley." (b) Gantry cranes, which are similar in general characteristics to (a), but where the crane is operated on tracks at floor level, the crane itself being supported on structural legs. (c) The usual equipment employed in telferage systems. (d) The jib crane, where a motor is used for driving the hoisting tackle. (e) Electric locomotive cranes, in which a number of motors may be used for driving the various elements. (f) Miscellaneous types, such as charging cranes, skip hoists and the like.

In this article the standard electric overhead traveling crane of class (a) has been selected as the basis of the discussion. As far as the motor is concerned

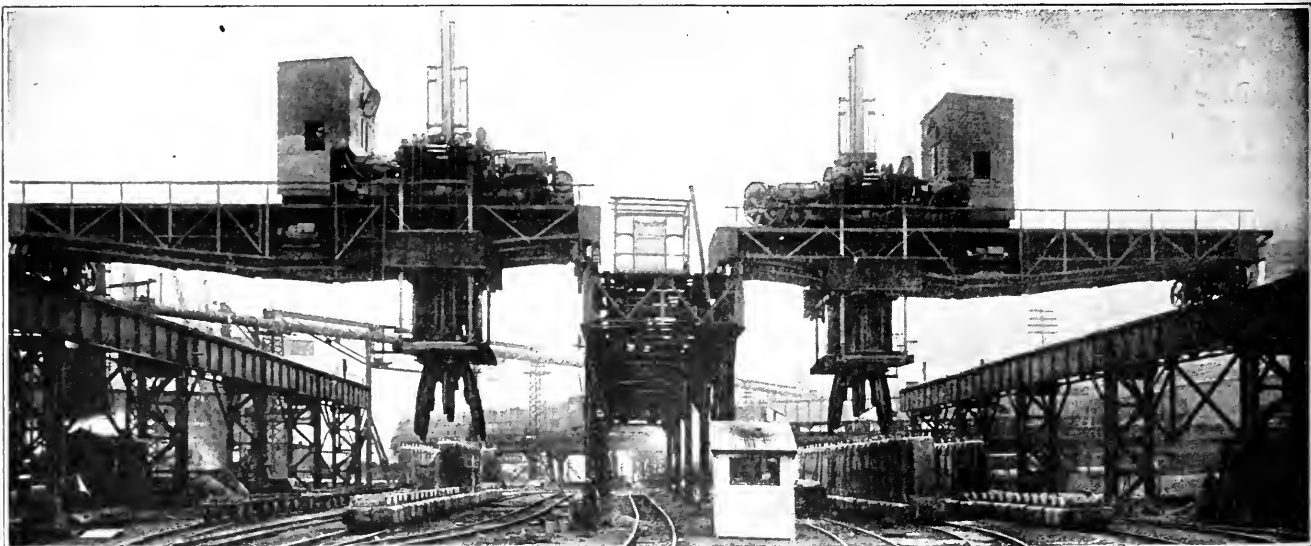
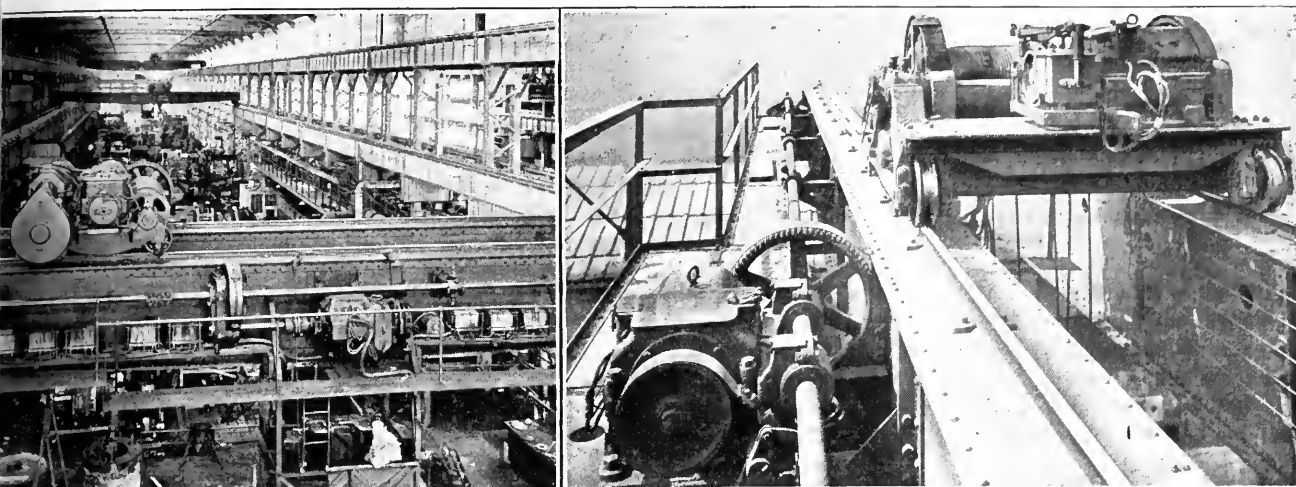


FIG. 1—ELECTRICALLY OPERATED YARD CRANES UNLOADING CASTINGS

or the three elements of the overhead traveling crane the straight series direct-current type is the one usually employed.¹ The speed-load characteristics of the series motor are such that under heavy loads the motor operates at a reduced speed, which is desirable from the standpoint of the supply circuits and generating equipment, while at reduced loads the motor operates at

of an overhead traveling crane when handling a 30-ton load² are shown in Figs. 5 to 8. These curves relate to one set of conditions only, but they indicate clearly the variations in the current requirements, and, moreover, they show that the demands on the various crane motors are likely to vary over wide limits except in those special cases where a fairly well-defined duty



FIGS. 2 AND 3—BRIDGE, TROLLEY AND HOIST MOTORS ON TWO TYPICAL CRANE INSTALLATIONS

higher speeds and the quick handling of the crane is thus facilitated under such conditions.

Where alternating current only is available it is sometimes satisfactory to use alternating-current motors of the slip-ring induction type, which are preferable as to torque and speed variation in comparison with the squirrel-cage induction motor. Neither of these alternating-current motors, however, has such a marked tendency to higher speeds at light loads as the series direct-current motor, and hence it may be desirable in those cases which require wide speed variation to convert from alternating current to direct current, so as to make possible the use of direct-current series motors (see footnote 1). Fig. 3 gives a good idea of one type of (inclosed) direct-current crane motor, while Fig. 10 shows the use of polyphase alternating-current motors for crane service.

Several features in the motors for cranes have received special attention. In the general class of inclosed direct-current motor shown in Fig. 3, for example, rugged construction is apparent. Reliability under the exceedingly severe operating conditions encountered has been secured by careful design of the bearings, so as to insure large and well-oiled bearing surfaces; the frame has been designed for unusual strength; the commutator and brush surface has been made large enough to meet the service conditions; the armature coils are heavily banded and in some motors the overhung portions of the armature coils are supported on shelves; and finally the use of commutating poles, which increase the life of the commutator and contribute to the ease of using the motor for reversing service permits handling sudden overloads without sparking. Similar care has been given to the design of alternating-current motors of the various types.

Graphic ammeter records taken on the three motors

cycle is repeated regularly, and possibly also in those cases where a crane is used only occasionally for repair work, as in a power house, where the heating of the motors is sometimes a problem of little or no importance.

Where the duty cycle is subject to fairly close determination the "square-root-of-mean-square" method for ascertaining the correct motor horsepower rating may be used, as fully explained in previous articles. One method employed by the manufacturers is to rate crane motors in brake horsepower on a basis of being able to operate continuously for thirty minutes, starting cold, at the full rated load without any part of the motor rising to any higher temperature than 55 deg. C. above the temperature of the surrounding air. A knowledge of the r.m.s. horsepower required, together with the manufacturer's rating basis, makes it possible to select the motor, whereas in those cases where the duty cycle is not well defined and where the maximum or full capacity of the crane is required at infrequent intervals it becomes more difficult to apply a definite method for the horsepower determination, and a greater degree of judgment must be exercised.

Care must be taken in the application of series motors to see that the maximum speed reached by the motor at light loads is not greater than the construction of the motor armature can stand. Some manufacturers, therefore, tabulate the maximum speeds for the various classes of series-wound crane motors, which must not be exceeded when the motors are carrying the friction load of the crane only. For example, the motors in Fig. 3 are listed at 2100 r.p.m. for this maximum speed, whereas low speed is listed as 550 to 600 r.p.m. and

¹The classification of cranes is based on an article by A. C. Eastwood, "Standard Handbook for Electrical Engineers," fourth edition, McGraw-Hill Book Company, New York.

²Figs. 2 and 3 are reproduced from C. W. Hill's treatise on cranes. Figs. 5 to 8 are due to the General Electric Company, Fig. 10 to the Wagner Electric Manufacturing Company, and Fig. 11 to the Crocker-Wheeler Company. Frequent references have been made to the "Standard Handbook for Electrical Engineers" and to bulletins or other data placed at the disposal of the writer by the Westinghouse Electric & Manufacturing Company and the other companies just mentioned.

moderate speed at 725 r.p.m. for this same type of motor.

A simplified wiring diagram showing the principal elements of a direct-current crane controller is shown in Fig. 4. In hoisting, the operation of this controller

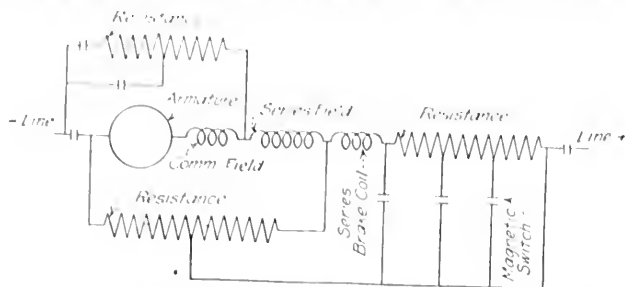


FIG. 4—SIMPLIFIED DIAGRAM OF DIRECT-CURRENT CRANE CONTROLLER

is similar to that of ordinary controllers, since the motor is merely connected to the line through armature resistance, as shown in the upper part of Fig. 9, for example, in which case the upper left-hand resistance is inserted for the purpose of starting up the motor at low speed. In lowering the load of a crane-hoist motor it is necessary to employ some means for braking the load. This may be done by an ordinary mechanical brake, by some form of electrically operated brake or by dynamic braking. The last two types are of interest from the motor or electrical control standpoint.

It is usually the practice to arrange electric brakes so that they exert their braking effect only when no current is being supplied to the motor from the line. As soon as the controller admits current to the motor the brake is released. Of the three types of electric brakes commonly employed (band, disk and shoe) it is the usual practice to furnish the disk brake when the brake is required merely for retarding the momentum of the moving parts, and it is constructed to hold, say, one-half of the full-load torque of the motors. For high retarding power the shoe brake is desirable, and it may be adjusted to hold more or less than full-load torque.

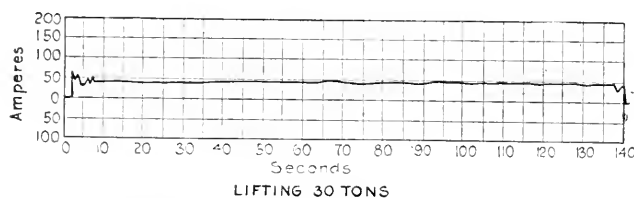
Dynamic braking is especially interesting because it involves some modifications in the controller. Consider, for example, the controller represented by Fig. 4. When the load is lowered the first position of the controller places the armature and the series fields across the supply mains through paths which are in parallel, each path having resistance, as in the third simplified diagram of Fig. 9. An inspection of this diagram shows that these connections place the armature and field winding in parallel, thus essentially making the machine a shunt motor for the time and starting the load at low speed. This first controller position for lowering is sometimes called the "kick-off" position.

As the load is lowered the armature is rotated and the motor is thus converted into a generator, which results in a "dynamic" braking current through the series field tending to stop the motor. By advancing the controller additional resistance may be inserted in the armature circuit, thus increasing the speed of lowering (see the lowest diagram in Fig. 9). Other types of controllers are available, but they differ chiefly in details and in some of the functions they are designed to cover.

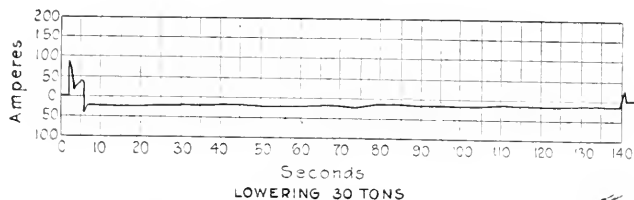
THE CROSS BRIDGE DRIVE*

While the normal speeds of crane bridges vary considerably, depending on conditions, from 250 ft. to 300 ft. (76.2 m.) per minute, which correspond to about 3 miles to 3½ miles (5.6 km.) per hour, are practical averages based on the speed at which a man can walk down a factory aisle while accompanying a piece of material being transported by the crane. Where very long runs are involved higher gearing is sometimes employed, resulting in speeds as high or even higher than 1000 ft. (304.8 m.) per minute.

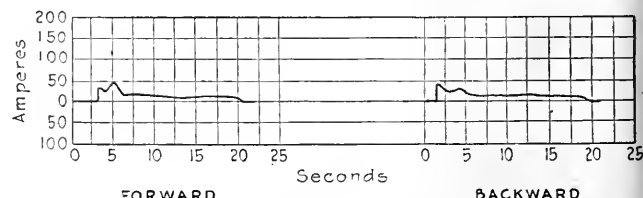
A. C. Eastwood (see footnote 1) cites an interesting case where a bridge speed of 500 ft. (152.4 m.) per minute was employed for a certain crane, which performed a regular duty cycle made up of short moves of about 24 in. (0.6 m.) at a time for twenty-four successive times, after which the crane returned to its



LIFTING 30 TONS

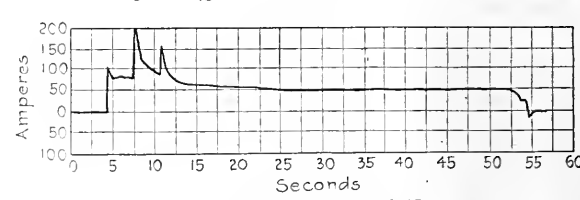


LOWERING 30 TONS



FORWARD

BACKWARD



TRAVELING 30 TONS

FIGS. 5, 6, 7 AND 8—AMMETER RECORDS FOR AN ACTUAL CRANE WHEN LIFTING, LOWERING, CARRYING LOAD (30 TONS) BACK AND FORTH ACROSS BRIDGE, AND TRANSPORTING ALONG CRANEWAY

When set it is self-adjusting in that any wear in the brake shoes is compensated for in such a way that the air gaps and hence the braking strength are kept constant. The disk brake, however, has an advantage over the other two types in that side strains are equalized as regards the shaft, and, moreover, the effectiveness of the braking does not depend on the direction of rotation, as may be the case with the other two types.

starting position. This cycle of operations continued for essentially twenty-four hours each day. After this crane was placed in operation it proved to be unsatisfactory because the operator found it almost impossible to stop at the required point, practically always going beyond and then finding it necessary to reverse and

*"Standard Handbook for Electrical Engineers," fourth edition, p. 1212.

going beyond in the reverse direction. This made several attempts necessary in each case to place the crane in the desired position. To reduce the gear ratio between the bridge motor and the driving shaft would tend to reduce the difficulty of stopping at a fixed point,

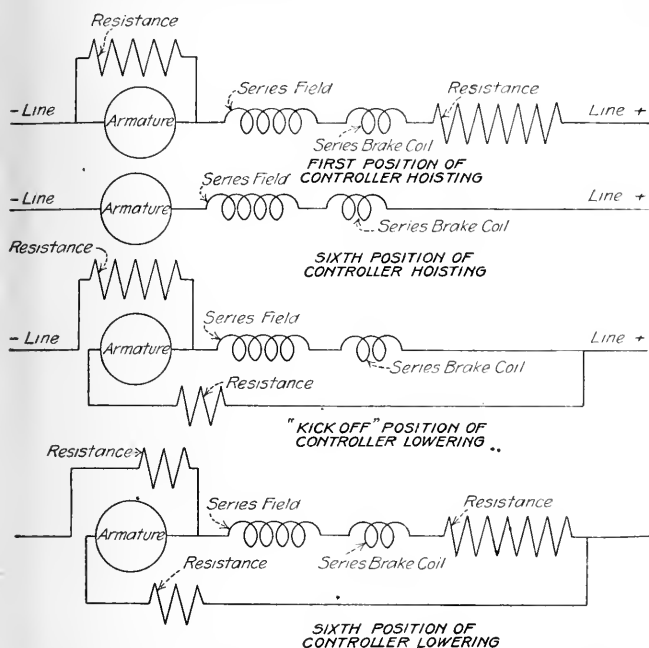


FIG. 9—CHANGES MADE IN CONNECTIONS WITH DIFFERENT POSITIONS OF CONTROLLERS

but theoretically such a reduction would also tend to lower production because of the reduced speed at which the bridge could be moved along the aisle of the workshop.

Nevertheless, the gear ratio was changed so that the reduction was three times as great as the original reduction, with the result that because of the increased accuracy in stopping at fixed points, the production or the output of the crane was increased over 400 per cent in spite of the decreased speed at which the bridge could be moved. This interesting case brings out in the form of a single example the need for careful attention to the gearing problem in crane operation as one of the features in the application of motors to such drives.

Special devices are available as protective features. One of these is the hoisting limit stop or switch,

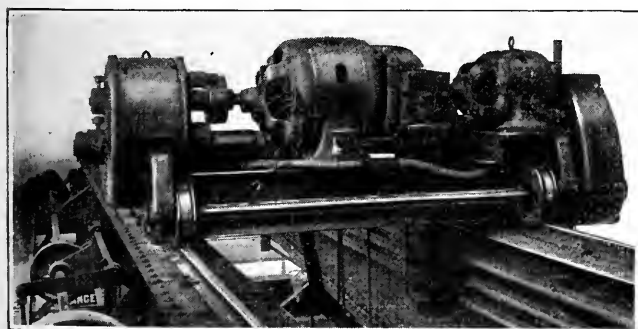


FIG. 10—ANOTHER TYPE OF DRIVE FOR TROLLEY AND HOIST

with which it is made impossible to raise a load by the hoisting motor so as to force it up into the trolley mechanism. One scheme for operating such limit switches is to have them cut off the supply current automatically when the hoisting tackle reaches a certain point and then to insert a dynamic brake circuit of such

low resistance that the motor and load are stopped practically at the instant of disconnection.

Panels are also equipped to protect against overloads and prevent injury to workmen making repairs due to the starting of the motors before work is completed.

In conclusion it should be stated that the economies

MOTOR CONNECTIONS FOR DIFFERENT SERVICES WITH FOUR TYPES OF MAGNET-SWITCH CONTROL

Characteristics	Reversing, Automatic-Acceleration, Speed-Control, Dynamic-Braking		Reversing, Automatic-Acceleration, Speed-Control	Reversing, Automatic-Acceleration
Form of Controller	1	2	3	4
Hoisting	One series motor or two series motors in series	Two series motors in series or parallel		
Bridge operation	One series motor or two series motors in series	Two series motors in series or parallel	One series motor or two series motors in parallel	One series motor
Trolley travel	One series motor or two series motors in series	Two series motors in series or parallel	One series motor or two series motors in parallel	One series motor

which were shown to be possible when correct applications of motors and control are made to lathes and planers are almost equally possible with the traveling crane because of its importance to production in the handling of materials.

Book Reviews

HOW TO MAKE HIGH-PRESSURE TRANSFORMERS. Second edition. By Prof. F. E. Austin, Hanover, N. H. 46 pages, 211 illustrations. Price, 65 cents.

Several methods of making different types of transformers for high-voltage use are given in this book in simple language. Information is given on the method of procedure for designing and constructing transformers for any special use and on formulas for the calculation of various losses, thus insuring a suitable design.

BUSINESS LAW FOR ENGINEERS. By C. Frank Allen. New York: McGraw-Hill Book Company, Inc. 291 pages. Price, \$3.

It was said recently before a large body of men by a speaker of some prominence that every successful business man must be something of a lawyer. Probably of no profession is this more true than that of engineering. The author of this volume, a professor of railroad engineering in one of the most prominent technical institutions in the United States, an engineer of wide experience, a member of the Massachusetts bar and a former practicing lawyer of considerable repute with engineering corporations, has undertaken after years of preparation to give the engineer, as he expresses it, "a sufficient understanding of important fundamental features of law so that he may have some idea of when or how to act himself and when to seek expert advice." The book, which is in two parts, (1) elements of law for engineers and (2) contract letting, seems very complete and goes well into detail without, however, being full of legal technicality. The layman can easily grasp its contents.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

ALLOWABLE LINE LOSS DEPENDENT ON SERVICE

Consideration of Kelvin's Law May Indicate Necessity of Smaller Line Loss Where Energy Is Purchased at Primary Rate

BY R. G. HARRIS

In working out sizes of transmission-line conductors the rule of "10 per cent allowable for line losses" has become so well established that power company engineers sometimes forget that it may not apply when figuring transmission lines for consumers. Although 10 per cent may be satisfactory for the company's lines, where the actual cost of producing energy at the switch-board is something under $\frac{1}{2}$ cent, it is another matter altogether if the energy is being transmitted by the purchaser, who has paid about $\frac{3}{4}$ cent per kilowatt-hour for it at a high voltage and has to figure in line allowances as well as mechanical efficiencies in his operating charges.

The use of Kelvin's law—namely, that the annual value of the power lost should theoretically equal the annual cost of the copper in the line—as an aid to judgment in finally determining the economic size of wire will very materially change the assumption as to line loss, and the 10 per cent assumption under the conditions mentioned above will generally be found to be very excessive.

PYROMETER SYSTEM FOR ANNEALING FURNACES.

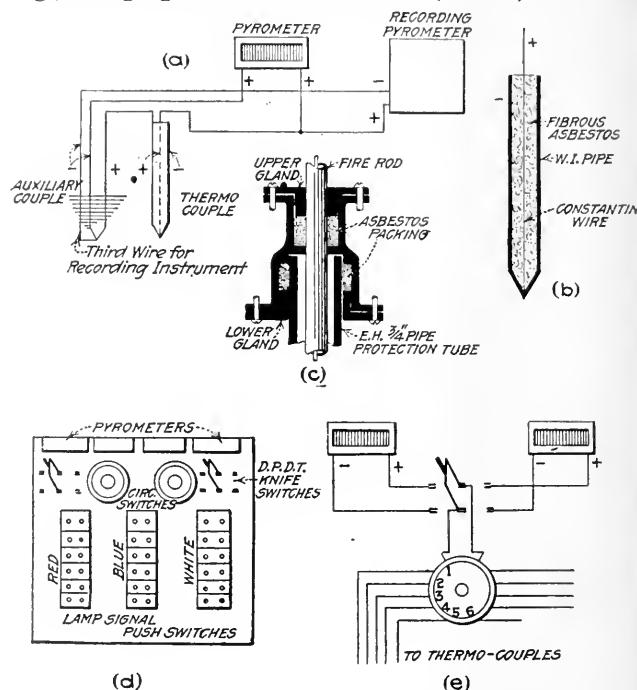
Mounting of Thermocouples, Method of Running Circuits and Provisions for Supervision of Furnace Operation

BY W. P. THOMAS

An indicating and recording pyrometer system that is giving complete satisfaction to both the furnace operator and the metallurgist was installed some time ago by the writer in connection with a battery of six annealing and hardening furnaces. Six indicating pyrometers with the auxiliary equipment are installed on the checkers' bench; the recording pyrometers are situated in the metallurgist's laboratory and signaling lamps are mounted over each furnace to notify the attendant when the temperatures of the furnace are high, low or correct. Three thermocouples are installed in each furnace so that the central and end temperatures can be observed, and so the operator can determine which fuel valve to operate to keep the temperature correct. To avoid the use of too many pyrometers and still not hinder the observation of temperatures, the thermocouples are connected in groups of six to three circular switches, which in turn are connected with double-pole, double-throw switches, as shown in the accompanying illustrations, so that readings may be checked.

A small hole is provided in each furnace where the

temperature is desired and the thermocouple centrally attached to a tripod the feet of which rest upon the top of the furnace. What might be called a stuffing box is provided to seal the space between the thermocouple and the furnace casing, the construction, (c) in the accompanying illustration, being such that the thermocouple can be raised or lowered by adjusting the tripod attachment. This arrangement also makes it easy to remove the thermocouples for renewal or inspection. To prevent the leads of the thermocouples carbonizing, owing to heat escaping through the holes in the top of the furnace, long enough thermocouples are used so that their upper ends can be bent at an angle of 90 deg., bringing the cold ends 1 ft. (0.3 m.) from the



SOME FEATURES OF PYROMETER INSTALLATIONS

(a) Method of connecting thermocouple with instruments. (b) Details of thermocouple construction. (c) Protection details of stuffing box. (d) Checkerboard. (e) Circular switch shown in (d).

middle of the furnace, where the circuits run into conduits leading to the checker's bench and metallurgist's office.

All of the wires, which have asbestos insulation, are installed in iron conduit. The checker's bench being centrally situated, a 2-in. (5-cm.) conduit was installed from it to a pull box placed between the third and fourth furnaces. From this point to the second and fifth furnaces $1\frac{1}{2}$ -in. (3.8-cm.) conduit is used and reduced to 1 in. (2.54 cm.) where it extends to the first and sixth furnaces. From the main conduit $\frac{3}{4}$ -in. (1.9-cm.) conduit extends above the furnaces to points over the thermocouples, where $\frac{3}{4}$ -in. (1.9-cm.) conduit tees equipped with porcelain bushings are provided. One-and-one-half-inch (3.8-cm.) conduit is used between the checker's bench and the metallurgist's laboratory.

AUTOMATICALLY OPERATED SYNCHRONIZING STATION

Arrangements by Which Two Transmission Lines
May Be Automatically Connected at a Point
Remote from Any Station or Substation

The Iowa Railway & Light Company of Cedar Rapids has two 13,200-volt transmission lines which it is desirable to operate in parallel, yet which join each other at a point where it is frequently desirable to open the circuit. Moreover, it is not desirable to interrupt service on either line to bring about the paralleling of the two sections after the line has been opened. A sub-

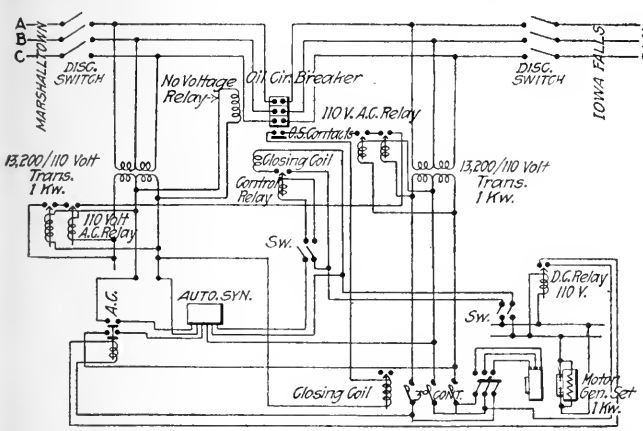


DIAGRAM OF CONNECTIONS IN AN AUTOMATIC SYNCHRONIZING STATION BETWEEN TWO HIGH-TENSION LINES

station simply for the purpose of connecting the lines together at this point did not seem to be justified. To meet this condition, therefore, the company's engineers have installed an automatic synchronizing station and a set of watt-hour meters, equipped with ratchets, to record the interchange of power between the two sections of the system.

The apparatus consists of two sets of 13,200/110-volt, 1-kw. standard transformers, two sets of 110-volt steel-mill type relays, an automatic synchronizing device, a 1-kw. motor-generator set, an oil circuit breaker and a few additional relays. The two sets of 110-volt steel-mill-type relays are connected across the phases of the secondary sides of the transformers, which are in turn connected in the 13,200-volt circuits. The contacts on these relays are in series, therefore the closing of all relays is accomplished when all phases are energized. When all of these series contacts are closed the small motor-generator set is started. It supplies energy through its direct-current unit, when it comes up to full voltage, to close the direct-current relay shown in the accompanying illustration. This in turn permits alternating-current energy to flow to the synchroscope.

The synchroscope, manufactured by the Westinghouse Electric & Manufacturing Company, consists essentially of two solenoids acting on cores hung on the opposite ends of a rocker arm. The solenoids are connected so that the right-hand end of the rocker is at the extreme lower end of the stroke when the electromotive forces to be synchronized have no phase difference and is at the upper end of the stroke when the phases are in opposition. This causes the rocker arm to oscillate up and down. When the right-hand end of the rocker arm approaches the lower end of its motion with less than a predetermined speed the contact closes the circuit

of an auxiliary relay, which in turn closes the circuit operating the closing coil of the main oil switch. The closing of the contact occurs before synchronism by a predetermined length of time sufficient to permit the main switch to complete the circuit exactly at the point of synchronism. The synchronizer does not make contact at all unless the difference in speed of the two machines at the different ends of the line is less than a predetermined amount.

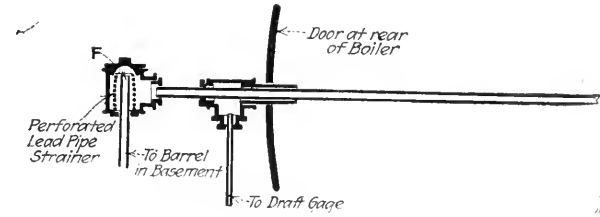
The contacts in the synchronizer at the oil switch are closed when the oil switch is open, and vice versa, to permit starting and stopping of the motor-generator set as desired. For protection against single-phase operation the no-voltage release coil is connected to all phases. The oil switch is not arranged for tripping on overload, the lines being protected at other points against difficulty from this source. The action of the alternating-current relay, which is operated by the motor-generator set, is analogous to the action of an operator before a switchboard plugging in a synchronizing receptacle.

This apparatus, together with the metering equipment, is installed out in the middle of a cornfield and takes care of itself entirely, except for a visit from an attendant about once every three months. The installation was worked out for the Iowa Railway & Light Company by John M. Drabelle, the company's electrical engineer.

OUTFIT DESIGNED FOR TAKING CONTINUOUS FLUE-GAS SAMPLES

Bonus Paid to Operators on CO₂ Present Is Determined by Use of Device That Collects Gas Over an Entire Eight-Hour Shift

After having tried a number of methods of determining the percentage of CO₂ in flue gases at its plant, the Bloomington & Normal Railway & Light Company of Bloomington, Ill., has developed the apparatus shown herewith. The company has installed an outfit of this character on each boiler in its plant. This apparatus in operation takes a continuous sample of the flue gas for eight hours after it is started. The plant is operated on eight-hour shifts, and at the end of each shift the gas is sampled in an Orsat set for CO₂, and occasionally for O and CO. The record of the result is made:



DETAIL DRAWING OF FLUE-GAS SAMPLING APPARATUS

on the power-plant report, and also on a bulletin board in the boiler room, to show the comparative record of each boiler and each fireman for the different shifts.

The water pipe used for filling the tank is near the bottom of the barrel so that water while filling the barrel shall not disturb the oil seal which is used over the water. When using an oil seal the CO₂ is generally 1 per cent higher than without it, because the oil prevents the escape of air and other gases which are in the

water into the boiler-gas sample under slight vacuum. All samples taken by this apparatus are tested by an efficiency man, the samples being received from the tank in 4-in. (10.2-cm.) gas stopper bags such as are used in stopping gas mains. The time required for filling the tank with water is three minutes, and about three minutes is required to run a sample through the Orsat machine.

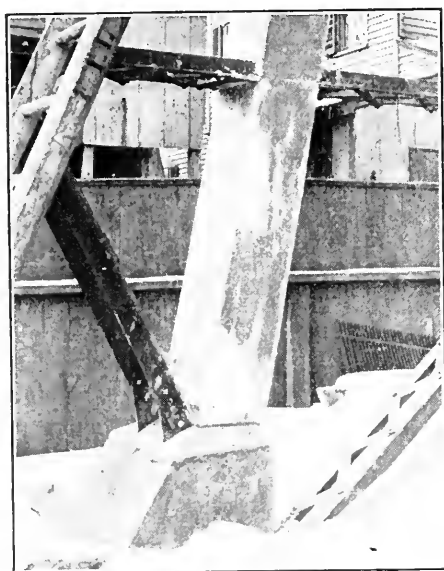
The outfit installed in the company's plant has been in operation for some time with good results. The principal difficulty with an arrangement of this kind is in keeping the pipe lines free from a deposit of fine ash which is likely to clog them. The bonus which the boiler-room operators are paid on CO₂ in combustion gases averages about 12 per cent.

FIREPROOFING TOWER LEGS TO SAFEGUARD SERVICE

**Legs Are Incased with Concrete to a Height of 40 Ft.
Above the Ground—Description of
Method of Reinforcing**

At the Margaret Street substation of the Springfield (Mass.) street railway a steel tower has been built to hold one end of a 66,000-volt transmission span across the Connecticut River, over which the Turners Falls Power & Electric Company is to supply energy to the railway system. A special feature of this tower is the fireproofing of the legs to a horizontal cross-section of 12 in. by 16 in. (30.5 cm. by 40.6 cm.), illustrated herewith.

The tower legs are of structural steel and are each incased with concrete to a height of about 40 ft. (20.2 m.) above the ground, thus clearing the maximum vertical range likely under any circumstances to be reached



TOWER LEG INCASED IN CONCRETE

by arcs or hot gases in case of oil-switch trouble at the substation adjacent to the tower. The concrete is reinforced with a loop of wire mesh surrounding the lattice work of the tower leg in each case. An outdoor substation equipment with transformers and switches occupies the area below the tower, which requires heavy bracing to serve as the span anchorage, as shown.

MECHANICAL SOOT BLOWERS MAKE 15 PER CENT SAVING

**Installation in an Iowa Plant Makes the Jobs of
Firemen More Pleasant and Enables Them
to Keep the Boilers Cleaner**

After one year's experience with mechanical soot blowers, Charles W. Smith, chief engineer for the Iowa Falls (Iowa) Electric Company, has reached the conclusion that the devices have proved themselves a good investment. The installation consists of three sets of Bayer type B cleaners on one 550-hp. and two 410-hp. Edge Moor water-tube four-pass boilers. Before these cleaners were installed the company was using the old hand-cleaning method. This method was expensive and unsatisfactory, costing \$840 a year. Practically all of one man's time was required, and it was found that there were few men who would stand in front of a hot boiler and blow every tube. Some tubes would be skipped, with the result that the boilers were never all clean. In fact, it was practically impossible for a man to hold a steam lance with full 175 lb. per sq. in. (12.3 kg. per sq. cm.) pressure on the line. After the new cleaners were installed it took two months to get the caked soot off the tubes which had grown there owing to the use of wet low-pressure steam before the mechanical cleaning system was used.

Several points in favor of the mechanical cleaning have been apparent. The main feature is that in blowing the soot it is possible to use full boiler pressure and do better work. With the old system the tubes were blown once every twenty-four hours. Now they are blown twice on every shift, and, moreover, the services of one man have been entirely dispensed with, thus making him available for other work.

Mr. Smith stated that these cleaners had effected a 15 per cent reduction in coal burned and had occasioned no maintenance expense. One pint (0.5 l.) of oil has been used on the swinging joints. Thus far the valve seats have not required grinding.

USE OF INSULATORS TO PHASE 66,000-VOLT LINE

**A Novel Method of Finding if Proper Phase Relation
Existed in Locality Where Potential Trans-
formers Could Not Be Employed**

A novel method of phasing out a 60,000-volt line was employed by the Southern California Edison Company recently when it became necessary to join the ends of an open loop. Potential transformers could not be used because the phasing-out point was remote from any station or instrument equipment. Suspension insulators were therefore employed, as explained in the following paragraph.

Three strings of five units each were hung on the wires of one end of the loop in such a manner that the lower ends of the strings could be swung against the three wires of the other end of the loop. One string would draw a spark about $\frac{1}{4}$ in. (6.2 mm.) long while the other two drew sparks more than 1 in. (25.4 mm.) long, showing that they were out of phase with their corresponding wires. These two wires were reversed and the loop closed through the pole top switch without disturbance.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

INCREASING BUSINESS ON SMALL-POWER MACHINES

Through Co-operation with Local Manufacturers'
Agents Considerable Load Has Been Placed
on Southern Company's Lines

The commercial department of the Birmingham Railway, Light & Power Company has been giving considerable attention recently to the development of small power business. A careful analysis was made of the market to determine which appliances offered the best advantages, and the campaign started, concentrating on these selected appliances.

The Birmingham company does not sell electrical appliances, and it was therefore necessary to secure the co-operation of the local agents in the district handling the various appliances. These agents were naturally enthusiastic over the plan and have taken hold and sold more small power devices than have ever been placed on circuit in that community before.

A large number of vacuum cleaners have been sold and a great many washing machines, vulcanizers, special shoe machines, refrigerating machines, dough mixers, etc. Coffee mills, meat grinders and peanut-butter makers have also been very strong, twenty-six peanut-butter machines having been sold in the last four months on extra meters, with all energy billed at the lighting rate. A short campaign on washing machines was also very successful, six washers having been disposed of in one day in spite of the fact that Southern cities have not yet broken from the negro washer-woman habit and taken to the modern method.

The result for the company has been most profitable and satisfactory. The active co-operation of the manufacturers' agents has reduced the company's responsibility and work to the minimum and at the same time organized an extensive selling force of expert men who have proved most effective.

POWER MEN TURNED TO ON SMALL APPLIANCES

In Certain of the Doherty Properties Sales Forces
Are Thereby Kept Intact at a Profit
to the Companies

Conditions in these war times are bringing about some interesting changes in the work of many central-station selling men. Not only is there trouble in securing fuel, but many companies after waiting months for new generating equipment have had to relinquish it to the government and see no possibility of increasing their capacity. The result has been that frequently power salesmen have had to discontinue the development of industrial business from the sheer impossibility of furnishing the necessary service.

In many cases it has been recognized that these power

men could meet the situation by turning their hand to the sale of meat grinders, coffee mills, drink mixers and the innumerable small appliances which are salable to the home, store and office; in fact, anything else that may be sold at a profit and provide the type of off-peak load at lighting rates which at such a time is desirable.

In three of the Doherty properties—namely, Warren, Mansfield and Massillon, Ohio—the power men are paying not only their salaries but a profit to their companies by the sale of such equipment. At the same time they are selling rectifiers, shafting, flywheels, pulleys and anything else along these lines which will show a merchandising profit and give service to the customer.

The salesmen of the Doherty organization are now all operating on a salary plus commission basis, which demonstrates whether or not the man is profitable. There is, therefore, no expectation of reducing the size of any of the local sales departments, but rather of concentrating the effort on the sale of appliances which will show a merchandising profit and not involve any additional peak load.

CARRYING CURTAILMENT POLICY TO EXTREMES

With Existing Delivery Situation, Interest Saving by
Carrying Lower Stocks May Be More than
Offset by Customers' Inconvenience

An example of the extremes to which a curtailment policy in the central station's new-business department may be carried is instanced by a New England jobber. A group of central stations under the management of a banking syndicate is at present purchasing electrical appliances in very small lots. Records are kept of the assignment of these appliances to the different companies under common management, one company being supplied with a certain class of appliances like percolators, another with heating pads, a third with sewing-machine motors, and so on. When a customer in any company desires to purchase an appliance not carried in sufficient stock locally the local manager consults his list and sends an order to the company carrying that particular equipment for early delivery. In due course the order is filled or an article sold on the spot replaced. In discussing this policy, the jobber pointed out that while it enables a minimum stock to be carried among a group of central stations, it is difficult to render adequate service to the public in this way.

The cost of sending appliances by parcel post or by express, with present-day lack of speed in transportation, tends to offset the saving effected in interest charges on appliances carried locally and to inconvenience the buying public perhaps more than is necessary in view of the off-peak character of much appliance service in relation to other demands upon the

plant. Even the local dealer does not benefit from this policy unless the central-station manager sees fit to fill orders from the retailer's stock in a co-operative spirit.

ELECTRIC INDUSTRIAL TRUCKS AT TERMINALS

Inasmuch as the Storage Batteries Are Charged During the Night, This Service Furnishes an Off-Peak Station Load

As evidence of what the electric industrial truck can do to reduce congestion at railroad terminals the accompanying illustration is given. Eleven large trunks are here shown being taken away from an Eastern rail-



ONE TRUCK EASILY CARRIES ELEVEN LARGE TRUNKS

road ferry station at one time. One advantageous feature of this load for central stations is that a large part of it is off-peak—the battery charging being done during the night.

SPECIAL ILLUMINATION DEMONSTRATION ROOM

Designed to Aid in Showing Prospective Customers the Latest Developments in Efficient Lighting

The Harrisburg (Pa.) Light & Power Company has recently installed under the salesroom a special illumination demonstrating room, intended to aid in showing prospective or present customers the latest developments in efficient illumination. A wide variety of lamps, reflectors and fixture equipment has been installed, so that it is possible to demonstrate office, factory, store or window lighting under varying conditions.

It is not the intention of the Harrisburg electric department to compete with the local-supply dealers now selling fixtures and reflectors to commercial and industrial customers. The fixture manufacturers, however, have co-operated in the equipment of this room with samples of the latest models, and fixtures will be sold at a profit to customers who come to the company for advice in illumination matters. This equipment, the company feels, places it in a position to give far more assistance to the consumer than the average electrical supply dealer can afford.

LIGHTLESS NIGHTS IN HYDROELECTRIC TERRITORY

Conservation of Fuels Shown to Be the Assured Result from the Widest Use of Energy Generated by Water Power

The Utah Power & Light Company, Salt Lake City, Utah, which operates with hydroelectric power, is running the advertisement here reproduced, with the

ELECTRICITY'S PART IN FUEL SAVING

So serious is the coal shortage throughout the United States that it has become the patriotic and imperative duty of each individual to aid to the utmost in the conservation of commercial fuel.

This can best be done by the use of Electricity, generated solely by water power.

The generating of hydroelectrical energy requires no fuel.

Even the water turning the wheels of the enormous power plants operated by this company is not consumed or contaminated, but returns at once and without diminution to its natural channels. During the present year—1917—the Utah Power & Light Company generated 500,000,000 kilowatt-hours of electrical energy, which in its many uses is doing work in the mines, factories, farms and homes of this great intermountain territory that otherwise would have necessitated the use of 1,000,000 tons of coal. It would have required 25,000 coal cars and more than 500 locomotives to have transported this vast quantity of coal to the consumers.

To curtail your use of electric service, or to fail in utilizing electricity to the very fullest extent in business and in your home, is to fail in doing your full share to support the government's fuel conservation policy.

There are many uses in every business and in every home for electric service where a direct and material saving of coal will result.

Electric cooking and electric ironing are important factors.

In 2200 residences, hotels and restaurants throughout this company's territory electric service is being used to-day for cooking. And by using electricity for this purpose these 2200 consumers are saving the government 30,000 tons of coal annually.

If 22,000 consumers used electricity for cooking the saving would be 300,000 tons of coal annually.

In practically every industrial pursuit in the intermountain West electricity is simplifying manufacturing processes, abolishing wasted effort, increasing production, cutting operating costs—and SAVING FUEL.

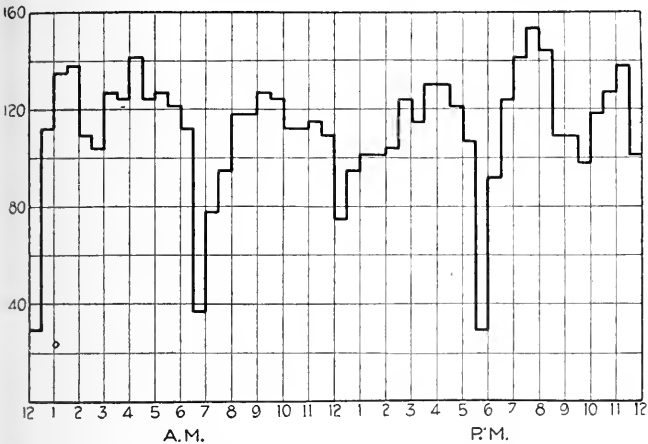
UTAH POWER & LIGHT COMPANY
Efficient Public Service

thought of indirectly educating the public to the inadvisability of observing "lightless nights" in hydroelectric territory. "Lightless nights" were instituted not to curtail electric lighting company revenue, but to conserve the supply of fuels. Where water power is used no energy is conserved by turning off the lights—rather is it wasted. In this instance the company urges the widest use of electricity, so that fuels will be used less and the supply thereby conserved.

LOAD CHARACTERISTICS OF AUTOMOBILE TIRE FACTORY

Assembled Data on the Machines Installed, on the Characteristics of Demand and on Unit Energy Consumption

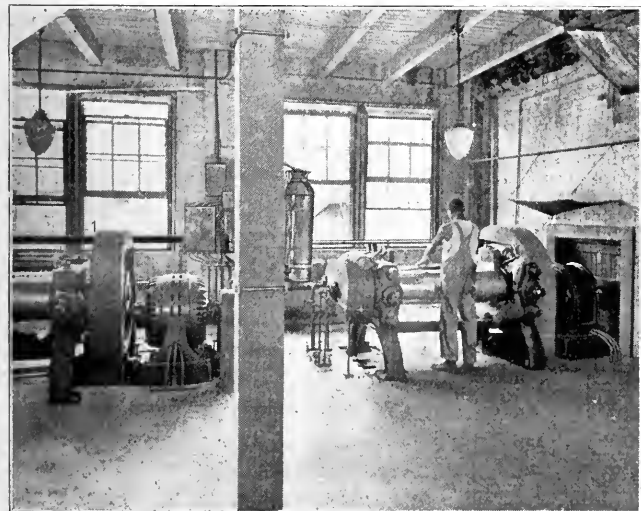
The installation of the Ehman Tire & Rubber Company of Chicago is an example of a medium-sized tire company from which data of a generally applicable character may be taken. All of the service is supplied at 220 volts, three-phase, 60 cycles, from the lines of the



LOAD CURVE OF TIRE FACTORY PRODUCING 500 TIRES A DAY (HALF-HOUR READINGS)

Commonwealth Edison Company. It is all utilized as alternating current except that energy required to operate a 90-hp. calender. Direct current for this machine is supplied by a 100-kw. rotary converter operating from the alternating-current supply. One calender is driven by an alternating-current motor, a departure from usual practice. Lighting is supplied through an auto-transformer connected so that all service will come through one meter and thus give the tire company the benefit of receiving a simultaneous maximum demand.

The table herewith is a complete record of the elec-



MOTOR-DRIVEN MILLS AND CALENDERS

trically driven apparatus at the plant of the Ehman company. It shows the connected electric load exclusive of lighting to be 750 hp. The curve reproduced shows the uniform character of the company's load. The maximum demand occurred between 7:30 p. m. and 8 p. m. and amounted to 153 kw., giving a demand fac-

tor of 27.2 per cent and a load factor of 74.7 per cent. The peak was only a few kilowatts above the usual demand. The total energy consumed in September, the month in which the demand curve was made, was 52,200 kw.-hr. During this month the company's output

DATA ON MOTOR APPLICATIONS

Number of Units	Type Machine	Type of Drive	Manufacturer	Size of Motor in Hp.
2	Mill	Gear	Birmingham	100.0
1	Mill	Gear	Birmingham	50.0
1	Mixer	Gear	Birmingham	75.0
1	Mixer	Gear	Birmingham	75.0
1	Hydraulic pump	Gear	Davis	7.5
1	Calender	Gear	Birmingham	50.0
1	Calender	Gear	Vaughn	90.0
2	Mills	Gear	Vaughn	35.0
1	Mill	Gear	Vaughn	100.0
1	Mill	Gear	Farrell	40.0
1	Mill	Gear	Birmingham	100.0
1	Tuber	Belt	Allen	5.0
1	Elevator	Belt	Otis	7.5
3	Buffers	Belt	.....	5.0
1	Labeling	Gear	.....	0.1
1	Experimental mill and calender	Gear	Vaughn	5.0
1	Cement mixer	.....	.....	5.0
2	Cove machine	Guard	Akron Rubber Mold	5.0
1	Cleaner	Belt	.....	3.0
1	Air compressor	Belt	Curtis	35.0
1	Bias shears	Belt	Birmingham	5.0
1	Tube wrapper	Belt	Akron Rubber Mold	2.0
1	Treadmill	Gear	Adamson	15.0
1	Rotary converter	.....	.....	100.0
Total.....				750 hp.

amounted to 500 tires a day, the tires including all of the more common sizes. It can also be shown that the energy consumption per tire was only 3.48 kw.-hr. and amounts to only a very small fraction of the tire cost. With the exception of three buffers and one cement mixer, for which the data could not be obtained, General Electric motors are used.

PRESENT-DAY VALUE OF STOCK OF MOTORS

Georgia Company Sells in Eighteen Months 175 Motors, Aggregating 7140 Hp., or an Average of 41 Hp. per Machine

During the last eighteen months the Georgia Railway & Power Company has sold to its various hydroelectric customers 175 electric motors, aggregating 7140 hp., the cost totaling \$101,667. The greater portion of these motors were furnished from the company's stock.

In the opinion of the sales department of the company, this stock has been a valuable asset in that some very substantial power business has been placed on the company's lines which might have been lost had not the motors been immediately available for emergency purposes. Moreover, new business has been secured owing to the fact that motors were delivered promptly, where, on the other hand, the customer might have been delayed through long deliveries from the manufacturer.

While the number, horsepower and value of motors handled by the company run into big figures, they do not include sales made by the motor manufacturers direct to customers. In the same period the manufacturers sold approximately 31,500 hp. in motors, aggregating \$662,000 in value. Calculations based on motor sales from company stock indicate the following average horsepower per motor: 220-volt, 19.8 hp.; 550-volt, 41.5 hp.; 2300-volt, 68 hp. The grand average size is 41 hp. per motor.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Starting Rotary Converters When Connected to Transformer Secondaries.—F. D. NEWBURY and M. W. SMITH.—When rotary converter transformers are permanently connected to the slip rings, starting from the direct-current end requires a larger starting current and the torque is not so good as with an arrangement where the alternating-current circuit is open. The authors analyze these conditions in this article.—*Electric Journal*, January, 1918.

Lamps and Lighting

A New Spherical Photometer for Incandescent Lamps.—The introduction of gas-filled lamps of novel shapes has made necessary a new style of photometer which will measure, not the mean horizontal luminous intensity, as in the old types of lamp, but the mean luminous intensity in space. With this end in view, a spherical photometer made of zinc sheets, polished on the inside, has been developed. An opening closed by a small panel permits the introduction of the lamp. Behind a disk of opal glass closing an opening on the horizontal surface of the apparatus, in an oblique direction from the lamp, is a Lummer-Brodhun photometer. In a tube connecting with the latter is another luminous source, also furnished with a disk of opal glass. The method of making the tests is to bring the lights derived through the two disks to equal values. How this is done is fully explained and the apparatus is illustrated by diagram and photograph.—*Revue Générale de l'Electricité*, Nov. 24, 1917 (abstracted from *Elektrotechnische Zeitschrift*, April 5, 1917).

Generation, Transmission and Distribution

The Properties of Electrolytic Copper.—B. WELBOURN.—The author of this article presents tests that were made on an experimental span under working conditions with different cross-sections of copper conductors and different numbers of strands.—*Journal of (British) Institution of Electrical Engineers*, December, 1917.

Suppression of Arcs Due to Accidental Ground.—M. H. COLBOHM.—Service disturbances or interruptions in transmission systems are in most cases occasioned by grounds or short circuits on the power line through outside influences, such as lightning, sleet or wind. Effective means for eliminating such causes cannot, therefore, be provided within the system itself and only relief in suppressing their bad effects on the system can be sought. Different kinds of equipment are in use for the elimination of ground trouble, depending upon whether the system operates with the neutral point isolated, dead-grounded or grounded through resistance. The author describes the kinds of equipment used in the three types of systems cited and points out their distinguishing features and their influence upon service. In this connection potential stresses, mechan-

ical stresses, reliability of operation, attendance required, detection of faulty lines, advantage of ground rheostat for line testing and emergency construction and comparative costs are taken up.—*Electric Journal*, January, 1918.

Aluminum-Iron-Rope Cable for High-Tension Transmission Lines.—A certain power transmission line in Germany designed and planned in 1914 could not be completed along the lines contemplated because of the shortage of copper. It was found impossible to substitute iron wire because the supports (already in place) had not been built strong enough to withstand the great stresses caused by the heavier iron wire. Other reasons, which are withheld from public discussion, prevented the use of steel-cored aluminum wire. The final solution of the problem, as reported by E. G. Fischinger of Dresden in the *Elektrotechnische Zeitschrift*, is as follows: Oil-saturated paper twine of 3.5-mm. diameter is wrapped with a strip of galvanized iron 7.5 mm. wide and 0.3 mm. thick in a "right-hand" spiral. Around this are wound in closely wrapped left-hand spirals six galvanized-iron wires 3.9 mm. in diameter. The iron core is then covered by twelve aluminum wires of 4.1 mm. diameter wound in a long-pitch right-hand spiral. The oiled paper is burned out as soon as the winding is completed, leaving a hollow iron-aluminum cable which has a wide range of elasticity, adapting it to severe wind and temperature stresses. The cable has a tensile strength of 6790 kg. (30 kg.-mm.²), or nearly one and a half times that of a pure aluminum cable.—*Schweizerische Bauzeitung*, Dec. 15, 1917.

Traction

Heating of the Armature in Traction Motors.—LEONHARD ADLER.—The author proposes to estimate the extent of armature heating by the measure of the resistance, a method much more rapid, simple and practical than the thermometric method. It is not necessary to measure the resistance of all the armature coils, but only of a portion of those in identical conditions. With high-powered motors it may be well to raise some of the brushes and insulate them by bands of presspan, though this precaution is not necessary with tramway motors, which usually have wave windings. One advantage of the method advocated is that it can be used when the tractors are in motion, which is impossible with the thermometric system. Resistances as low as 0.001 ohm can be measured by the Thomson apparatus.—*Revue Générale de l'Electricité*, Nov. 24, 1917 (abstracted from *Elektrotechnische Zeitschrift*, June 28, 1917).

Further Railroad Electrification Important.—F. H. SHEPARD.—The author points out in this article that electrical equipment provides a most effective way of increasing transportation capacity.—*Electric Railway Journal*, Jan. 5, 1918.

Installations, Systems and Appliances

Steam Central Station for Hanover, Germany.—The much-discussed plans for a single central station for all Germany have been brought nearer completion by the beginning of work on a state-owned power station in Hanover. This station will be operated by steam turbines of 10,000-kw. rating each—three of these turbines being installed to start with. It will form the connecting link between the two finished stations at Dörverden (Weser River) and Minden (Rhine-Weser Canal) and the two stations now nearing completion on the upper Weser and the Main, all of which are of the hydro-electric type. The completion of the Hanover station will form the last link of the chain reaching from the upper Main River to the North Sea coast, covering all of Germany west of the Elbe. The Hanover station is designed for three stages of development—50,000,000 kw.-hr., 90,000,000 kw.-hr. and 120,000,000 kw.-hr. The estimated construction cost will be 13,000,000 marks (\$3,250,000), and maintenance costs \$750,000 annually.—*Schweizerische Bauzeitung*, Dec. 15, 1917.

Electrophysics and Magnetism

Some Electrical Properties of Silver Sulphide.—GEORGE W. VINAL.—Silver sulphide may be prepared in the form of short wires or thin strips like a metal. The wire, which must be drawn hot, has been found to conduct electricity like a metal of high specific resistance and has a practically zero temperature coefficient. The strip of sulphide, rolled at room temperature, has a large negative temperature coefficient and shows both metallic and electrolytic conduction at the same time. It has a volt-ampere curve characteristic of a pyro-electric conductor. The resistance of these strips has been examined with both alternating and direct current, with the result that the alternating-current resistance was nearly always found to be higher than that with the direct current, and the passage of a small alternating current of a frequency as low as 60 cycles increased temporarily the resistance of the sulphide, while a small direct current produced the opposite effect.—*Bureau of Standards, Scientific Paper No. 310*.

Units, Measurements and Instruments

A Method for Testing Current Transformers.—FRANCIS B. SILSBEE.—A general method is outlined in this paper for the determination of the ratio and phase angle of current transformers in terms of the constants of previously calibrated standard transformers of the same nominal ratio. It has been shown that such methods are essentially more sensitive, or, conversely, may be used with much less sensitive instruments, than the laboratory methods now in use for the absolute determination of the ratio and phase angle of a single transformer. Two of the most convenient of the many possible modifications of the general method are described in detail. It is hoped that the methods will be found useful in commercial plants where delicate laboratory equipment is not available and where large numbers of transformers must be tested rapidly and with moderate accuracy.—*Bureau of Standards, Scientific Paper No. 309*.

Telegraphy, Telephony and Signals

Theoretical Calibration of Condenser Transmitter.—I. B. CRANDALL (Research Laboratory of the American Telephone & Telegraph Company and Western Elec-

tric Company).—The object of this paper is to complete as far as necessary the mechanical theory of the condenser transmitter. The mechanism of air-damping has been determined, and formulas have been obtained from which practical calculations can be made. A complete theoretical calibration of a condenser transmitter has been given which is consistent with the experimental calibration and which does not disturb the uniform frequency-sensitiveness characteristic of the instrument except at frequencies very near zero. The principles have been given for the design of air-damped systems of maximum damping and condenser transmitters having rigorously uniform sensitiveness over an extended range of frequencies, including zero.—Presented before American Physical Society, Dec. 28, 1917.

Measurement of Continuous Waves.—A discussion on how to calibrate a wavemeter that is recommended in the article.—*Wireless World*, December, 1917.

Miscellaneous

Industrial Specialization of Engineers.—E. PIERNET.—A plea for the establishment of technical high schools after the model of the Ecole Supérieure d'Electricité of France and the German "Hochschulen." The results due to the latter as impressed upon the author in the course of many years' employment in a large metallurgical plant on the Saar are outlined.—*Revue Générale de l'Electricité*, Nov. 24, 1917.

Effect of Brick Arch on Smoke Abatement.—An article on the principles underlying methods of securing complete combustion.—*Power Plant Engineering*, Dec. 1, 1917.

A New Insulating Material.—A new type of insulating material for which special properties are claimed is described. Besides having good insulating properties, it can be molded to any desired shape and cut or worked either by hand or machine. It is also practically incombustible, non-absorbent and does not have to be varnished. It is considered suitable for many electrical applications for which porcelain, marble and various vulcanized preparations are at present employed. The cost is also stated to be relatively low. The material is said to have the following constituents:

	Per Cent
Powdered flax	51.7
Sifted mica	14
Mineral rubber	20
Resin	1
Rubber solution	10
Flowers of sulphur.....	3
Selenium bisulphide	0.3

It is pointed out that the selenium bisulphide is used only as a suitable binding material, which facilitates the combination of the other ingredients and evaporates when the substance is left in the air after mixing. Carbon bisulphide may also be employed. The other substances are all capable of close mixing. The mineral rubber recommended is a soft mineral deposit which occurs in certain oleaginous schists. The proportions of the materials may be varied within certain limits, according to the use to which the material is to be put. After the substance has been dried it can be softened by being immersed in a steam-jacket vessel. When thus reduced to the plastic state it can be compressed into any desired form.—Abstracted from the *Revue Générale d'Electricité* in the *London Electrician*, Dec. 7, 1917.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Summary of Investigations, Available Apparatus and Research Suggestions

INVESTIGATIONS UNDER WAY OR COMPLETED (RESEARCH WORK REPORTED SINCE DEC. 15)*

CONDENSERS, ABSORPTION IN.

The absorbed charge is allowed to flow continuously through a sensitive shunted galvanometer; simultaneous readings of deflections and time are noted. It is then possible to plot discharge current with time of flow and determine, with a planimeter, the integrated value of idt between chosen time limits (in certain cases the time of flow is ten hours or more). The absorbed charge is studied as a function of the time of charge and of the charging voltage. Results are expressed graphically. A striking result is that the absorbed charge may be hundreds of times greater than a computed charge calculated from $hQ-CV$, where V is the steady applied voltage and C the capacity as measured on 60-cycle alternating current.—*L. Pyle, Washington University, St. Louis.*

CORE LOSS AT HIGH FREQUENCIES.

For the purpose of measuring the losses due to eddy currents and hysteresis, two toroids, both being alike in every respect except that only one contains a specimen of the iron whose losses were to be determined, were connected in series with each other in the secondary of an oscillating circuit. Each of these toroids was placed in a separate calorimeter. If the heat capacities of the calorimeters as well as of the toroids are the same and the I^2R losses in the winding of each toroid are equal, then the heat produced by the specimen of iron in one calorimeter may be balanced in the other calorimeter by means of a direct-current heating coil. The Chaffee gap was used as the source of the oscillations, and the Braun tube was to obtain the oscillograms. The experimental results indicate: (1) that the loss per cycle per cubic centimeter decreases with an increase in frequency; (2) that there is a non-uniform distribution of the magnetic flux due to the "skin effect" produced by the eddy currents.—*C. Nusbaum, Harvard University.*

CORONA (DIRECT-CURRENT), INFLUENCE OF SPARK ON.

A spark gap in series with a discharge tube affects the positive and negative corona in very characteristic ways, the changes being due to intermittent currents. A hot-lime cathode tube has been developed and used in observing the weak pulsating currents which pass through the spark and the corona tube. Evidence can be given in favor of the view that the corona resembles the arc discharge. An attempt at an explanation of the pulsating current has been made.—*S. F. Crooker, University of Illinois, Urbana.*

CORROSION.

Corrosion of non-ferrous metals in sea water and corrosion of condenser tubes in service on land. The inquiry will later be extended to non-ferrous metals under atmospheric conditions.—*Capt. Bengough, Imperial College, London, England.*

FURNACE, ELECTRIC.

Heat is generated by contact resistance between specially shaped graphite parts. An endeavor is being made to substitute pressed carbon similar to that used in arc-lamp electrodes, as the latter can be more easily obtained in England.—*National Physical Laboratory, England.*

FURNACE, ELECTRIC.

Considerable success has been achieved in producing very perfect electrical oscillations and transformations of stored potential electrical energy into the form of heat by the application of a so-called power condenser, and an electric furnace has been constructed based on this principle.—*E. F. Northrup, Princeton University.*

HIGH-VOLTAGE TESTS.

Efficiency of high voltage transmission and the peculiarities of insulators for this kind of work. A new transformer will be installed to permit the production and use of higher voltages than those yet attempted.—*C. F. Harding, Purdue University.*

POWER IN ALTERNATING-CURRENT CIRCUITS.

Derivation of expressions for power and stored electrostatic and magnetic energy in a general network of conductors, with sources of alternating-current power connected thereto. The method of conjugate complex quantities is used.—*J. Slepian, Westinghouse Electric & Manufacturing Company.*

RECTIFIERS, ALUMINUM.

For each of the four cells required in the ordinary arrangement for rectification of alternating current with lead-aluminum cells there was substituted a group of ten cells in series, and by this means a 2200-volt alternating current was rectified. With a considerable inductance in the circuit, the current curve was smoothed out so that it showed less than 20 per cent varia-

tion from its maximum value. When a constant voltage is desired but little or no current, a condenser across the terminals is used with good result.—*N. H. Williams and J. M. Cork, University of Michigan.*

APPARATUS AVAILABLE FOR RESEARCH

BALTIMORE, MD.

Facilities are available for testing high-tension cables for dielectric losses, temperature rise, heat dissipation, current-carrying capacity, etc. A special nine-hole conduit line has been constructed, surrounded by sand which is held in place by a wooden framework. The specimen cable occupies the central duct, while the outside ducts are taken by the "heater cables" for maintaining a desired temperature. A differential galvanometer-type thermometer is used, with numerous coils for measuring the temperature in the ducts. Three-phase 25-cycle current can be sent through the short-circuited specimen cable and high voltage applied at the same time, duplicating actual running conditions, or the high voltage may be applied to it on open circuit for measuring dielectric losses. For the results of some tests using this equipment see *Proceedings A. I. E. E.*, June, 1917, p. 443.—*Consolidated Gas, Electric Light & Power Company.*

HOUSTON, TEX.

Two synchronous machines are available for tests on sudden short-circuits: (1) Standard 45-kva., 500-volt, 60-cycle salient-pole alternator equipped with exploring coils at the top, middle and bottom of stator slots, and full-pitch and short-pitch coils on the rotor. (2) Special 5-kva., 220-volt, four-pole, 1800-r.p.m. non-salient pole alternator with characteristics approximating those of a turbo-alternator. The machine is equipped with several exploring coils in the stator and rotor having a span of a single tooth or a span equal to that of a pole. The rotor coils are brought out to an insulated fiber disk, and any one of them can be connected to a special pair of slip-rings for test purposes.—*N. S. Diamant, Rice Institute.*

SUGGESTIONS FOR RESEARCH

ALTERNATING CURRENTS.

A computing device which would add and multiply complex quantities or vectors. Such a device or machine would greatly save the labor in transmission-line computations and in the pre-determination of performance of some types of electrical machinery.—*Editorial Suggestion.*

BATTERIES.

Some experiments seem to indicate that the electrolytic action in a lead battery is facilitated and made more complete in the presence of radio-active salts, for example radium barium sulphate. Further systematic experiments are desirable (see a recent French patent issued to Mr. Thofehern).

CABLES.

The problem is to dispose of heat due to copper and dielectric losses. This may be done in two ways—(1) by minimizing the amount produced, (2) by quickly conducting away the heat that is produced. The first is largely the problem of the cable manufacturer. The use of certain insulating materials in saturating paper insulation greatly reduces these losses. Cable ratings under some conditions may be more than doubled. We suggest that further investigations be made on the subject of dielectric loss in cables to the end that the laws governing it may be definitely known. It will then be possible for the manufacturer to give an even quality of cable with minimum dielectric loss. The second point is to conduct the heat away from cables after it has been generated. Most of the underground conduits now in use were built without any regard to their capacity to dissipate heat, and thereby immense sums of money have been thrown away. We further suggest that the use of 20,000-volt or 30,000-volt cables be investigated.—*A. I. E. E. Committee on Transmission and Distribution.*

CONDUCTORS, HARDNESS TESTS.

Development of a simple measure for detecting hard-drawn copper wire which is unsuitable for winding electrical coils. The method should be simple enough to be used in a factory without refined apparatus.—*C. E. Skinner, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.*

(1) A piece of steel wire might be pressed crosswise into the lateral surface of the copper wire under investigation. The magnitude of the impression left with a given force would be an indication of the degree of hardness. (2) There might be a difference of electric potential between soft copper wire and partially hard-drawn copper wire. The electrolyte used for this purpose should be acidulated copper sulphate. The difference of potential can be measured by a potentiometer. (3) One end of a piece of wire under test is clamped in a vise and the other end is provided with an iron tip. The wire is then made to vibrate under the action of an alternating-current electromagnet. The behavior of a soft wire will probably be different from that of a hard-drawn one. The vibrations can be made quite intense by adjusting the length of the sample to a natural frequency equal to or a multiple of that of the alternating current in the electromagnet.—*Editorial Suggestions.*

COPPER, TEMPERATURE COEFFICIENT.

Determination of the resistance coefficient of copper for a wide range of temperatures exceeding 200 deg. C.—*B. A. Behrend, Boston, Mass.*

CRANE.

In a traveling crane, a safety limit stop based on a dynamic brake action on the bridge travel motor, in conjunction with the ordinary type of rigid or spring bumpers. The museum will be pleased to receive expressions of opinion on the possibilities of such a device.—*American Museum of Safety, New York City.*

ELEVATORS.

Improvements in motors and control where only single-phase supply is available. This includes not only the use of single-phase motors, but also transformation to polyphase or to direct current.—*Editorial Suggestion.*

HYSTERESIS.

Rotatory hysteresis and the diminution of molecular losses at high densities.—*B. A. Behrend, Boston, Mass.*

*Reported in the *Michigan Technic*, December, 1917.

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

If Your Paper Is Late

If your copy of the ELECTRICAL WORLD is late in reaching you, please wait a day or so before writing us that it has been lost. Unparalleled congestion of the mails has caused delays in delivery of all mail matter.

SWEEPING ORDER OF FUEL ADMINISTRATOR

To Solve Its Problem the Fuel Administration Orders
Suspension of Industries for Five Days
and Ten Mondays

The text of Dr. Garfield's order closing down industries to conserve fuel had not been completed at a late hour on Wednesday evening, Jan. 16. The Fuel Administration, however, issued a general statement on the order, and also an abstract of the essential provisions of the order.

"ALL INDUSTRY EQUALLY RESTRICTED."

The statement that was issued by the Fuel Administrator follows in part:

The unprecedented adverse weather conditions of recent weeks and the inadequacy of the present coal supply and transportation facilities to meet the enormous wartime demand have made necessary immediate restrictive measures to the use of coal in that part of the United States east of the Mississippi River.

The movement of coal in transportation must be so directed as to aid the Director-General of Railways in dealing with the railroad emergency created by recent blizzard conditions. Domestic consumers of coal must be kept warm, and other absolutely necessary consumers must be supplied.

All industry must be equally restricted in its use of coal in order that the available supply for the remainder of the winter may be properly distributed and may be made sufficient for absolutely essential needs during the remainder of the winter.

To meet these necessities, the Fuel Administration has ordered as an immediate emergency measure that on the days of Jan. 18, 19, 20, 21 and 22 preference and priority in the use of coal shall be given only to those consumers whose consumption of coal is absolutely necessary.

During the five days designated no manufacturing industry shall be allowed to operate even if it has its coal supply on hand. By this means all industry will be placed on an equal footing and each will be called upon to make its share of the sacrifice necessary to maintain the nation at the highest possible point of military and economic efficiency for the prosecution of the war.

In addition to this emergency restriction over the designated five days, the Fuel Administration has ordered that all use of fuel except by consumers classed as absolutely necessary shall be prohibited on Monday of each week from Jan. 21 to March 25; that is, on Jan. 21 and 28, Feb. 4, 11, 18 and 25 and March 4, 11, 18 and 25.

The order under which these restrictions are made is designed to distribute with absolute impartiality the burden of patriotic denial. All classes of business are treated alike.

Except on the days covered in the order, the normal

supply of coal to all consumers will be maintained. The necessary consumers designated in the order are given preference and priority in the delivery and use of coal at all times as well as on the days when other use of coal is prohibited.

The United States Fuel Administration counts upon the complete patriotic co-operation of every individual, firm and corporation affected by the order in its enforcement. Every effort will be made by the Fuel Administration and other government officials charged with the enforcement of the order to carry out the plan proposed without undue interference with the ordinary course of business.

It is the earnest desire of the Fuel Administration to prevent entirely any dislocation of industry or of labor.

ESSENTIAL PROVISIONS OF ORDER

The abstract of the order as issued in Washington follows:

(1) Until further order of the United States Fuel Administrator, all persons selling fuel in whatever capacity shall give preference to orders for necessary requirements

- (a) Of railroads;
- (b) Of domestic consumers, hospitals, charitable institutions and army and navy cantonments;
- (c) Of public utilities, telephone and telegraph plants;
- (d) Of ships and vessels for bunker purposes;
- (e) Of the United States for strictly governmental purposes, not including orders from or for factories or plants working on contracts for the United States;
- (f) Of municipal, county or state governments for necessary public uses;
- (g) Of manufacturers of perishable food or of food for necessary immediate consumption.

The order further provides that on Jan. 18, 19, 20, 21 and 22, 1918, no fuel shall be delivered to any person, firm, association or corporation for any uses or requirements not included in the foregoing list until the requirements included in the list shall have been first delivered.

On Jan. 18, 19, 20, 21 and 22, 1918, and also on each and every Monday beginning Jan. 28, 1918, and continuing up to and including March 25, 1918, no manufacturing plant shall burn fuel or use power derived from fuel for any purpose except—

(a) Such plants as from their nature must be continuously operated seven days each week to avoid serious injury to the plant itself or its contents.

(b) Manufacturers of perishable foods.

(c) Manufacturers of food not perishable and not in immediate demand, who may burn fuel to such extent as is authorized by the Fuel Administrator of the state in which such plant is located or by his representative authorized therefor, upon application by the United States Food Administrator.

(d) Printers or publishers of daily papers may burn fuel as usual excepting on every Monday from Jan. 21 to March 25, 1918, inclusive, on which days they may burn fuel to such extent as is necessary to issue such editions as such papers customarily issue on important national legal holidays, and where such papers do not issue any editions on a holiday they are permitted to issue one edition on the said Mondays.

(e) Printing establishments may burn fuel on Jan. 18, 19, 20 and 22 to such extent as is necessary to issue current numbers of magazines and other publications periodically issued.

On each Monday, beginning Jan. 21, 1918, and continuing to and including Monday, March 25, 1918, no fuel shall be

burned (except to such extent as is essential to prevent injury to property from freezing) for the purpose of supplying heat for:

- (a) Any business or professional offices, except offices used by the United States, state, county or municipal governments, transportation companies, or which are occupied by banks and trust companies or by physicians or dentists;
- (b) Wholesale or retail stores, or any other stores, business houses or buildings whatever, except that for the purpose of selling food only, for which purposes stores may maintain necessary heat until 12 o'clock noon; and for the purpose of selling drugs and medical supplies only stores may maintain necessary heat throughout the day and evening;
- (c) Theaters, moving-picture houses, bowling alleys, billiard rooms, private or public dance halls, or any other place of amusement.

On the above specified Mondays no fuel shall be burned for the purpose of heating rooms or buildings in which liquor is sold on those days.

No fuel shall be burned on any of the foregoing specified Mondays for the purpose of supplying power for the movement of surface, elevated, subway or suburban cars or trains in excess of the amount used on the Sundays previous thereto.

The order provides that nothing in this order shall be held to forbid the burning of fuel to heat rooms or such portions of buildings as are used in connection with the production or distribution of fuel.

The state fuel administrators are authorized by the order to issue orders on special applications for relief, where necessary, to prevent injury to health or destruction of or injury to property by fire or freezing.

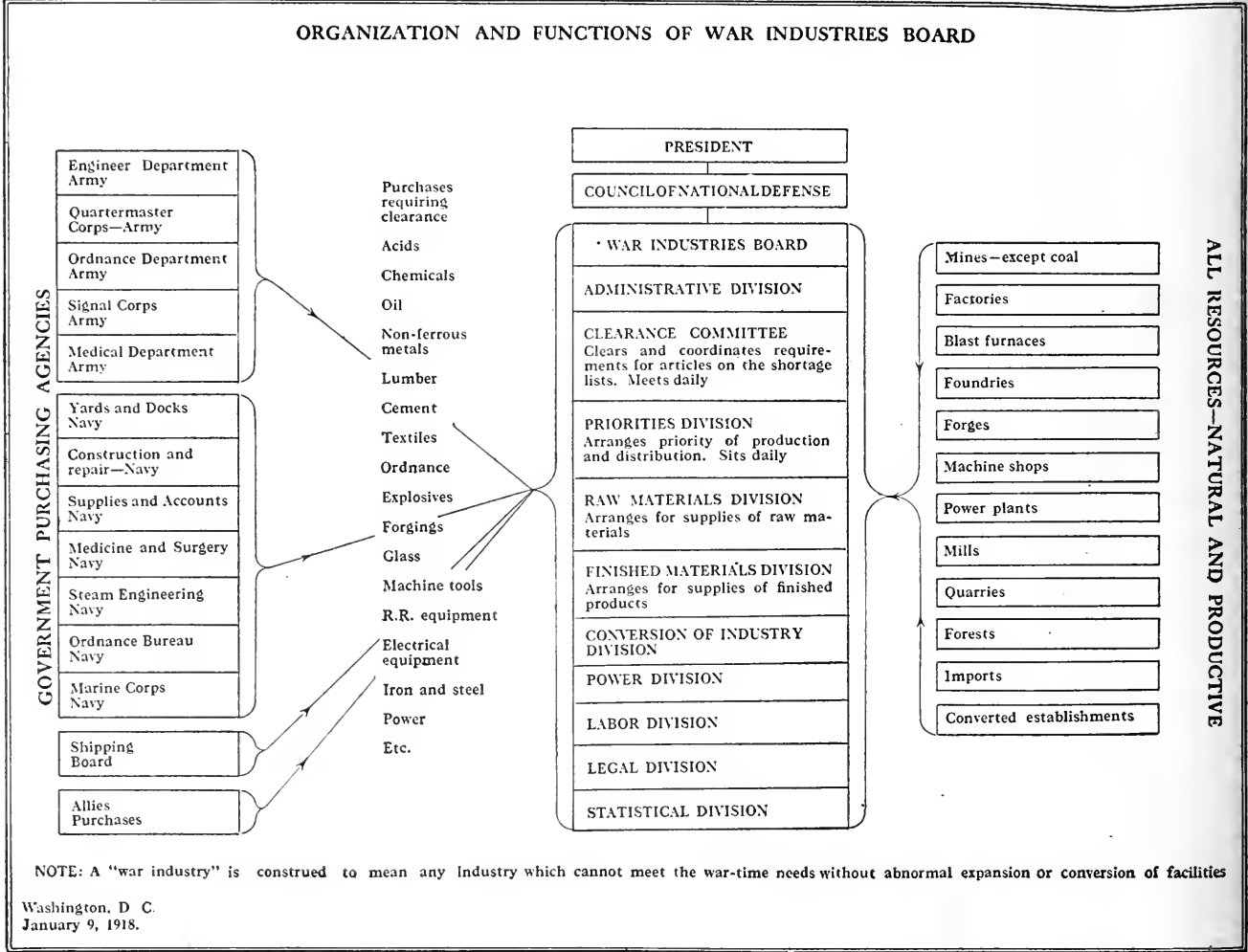
The order is effective in all of the territory of the United States east of the Mississippi River, including the whole of the States of Louisiana and Minnesota.

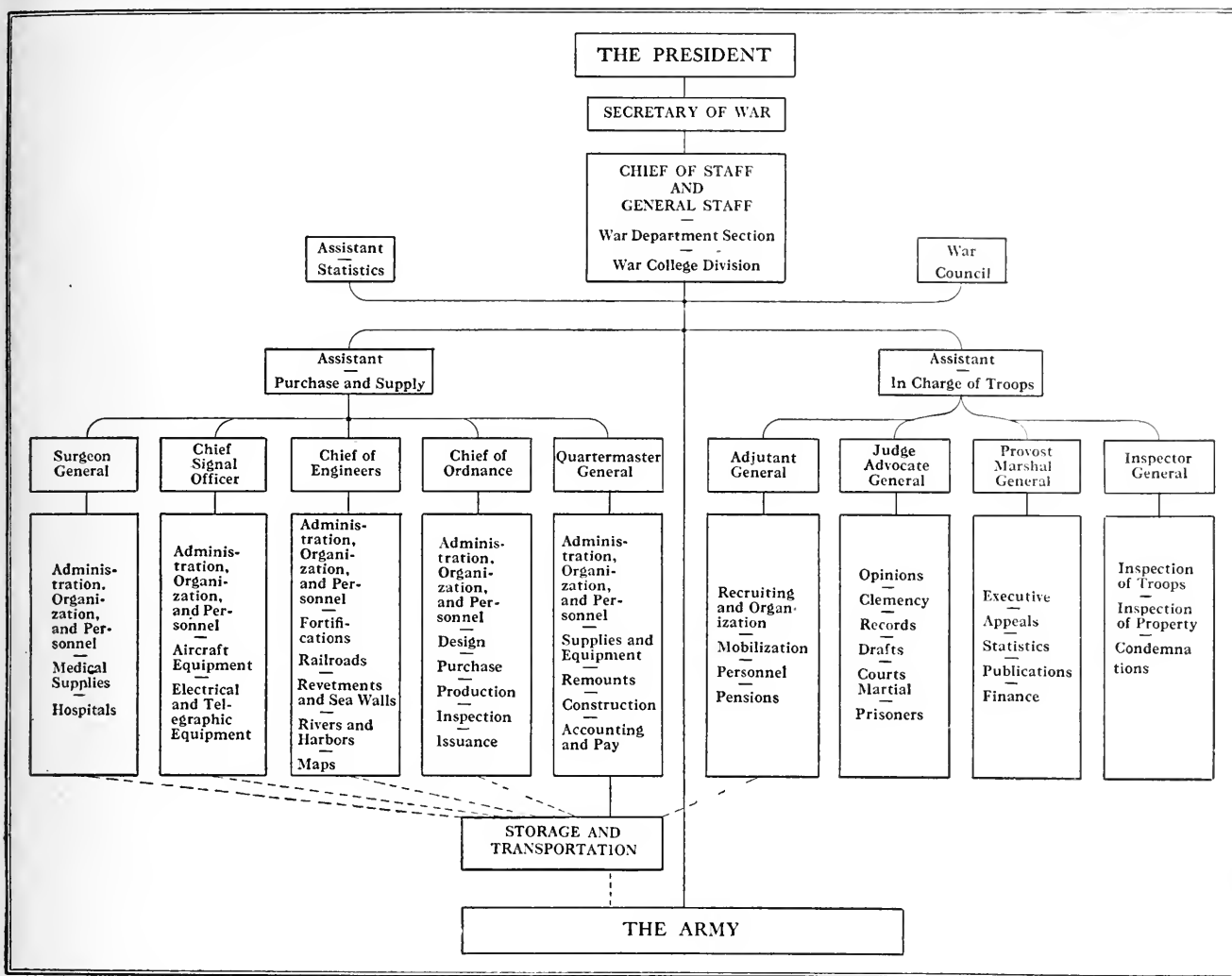
CHARLES L. EDGAR VIEWS EFFECT OF THE FUEL ORDER

Little Reduction in Lighting, but Considerable Reduction in Output to Industrial Plants Other Than Those Engaged on Government Work

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, said that until he had seen the detailed order of the Fuel Administration he could make no accurate estimate of how much it will reduce the coal consumption at the Edison plant. He added:

About one-half of our product is power and the other half light. There will probably be little reduction in the use of light. We have 1,000,000 customers who will use practically as much light, and the streets must be kept lighted. About one-third of the power we supply goes to government plants or factories making war supplies. From what I now know of the order there will be a considerable reduction of the two-thirds of our power output which goes to other industrial plants. We use about 5000 tons of coal a day. The recent "lightless" night order and other economies in the use of lights have reduced our daily coal consumption only from 30 to 40 tons a day. We have plenty of coal. I have not as full a knowledge of the coal situation as if we had ourselves been affected by the shortage. I did not suppose, however, that the situation was so serious as is indicated by the order just issued. This will bring great hardships to working people and their families, coming as it does in the middle of winter. I believe that the administration officials, realizing the hardships the order would bring, must have felt fully justified from the conditions in adopting such drastic measures.





CO-ORDINATION PLAN FOR WAR PURCHASING

Outline of the New War Department Arrangements for Purchasing Supplies of Every Character for War Purposes Here

Secretary of War Baker explained in considerable detail to the Senate committee on military affairs on Jan. 12 the reason for his personal objection at this time to the creation of a Director of Munitions to supervise all purchases of supplies of every sort for war purposes in this country. These reasons may be summarized briefly by the statement that the reorganization of the War Department and the War Industries Board will provide an entirely suitable agency for promptly and efficiently performing such work and should be tried before the present organization, now in process of remodeling in the light of the experience of the administration in war work up to date, is thrown into inevitable confusion by drastic changes.

The War Department is not alone in making great drafts on the industries of the country. The Allies' Purchasing Board, the Navy Department and the Shipping Board are similarly straining the resources of our manufacturers and no legal remedy for this condition has been provided by Congress. But the four great purchasing agencies have agreed to joint action through the War Industries Board, which has been reorganized in order that it may do for all American munition manufacturers what the central bureau of the War Department does for its five great purchasing

branches. The requirements of the four agencies are reported to a central committee, which is directly in touch with the manufacturing facilities of the country and not only knows how much work each factory is doing for the government but also how much it is doing for necessary civilian customers. It is this committee which passes on the priority to be given each of the orders. If its decisions are questioned, the appeal is made to the War Industries Board, which thus becomes arbiter of manufacturing priority in this country in every industry furnishing supplies for military uses.

Secretary Baker assured the Senate committee on military affairs that this system of handling the government war purchases in co-operation with those of the Allies was not only the best that careful study had been able to suggest but had met with the approval of the industrial leaders to which it had been submitted. It disorganized none of the existing machinery and interfered as little as possible with meeting civilian demands, in his opinion. It was the equivalent, he believed, of a special director of munitions, for any functions which such a director would possess would be possessed by Daniel Willard, chairman and executive officer of the War Industries Board. The chairman did not have legal authority to enforce his decisions, but as each of the four great war purchasing agencies had agreed to recognize his decisions as binding, it had not seemed necessary to ask congressional action to confer legal powers upon him.

The essence of the organization, according to Secre-

tary Baker, is that each of the four great purchasers—the Allies' committee, the War and Navy Departments and the Shipping Board—has its own organization for acquiring its supplies in the desired order. While the War Industries Board has these orders filled in the sequence of the war needs, manufacturing facilities and civilian requirements are served in the best possible manner. It is apparently the administration's answer to the criticism that Washington had no logical plan for mobilizing the nation's resources. According to Secretary Baker, it is the most complete plan for the purpose that has been advanced in this country or Great Britain. It manifestly created a deep impression upon members of the Senate committee, who have indicated their disapproval of many features of the work of the War Department since the United States entered upon the war.

WESTINGHOUSE COMPANY

ISSUES \$15,000,000 NOTES

One-Year Securities Put Out Without Objection of Federal Reserve Board—Unfilled Orders Jan. 1, Excluding Rifles, \$130,000,000

The Westinghouse Electric & Manufacturing Company has sold \$15,000,000 of one-year 6 per cent notes to Kuhn, Loeb & Co., New York. The notes were offered by the bankers to the public at 99 and interest, yielding a little over 7 per cent net.

A letter to the bankers from Guy E. Tripp as chairman of the Westinghouse company gives the following information regarding the purpose of the issue:

In order to assure to itself for a fixed period working capital temporarily required to carry the large inventories which it is essential that the company should have under present conditions, the Westinghouse Electric & Manufacturing Company has decided to create an issue of 6 per cent one-year gold notes, limited to \$15,000,000. This company has advised the Federal Reserve Board of its intention to issue these notes, and the board has stated that it has no objection to the issue being made.

The indenture under which the notes are to be issued will provide that the company (including its proprietary companies as defined in said indenture) shall at all times while the notes are outstanding have on hand current assets, as defined in said indenture, equal to at least twice the amount of its current obligations, as also therein defined, and that it will not hereafter and so long as any of the notes are outstanding make or permit to be made any mortgage on any of its properties or the properties of any of its said proprietary companies.

The new notes will be issued in denominations of \$1,000 each, will be in coupon bearer form and will mature on Feb. 1, 1919. Interest at the rate of 6 per cent per annum will be payable semi-annually on Aug. 1, 1918, and Feb. 1, 1919. Both principal and interest of the notes will be payable without deduction for any tax or taxes which the company or the trustee under the indenture may be required to pay or to retain therefrom under any present or future law of the United States of America (except any federal income tax) or of any state, county, municipality or other taxing authority therein.

As of Jan. 1, 1918, the company had on hand unfilled orders amounting to more than \$130,000,000, exclusive of contracts for rifles. As of Dec. 1, 1917, its current assets as they will be defined in the indenture amounted to over \$71,000,000, while its current liabilities as so defined amounted to less than \$24,000,000, which the present issue of notes will not increase, as the proceeds thereof will be applied to the payment of outstanding notes. The funded debt of the company, consisting almost entirely of the Westinghouse Machine Company first and refunding mortgage

bonds, due 1940, amounts to about \$6,700,000, and its capital stock, now paying 7 per cent dividends per annum, amounts to \$74,812,650 and has a present market value of over \$60,000,000.

The earnings of the company for the eight months ended Nov. 30, 1917, after deduction of all interest charges and after setting aside a maximum reserve for all income and excess profits taxes, amounted to \$9,032,823, which is only \$582,101 less than for the same period of the previous fiscal year, when there were no war income or excess profits taxes deductible.

WAR SERVICE WORK OF MANUFACTURERS' COMMITTEES

Meeting of Chairmen of Group Committees of Manufacturers of Electrical Supplies Emphasizes Desire to Organize the Whole Industry

A meeting of chairmen of the war service group committees of manufacturers of electrical supplies was held on Jan. 11 at the rooms of the Associated Manufacturers of Electrical Supplies, New York. It was called to hear reports from the chairmen of the committees and to further the co-ordination of their war service work for the government. Robert K. Sheppard, chairman of the General War Service Committee of the Electrical Manufacturing Industry, presided.

It was made plain at the meeting that, as stated previously in the ELECTRICAL WORLD, the whole purpose of the movement is to effect complete organization of every branch of the industry in the interest of service to the government. To this end the chairmen of the committees are corresponding with and obtaining reports from manufacturers without regard to the question of whether they are or are not members of the association. The committees are termed "group" committees and in every instance regard themselves as serving to centralize the activities of all of the productive capacity of groups within the industry in order that this entire capacity may be made available to the government without loss of time or effort on the part of the federal authorities.

GRAVE POWER SHORTAGE IN NEW JERSEY PLANTS

Public Service Electric Company, on a "Hand-to-Mouth" Basis of Coal Supply, Has to Cut Service Radically

As a result of coal shortage the Public Service Electric Company, Newark, N. J., is able to operate generating stations at only about 50 per cent of capacity. It is on a "hand-to-mouth" basis of coal supply. Facing absolute shortage of energy to meet requirements of its power customers, the company created a zone system under which partial service is given.

Power customers receive service from 7 a. m. to 4 p. m. on Monday, Wednesday and Friday in the Essex and Bergen divisions and on Tuesday, Thursday and Saturday in the Hudson, Passaic and Central divisions. The Southern division, in the district around Camden, is not affected now by these restrictions. In the other divisions named the company tries to meet the normal requirements of power customers in accordance with the schedule of days indicated.

The company has also reduced the quantity of street lighting in the various communities served.

War's Effect on Cost and Quality of Service

Paper of Lynn S. Goodman and William B. Jackson, Presented Before American Institute of Electrical Engineers—Average Coal Cost Increase 100 per Cent—
Discussion in Boston and New York

A PAPER by Lynn S. Goodman and William B. Jackson on "Effects of War Conditions on Cost and Quality of Electric Service" was presented at an intersectional meeting of the American Institute of Electrical Engineers in Boston on Jan. 8, in New York on Jan. 11, and in Chicago on Jan. 14. The paper was presented under the auspices of the committee on the economics of electric service.

The employment of women has enabled electric utilities to obtain an additional class of labor at a relatively low rate, but when women take the places of men more women employees are required than the number of men replaced, and the war conditions tend to exhaust the supply of even this class of labor by offering wider fields of employment. The necessity for female labor to become more nearly self-supporting during war times further tends to increase the female wage scale.

It is recognized that the labor cost to public utilities will further advance either by increases in the direct wage or by some system of war additions such as are being employed by the other nations at war. This system of war additions is generally recognized as a measure to compensate for the temporary increases in living costs during the war period and is adopted principally in order to facilitate the ultimate return to normal conditions. By normal conditions is meant the conditions which would have been attained normally had war conditions not intervened.

From 1902 to 1912 the average wages per employee (exclusive of general officers, managers and superintendents), according to United States Census statistics, increased 11 per cent. During the war period thus far salaries of officers, managers and general superintendents in general have not increased greatly, but increases in wages in operating departments have ranged from 15 to 50 per cent, and Messrs. Goodman and Jackson are of the opinion that 25 per cent may be taken as the average increase thus far occasioned by the war. The increase in wages of 25 per cent means an estimated outlay of \$19,000,000 for the year.

The draft on men for government service and the war scale wages in industrial fields mean cost for training new operatives, and the continual change has also an effect on economy of operation and quality of service.

On the average, the authors conclude, the cost per ton of coal to electric companies has increased a little more than 100 per cent on account of war conditions. A conservative figure for the increase in tonnage due to lower quality and non-uniformity of grade is 10 per cent, making a total increase of \$60,000,000 on top of the estimated expenditure of \$50,000,000 had normal conditions prevailed in 1917.

It is estimated by Messrs. Goodman and Jackson that the increase in cost of materials and supplies other than fuel is 75 per cent, or \$30,000,000. In many cases the necessity or advisability of retaining present equipment in service until change is imperative introduces an element of reduced economy.

Protection of plants adds to cost of service an estimated \$2,000,000 or \$3,000,000. Normal taxes might have been \$25,000,000, but it is guessed that the increase above this will be, say, \$7,500,000.

The total of \$116,500,000 thus indicated is a quarter of the normal estimated gross revenue for 1917. It wipes out two-thirds of the sum that would have been available for interest, dividends and surplus. Messrs. Goodman and Jackson conclude that it puts the electric companies in a critical position.

Reviewing other considerations, the authors say that the advantages of the central station are so large that it is advisable for the government to use every reasonable means to encourage the central-station companies and discourage individual power plants during the war period.

One phase is improvement in load factors arising from putting less essential industries on an off-peak basis and the fact that war industries give an exceptionally long home demand.

Coal clauses, adopted by many companies, are regarded as only a partial remedy as the increase in cost for coal is only about one-half of the total increase in cost due to war conditions. Extension of the central station into the field served by isolated plants and especially the acceptance of temporary or auxiliary loads carries the menace that the central utility will be burdened with unused and abnormally expensive station capacity at the end of the war period.

Discussion at the New York A. I. E. E. Meeting

In opening the discussion E. W. Rice said that while the Goodman and Jackson paper paints a somber picture it presents a definite problem to engineers. With a problem well stated the solution is half found.

The grave fact that the New York Central Railroad came within three hours of having to suspend service for lack of coal should bring home to every one the necessity of conserving fuel, said Colonel Arnold. Every central-station company is doing what it can in this direction. Additional help can be afforded by electric service companies, through the consent of public utility commissions, by curtailing the amount of energy supplied to other than essential industries and by serving munition plants and other industries necessary to the conduct of the war to the maximum of their facilities. Industries which would suffer seriously by having their energy supply curtailed could be served during off-peak periods. By classifying different loads central stations could so group and serve these industries that their demands would overlap to better advantage and give better load factors. Thus the maximum use of equipment could be secured.

Pooling of generating and transmission facilities would also greatly relieve present difficulties, it was pointed out, as loads could be carried on the most economical generating equipment, less reserve capacity would be required, and advantage could be taken of

diversity factors, thus reducing peak loads, etc. Where exhaust steam can be used throughout the year there is an advantage in isolated-plant service. Otherwise it is generally cheaper to buy central-station power.

VALUE OF WATER-POWER DEVELOPMENT

Philip Torchio pointed out that it is inequitable for public utilities to be required to furnish service at the same rates as in normal times when other industries are allowed to increase prices to cover increased expenses. Referring to the shortage of coal and the necessity of conservation, he stated that if all of the water power east of the Rocky Mountains (*i.e.*, one-third of the total) were developed, 50 per cent of the coal used for primary power could be replaced. However, even after all water power is developed there will still be need of coal for generating purposes; therefore steam stations will be a permanent factor in the national development. If all stations in the country could be brought to the stage of development which some of the modern ones have reached, four times as much energy could be developed per pound of coal. In other words, a considerable saving could be realized by carrying loads of the inefficient plants in modern systems. Referring to the effect of war conditions on cost of operating electric utilities, Mr. Torchio said that in New York the total cost has increased 50 per cent, while the operating cost has increased 95 per cent. In concluding his remarks, he read a forecast he made ten years ago regarding the necessity and advantages of a nation-wide network of electric service lines.

HANDICAPS UNDER WHICH CENTRAL STATIONS LABOR

Major Betts referred to steps taken by the New York companies several years ago to obtain emergency service from each other. The wisdom of such arrangements in every locality was demonstrated lately in New Jersey, where several water companies had to depend on one company for supplying service.

Referring to the handicaps under which central stations have to meet increased demands for energy, Major Betts pointed out that the cost of labor has increased phenomenally, that help is uncertain and of a shifting nature, and that coal deliveries are slow if forthcoming at all. Owing to the latter cause and the inability to get additional generating equipment, the New Jersey company has had to cut off 40 per cent of its power load, causing cessation of many necessary industries and throwing many employees out of work.

The vital problem is to keep industries going, not only because the products of many are essential, but because employment depends on operation of factories. The uses for coal should therefore be classified and preference given to those which have essential products and a large number of employees. In justification of this priority list, Major Betts pointed out that there is just as much reason why power supplied to certain industries should be curtailed as there was that the draft law be put into effect. In view of this necessity central stations should take steps to acquaint present and prospective consumers with uses of energy which inure to the nation's interests.

W. S. Dorcess spoke of the effect of present conditions on the cost of power, calling attention to the inefficiency and changing nature of labor, its higher cost, the necessity of having to shorten working periods, the

higher prices of materials and supplies, including fuel, and larger losses due to use of lower-grade fuels. He estimated that the average price of all labor in central-station service has increased 30 per cent, that repair materials have increased as much as 90 per cent, and that the average price of fuel has increased 65 to 70 per cent (over 100 per cent in some cases).

H. M. Hobart said that while it was formerly impossible to secure some large loads unless the price of energy was brought lower, the war has forced them to apply for central-station service. Furthermore, war conditions have made all plants operate more economically and with least reserve equipment.

RELATION OF CENTRAL STATION TO WAR PROGRAM

Prof. D. C. Jackson said that the success of the war depends on the rate of industrial production rather than on any particular implement of warfare. For this reason the central station is eminently important, as it furnishes the quickest means of speeding up production. National authority should take this into account, he said. Labor shortage in the electric service field is due to distribution of labor rather than to actual shortage of men. The solution to this difficulty is to adapt the labor of which there is a surplus to the trades in which there is a scarcity of help.

In the absence of Mr. Bartlett, who presented a written discussion, Mr. Jackson read the paper, which contained observations on turn-over of labor. Statistics showed that in one case this was as great as 211 per cent. The reasons attributed for this were varying remuneration, men enlisting for military service, difficulty of filling positions, and unsettled labor conditions. Competition in securing labor was emphatically discouraged. Reference was made to one executive who said he could operate with women except in positions requiring manual labor. To hold men it was urged that the department heads get closer to the hearts of their men.

PRESENT COSTS AND RATES

F. A. Bryan brought out that, owing to the high cost of fuel, customers who formerly used isolated plant power have demanded central-station power. This means that the steam plant that had been held purely as reserve for his hydroelectric plant has had to be brought into regular service, thus requiring fuel at the present very high cost and materially increasing operating expenses and necessitating early additions and extensions. The question was raised whether the managers of electric properties are justified in taking on such additional business in the light of the very high cost of plant equipment and extensions and the high price of labor, fuel and supplies, unless they can have some assurance that these conditions will be taken into consideration by regulatory bodies both as they affect the present costs and as they affect them for the period succeeding the war.

F. G. Hudson stated that the regulatory bodies should appreciate the necessity of higher rates in the conditions under which utility corporations have to operate. In view of the increasing operating cost, it would be precarious and unwise to ignore the necessity for effectively working out the serious problems now presented. Certain partial solutions were suggested. Mr. Hudson also advocated the consideration by proper authorities of arranging some plan whereby skilled

workmen may be retained in positions for which they are best fitted, to the end that satisfactory service may be maintained.

Mortimer Freund said that while the central station is of prime importance, especially now, the individual power plant should not be discouraged so long as every effort is made to fulfill heat, light and power requirements with the least possible fuel waste. He discussed several situations where he considers the private power plant can supply electric service economically, and suggested the possibility of co-operation between private plants and central stations in supplying energy.

Discussion at the Boston A. I. E. E. Meeting

N. J. Neall, Boston, consulting electrical engineer in the building of the Ayer (Mass.) cantonment, said that the price per kilowatt-hour had not been increased materially to the public. He doubted whether the utility financial return situation was so serious as the authors contended. The remedy lay in rate increases. Net loss of revenue applicable to dividends could not be appraised fully until the effect of increased power rates was seen. Unless ordinary demands for service were financed as the need was met, the utility would hardly be in the position of being under obligation to meet such demands.

Mr. Neall suggested pooling coal distribution by utilities. Possible gains in economy of utility service lie along such lines as more economical use of coal, burning poorer grades of coal, substitution of other metals for present standard material, use of booster transformers in place of copper on certain distribution circuits, location of plants at mines and development of water power, with consolidation and interconnection of systems. Cultivation of off-peak loads is important, and non-essential industries might help by running lights and staying off the peak.

Prof. C. A. Adams, Harvard University, emphasized the efficiency decrease in plant operation due to coal high in ash. Ten per cent, he held, was a great underestimate of the decrease in economy in central stations resulting from poor fuel. Twenty per cent ash occurred in some cases. This meant larger stand-by losses, since more boilers must be held on the line than with good coal. Slate and stone in coal might increase consumption 30 per cent. The number of boilers for a given load might increase by 40 per cent in some cases.

GREAT IMPORTANCE OF CONTINUOUS SERVICE

Joseph Sachs, Westinghouse Electric & Manufacturing Company, Pittsburgh, cited the great importance of continuous service in munition plants. Some action should be taken by the government or others so that maintenance needs of central stations would not be overlooked by manufacturers. Where electrical material is being pushed into the background because plants are producing munitions on a large scale, there is danger that breakdowns may be protracted by shortage of needed supplies. This situation obtains in Germany. Night work by non-essential plants is now being practiced in Pittsburgh. The speaker thought the chances of increasing central-station efficiency poor at present. The present problem is one of production without regard for money making, stated D. B. Galusha of Stone & Webster, Boston. If private capital cannot

furnish sufficient power, the government would have to do so. Mr. Galusha said that powdered fuel was being used successfully in one of the Western central stations of Stone & Webster where fuel oil could not be obtained on a satisfactory basis, or coal of a grade which could be burned on chain-grate stokers.

J. F. Vaughan, consulting engineer, Boston, pointed out the small percentage increase 1 mill represents on a 10-cent lighting rate as compared with a similar net advance in power charges.

B. A. Behrend, consulting engineer, Boston, objected strenuously to the policy, advocated in some quarters, of having central stations give poorer service.

Prof. D. C. Jackson, Massachusetts Institute of Technology, Cambridge, urged larger use of the central station on account of the reduced number of men required for a given output for installation, operation and supervision. The men at the front would be absolutely serviceless unless backed up by manufacturers having ample power supply. The speaker touched briefly upon the desirability of utilizing men trained in one trade in another trade in the off-season, such as converting bricklayers into sheet-metal workers during the winter. A prominent union official also favored this idea, Professor Jackson said.

AN "INDUSTRIAL LEGION"

The need of a sane return to investors, of an increased number of off-peak customers, and the tendency of the isolated plant to reach a more critical position, were emphasized by Prof. R. G. Hudson, Massachusetts Institute of Technology, who also stated his belief in the establishment of an "industrial legion" with appropriate insignia for those helping the country's war work at their posts in power plants, etc.

A written discussion submitted by W. S. Gorsuch, New York, analyzed the effect of increased wages, reduced working hours, inefficient labor and increased coal cost upon unit generating expenses. In many cases, he held, inefficient labor was paid more now than better men received before the war. The cost of a large portion of power-plant labor had increased from 30 to 55 per cent. Present increased wages were liable to remain after the war, but doubtless more efficient labor will be available. Repair parts in some cases are 90 per cent more costly than previously, discouraging maintenance work. With detailed figures, the writer showed that if any corrections or increases are made in rates to cover increased cost of coal, they should be made on the basis of B.t.u. per dollar and not on the increased cost of fuel per ton.

Mr. Gorsuch stated that the recent rise in labor and material costs had increased operating expenses at a rate much faster than any possible economy resulting from increased load factor. The question whether it was worth while for some small companies to generate their own energy or purchase it from an ample source was purely an economic one, he said. To illustrate this, consider two plants, one having a maximum load of 40,000 kw. and a 45 per cent load factor and the other a maximum load of 10,000 kw. and a 25 per cent load factor, with non-simultaneous peaks. In a typical case the load curve of the smaller plant was superimposed on that of the larger, with a resulting diversity in power-station demands of 5000 kw. and a reduction in the cost of generation.



Nation Needs Men for Searchlight Regiment

The Fifty-sixth United States Engineers, Now Being Organized, Offers Opportunity for Young Men with Electrical Experience or Fundamental Knowledge of Electricity and Mechanics for Special Service Abroad

AN EXCELLENT opportunity is being offered to young men possessing a knowledge of electricity and mechanics, as well as to experienced electricians, gas-engine operators and machinists, to serve the government effectively in its fight for democracy. The War Department is organizing a regiment of searchlight companies for special service abroad. These units will be highly specialized and used for battle illumination and anti-aircraft protection. The companies will be armed and equipped as regular military units and will form part of the regular army organization. They will be called upon for extremely active work in the war zone, and pains are being taken in the selection of the personnel of the companies.

In special cases men of proper experience who already have been drafted into service may be transferred. In order to obtain those of suitable qualifications, a special ruling will permit men within the draft age but not yet called to be inducted directly into this regiment. The plan is to obtain bright, young, intelligent and ambitious men who possess a fundamental knowledge of electricity and mechanics, as well as trained and experienced electricians, gas engine operators and machinists. The enlisted personnel will embrace men experienced in one or more of the following occupations: Electricians, gas-engine operators, machinists, motor-truck drivers, blacksmiths, horseshoers, mechanics and general all-around utility men.

Men must first enlist as privates and will be paid \$30 per month, together with food, clothing, medical attention, etc. Non-commissioned grades will be available at rates of pay from \$36 to \$96 per month, and future promotion is open to those of ability.

Specialized service of this character offers unusual opportunities for those capable of performing it. The character of the work will be highly interesting and varied. The man who has the necessary training and ability cannot serve his country better than by joining such an organization.

The war as it is now being fought offers great opportunities for the use of searchlights for defensive as well as for offensive operations. Among the uses of projectors on the battlefield are the following:

To discover and keep in touch with the movements of the enemy during the night.

To seek out and illuminate hostile objectives, so as to fire upon them.

To blind the enemy.

To illuminate roads and possible hostile positions in the more distant foreground periodically by the light.

To search the near foreground.

To support fire effect by illumination of hostile targets.

To disturb hostile works by alternate blinding and turning on the beam or by working the beam back and forth.

To blind opposing searchlights.

To support attacks in the foreground by throwing the beam in front of the advancing troops and screening their movements.

To reveal obstacles to their own artillery, which is thus enabled to destroy the obstacles.

To blind the enemy and disturb his forward march and firing capacity and confuse him by making him think his plans are discovered.

To facilitate the landing of aviators at night.

For anti-aircraft work and night-bombing defense.

The foregoing summarize the general activities of this new regiment. Information may be obtained by writing directly to the commanding officer, Fifty-sixth United States Engineers, Washington Barracks, D. C. The applicant must give the following information: (1) Name, (2) address, (3) age, (4) married or single, (5) nationality, (6) whether he will enlist for the period of the war, (7) brief statement of education, (8) present occupation, (9) experience, (10) name and address of present or former employer, (11) whether or not the applicant has been drafted.

Cleveland Rate Case.—F. W. Ballard, employed by the city of Cleveland as expert in its contest before the Ohio Public Utilities Commission with the Cleveland Electric Illuminating Company, has written a review of the case which is to be published in a magazine in February. Copies of the review, however, have been sent to Governor McKim, the utilities commission and the Cleveland Engineering Society. Mr. Ballard is preparing an argument against the valuation to be presented to the commission. The order as to the valuation has been appealed to the Ohio Supreme Court. Unless this court should nullify the order, the rate will be based upon this valuation and the ordinance would thus be rendered void.

Autonomic Electrical Troubles.—That conditions in the German and Austrian electrical industries are not so rosy as reported dispatches seem to indicate is shown in occasional quotations from financial reports to stockholders of electrical concerns. The following is from a report issued to stockholders by directors of the Austrian Siemens-Schuckert works: "It is true that these works operated at full capacity, but nearly half of the work is done for the War Department, which precludes the charging of profitable prices for our products. It must also be remembered that while wages, materials and overhead expenses are rising continually, the productive capacity of such employees as we can obtain is gradually sinking lower and lower. Under these conditions profits and dividends are unlikely."

Postponement of "Anti-Trust" Cases.—In petitioning the United States Supreme Court to postpone the hearing of "anti-trust" cases until the next term, Attorney General Gregory gave the following reasons for his request: "The order that the government in this time of stress may not meet with competition from private enterprises in its financial operations and the flotation of loans, the Treasury Department has been constrained to urge that all private financing on a large scale shall be delayed so far as at all possible. Thus, in its annual report on the finances for the fiscal year ended June 30, 1917, the Secretary of the Treasury makes the following observation: 'The government must, if necessary, absorb the surplus of new capital available for investment in the United States during the period of the war. This, in turn, makes essential that unnecessary capital expenditures should be avoided in public and private enterprises.' It is quite probable that the dissolutions which are sought in the pending cases against the United Shoe Machinery Company, International Harvester Company, United States Steel Corporation, Eastman Kodak Company, American Can Company, Borden Oats Company and Corn Products Refining Company will require financial operations on a large scale if they are to be genuine and effective. As important as the remedy sought in these cases is believed to be, it must be delayed for the moment to the paramount needs of the hour."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electric Shop Discontinued.—The Commonwealth Edison Company original electric shop, Jackson and Michigan Boulevards, Chicago, which was operated for nine years from January, 1909, was discontinued on Jan. 1, 1918. George B. Johnson, manager of the shop, has been transferred to the contract department. This electric shop was one of the best known in the country and has been visited by many thousands of persons in the electrical industry interested in modern ideas on electrical merchandising.

Chicago Sanitary District Seeks Plan to Get More Water from Lake Michigan.—The Sanitary District of Chicago has passed an ordinance tendering \$475,000 to the United States. In return the Sanitary District expects to get an unqualified permit, by act of Congress, for the immediate use of 520,000 cu. ft. of water a minute from Lake Michigan, with provision that additional water may be withdrawn, up to 720,000 cu. ft., as the population of Chicago increases. The latter figure is the maximum that can be handled by the channel and works as at present constructed. If the federal government accepts this offer, it is expected that the \$475,000 will be expended by it in building compensating works in the St. Clair and Niagara Rivers to preserve water levels which it is said would be lowered if the Sanitary District were permitted to take the additional flowage. The proposed compromise is based on the report of federal engineers, of whom Gen. William M. Black, now chief of engineers in the United States Army, was the senior. This report was made on account of a federal lawsuit intended to limit the Sanitary District to the use of 250,000 cu. ft. of water.

The J. E. Aldred Lectures.—Through the generosity of J. E. Aldred there has been founded in the department of engineering of Johns Hopkins University, Baltimore, a course of lectures on engineering practice. The course of lectures is one feature of a general plan, made possible by Mr. Aldred's gift, for furthering and improving undergraduate instruction in the methods and problems of the practice of engineering. The lectures will deal, therefore, with the practical phases of engineering problems rather than with theory. They are not expected to discuss new and striking applications as much as to deal with every-day working methods of design, construction and operation. During the year three lectures each will be given upon the general subjects of civil, electrical and mechanical engineering. They will be given on Wednesday evenings at 8 o'clock in the auditorium of the Civil Engineering Build-

ing of the university at Homewood. The lectures are open to the general public. A partial list of the lectures follows: Jan. 16, "Steam-Electric Power Plant Design," A. S. Loizeaux, electrical engineer Consolidated Gas, Electric Light & Power Company, Baltimore; Jan. 30, "The Relation Between Civil Engineering and Military Engineering," Major-General William M. Black, chief of engineers, U. S. A., Washington; March 6, "The Growth of Electric Systems," Julian C. Smith, vice-president Shawinigan Water & Power Company, Montreal, Canada; March 13, "Coal and Its Combustion in Boiler Furnaces," E. G. Bailey, president Bailey Meter Company, Boston.

Underwater Section of Halifax Power Cable Survives Explosion.—In the explosion at Halifax, N. S., on Dec. 6 service was interrupted on a 13,200-volt transmission circuit by which the Nova Scotia Tramways & Power Company supplied energy to the suburb of Dartmouth, on the east side of Halifax Harbor. The overhead section of this line was illustrated in the ELECTRICAL WORLD of Dec. 15, 1917, page 1162. Since the visit of the representative of this journal to Halifax it has been learned from H. R. Mallison, managing director of the company, that the submerged portion of this circuit sustained no damage. The underwater section consists of 2800 ft. of three-conductor, No. 4 R. & S. stranded rubber tape and varnished-cambic insulation, jute fillers, varnished-cambic belt, lead sheath, jute bedding and No. 4 B. W. G. wire armor, designed for 15,000 volts working pressure. This portion of the cable was laid in two sections, the joint being approximately in the middle of the harbor and well within the explosion zone. The shore-end sections consist of about 600 ft. of three-conductor No. 2 B. & S. gage, stranded, of the same general construction as the submarine section. These shore sections are joined to the submarine section at approximately the shore line and continue underground to the terminal pole, where they are connected with the aerial lines. The explosion damaged the pot-heads on the shore poles on each side of the harbor and they had to be replaced. In underrunning the submarine cable for inspection a 5-ton anchor was discovered firmly fixed to the cable; but the anchor had been there prior to the explosion and apparently caused no damage to the cable at the point of contact, although it is apparent that the anchor lifted the cable to the surface before it was cut away and drew the cable very tight from the east shore of the harbor. In grappling for the cable a large amount of wreckage was found, including piles, timbers and fragments of iron presumably blown into the water from the ship Mont Blanc. The cable was found completely covered with a tar-like substance such as smeared survivors from the explosion who were in the vicinity. Temporary service to Dartmouth pending repairs to the transmission line and pot-heads has been supplied from the plant of the Woodside sugar refinery.

Max Thelen was re-elected president of the Railroad Commission of California at the annual meeting of the commission on Jan. 2. This will be President Thelen's fourth term as head of the commission.

O. S. Yager has resigned his position as assistant to general manager of the Logan County Light & Power Company, Logan, W. Va., to become municipal superintendent of the city of Eaton Rapids, Mich.

P. M. Richards, formerly superintendent of the city light and water plant of Metropolis, Ill., is now associated with the Chuse Engine & Manufacturing Company at Mattoon, Ill., in the capacity of erector on outside work.

J. H. Kracke, formerly commissioner of plants and structures in the city government, has succeeded Col. William Hayward, now in military service, as a member of the Public Service Commission for the First District of New York.

A. D. Johnson, formerly Cambria representative for the Wisconsin Power, Light & Heat Company, has been appointed division superintendent for the company, with headquarters at Portage, Wis., succeeding F. M. Nourse, who has accepted a position in Chicago.

J. H. DuFresne has resigned as auditor and assistant treasurer of the Choctaw Power & Light Company, McAlester, Okla., to become auditor of the Minneapolis General Electric Company, Minneapolis, Minn. Mr. DuFresne was also chairman of the auditing and accounting committee of the Gas, Electric and Street Railway Association of Oklahoma.

Capt. Edwin W. Moore, chief senior aide to Major-General John F. O'Ryan, commanding the Twenty-seventh Division, U. S. A., besides being president of the Bare Wire Company, as stated in the Jan. 5 issue of the *ELECTRICAL WORLD*, is president of the Habirshaw Electric Cable Company of Yonkers and the Electric Cable Company of Bridgeport.

Van Dusen Rickert, who early in October resigned as assistant general manager and assistant secretary and treasurer of the Eastern Pennsylvania Railways Company and assistant general manager and secretary and treasurer of the Eastern Pennsylvania Light, Heat & Power Company, to take effect when a new general manager was appointed, severed his connection with these companies Dec. 31.

James E. Davidson, vice-president and general manager of the Nebraska Power Company of Omaha, Neb., is the new president of the Nebraska Section, N. E. L. A. Mr. Davidson was formerly with the public utility companies at Port Huron, Mich., and served as secretary-treasurer of the Michigan Electric Association. Later he became president and manager of the Consolidated Lighting Company of Montpelier, Vt. He was president of the Vermont Electrical Association in 1909 and president of the New England Section of the National Electric Light Association in 1910-1911.

Men of the Industry

Changes in Personnel
and Position —
Biographical Notes

W. D. Clark has succeeded R. S. Dunning as secretary of the Cleveland Electric Club, Jovian Chapter.

E. H. Merrill has been appointed chief engineer of the Galesburg (Ill.) Railway, Lighting & Power Company to succeed L. N. Jenkins.

L. N. Jenkins has resigned as chief engineer of the Galesburg (Ill.) Railway, Lighting & Power Company, to take a position in Omaha, Neb.

Michael Condon, Orange, N. J., has been named engineer for the municipal power plant, Orange, by the City Commission, to succeed James McElroy, deceased.

Guy E. Tripp, heretofore chairman of the Westinghouse Electric & Manufacturing Company, has been appointed head of the division of production in



G. E. TRIPP

the ordnance department of the United States Army. He has already entered upon his duties, and the board of directors of the Westinghouse company has given him a leave of absence for the duration of the war.

E. A. Baily, secretary to the vice-president of the Edison Electric Illuminating Company of Brooklyn, is now in Washington, D. C., for an indefinite period, where he is associated with the section on national organization of the war savings committee of the United States Treasury Department. Through this committee the government placed on sale on Dec. 3, 1917, \$2,000,000,000 of war savings and thrift stamps. Mr. Baily is devoting his time in interesting public utilities, including electric lighting, natural and artificial gas, water and street railway companies, in establishing booths for the sale of the new thrift and war savings stamps.

R. S. Dunning has resigned as secretary of the Cleveland Electric Club, Jovian Chapter, and is engaged in sale promotion work with the Forest City Rubber Company of Akron, Ohio. Under Mr. Dunning's secretaryship the Cleveland Electric Club was noted for the interest of its members and for the activities of the organization.

William Marconi, the inventor of the Marconi wireless system, has been appointed Italian high commissioner to the United States. Last spring Mr. Marconi, who is an Italian senator, was a member of the Italian commission which visited the United States. On his return from this country to Italy he served on the staff of General Diaz, the Italian Commander in Chief, giving special attention to the wireless system at the front.

Charles R. Underhill, chief electric engineer of the Acme Wire Company, New Haven, Conn., has just been appointed captain in the Aviation Section of the Signal Reserve Corps. Mr. Underhill, who has been with the Acme company since the summer of 1911, the inventor of a number of signal and wireless-telegraph devices besides being the author of a work on electromagnetic winding in which a number of original formulas are given.

F. Emerson Hoar, for five years head of the gas and electric department of the Railroad Commission of California, is leaving for Petersburg, Va., for three months' training as a captain in the Engineers' Corps. Mr. Hoar, who was born forty years ago in Kern County, California, served during the Spanish American War with Company I, First California Volunteers, the regiment which took Manila. After the war he remained at Manila two years, working there as a civilian in engineering work. It is with the greatest reluctance that the Railroad Commission releases Mr. Hoar from his present important work, which includes investigation of the feasibility of interconnecting transmission line systems of the State and otherwise conserving fuel and power generally. Within the past year Mr. Hoar has had charge of very important studies in connection with oil resources, industrial power rates and, in fact, many of the larger problems brought before the commission in which gas and electric utilities are involved.

Obituary

Charles J. Klein, inventor, connected with the push-button specialties department of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., was stricken with apoplexy on Dec. 3, at the age of fifty-five years, death resulting. Mr. Klein was born in New York City and had been connected with the electrical industry in its early stages, having been associated with Mr. Edison in the installation of the first electric station in New York City. A number of products have been developed by the Cutler-Hammer company from the patented push-button mechanisms devised by Mr. Klein.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Electrical League of Cleveland.—Mrs. C. S. Hoover addressed the Electrical League of Cleveland on Jan. 10 on the subject of "The War Work Done by the Daughters of the British Empire."

Empire State Gas and Electric Association.—The electric section of this association held a meeting on Jan. 18 at Rochester, N. Y., to discuss war economies, interconnection of systems and transformer loads.

Indiana Engineering Society.—The thirty-eighth annual meeting of the Engineering Society will be held at Indianapolis Jan. 25. The meeting, instead of being a three-day affair as usual, will be a one-day meeting with three full sessions. Separate meetings for different branches of engineering will be held. Charles Brossman, Indianapolis, is secretary of the society.

Fifth National Foreign Trade Convention.—The Fifth National Foreign Trade Convention will be held April 18 to 20 in Cincinnati, the convention theme to be "The Part of Foreign Trade in Winning the War." A tentative list of topics to be discussed at this meeting is as follows: "After-War Conditions of Foreign Trade," "Exports Control and Imports Control," "Foreign Credits," "Education for Foreign Trade," "The Smaller Manufacturer and Merchant," "Getting Into the Game" and "The Merchant Marine." Delegates are urged to advise, in writing, the secretary of the National Foreign Trade Council, 1 Hanover Square, New York City, what group sessions they desire to participate in, specifying the phase of the subject in which they are interested.

Meeting of Brooklyn Company Section, N. E. L. A.—At the Jan. 15 meeting of the Brooklyn Company Section of the National Electric Light Association the chief speakers were W. H. Wells, advertising manager; W. F. Wells, vice-president and general manager, and T. I. Jones, general sales agent of the company. Mr. Jones' paper formed the chief topic of discussion for the evening. He reviewed briefly the sales activities of the Edison company for the year 1917, showing the results in curves. During the year 1917 a change was made in the sales policy of the Edison company, particularly with reference to incandescent lamps, and the new policy was outlined by Mr. Jones. Among the visitors were a number of prominent central-station executives and manufacturers' representatives in the district. Short addresses were also made by C. G. M. Thomas, treasurer of the Consolidated Gas Company of New York; Adam

Page of the Harrison Lamp Works of the General Electric Company; D. F. Atkins, electrical engineer, Department of Water Supply, Gas and Electricity; W. J. Clarke, vice-president Westchester Lighting Company, Mount Vernon, N. Y.; O. H. Caldwell, *Electrical Merchandising*, and H. H. Barnes, engineer of the New York office of the General Electric Company.

Electric Club-Jovian League.—Capt. Charles E. Marian, chief examining officer for the Chicago district of the aviation department of the Signal Corps, addressed the Electric Club-Jovian League on Jan. 10. Announcement was made that the club's committee chairmen for 1918 are: R. I. Phillips, finance; E. A. Rummeler, speaker; J. G. Harvey, entertainment; Norman F. Obright, reception; C. W. Pendell, attendance; George C. Keech, welfare; E. S. Butt, publicity; W. H. Coleman, permanent quarters; William P. Bear, war activities, and J. R. Cravath, civic committee.

New York Electrical Society.—Continuing the war series of meetings that have been running during the winter, the New York Electrical Society announces another of timely interest for Jan. 24 to be held in the Engineering Societies Building at 29 West Thirty-ninth Street. On this occasion the address will be "The Telephone in the World War." It will be delivered by H. J. Carrol of the New York Telephone Company's lecture bureau. The membership committee, under the chairmanship of Walter Neumuller, is engaged in a campaign which has secured more than 150 members.

Contractors and Jobbers Hold Meeting in St. Louis.—A meeting was held jointly by the co-operative committee of the St. Louis Electrical Contractors, Jobbers and Dealers and the Missouri State Association of the National Association of Electrical Contractors and Dealers in St. Louis on Jan. 5. Beginning with the morning session, the following chairmen of standing committees delivered reports: Industrial development, Gus Schwedler of the Sparks Electric Company, Kansas City; universal data and sales book, O. L. Fickie of the Union Electric Company, Kansas City; liability insurance, W. L. Hutchison of the Kansas City Electric Construction Company; merchandising, J. J. Magee. In the absence of E. L. Heath, chairman of the credit committee, W. J. Burton of the Frank Adam Electric Company, St. Louis, presented a paper on "The Value to the Contractor of Trade Acceptances." The time being limited, the following committees were unable to report: House wiring, Robert B. Randall, chairman; jobbers, W. A. Koeneman; central stations, George Gamp; architects and engineers, W. J. Sutter. These additional committees were created: Unit prices, Edward Allison of the W. A. Corrao Electric Company, St. Louis, chairman; also standard forms and accounting and standard costs, with the selection of chairman deferred.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Continuous Service Rate.—The Pennsylvania Public Service Commission, in a case affecting the Butler Light, Heat & Motor Company, holds that when a company purchasing electric power from a power company must have continuous service and cannot bring itself within those provisions of the schedule of rates of the power company limiting the service to off-peak hours, it cannot demand the off-peak-hour service rate but must pay the continuous service rate.

Providing Working Capital.—Working capital is considered by the New Jersey Board of Public Utility Commissioners in a case affecting the Tintern Manor Water Company, the decision declaring: "It may well be that a company is required to borrow money in order to finance its operations, but this fact alone is not clear evidence that an allowance of working capital should be made. Where bills are payable entirely in advance at the beginning of the year, the money required to operate the company for the year is deposited to the credit of the company and may be actually increased, owing to interest on bank balances."

Method of Accounting for Service.—The method of recording messages used by the New York Telephone Company—having the operator press an electric button connected with a recording machine as soon as a call has been completed—was found by the New York Public Service Commission, Second District, to be as nearly accurate as any registering system which depends in any degree upon the accuracy of the people operating it. "So far as the commission has been enabled to observe," the decision says, "the company has always tried to avail itself of the best appliances that are to be had and to maintain a high standard of efficiency in the conduct of its business. Its failure to give entire satisfaction in connection with the matter now under discussion has not, in the opinion of the commission, been due to any desire upon the part of the company to maintain a registering method that is only partially satisfactory for one minute longer than seems necessary for the good of the system as a whole. If the commission did not believe that this was so, it would regard the condition of which Dr. Tracy [the complainant in the case] complains as intolerable, and would be willing to go to almost any length in compelling the company, at whatever cost, to rectify it immediately. Believing it to be so, it feels that this whole matter can be allowed to rest where it is for a while longer, until some better solution presents itself."

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

SEPTEMBER ELECTRICAL

EXPORTS COME TO \$4,190,110

The Large Amount of \$773,217 for Insulated Wire and Cable Included in Figures for the Month's Total

During September last exports of electrical goods from the United States amounted to \$4,190,110, in comparison with \$3,491,217 in September, 1916. These figures included an item of \$773,217 for insulated wire and cable armament, which is particularly large for that trade.

Figures also show exports of electrical goods for the first nine months of 1917 to have been \$40,225,951, as compared with \$27,027,623 for the corresponding period of 1916 and \$17,239,950 for the corresponding period of 1915. From the figures for the first three quarters, it appears that the total for 1917 will be somewhat more than \$50,000,000. However, the shipping conditions of the fall months of 1917 were such that it would not be surprising if the figures for those months when disclosed should show a considerable falling off over the previous months of the year.

The following figures were compiled by the Bureau of Foreign and Domestic Commerce:

Articles	1916	1917	1916	1917
Batteries	\$157,051	\$187,665	\$1,331,054	*\$2,568,047
Carbons		96,297		336,180
Dynamos and generators	108,453	106,784	1,129,872	1,718,005
Fans	23,593	65,558	255,231	487,330
Heating and cooking apparatus		39,927		*85,396
Insulated wire and cables	513,946	773,217	3,012,318	5,491,054
Interior wiring supplies, including fixtures	71,840	64,713	646,624	929,764
Arc lamps	982	1,193	12,946	13,415
Carbon-filament lamps	7,541	6,948	71,570	138,317
Metal-filament lamps	86,539	205,793	1,066,637	2,013,975
Magnetos, spark plugs, etc.		239,724		*712,345
Meters and measuring instruments....	85,395	111,906	624,242	808,181
Motors	327,727	456,117	3,467,002	*4,586,287
Rheostats and controllers		4,882		*37,845
Switches and accessories		166,299		466,897
Telegraph apparatus, including wireless..	10,671	17,707	120,761	470,351
Telephones	69,933	106,758	1,217,793	1,495,245
Transformers	103,251	88,660	801,935	1,038,650
All other	1,924,295	1,450,962	13,269,638	16,828,667
Total	\$5,491,217	\$4,190,110	\$27,027,623	\$40,225,951

*Figures cover period beginning July 1.

THE GROWING SCARCITY OF SKILLED MECHANICS

Appliance Manufacturer Unable to Place New Line of Goods on the Market Owing to Labor Shortage

Added to the difficulty of obtaining an adequate and steady supply of raw material, such as aluminum, brass, copper, steel, etc., a manufacturer of vacuum cleaners and other household appliances states that the growing scarcity of labor is becoming a real menace. As yet no attempt has been made to train and introduce women into this plant, but as could be gathered it seems only a question of time. For example, where in one department the complement was twenty-five men—this is a moderate-sized factory—now four is the largest number that can be had; in another department, where fifteen men were employed, two now report for

work; in still another room, where ten skilled men were necessary, only one man is on hand. The manufacturer in question, in lamenting this state of affairs, remarked that there seemed to be no relief in sight.

With the rapidly diminishing staff of factory workmen—skilled mechanics in their respective lines—has come the rapidly advancing scale of wages. The munition plants are attracting the services of mechanics, especially metal workers, as in this case, by paying them three times the money a manufacturer of the kind referred to can afford if he is to market his specialties with any margin of profit remaining. The cost of production follows the various increases of wages, so that the danger point has been reached.

For some time this producer was, and he is yet, hoping to place on the market a new line of electrical goods. The raw material is assembled and ready to be put in process, but the labor is the "missing ingredient" that is blocking further progress. The entire force of the factory must devote its time to keeping his regular lines in shape, which leaves any expansion along new lines almost impossible. Just how many other plants are either ruefully contemplating a like condition or else already experiencing it a special investigation alone would determine.

THE VOLUME OF HEATING

DEVICE BUSINESS IN 1917

Gross Sales of All Companies Are Estimated by Competent Authority to Be \$5,000,000, Which Is \$1,000,000 Ahead of the Figures for 1916

An authority on heating-device sales, whose knowledge of the entire business is gained through close association with the resistance-wire patent control, has given the following data as the best obtainable on the field as a whole:

"Heating-device sales for the year 1916 were \$4,000,000 and for 1917 were \$5,000,000 at manufacturers' prices. This total volume was divided in the proportion of 60 per cent socket appliances and 40 per cent ranges and other devices. If it be assumed, as it may be conservatively, that \$5 is the average selling price per socket device and \$60 is the average price per range, it is apparent that 400,000 socket devices and 50,000 ranges and other devices were sold in 1917. The average connected load of socket devices may be taken at 660 watts. On this basis the sales of 1917 alone added to the lines of central stations 264,000 kw., or a demand which if produced simultaneously would amount to a peak five-eighths as great as the peak of the Commonwealth Edison Company in Chicago in 1917. A little further estimating, based on published data on heating device use (see ELECTRICAL WORLD, July 7, 1917, page 19), shows that this 264,000 kw. of connected load meant annually an energy consumption of 40,429,600 kw.-hr. At 5 cents per kilowatt-hour this means \$2,021,480 in central-station revenue. Likewise, with the electric ranges a 5-kw. average rating can be assumed, giving 200,000 kw. in ranges sold during the year, or more than enough entirely to load to its ultimate capacity the new Windsor (W. Va.) power house jointly owned by the American Gas & Electric Company and the Insull interests. The central-station revenue from these ranges will probably be not less than \$36 a year each, or \$1,500,000. In other words, there is no single electric light and power company in the world capable of carrying the total connected load which would be produced if all the heating devices, including ranges, etc., sold in 1917 were simultaneously connected to its lines. The importance of this fact is more appreciated when it is considered that heating devices in quantities nearly as large have been sold

for many years and are still operative. It should also be pointed out that each 1000 kw. of heating devices connected calls for its quota of boilers, turbines, generators, switchboards, feeders, substations, transformers, wire, meters and supplies. Thus the 464,000 kw. of heating devices of necessity made possible the sale of much other equipment. Of such sales the size of the item of meters alone is surprising, since a very large percentage of the 50,000 ranges necessitated the purchase of three-wire, 25-amp. meters. So, taken on the whole, the heating device business is not the 'piddling' little affair it is sometimes assumed, in ignorance, to be."

ELECTRICAL SUPPLIES

FOR THE GOVERNMENT

Bids Now Being Asked for Considerable Quantities of Wiring Equipment—List of the Desired Articles

Bids are being asked for by the General Engineer Depot, Washington, D. C., for furnishing a considerable quantity of electrical goods to the government. Proposals will be opened Jan. 21. The electrical goods which the government is calling for are listed in the following table:

600 lightning arresters, 1250-2500 volts.	400 linemen's slack tackle.
600 gapments for above.	3200 enamel hoods.
600 350-volt lightning-arresters.	1600 linemen's hatchets.
3000 guy anchors.	2200 hatchet handles.
60,000 galvanized cross-arm braces.	832,000 glass insulators.
480,000 malleable-iron wall brackets.	24,000 porcelain knobs.
60,000 oak brackets.	480,000 locust insulator pins.
600 linemen's tool belts.	555 kerosene fire pots.
1,200,000 unglazed porcelain cleats.	555 melting pots.
60,000 cut-outs.	80,000 connecting plugs.
6,000 galvanized guy clamps.	480,000 porcelain rosettes.
600 splicing clamps.	480,000 reflectors.
20,000 cable connectors.	800 wire reels on wheels.
48 fuse plugs.	3200 reducers.
48,000 inclosed fuses.	400 tube cutters.
200 lb. round fuse wire.	400,000 lb. friction tape.
600 fuse boxes.	9600 copper terminals.
2,000 fuse links.	36,800 cable taps.
90 wire grips.	1600 safety straps.
	769,600 porcelain tubes.
	480,000 sockets.
	160,000 snap switches.
	36,000 D. P. S. T. knife switches.

METAL MARKET SITUATION

Wire Is Following Base in a Downward Tendency—Lead, Brass and Aluminum Are Higher

No uneasiness is expressed by either manufacturing consumers or jobbers regarding the supply of copper. The metal is moving freely at the established price, and wire—bare, covered and weatherproof—is being shaded in price, according to reliable reports. When the transactions have seemed to warrant the reduction base was quoted as low as 28 cents and weatherproof at 26½ cents. The jobbing houses in some instances are speaking of the current situation, especially on wire, as a falling market; but prices remain fairly steady for usual requirements.

Lead has advanced, as well as aluminum. Old metals also effect an upward tendency, with brass following in the same way. Tin is still scarce; in fact, buyers are placing orders at the convenience of the market, with none offering.

NEW YORK METAL MARKET PRICES

	Jan. 7			Jan. 14		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	27.00*			27.00*		
Lead, trust price	6.50			6.75		
Silver, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter.....	19.00			19.00		
Nickel, spot	7.82½	to	7.92½	7.82½	to	7.92½
in, Straits	85.00*			85.00*		
Aluminum, 98 to 99 per cent.	34.00	to	36.00	35.00	to	37.00

OLD METALS

Heavy copper and wire.....	22.00	to	22.50	21.50	to	22.00
Brass, heavy	14.00	to	14.50	13.75	to	14.00
Brass, light	10.00	to	10.50	10.00	to	10.50
Lead, heavy	6.00	to	6.12½	6.25	to	6.37½
Inc. old scrap	5.00	to	5.50	5.00	to	5.50

*Nominal.

THE WEEK IN TRADE

REPORTS from all sections indicate a brisk opening of trade so far in January. Shipments and deliveries continue to be disastrously affected by freight and express embargoes, with not much improvement in the transportation congestion at the principal terminal points. Business, however, is sound and increasing in volume. A few price advances have been made during the week, notably on friction tapes and electric sewing machines. Severe weather conditions have held up the supply of heating appliances, and an acute shortage in the large cities in the East has followed. In certain sections some kinds of conduit, as well as large and small motors, are scarce, with lamps still short. Building operations show some improvement, particularly where governmental activities along war lines exist. Financially the trade is reported to be on a sound basis, collections being generally mentioned as fair.

NEW YORK

During the past week considerable activity in the further receipt and sale of heating appliances was in evidence. The continued severe cold weather and record-breaking snowstorms in the Middle West have interfered greatly with shipments. The outlook for better and more certain deliveries, which seemed on the point of improvement, is now somewhat dubious. Revision in price to a 30-cent base of wire products is in progress. Collections have fallen off to a slight degree.

TIME SWITCHES.—Apparently a stronger demand is developing. A manufacturer who specializes on these goods says that while prices have not changed recently deliveries cannot be made under six months.

COLLECTIONS AND CREDITS.—January so far is making only a fair showing on collections, although no uneasiness is displayed by the jobbing houses and distributors. Jobbers state that not a few manufacturers are making liberal discounts for prompt and anticipated settlement of bills; in fact, far in advance of maturity. This practice is being followed right down the line to the dealers. The money is needed to finance current obligations.

SEWING MACHINES.—An advance of from \$2 to \$3.50 on certain types of electric sewing machines is reported as immediately effective. The supply of stock in the factories is said to be none too large, though no shortage is in sight.

RADIATORS.—The New York distributing and jobbing trade has not had its stock replenished. From reliable sources it is ascertained that shipments of these goods are in transit, but no one seems to know where they are or when deliveries may be reckoned on with any degree of positiveness. During the recent cold snap one of the largest distributing concerns in the East had one radiator in its showrooms, and four officers of the company endeavored to commandeer it for their personal use at home. Several jobbers stated that they could have sold from 500 to 1000 heaters readily if it had been possible to procure them.

GEARS AND PINIONS.—With the drawback incidental to uncertain deliveries, gears and pinions of standard grades are coming through in a fair way. Where new goods cannot be had unless subject to long delays, the second-hand market furnishes the supply quite satisfactorily.

FRICTION TAPES.—New prices are being quoted in certain quarters on friction tapes, effective Jan. 14, the change representing a sharp increase, ranging from 15 to 25 per cent.

PORCELAIN.—A slight betterment of conditions is noted in porcelain goods, shipments of which are moving as well as the embargoes in the East will permit. No recent differ-

ence in prices has been made so far as could be learned from local jobbers.

SOCKETS.—Where a few weeks ago the supply of standard sockets was regarded as approaching a shortage, now there is no trouble in getting stock. Prices have not been changed, but a revision is looked for.

CHICAGO

Two blizzards which have swept over the Central West this week have pretty effectually tied up the trade. There were very few shipments arriving at the jobbing houses. What is more disastrous is that for several days the drifts cut off shipments from jobbing houses to customers. On Saturday, Jan. 12, it was even impossible to get out express shipments because street traffic was deadlocked. Express companies flatly refused to send out wagons and trucks. Orders have continued to come in, however, and in some quarters the comment is heard that in spite of the severe weather business for this season of the year is fair. Especially with industrial companies business remains good.

COPPER.—As was predicted last week, rubber-covered copper wire is down to a 30-cent to 32-cent base. Weather-proof wire can be bought as low as 28 cents. It is the opinion in the trade that the action of the authorities at Washington in again fixing the price of copper at 23.50 cents will give a stable market for the next four months.

PORCELAIN INSULATION.—Now that the government demand for standard porcelain for cantonment construction is past the peak, better deliveries on all porcelain goods are expected by the Chicago trade.

MOTORS.—The aeroplane and aeroplane parts factories which are being and have been established at various points in the Middle West have called for great quantities of standard electric motors. The business of these great new plants went in most cases to the firm which could deliver on demand. To meet the requirements for speed, motors were shipped from jobbing warehouses from coast to coast. The electrical goods, it is said, were always on hand when needed and did not delay the jobs.

BOSTON

Jobbers report a slight falling off in business, but this is looked upon as temporary. Government orders predominate, as usual in these days. The freight congestion on the railroads is a severe handicap to deliveries, both of raw materials and finished products. Heavy storms in the Middle West are indirectly affecting New England transportation facilities, and disadvantageously. Prices remain steady, an advance being looked for, however, in insulating tape in the near future. Lead-covered cable is quoted somewhat higher, owing to a recent advance of about 0.5 cent per pound in lead.

Mill and government collections remain in the gilt-edged class, but jobbers report little improvement in contractors' payments. In some cases central-station remittances are reported as slower than usual, but no fear appears to be abroad as to the fundamental soundness of such customers. The coal situation remains very serious.

The Narragansett Electric Lighting Company of Providence, R. I., expects to start service with a 45,000-kw. turbo-generator this week, materially relieving the power situation through the interconnected transmission lines. This company will shortly purchase \$25,000 more of electric motors and is optimistic as regards 1918 business.

MOTORS.—Stocks are improving in smaller sizes, but there is a decided shortage in units of more than 75-hp. rating. Government demands for large motors are unceasing. Prices remain firm, with no immediate prospect of a change, and deliveries show little improvement. Not infrequently motors are diverted to central-station customers en route from the factory to the stockroom.

METERS.—The low volume of house-building contracts has cut down the sale of meters to less than three-fourths of the normal rate. Factory stocks are accordingly improving against expected future demands. Prices steady.

TRANSFORMERS.—Deliveries of six to eight months are quoted on transformers of 100 kw. and more for industrial work, with about half this period on priority orders and on small units. Demand continues heavy with prices firm.

LAMPS.—The general supply situation improves. Curtailment of use to save fuel is now being felt in the trade, especially in sign lamps. Factories are seizing the opportunity to stock up on these small sizes. Glass shortage is upsetting some producers, and transportation delays, combined with breakages from rough handling, are rather burdensome. The labor supply has been studied effectively at the factories and the effect of the draft has been discounted. Pooling shipments in a single carload has not always worked well, in view of delays in transit. In one typical case a pooled shipment took five weeks as compared with five days' normal time between factory and distributor. Business holds good, despite the 10 per cent price advance of Jan. 1.

CONDUIT.—Jobbers' stocks are getting low and deliveries are getting poorer, owing to railroad embargoes. The mills are finding raw-material deliveries unsatisfactory. So far prices remain steady.

ASBESTOS INSULATION.—Deliveries are improving somewhat in ebony wood, and prices show little change. There is no local stock of plain asbestos wood reported by one large dealer.

FIBER CONDUIT.—Business continued brisk up to Jan. 1. Frozen ground accounts for a lull at present. A good deal of construction is expected this year in war-service plants.

ELECTRIC HEATERS.—Large sales are registered, one jobber's turnover running into thousands, with a demand great enough to warrant sending the purchasing agent to the factory.

ATLANTA

The general undertone of the electrical business, despite the many existing hindrances and elements of uncertainty, appears more confident, though there is no disposition to minimize the possible effects of further economic changes.

The intensely cold weather experienced in the Southeast lately, with storms in some sections, has interrupted business more or less generally, aggravating the already serious fuel and transportation problems, accentuating the difficulties in distribution and slowing up construction. While the fuel situation in the Southeast has shown a slight improvement this week, the necessity for further relief is still great, especially at industrial centers, where the fuel requirements are in excess of normal on account of the increase of government orders and shortage of rainfall.

The protracted drought is now being felt by hydroelectric companies, which experienced practically no difficulty from this source during December.

The consensus of opinion among the jobbers and manufacturers is that the volume of electrical business for 1918 will be even greater than that recorded in 1917. The optimistic feeling is engendered, no doubt, by the fact that a large amount of capital will be invested in shipbuilding at the Southeast coast cities, which will also require the expenditure of a big portion of the \$35,000,000 recommended by the Shipping Board to house workmen engaged at these points. Then, too, work is just being started on the Muscle Shoals nitrate plant. Information secured from reliable sources indicates that one of the government repair shops will be in Atlanta. It is expected that the general contract will be let this week calling for the expenditure of approximately \$1,750,000 covering this structure. Reports from Nashville, Tenn., state that the Du Pont Company, Wilmington, Del., contemplates the erection of a ninety-million-dollar plant on the Cumberland River, Tennessee, under government supervision.

FRICTION TAPE.—The demand is very heavy. Prices are up 40 per cent over January, 1917, this class of goods naturally following the price of cotton. Deliveries are reported as being good.

SOLDER.—This item closely follows the tendency of friction tape in demand, but prices have not advanced so

rapidly, being 20 per cent up over this period last year. Deliveries are good also.

LAMP GUARDS.—The recent advance in the price of lamps has stimulated this line, and a brisk trade is noted. Jobbers say that this activity is actuated by new year economies effected in lighting and lamp purchases by industrial plants. Deliveries are very good and prices firm.

PORCELAIN.—The call continues strong, and no price advance has been noted during the last thirty days. Jobbers report deliveries poor, running from four to six weeks.

WIRING DEVICES.—The class of goods used for inside purposes is in great demand and the volume of business is considerably above normal. Factory promises and shipments are fair, but deliveries have not been so good recently.

WIRE.—Prices have been weakening slightly during the past month on rubber-covered and weatherproof. Shipments are bad.

RECTIFIERS.—Considerable activity is noted in these for service with lighting and starting batteries, and an excellent business is being done. Up to a few weeks ago local stocks were in comparatively good shape, but transportation difficulties have affected these also and stocks are becoming depleted.

SEATTLE

Northwest jobbers, in Seattle particularly, report a noticeable increase in buying. January to date in sales to shipyards and industrial plants far outstrips the same month last year. This increase in sales is due to the number of shipyards and allied plants as compared with last year. It is believed the volume of sales to shipyards which now obtains will continue increasing throughout the present year. Jobbers generally are buying heavily since annual inventories were taken in an effort to fill stocks before drastic steps are taken by the government to eliminate manufacture and shipments of so-called non-essentials. Prices are standing still. Three-quarters-inch black conduit is exceptionally hard to get. There is a shortage of both large and small motors and a distinct shortage in lamps.

A perceptible impetus has been felt along building lines in both Seattle and Tacoma since the first of the year. This applies to residence building solely, to care for 20,000 shipyard employees whom the government intends placing in Puget Sound cities. It is announced that the government does not plan to erect dwellings to care for workers, but depends upon property owners to prove their civic and patriotic spirit by building on unimproved lots to care for the influx. The mobilization of skilled labor for war purposes is to receive its first test in Seattle. Electrical dealers, specifically, feel the effects of the residence building program under way. Sales of wiring materials, fixtures, lamps, bells, etc., are increasing daily. Jobbers are caring for the demand easily. The commercial boat and yacht builders and machinery houses are having a hard time meeting the extraordinary demand for craft, both for commercial purposes and pleasure. Electrical dealers are doing a neat business with these concerns.

The United States Shipping Board recently announced, in spite of reports to the contrary, that wooden shipbuilding plants in the Seattle district will continue to receive government contracts to their full capacity as long as prices and deliveries are satisfactory. Additional contracts for Puget Sound yards are now being arranged.

For the first time in two weeks normal train service over all transcontinental lines has been resumed. Although freight shipments from Eastern points were delayed, jobbers were not seriously inconvenienced and the shipbuilding program was not halted noticeably. Deliveries long past due are coming through slowly. Advantages predicted when the government took over the railroads, such as the intra-terminal shipping maximum loading of cars, have not yet materialized. Much of the freight congestion at Northwest lumber mills, however, has been relieved.

On flood lamps an increasing demand is noted from several sources, particularly shipyards and government cantonments. Stocks seem ample. Sales, however, are expected to decrease with the coming of spring. There has been no

noticeable change in prices for months. Farm lighting outfits continue moving well, although a large volume of sales were made prior to the holidays. The campaigns conducted in the fall and early winter are declared very successful, especially among farmers in eastern Washington.

Switchboard instruments and switches of all kinds are moving very satisfactorily. Stocks are in fair condition and prices remain steady. Telegraph and telephone apparatus is moving very slowly. A majority of the sales are for repairs and maintenance. The recent storms and the subsequent damage to lines in the upper Sound country resulted in a slight increase in the buying of wire, insulators and pole-line materials. The volume of sales is very small. Electric glassware fixtures and the like are moving faster. There are ample stocks and even prices. Some jobbers are ordering for spring deliveries. Sales are expected to exceed by far last year's record on account of the anticipated increase in residence building. Flashlamps and flashers are moving fairly well. There had been a heavy movement, but sales are now smaller. A shortage of this merchandise is at hand and deliveries are very slow. Jobbers are ordering heavily. No increase in prices is noted.

Credit managers, as a whole, report that collections during 1916 were considerably better than in 1917. This applies to all months excepting December last, and to all credits with the exception of the government. However, government collections are improving steadily, owing, it is said, to more expeditious and efficient handling of supplies. Government purchases for the navy, from which Seattle jobbers derive a large business, are not paid for until ten days after the merchandise is inspected and approved. Heretofore in many instances goods were not inspected for months after delivery on account of the enormous volume. This necessarily made collections slow. Very few new credits of any size were placed since the first of the year. Credit managers say, however, that there is no occasion for pessimism and that undoubtedly 1917's record for business will be equaled if not exceeded this year. December's collections were easy and highly satisfactory.

SAN FRANCISCO

Beginning immediately after the holidays, building activity in San Francisco increased remarkably. During the months of November and December there had been very much less than the usual construction, particularly in apartments, hotels and office buildings, but in the first twelve days of January the city building department reported having passed upon a greater amount of work than the total for the months of November and December. Many of the new structures are machine shops, garages and warehouses, with a few loft buildings. The inquiries now regularly being made at the building inspector's office indicate that activity in this line will probably continue for some time.

The petroleum industry constitutes an important feature of California trade and construction activity just now. From the oil districts in the vicinity of Coalinga and Taft, and, in fact, wherever oil fields are tapped by the long-delivery pipe lines, the demand for electrical equipment has been steady and very heavy. Producers' committees have been successful in securing special priority orders on motors and other equipment for oil-field use. Transportation has been receiving careful attention, and especial effort is being made to increase warehouse and terminal storage space. In response to the Railroad Director's appeal for freight clearance, a committee was last week formed in San Francisco which released 200 freight cars for service within forty-eight hours.

At a hearing before the Railroad Commission this week, at which the advantages of interconnection of transmission lines were discussed, complaint was made that power companies are getting into bad shape financially because of increasing costs and unchanging rates. The construction of hydroelectric development is held up on this account, and a power shortage is predicted as a result, because industrial demands in the bay region are rapidly increasing and even the present sources of supply are barely sufficient. Moreover, the California rainfall this winter has thus far been the least recorded in sixty-nine years and water power next season will be affected accordingly.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must

increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.&S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil.....	List to \$61.00
Coil to 1000 ft.....	5% to \$59.17
	No. 12 Solid
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	10% to \$68.87

Twin-Conductor

	No. 14 Solid
Less than coil.....	List to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
	No. 12 Solid
Less than coil.....	List to \$135.00
Coil to 1000 ft.....	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil.....	List +10%
Coil to 1000 ft.....	List —10%
	No. 12 Solid
Less than coil.....	List +10%
Coil to 1000 ft.....	List —10%

Twin-Conductor

	No. 14 Solid
Less than coil.....	List +10%
Coil to 1000 ft.....	List —10%
	No. 12 Solid
Less than coil.....	List +10%
Coil to 1000 ft.....	List —10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List to 10%
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	20%
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

	No. 6 Regular	No. 6 Ignitor
Each Net		
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

	No. 6 Regular	No. 6 Ignitor
Each Net		
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175	.3275
Barrel lots.....	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft
3/4-in. s. stp. Net to \$75.00.....	—12% to \$69.75	
3/4-in. d. stp. +10% to 75.00.....	—9% to 72.00	
1/2-in. s. stp. List to 100.00.....	—12% to 93.00	
1/2-in. d. stp. Net to 100.00.....	—9% to 96.00	

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/4-in. single strip.....	\$75.00	\$63.75
3/4-in. double strip.....	78.25-78.75	71.25
1/2-in. single strip.....	100.00	85.00
1/2-in. double strip.....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	2.....	.47
5/8.....	.15	2 1/2.....	.55
3/4.....	.18	3.....	.65

-NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—			
\$25.00-\$55.00.....	\$20.50-\$24.75	\$20.00-\$22.00	
1/4-in.—	\$28.00-\$60.00	\$22.50-27.00	\$22.00-\$24.00

NET PER 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in..			
Net to..\$55.00.....	\$25.00-\$37.50	\$22.50-\$24.75	
1/4-in..	Net to..\$60.00	\$27.00-\$30.00	\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	4% to 6%	7% to 9%
2500 to 5000 lb.....	6% to 8%	9% to 11%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	1.3% to 3.7%	4.3% to 6.7%
2500-5000 lb.....	3.3% to 5.7%	6.3% to 8.7%
(For galvanized deduct six points from above discounts.)		

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50
	600-Volt		
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	.28%
1/5 to std. pkg.....	.38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	.28%
1/5 to std. pkg.....	.38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List.
Regular, clear:		
10 to 40-watt—B.	100	\$0.30
60-watt—B.	100	.35
100-watt—B.	24	.70
75-watt—C.	24	.70
100-watt—C.	24	1.10
200-watt—C.	24	2.20
300-watt—C.	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4 3/4 in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$24.90 to \$31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$35.60
Coil to 1000 ft.	22.50 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25
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OUTLET BOXES

Nos.	List.
101—A, A1 1/2, 4 S.C., 6200, 320	per 100 \$30.00
102—B.A., 6200 S.E., 300, AX, 1 1/2,	30.00
4 S.	25.00
103—C.A., 9, 4 R. B 1 1/2	20.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%-37%	20%-32%
\$10.00 to \$50.00 list.	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to \$20.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75	
1/5 to std. pkg.	15.60 to 20.75	24.20	

CHICAGO

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$11.85	\$30.75	
1/5 to std. pkg.	11.10	24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets	500	\$0.32
1/2-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	14%
1/5 to std. pkg.	30%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.	List to + 5%
\$10 to \$25 list.	10% to 11%
\$25 to \$50 net.	14% to 15%
	Low Grade
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.	+ 5%
\$10 to \$25 list.	10%
\$25 to \$50 list.	14%
	Low Grade
Less than \$10 list.	5%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

	List
Union and Similar—	Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00		
list	List	+ 10%
\$2.00 to \$10.00	10% to 20%	10%
\$10.00 to \$50.00	20% to 30%	20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00		
\$2.00 list	25%	15% to 20%
\$2.00 to \$10.00	25%	20%
\$10.00 to \$50.00	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	\$5.00 to \$7.50
Discount	25% to 30%

CHICAGO

List price	\$5.50 to \$6.00
Discount	30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net.
No. 18, less than full spools.	\$0.44 1/4
No. 18, full spools.	0.43 1/4

CHICAGO

	Per Lb. Net.
No. 18, less than full spools.	\$0.64 to \$0.65
No. 18, full spools	0.54 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	
11.	\$15.00-\$18.00	\$13.00-\$14.00	\$11.00-\$11.50	
12.	23.25- 25.41	21.30- 21.78	15.97- 19.35	
10.	32.40- 35.21	29.70- 30.18	22.13- 27.00	
8.	45.70- 49.12	41.90- 42.12	30.88- 38.00	
6.	72.40- 77.84	66.35- 66.72	48.93- 60.30	

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14....	\$18.00	\$13.00	\$11.50
12....	25.33-25.69	22.02-23.82	18.35-19.85
10....	30.48-33.24	27.94-30.03	22.86-27.70
8....	42.54-47.04	38.99-41.98	31.90-39.20
6....	66.46-67.38	56.15-62.05	50.53-55.85

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.21
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$40.00 to \$40.35
25 to 50 lb.	39.00 to 39.35
50 to 100 lb.	38.00 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Vertical Rotative Dry-Vacuum Pump

Attention is called to the fact that the vertical type of dry-vacuum pump manufactured by the Wheeler Condenser & Engineering Company of Carteret, N. J., is in demand by ship and stationary plant builders who are anxious to save as much space as possible and who at the same time have their eyes open to economy. Where much condensing is to be done and where high vacuum is to be maintained it is generally best to install separate condensate and air pumps. Thus a motor or turbine-driven centrifugal hot-well pump can easily take care of the condensate while this Wheeler dry-vacuum air pump withdraws the air.

The inlet valves of this vacuum pump are of the semi-rotative type, which are so manipulated by the valve gear as to draw air from the condenser during its full stroke. Clearance difficulties are eliminated in this design of valve gear by providing ports which register with an equalizing passage. The discharge valves are of the poppet type and are easily accessible. In fact, all parts are easily accessible, a point that is of great value in high-vacuum pumping machinery. Valve arrangement is such as to insure perfect drainage at all times.

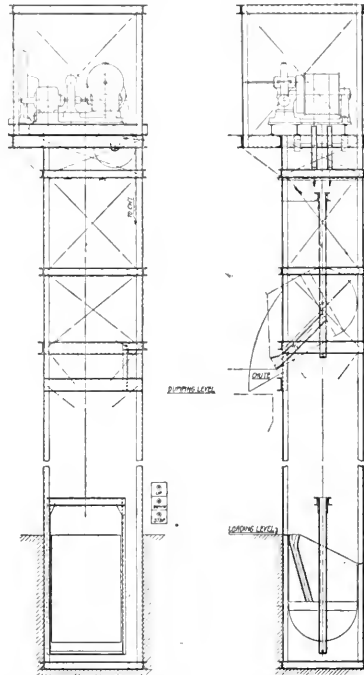
The makers point out that a motor-driven dry-vacuum pump has numerous other advantages over direct steam drive, among which are ease of installation, less attention required, no steam pipe radiation losses, and improvement of plant load factor.

Skip Hoists

Automatically operated skip hoists for the speedy and efficient handling of coal, ashes and similar materials in gas plants, central stations, mining plants, factories, etc., have been developed by the Otis Elevator Company of New York City. These skip hoists may be divided into two classes according to whether the bucket for carrying the load travels vertically or on an incline. Both vertical and incline hoists may be equipped with a single hoisting bucket, which may or may not require a counterweight, or with two hoisting buckets running on separate tracks, the one acting as the counterweight for the other. For the duties generally found in handling coal, ashes, etc., in manufacturing plants and central stations standard elevator hoisting machines are used. These can be installed either overhead or at ground level, adjacent to the hoistway. The usual machine consists of a single or double drum, a

worm-gear reduction, an electrically released, spring-applied shoe brake and a motor, all of these parts being mounted on a heavy cast-iron base plate to preserve alignment.

The control system generally furnished is entirely automatic. The operation is by means of three push-buttons marked "up," "down" and "stop." When the bucket has received its load the attendant presses the "up" button, which causes the machine to start, and from this point the operation is entirely automatic. The machine accelerates to full speed, the bucket rises to the upper



DETAILS OF AUTOMATICALLY OPERATED
SKIP HOIST

level, and at the proper point the machine slows down and the bucket travels into the dumping position, where on single skips it stops and automatically remains for a predetermined interval which is sufficient to allow the material to be entirely discharged from the bucket. The machine then automatically starts in the "down" direction and continues in operation until the bucket reaches the lower level and automatically stops in the loading position. A pressure of the "stop" button at any time during the travel of the bucket will cause the machine to come to rest.

In the case of a double skip hoist, when the ascending bucket reaches the dumping position the machine remains stationary until it is again started by the operator at the loading point, the operator having in the meantime attended to the loading of the other bucket.

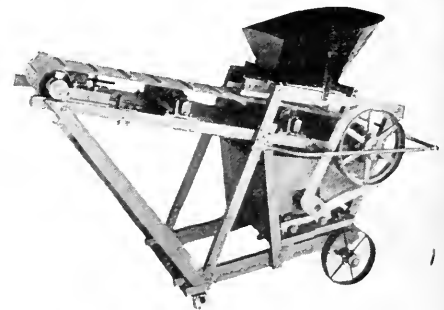
The bucket usually furnished for vertical skip hoists, either of the single or double skip type, is made of heavy steel plates reinforced with structural shapes and provided with two cams symmetrically placed on each side of the bucket. These cams are made of channels or angles properly shaped and riveted to the bucket. The bucket is supported in a steel frame or sling by means of two trunnions and is held in an upright position and guided during its travel by means of two steel brackets bearing against angle-iron guides.

Renewable Fuse

The Chicago Fuse Manufacturing Company of Chicago is marketing the fuse it has purchased from the Multi Refillable Fuse Company under the trade name of "Union." The present form of the fuse is the result of extensive experiments and improvements. The tubing used is the best-quality horn fiber of extra thickness. The ferrules and caps are of brass and designed to withstand the heavy strains incident to a fuse without powder filler. The method of attaching the cap allows an exceptionally heavy pressure to be brought to bear upon the contact with the end of the renewable element, thus reducing the heat developed to a minimum and guarding against accidental loosening of caps through rough usage.

Car-Loading Machine

The Link-Belt Company of Nicetown, Philadelphia, Pa., has recently put on the market a low-priced machine for loading all kinds of material into box cars. The machine is shown in the accompanying illustration and is called the Link-Belt BX loader. It is a portable machine, driven by motor or gas

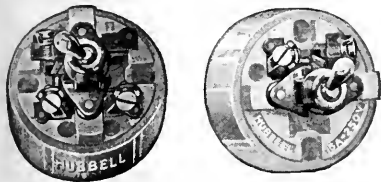


MOTOR-OPERATED LOADING MACHINE

engine, and handles the material delivered to it through the steel hopper on a flat belt. On a recent test it loaded eighty box cars in six days with but two men. Its capacity is 80 tons to 100 tons per hour.

Toggle Snap Switch

Harvey Hubbell, Inc., of Bridgeport, Conn., has brought out a toggle surface switch which differs from the ordinary snap surface switch in that manipulation is by the throw of a lever or toggle, instead of by the turning of a key or button. Throwing the lever



SWITCH IS SELF-INDICATING.

up makes the circuit; throwing it down breaks the circuit. The advantages claimed for the toggle movement in a surface switch are, first, that it permits making the switch more attractive and stronger than the ordinary switch; second, manipulation is much more convenient by means of the lever than by the turning of a key; third, the switch is self-indicating, the position of the lever showing at a glance whether the current is "on" or "off" without any marker or dial. This switch conforms with the National Electrical Code standard requirements.

Plug Receptacle

The Gordon Electrical & Manufacturing Company, 430 South Green Street, Chicago, recently placed upon the market its No. 1708 Edison screw-plug flush receptacle. All plugs are made of solid brass in accordance with the requirements of the Underwriters' Laboratories, Inc., which has thoroughly approved the receptacle. The product is a slight departure from the ordinary receptacle in that the terminals and contact pieces together with brass-plated brackets at each end are used.

Automatic Controller or Rotary Switch

The accompanying illustration shows an automatic controller constructed by the Reynolds Electric Company of Chicago and New York for a fire-alarm siren made by the Federal Sign System (Electric) of Chicago. By an ingenious arrangement of contacts the sounds from the siren are graduated in



FOR A FIRE-ALARM SIREN.

tones ranging from low to shrill, and by means of suitable gearing the blowing, after continuing for a period of two minutes, is automatically cut off. To start the controller the mere pressing of a push-button switch suffices.

This closes the circuit and starts the motor driving the controller, another switch on the controller opening the motor circuit after two minutes' operation, thus making practically an automatic device.

The motor is directly geared to the controller to insure a positive drive. The fingers are reinforced at the contact end and are of the "quick-break" type, and a holder provides for 1-in. (2.54-cm.) take-up in case of wear. The contacts are removable and adjustable.

Similar controllers are now being furnished by the Reynolds Electric Company to the city of Chicago for flashing "stop" signals, gate lights and ringing gongs when a drawbridge is open and the gates are down, giving a positive alarm both by light and sound.

Externally Operated Switches

The Trumbull Electric Manufacturing Company of Plainville, Conn., has developed several externally operated switches, one of which is shown herewith. In the fusible-top type the cover



FUSIBLE-BOTTOM TYPE OF SWITCH

prevents the switch from being connected until the box is closed, and in the fusible-bottom type the catch at the side prevents the switch from being connected until the box is closed. It is pointed out that the box cannot be opened when the switch is in contact and that it can be locked and sealed when the switch is in open position. The switches are of the quick-break type.

Motor-Generator Sets

Unit-type motor-generator sets for battery-charging and signal work are being made by the Electric Specialty Company of Stamford, Conn. These motor-generator sets are for charging storage batteries, operating electromagnets, bells or any form of signals. They are constructed to operate on 110 volts or 220 volts direct or alternating current. The smallest size delivers 20 watts and is intended for use only where a very small amount of power is required. Other types are suitable for charging one 6-volt battery at 8 amp. and 12-amp. respectively. The largest size, rated at 300 watts, will charge five 6-volt batteries at 10 amp. charge, tapering down to 8 amp. One type of

set is furnished with oil-wick bearings and the other with oil-ring bearings. Motor-generators of more than 100 watts capacity only are regularly furnished with rheostats.

Light for Shaving

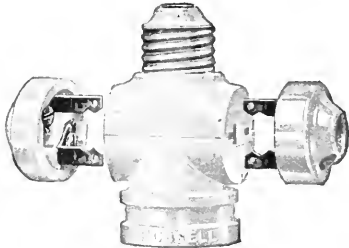
An electric light attachment to be used with a safety razor has recently been developed and is shown herewith. The outfit is complete with razor, trench mirror, strop handle and extra blades. The "Shavelight" attachment can also be used to advantage with a pencil or a fountain pen. The battery is of standard size and said to last for more than 100 shaves. The whole outfit is contained in a handsome khaki case. The Shavelight Corporation of 30 Church Street, New York City, is the manufacturer.

Pulley-Driven Propeller Fans

Pulley-driven propeller fans are one of the latest additions to the ventilating-fan equipment of the Batterman Truitt Company of Chicago. These fans are equipped with split-hub-type pulleys, the pulley being overhung on the fan shaft. This construction, it is pointed out, allows the removal or replacing of the belt at will and without necessitating the loosening of bearings and dismantling the fan frame. These fans are of two-bearing-type construction, having one bearing on each side of the fan wheel. These bearings are mounted in a retaining housing and are rigidly set in this housing with adjustable set-screws, thus allowing for their removal for inspection purposes. The bearings are of the split-bearing, ring-oiling, ball and socket type. These fans are made in diameters from 18 in. to 60 in. (45.7 cm. to 152.4 cm.).

Double-Outlet Current Tap

Harvey Hubbell, Inc., of Bridgeport, Conn., is supplementing its standard-single-outlet current tap with a new one providing two plug outlets in addition to the lamp outlet. This tap is to be known as No. 6553. This de-



TWO PLUG OUTLETS PROVIDED IN ADDITION TO LAMP OUTLET.

vice is constructed throughout of porcelain and is fitted with a shade-holder groove and slots so designed as to accommodate any one of this company's different styles of interchangeable plug caps.

Trade Notes

RATHBONE, SARD & COMPANY of Chicago are establishing wholesale offices and warehouses to handle their business in the Pacific Northwest.

THE WESTERN SERVICE COMPANY, Spencer, Iowa, has been organized for the purpose of engaging in civil and electrical engineering and power-plant efficiency practice.

THE PITTSBURGH ELECTRICAL SPECIALTIES COMPANY has moved from Pittsburgh to New York City, with offices at 336-338 Broadway. The factory is at 41 Greenwich Street.

GEORGE A. SCHNEIDER will succeed J. W. Tabb as manager of the Western Electric Company's branch at Buffalo, N. Y. George Seiss has been made assistant manager of the Cleveland office.

R. H. BALFOUR, sales manager of the Eugene F. Phillips Electrical Works, Ltd., Montreal, Canada, has been elected a director of the company. The capital of the company has been increased to \$4,000,000.

F. V. GENTT, manager of the Louisville (Ky.) branch of the General Electric Company, has gone to Cincinnati, Ohio, where he will have charge of the central station and electric railway sections of the company.

J. C. MANCHESTER is now district sales manager for the Economy Fuse & Manufacturing Company, San Francisco. Mr. Manchester was formerly connected with the Interstate Electric Novelty Company in that city.

THE ESTERLINE COMPANY of Indianapolis, Ind., announces the appointment of J. S. Pandiani, Via Mario Pagano, 27, Milan, Italy, as trade representative for that country. Mr. Pandiani was until recently manager of the meter and supply department of the Italian Westinghouse Company and will in the future give his attention to the sale of Esterline instruments and permanent magnets throughout Italy.

MCDONNELL & COMPANY of San Francisco, Cal., are distributing a circular dealing with the Poulsen Wireless Corporation. The patent originally introduced in this country from Denmark has been amplified by L. F. Fuller. The system has been adopted by the United States government at Cavite, Philippine Islands, for a plant nearing completion. The French government has closed a contract with the corporation for what is described as the most powerful wireless installation in the world.

THE GUARANTY TRUST COMPANY of New York City has compiled a complete list of holidays of all nations in a booklet of 145 pages. The reader may determine in a moment whether any day of the year is a holiday anywhere in the world; or, if the question is approached from the opposite side, what days in the year are celebrated as holidays by any particular country. It is designed for the use of manufacturers, jobbers, etc., doing an international business. Its compilation was made necessary by the new position of world leadership taken by American business men. A knowledge of what days are closed to business in any given country is highly important in carrying on international trade.

THE PHILADELPHIA STORAGE BATTERY COMPANY of Philadelphia has secured the services of G. L. Barrett as manager of the Southwestern division, and he will be found at 2605 Locust Street, in the Coliseum Building, St. Louis. Mr. Barrett was formerly president and general manager of the Willard Storage Battery Company of Texas, and has been in Texas for two and a half years handling the Southwestern distribution of the Willard storage batteries. Previous to that he was connected with the Willard company at Indianapolis and Cleveland, working in the starting, lighting and vehicle field. For six years previous to this he was in the automobile business in Minneapolis, Minn., in both gas and electric lines.

FORD, BACON & DAVIS announce the formation of the Ford, Bacon & Davis Corporation, organized for the purpose of conducting a general contracting business, with particular reference to industrial, public utility and power plants, steam and street railroads, docks, steamship and railway terminal facilities, subways, tunnels, hydroelectric and irrigation projects. In effect this means the continuance in corporate form of construction work which heretofore has been handled by the firm direct. The corporation's headquarters are at 115 Broadway, New York, with offices at New Orleans and San Francisco. The facilities from the firm of Ford, Bacon & Davis, now

in its twenty-fourth year, which continues as heretofore, are available to the new corporation.

THE DRIVER-HARRIS COMPANY of Harrison, N. J., has announced an additional benefit according to its employees in the nature of paid-up life insurance. On Jan. 1 there was distributed to all employees who had been with the company at least six months on that date a life insurance policy for \$500. It is the intention of the company to make a further distribution of these policies as other employees reach the six months' service period. The extra wage distribution this year was increased by 1 per cent over what has been paid heretofore. This distribution is based on salaries earned and terms of service and is distributed twice yearly. The percentage is graduated, beginning at 6 per cent to employees who have been with the company six months and increasing one-half of 1 per cent for each succeeding year of continuous service. The Jan. 1 distribution amounted to about \$15,000. The fourth annual dinner of the company was held at the Downtown Club, Newark, N. J., Dec. 28, and was a very enjoyable affair.

THE NATIONAL BANK OF COMMERCE of New York City has compiled interesting statistics and information on the trade between the United States and New Zealand. The changes in trade routes occasioned by the war have greatly favored the export business of the United States. The bank has issued this statement which discusses the development of trade from the beginning of 1915 until the present: "In the field of electrical machinery the United States is gaining. In 1915 it supplied approximately one-fifth of all the electrical machinery which was imported into New Zealand, and in 1916 supplied one-fourth. It has met the Japanese as competitors in electrical supplies, but Japanese articles have apparently been found unsatisfactory. There is a great trade in New Zealand in electric torches and batteries. Americans lead the market, and for similar articles the American product is much cheaper. American batteries are also accompanied by a guarantee of service. Japan has delivered a great number of torches and batteries, but they are not satisfactory."

Trade Publications

PLIERS.—"Rimco" rubber-insulated pliers are illustrated and described in a leaflet prepared by the Rubber Insulated Metals Corporation of Plainfield, N. J.

LAMPS.—The Westinghouse Lamp Company of New York City has prepared a folder showing the growth of its plants caused by the increase in demand for its lamps.

SWITCHES AND PANELBOARDS.—The Leonard-Bundy Electric Company of Cleveland, Ohio, is distributing its bulletin E, descriptive of safety-type knife switches and panelboards.

FANS.—The Baiterman Trullitt Company of Chicago has prepared bulletin No. 43, descriptive of its pulley-driven propeller fans. This company has also issued its bulletin No. 44, giving information on its "Autovent" louvers.

REAMERS.—The Taft Pierce Manufacturing Company of Woonsocket, R. I., is distributing its bulletin No. 101, descriptive of the Martell system of line reaming bearings. Special applications of the Martell reamer are outlined.

FUSES.—The Trico Fuse & Manufacturing Company of Milwaukee, Wis., has prepared a leaflet descriptive of its renewable cartridge fuses. Seventeen features of these fuses are pointed out in this leaflet. This company has also printed a leaflet giving list prices of the fuses.

CHAIN DRIVES.—"The Ideal Drive for Rubber Mill Machinery" is the title of book No. 299, which has been prepared by the Link-Belt Company of Chicago, Ill. Illustrations and reasons why the Link-Belt drive is the ideal drive for rubber mill machinery are given. The bushed joint of the Link-Belt silent chain is described, as are casings for silent chain drives.

LIGHTING AND POWER PLANTS.—The Main Electric Manufacturing Company of Pittsburgh, Pa., has issued its catalog No. 100, in which are described the Main electric lighting and power plants. Valuable technical data, the amount of energy used by various appliances and wiring information are included. This is a well prepared and illustrated catalog and should be in the hands of all interested in this subject.

ROOF CONSTRUCTION.—The Asbestos Protected Metal Company of Pittsburgh, Pa., has prepared its bulletin No. 59 on the subject of "Roof Construction for Factory Buildings." In this bulletin it is brought out that the gypsum roof made by this company not only meets all of the exacting requirements of an ideal roof construction, in a way that entirely overcomes practical and economic objections, but offers several distinctive advantages that cannot be obtained with any other type of roof. Illustrations of representative installations are given.

GAS METERS.—The Backarach Industrial Instrument Company of Pittsburgh, Pa., is distributing its catalog E, descriptive of its "Hydro" gas meters. A review of the various methods employed for measuring gases, such as impact and Pitot tubes, orifices, nozzles, Venturi tubes, etc., is given. It is pointed out that in each of these devices the differential pressure is the quantity to be measured, and then follows a description of the "Hydro" instrument which measures and records this differential pressure accurately. Applications of the Hydro volume meter to blast furnaces, by-product coke ovens, gas works, producer plants, etc., are given, as well as for measuring air for mine and building ventilation.

New Incorporations

THE MENAHEG (MINN.) ELECTRIC COMPANY has been incorporated with a capital stock of \$10,000 by S. J. Zeeman and others.

THE ELECTRIC SERVICE COMPANY of Cedar Rapids, Iowa, has been chartered with a capital stock of \$20,000 by C. E. Rowe and others.

THE ELECTRIC MANUFACTURING COMPANY of Cairo, Ill., has been incorporated with a capital stock of \$550,000 by Henry Tideman, Charles M. Roos and James H. Galligan.

THE HOLLY (S. C.) HILL ELECTRIC SERVICE COMPANY has been incorporated by S. P. Wells, B. R. Bennett and R. G. Carson of Holly Hill. The company is capitalized at \$10,000.

THE CENTURY TELEPHONE CONSTRUCTION COMPANY of Buffalo, N. Y., has been incorporated with a capital stock of \$10,000 by E. H. Letchworth, W. M. Wilkins and C. M. Baldy of Buffalo, N. Y.

THE STORAGE BATTERY REBUILDING COMPANY of Cleveland, Ohio, has been incorporated by Henry L. Beggs, Samuel L. Bowls, Lawrence C. Meyer, Arthur W. Longbarger and Gilbert J. Spencer. The company is capitalized at \$15,000.

THE HYDRAULIC ELECTRIC COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$50,000. The incorporators are: J. J. Hobbs, Randolph C. Shaw and A. W. Britton, all of New York, N. Y.

THE MONARCH STORAGE BATTERY COMPANY of Grand Rapids, Mich., has been incorporated by T. H. Lavier, H. B. Knowlson, H. G. Dykhouse and others. The company is capitalized at \$20,000 and proposes to manufacture and deal in storage batteries.

THE WAYLAND (MICH.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of \$5,000 to furnish electricity for lamps, heaters and motors in Wayland. The incorporators are: L. B. Mason, E. O. Hanlon, A. E. Weaver and others.

THE RICHARDSON AUTO ELECTRIC CORPORATION, Charles Street and Lafayette Avenue, Baltimore, Md., has been incorporated by Donald R. Richardson, Frank Laurence Pollard and Carl C. Schmidt. The company is capitalized at \$50,000 and proposes to manufacture and repair batteries.

THE BLESSING MANUFACTURING COMPANY of San Francisco, Cal., has been chartered with a capital stock of \$20,000 by H. H. Traub, J. W. Lederman, E. D. Lederman, L. Van Orden and T. E. Pawlicki, all of San Francisco, Cal. The company proposes to manufacture tools and machinery for the development of power by gas, steam, electricity, etc.

THE I. H. SIMPSON HARDWARE COMPANY of New York County, N. Y., has been incorporated by I. H. Simpson, 410 West End Avenue; C. W. Simpson, 356 Fourth Avenue, New York City; L. Genn, 42 Montrose Avenue, Brooklyn. The company is capitalized at \$50,000 and proposes to do a general contracting and electrical business and deal in plumbers' supplies.

New England States

RANGELEY, MAINE.—The electric plant of the Quossoc Light & Power Company is nearly completed, and is expected to be ready to put in operation about Feb. 1. F. B. Colby is president and manager.

CAMBRIDGE, MASS.—Extensive improvements are contemplated by the Cambridge Electric Light Company, including the installation of a 12,500-kw. turbine, two 600-hp. boilers, ash-handling system and extension of switchboard. Welles E. Holmes is general manager.

GARDNER, MASS.—The Gardner Electric Light Company contemplates the installation of an additional 1500-kva. bank of transformers this spring. C. A. Ware is manager.

MANSFIELD, MASS.—Two 250-kva. Westinghouse transformers will soon be installed in the municipal electric-light plant to replace two 125-kw. transformers now in use. George W. Wood is manager.

NORTH ATTLEBORO, MASS.—The extension of the commercial lighting lines of the municipal electric-light plant into Adamsdale is under consideration; also the purchase of electricity from the Attleboro Steam & Electric Company. William Plattner is manager.

PITTSFIELD, MASS.—The Pittsfield Electric Company is planning to install a 2500-kw. General Electric turbo-generator and two 520-hp. Babcock & Wilcox boilers. W. A. Whittlesey is superintendent.

READING, MASS.—Extensions and improvements are being made to the municipal electric-light plant, including an addition to boiler room, a new 600-kw. General Electric turbine, Wheeler condenser, an additional boiler, new switchboard, and changing the plant from two to three phase system. Arthur G. Sias is manager.

WEST SPRINGFIELD, MASS.—The Gilbert & Barker Company, Church Street, has awarded a contract for construction of an addition to its power plant, 55 ft. x 95 ft., one story, to the H. Wales Lines Company, 134 State Street, Meriden, Conn.

HARTFORD, CONN.—Contract has been awarded to J. H. Crozier, 721 Main Street, Hartford, and plans filed by the Southern New England Telephone Company, 185 Pearl Street, for additions and alterations in its exchange building, to cost about \$10,000.

Middle Atlantic States

BROOKLYN, N. Y.—The Transit Development Company, a subsidiary of the Brooklyn Rapid Transit Company, has awarded a contract to the Structural Concrete Company for the construction of an addition to its electric generating plant at Kent and Division Avenues, to cost approximately \$500,000. The building will be 211 x 257 ft., six stories high.

FREDONIA, N. Y.—The city of Fredonia has entered into a contract with the Niagara & Erie Power Company of Buffalo for furnishing electricity for lighting the streets, parks and public buildings in Fredonia for a period of five years. The municipal electric light plant will be closed down.

GOWANDA, N. Y.—The construction of a new electric power plant is reported to be under consideration by the Gowanda Light & Power Company.

LONG ISLAND CITY, N. Y.—The power plant of the New York & Queens Electric Light & Power Company on Mills Street was recently damaged by fire, causing a damage of about \$15,000.

NEW YORK, N. Y.—Bids will be received by the State Hospital Commission Capitol, Albany, N. Y., until Jan. 29, for installation of an electric-lighting system consisting of underground feeder, poles, etc., for incandescent lamps, at the Manhattan State Hospital, Ward's Island. T. F. Pilcher is State architect.

ANDOVER, N. J.—Due to the scarcity of both coal and water, the Andover Electric Company, which has had dual power, has issued notification that it has been compelled to suspend operations temporarily.

EAST ORANGE, N. J.—The City Council in its annual budget for 1918, has provided for an appropriation of \$52,500 for street-lighting purposes. The requisition has been approved.

EDGEWATER, N. J.—Plans have been filed by Spencer Kellogg & Sons for the construction of an addition to its power house, about 50 ft. by 50 ft., one story, at its plant. Contract has been awarded to the John W. Ferguson Company, 152 Market Street, Paterson.

JERSEY CITY, N. J.—Contract has been

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

awarded by the Erie Railroad Company to F. A. Knapp, Jersey City, for the construction of a galvanized iron boiler house at its yards at the foot of Pavonia Avenue.

KEARNEY, N. J.—Plans have been filed by the Federal Shipbuilding Company for the erection of a large power house and boiler shop at its works, to cost \$60,000 and \$170,000, respectively.

MATAWAN, N. J.—The installation of electrically operated pumping machinery in the municipal water-works system is under consideration by the Borough Council.

NEWARK, N. J.—The lowest bid submitted to the Board of Freeholders for the installation of electric-lighting and power wiring in the laundry building at the County Hospital at Overbrook, was submitted by the Beyer Engineering Company of Newark, at \$14,174.

TOMS RIVER, N. J.—The Board of Public Utility Commissioners has granted the Toms River Electric Company permission to issue \$15,000 in capital stock, the proceeds to be used for extensions, improvements, etc.

TRENTON, N. J.—Work has begun on placing of foundations for the new 2000-hp. engine and generator to be installed in the plant of the Trenton & Mercer County Traction Corporation, for which orders have already been placed. The company is making extensive improvements throughout its entire plant and has also commenced the reconstruction of the portion of its car barns recently destroyed by fire.

BRIDGEPORT, PA.—Plans have been filed by the Philadelphia & Reading Railway Company, Reading Terminal, Philadelphia, for the erection of an addition to its local power house, about 95 ft. x 100 ft. Contract for the building has been awarded.

CLIFTON HEIGHTS, PA.—Plans are being prepared for interior alterations to the local electric plant to provide for the installation of power equipment. Frank E. Hahn is architect.

COATESVILLE, PA.—The Chester Valley Electric Company is erecting a new electric transmission line from its station at Phoenixville into Coatesville, a distance of about 18 miles, to supply electricity to the plants of the Midvale and Lukens Steel companies in Coatesville.

HARRISBURG, PA.—Extensive improvements are contemplated by the Harrisburg Light & Power Company in its steam heating plant. C. M. Kaltwasser is manager.

NEW BOSTON, PA.—Plans are being considered by the New Boston Coal Land Company for equipping its Morea mine for electrical operation throughout.

NORRISTOWN, PA.—The Counties Gas & Electric Company has filed notice with the Public Service Commission of an issue of bonds to the amount of \$300,000 for extensions, improvements, etc., to its system.

PITTSBURGH, PA.—A permit has been granted to the National Biscuit Company for the erection of bakery, power plant, garage and stables at Penn Avenue and Lambert Street. The total cost is estimated at \$550,000.

PITTSBURGH, PA.—Application has been made by the Allegheny County Steam Heating Company of Pittsburgh for permission to lease a portion of the Allegheny County Prison, which will be utilized as an auxiliary to its present plant.

WILLIAMSPORT, PA.—Extensive improvements are contemplated by the Lycoming Edison Company to its plant and system during 1918. Arrangements are now being made for an appropriation of about \$250,000 for the proposed work.

BALTIMORE, MD.—Plans have been filed by the Bartlett Hayward Company, Scott and McHenry Streets, for the erection of a new transformer station at Hamburg and Gunpowder Streets. Contract for building has been awarded to Morrow Brothers, Fidelity Building, Baltimore.

CUMBERLAND, MD.—The Cumberland Electric Railway Company is planning to construct an extension to the plant of the Kelly-Springfield Tire Company and to the new Ridgedale addition and also double-tracking on Green and Water Streets.

PRINCESS ANNE, MD.—E. C. Cannon, owner of the local electric-light plant, ex-

pects to establish a 24-hour service April 1, unless prevented by war conditions.

CHARLESTON, W. VA.—The Charleston-Dunbar Traction Company expects to place in service 9 miles of track between Dunbar and Poca during 1918.

DUNGANNON, VA.—Plans are being considered by Charles F. Hagan, trustee of Patrick Hagan Estate, Bristol, Va., for the construction of a hydroelectric power plant on Clinch River, near Dunganon.

GLEN LYN, VA.—Plans have been completed by the Appalachian Power Company of Bluefield for the construction of a steam-driven electric generating plant on New River providing for an ultimate development of 75,000 kw. The power house and equipment will cost about \$2,000,000. The initial installation will have a generating capacity of 16,750 kw. The water intake, etc., will provide for ultimate capacity. Contracts for equipment, including turbine, boilers, transformers, condensers, pumps, automatic stokers, switchboard, coal-handling machinery, etc., have been awarded. Viele, Blackwell & Buck, 49 Wall Street, New York, N. Y., are designing and constructing engineers.

RICHMOND, VA.—Plans have been prepared and application filed for permit by the Virginia Railway & Power Company for an addition to its power plant at the foot of Twelfth Street, to cost about \$6,000.

SUFFOLK, VA.—The Virginia Railway & Power Company, it is reported, will erect an electric transmission line from Petersburg to Suffolk.

THE PLAINS, VA.—The Plains Electric Light Company, it is reported, is planning to rebuild its electric-light and power plant, recently destroyed by fire.

WYTHEVILLE, VA.—R. P. Johnson, First National Bank Building, Wytheville, it is reported, would like to receive prices on a 200-kw. (Westinghouse preferred) direct-current, 250-volt, 800 amp., 200 r.p.m. generator, second hand, in good condition.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 1653—30 motor-generator sets, Philadelphia, Pa., Schedule 1652—one mill type tractor. Application for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 1 for the installation, complete, of an elevator in the United States post office and court house extension at Oklahoma City, Okla., and in the United States court house, etc. (remodeling), at Austin, Tex. Drawings and specifications may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the general engineer depot, 1438 U Street Northwest, Washington, D. C., until Jan. 21, for furnishing (under circular 513) the following supplies: 1600 lightning arresters, 1600 extra gaskets, 1600 lightning arresters, 8000 guy anchors, 160,000 cross-arm braces, 480,000 short malleable brackets, 160,000 oak brackets, 1600 tool belts, 3,200,000 porcelain cleats, 80,000 cut-outs, 80,000 cutouts, 16,000 guy clamps, 1600 splicing clamps, 160,000 cable connectors, 160,000 cable connectors, 648,000 plug type fuses, 156,000 inclosed fuses, 72,000 inclosed fuses, 3200 lb. fuse wire, 1600 fuse boxes, 4000 link fuses, 8000 link fuses, 4000 wire grips, 400 lineman's slack tackle, 3200 enameled hoods, 1600 hatchets, 2200 handles, 800,000 brass insulators, 32,000 porcelain insulators, 24,000 porcelain knobs, 480,000 insulator pins, 555 kerosene fire pots, 555 melting pots, 80,000 connecting plugs, 480,000 pendant cap rosettes, 480,000 reflectors, 800 wire reels, 1600 reducers, 1600 reducers, 240,000 brass sockets, 200,000 brass sockets, 40,000 cleat base sockets, 160,000 rotary switches, 24,000 knife switches, 12,000 knife switches, 1600 safety straps, 769,600 porcelain tubes, 400,000 lb. black friction tape, 9600 copper terminals, 4800 cable taps, 32,000 cable taps and 400 tube cutters. For further information address the above office.

North Central States

BELLAIRE, MICH.—The city of Charlevoix has entered into a 10-year lease with the Hydraulic Power & Light Company for all power generated by the company, with an option to buy the plant, which will be submitted to the voters in the spring. The installation of a 350-hp. vertical hydroelectric generating unit this spring is under consideration by the city of Charlevoix. Henry Richardi is president and treasurer.

BENTON HARBOR, MICH.—The Benton Harbor St. Joe Railway & Light Company is changing its system from 2300-volt delta to 4000 volt Y. John A. Cavanaugh is superintendent.

ROYNE CITY, MICH.—The Roynce City Electric Company will add 10 incandescent street lamps as soon as the weather will permit. Extensions and additions to the domestic service will require rearrangement and addition to transformer outfit in the spring. Charles T. McCutcheon is superintendent.

CHARLEVOIX, MICH.—The city of Charlevoix has entered into a contract with the Hydraulic Power & Light Company for a lease of all power generated by the company for a period of ten years, with an option to buy. The proposal will be submitted to the voters in the spring.

COLDWATER, MICH.—The Board of Public Works is contemplating the installation of a 750-kw. turbo-generator set, barometric condenser, centrifugal circulating pump, flywheel air pump, feed water heater, etc., in the municipal electric-light and water works plant. L. E. McQueen is superintendent.

HOWELL, MICH.—The Board of Public Works contemplates improvements to the electric-light plant, including the erection of a new smokestack and installation of water equipment.

JONESVILLE, MICH.—The Board of Public Works contemplates the installation of a motor-driven centrifugal pump (200 gal. per minute), motor 20 hp., 440 volts, three-phase, 60 cycles, to replace one of two steam fire pumps now in use. R. S. Newton is superintendent.

LAWTON, MICH.—Plans are being considered for changes in the pumping equipment of the municipal electric-light and water-works plant in the near future. As yet nothing definite has been decided upon. R. W. Brown is engineer power station.

MARSHALL, MICH.—The Board of Electric Light and Water Commissioners is considering some changes at the municipal electric-light plant, which will increase the efficiency of the waterwheel equipment. Details have not yet been worked out. P. S. Joy is superintendent.

MILFORD, MICH.—The Milford Electric Company is installing another 30-hp. water wheel on Pettibone Creek in Milford and will operate a motor in connection with generator. F. S. Hubbell is proprietor.

OVID, MICH.—The village of Ovid will soon purchase two 250-hp. water-tube boilers and electrically-driven pumps. Fred G. Davis is superintendent.

PETOSKEY, MICH.—Improvements are being made to the municipal electric-light plant, including the installation of two 75-kw. umbrella type generators, directly connected to waterwheels located at the municipal water-works plant further down the river; water is conveyed to this point. The discontinuance of the direct-current service is contemplated upon the completion of the new plant. J. E. Niles is city clerk and purchasing agent.

PORTLAND, MICH.—The Board of Public Works is planning to install an ornamental lighting system next April and May, consisting of 42 single-lamp posts. G. A. Knox is president of board.

ST. CHARLES, MICH.—The Board of Public Works is planning to install a new series street-lighting system in the spring. David G. Howey is superintendent.

STURGIS, MICH.—The Board of Public Works contemplates the installation of a 500-kw. auxiliary generating unit, either oil or steam, during the coming year. J. S. Flanders is manager.

CINCINNATI, OHIO.—The City Council has granted the Cincinnati, Lawrenceburg & Aurora Electric Street Railroad Company a franchise to construct a street railway from Cincinnati to Anderson Ferry.

CLEVELAND, OHIO.—The Willard Storage Battery Company, it is reported, contemplates the construction of an addition to its plant, 100 ft. by 135 ft. Bids for the work, it is understood, will soon be asked for.

CLEVELAND, OHIO.—Improvements are contemplated to the municipal electric-light plant, involving an expenditure of about \$700,000. The proposed work will include the installation of switchboard, generator, boilers and engines.

CLEVELAND, OHIO.—Bids will be received at the office of commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until Jan. 25, for coal storage bunker for the division of light and heat. Specifications may be obtained at the office of division of light and heat.

PENINSULA, OHIO.—The Moody &

Thomas Milling Company is reported to be considering the construction of a new electric power plant, to replace the one recently destroyed by fire.

PUTTICE, KY.—The South Kentucky Power Company contemplates erecting an electric transmission line to Lebanon, Tenn., to furnish electrical service in Watertown and Alexandria. The company has a plant in Watertown which supplies electricity there and in Alexandria.

MAYSVILLE, KY.—The new steam turbo-generating plant of the Maysville Power Company will be finished and put in operation in about two months. When completed the plant will furnish electricity for the entire systems of the Maysville Gas Company and the Maysville Street Railroad & Transfer Company. The present power plant of the Maysville Gas Company will be held intact for use in emergencies. Horace J. Cochran is president and manager of the Maysville Gas Company.

WALTON, KY.—The Walton Electric Light Company contemplates the purchase of a generator to be directly connected to engine, already installed; also to erect a 10,000-gal. oil storage tank. E. L. Kelly is owner and manager.

WILLIAMSBURG, KY.—The Williamsburg Electric Light Company is contemplating establishing a 24-hour service. H. L. Bryant is secretary and general manager.

CRAWFORDSVILLE, IND.—The Crawfordville Electric Light & Power Company (municipal) is installing a 350-hp. Stirling boiler. F. H. Miller is manager.

HAGERSTOWN, IND.—The new City Council, it is understood, will take action in establishing a 19-hour or 24-hour service soon after taking oath of office. The municipal electric light department will be in the market for a new engine and generator, directly connected, at an early date; the engine will be of the fuel-oil type, with rating from 125 hp. to 200 hp.; generator will be 220-volt, two-wire, complete with switchboard. R. G. King is manager.

LA GRANGE, IND.—The La Grange County Light & Power Company is contemplating the installation of a new 400-hp. Fitchburg engine and changing the plant from 133 cycles, single phase, to 60 cycles, three phase, next summer. L. G. Young is superintendent.

BELLEVIEW, ILL.—The St. Clair County Gas & Electric Company is trying an experiment in the use of natural gas to replace coal. Should the tests prove successful the company will ask the Illinois Public Utilities Commission for permission to make the necessary changes in its plant.

BLOOMINGTON, ILL.—A 600-kva. turbo-generator set will be installed in the municipal electric-light plant as soon as conditions become normal. C. C. Williams is superintendent.

CHICAGO, ILL.—The capital stock of the Midland Electric Steel Company has been increased from \$40,000 to \$100,000.

CHICAGO, ILL.—The Lincoln Park Commissioners contemplate the installation of a 500-kw., three-phase, 2300-4000-volt turbo-generator for heating system; also 300 additional 400-cp. type C park lamps, on concrete poles, and arranging all multiple circuits to regulated type. Claude H. Shepherd is electrical engineer.

ELBURN, ILL.—Preparations are being made to install a Westinghouse 50-kva., single-phase, 60-cycle, 1100-volt generator in the municipal electric-light plant. Machinery has already been purchased. A. S. Sharp is superintendent.

FISHER, ILL.—The construction of a new electric plant changing from steam to oil equipment is under consideration by the Town Board. Nothing definite has been decided upon. A. L. Baker is engineer.

GOLCONDA, ILL.—The Golconda Light & Water Company contemplates the installation of a 25-kw., three-phase, 2300-volt generating unit, directly connected. Nothing definite has yet been decided on. R. H. Williamson is secretary and manager.

GRAYVILLE, ILL.—The Electric Light Commissioners are installing an ornamental street-lighting system, consisting of 11 ornamental standards mounted with one 100-cp. and four 80-cp. lamps. C. Richards is superintendent.

LA SALLE, ILL.—Plans are now being prepared for the installation of a 250-hp. engine to operate arc machines. E. Byrne is city engineer.

MILLSTADT, ILL.—Preparations are being made to install a Chuse non-releasing Corliss engine, directly connected to a 72-kw. generator and an 80-hp. boiler, at the municipal electric-light plant. E. W. Marxer is Mayor.

PENDLETON, ILL.—Work is nearly

completed on the erection of 3 miles of electric transmission lines into the country. Alva Apple is superintendent of the municipal electric-light plant.

PERU, ILL.—Improvements to the municipal electric-light plant, consisting of the installation of a 200-hp. American Stumpf uniflow engine, directly connected to a 150-kva. General Electric three-phase, 60-cycle, 2300-volt generator and mechanical draft system, will be completed about Feb. 1. J. H. Hahn is superintendent.

SAVANNA, ILL.—The installation of a 625-kva. turbine is under consideration by the People's Gas & Electric Company. F. P. Bowen is manager.

STAUNTON, ILL.—The car barns and repair shops of the Illinois Traction System were recently destroyed by fire, causing a loss of about \$35,000.

STRONGHURST, ILL.—The new electric plant of M. F. T. Schierbaum was put into operation Jan. 5. The equipment consists of a 75-kw., single-phase, 60-cycle Royal Electric generator, with exciter; a 75-hp. Frost engine and an 80-hp. Frost boiler. The old plant was destroyed by fire on Nov. 10, 1917.

WINNETKA, ILL.—The installation of a Manistee Roturbo condenser in the municipal electric-light plant is under consideration. H. L. Woolhiser is manager.

MADISON, WIS.—Plans are being prepared for the erection of a substation on Sprague Street for the city. E. E. Parker is city engineer.

SHEBOYGAN, WIS.—Plans are being prepared by Juhl & Sixta of Sheboygan, architects, for an addition to the power house of the Badger State Tanning Company.

BLOOMINGTON, MINN.—Contract has been awarded for electric wiring of the Consolidated School Building to the Sterling Electric Company, 33 South Fifth Street, Minneapolis, at \$2,773.

VIRGINIA, MINN.—C. E. Nystrom, architect, has been authorized to advertise for bids for electrical work for the new school building. The cost is estimated at about \$10,000.

ALGONA, IOWA.—New equipment is being installed in the municipal electric-light plant, consisting of a 200-hp. oil engine and a 170-kva. General Electric generator. When completed the system will be changed from 1150 volts to 2300 volts. J. W. Kelly is superintendent.

BLOOMFIELD, IOWA.—Two new electric generators, one 225-kw. and one 75-kw. alternating current, will be installed in the municipal electric-light plant this year. Improvements, including the installation of two 150-hp. boilers and erection of brick smokestack, were made to the plant during 1917, at a cost of about \$8,000. T. Z. Millard is general superintendent.

CEDAR RAPIDS, IOWA.—Extensions are contemplated by the Iowa Telephone Company, including the installation of approximately 30 blocks of conduits, tile, etc., and improvements to telephone exchange, to cost about \$40,000. J. M. Rider, 319 South Second Street is manager.

CORYDON, IOWA.—The installation of a new generator in the municipal electric-light plant is under consideration by the electric light committee. A. T. Gallagher is clerk.

DES MOINES, IOWA.—Plans have been prepared, it is reported, by the Inter-Urban Railway Company for the construction of a four-story terminal station in Des Moines, to cost about \$200,000.

EMMETSBURG, IOWA.—The Northern Iowa Gas & Electric Company contemplates extending its electric transmission line to Dickens.

ST. ANSGAR, IOWA.—The Light & Power Company of St. Ansgar is contemplating the development of a new water power this year. O. H. Koch is secretary.

PLATTSBURG, MO.—The Clinton County Telephone Company contemplates improvements to its system, to cost about \$15,000.

LESTERVILLE, S. D.—The proposal submitted by Otto S. Olson for the installation of an electric-lighting system in Lester-ville, to cost about \$8,000, has been accepted by the Town Board.

BANCROFT, NEB.—Bids will be received until Jan. 31 for construction of a complete electric system, water-works extensions and municipal building, to cost approximately \$39,700. The Electrical Development, Frances Building, Sioux City, Iowa, is engineer.

TECUMSEH, NEB.—The City Council is considering the purchase of an engine for the water-works plant.

OAKLEY, KAN.—Plans are being considered for the installation of a new generating unit in the municipal electric-light plant, consisting of (probably) 150 to 175

up, to replace the present engine. Not yet definitely decided upon; also for a new well and motor. Grant Maurer & Son are engineers. W. B. Day is superintendent.

KINSLEY, KAN.—The Kinsley Electric Light & Power Company is erecting an electric transmission line (a total of 30 miles) to Garfield. A. L. Moe is owner and manager.

SABETHA, KAN.—The City Council is planning to change equipment of the municipal electric-light plant from single to three phase system. C. A. Darby is city engineer.

STOCKTON, KAN.—New equipment, including one 200-hp. Fairbanks-Morse engine (oil burning) and a 170-kva. generator, directly connected, is now being installed in the municipal electric plant. F. A. Chipman is city clerk and purchasing agent.

WELLINGTON, KAN.—The city of Wellington contemplates purchasing 100 water meters to complete metering all service. Specifications have been completed for the immediate construction of a 500,000-gal. reservoir, five new wells and installation of five low-pressure pumps, necessary piping and electrical equipment. J. R. Murphy is superintendent of public utilities.

WILSON, KAN.—Plans are being prepared by A. A. Potter, dean of engineering department, State Agricultural College, Manhattan, for extensions to the municipal electric-light plant, to consist of the installation of one 150-hp. uniflow engine directly connected to three-phase, 2300-volt generator, together with two 80-hp. horizontal return tubular boilers. J. H. Williams is superintendent.

Southern States

ABBEVILLE, S. C.—The Abbeville Cotton Mills, it is reported, will receive bids for electric wiring of 100 cottages.

LOCKHART, S. C.—Plans are being prepared for the construction of a hydroelectric power plant for the Lockhart Power Company, a subsidiary of Monarch Mills. Elmsie Nicholson of Union, S. C., is treasurer of Monarch Mills.

AMERICUS, GA.—Owing to an increased price for street-lighting service under a proposed new contract with the Americus lighting company, steps have been taken to establish a municipal electric-lighting plant in Americus. The contract for street-lighting will soon expire.

ATLANTA, GA.—With a view of improving the street car line service from Buckhead to Camp Gordon, the Georgia Railway & Power Company proposes to double-track the railway to a point near the intersection of Piedmont Road and Peachtree Road.

ATLANTA, GA.—The Doss Rubber Company contemplates the construction of a plant to manufacture inner tubes, which will be equipped for electrical operation. The company, it is reported, is in the market for motor-driven calenders and miscellaneous motor-driven machinery.

ATLANTA, GA.—Arrangements have been made by the Southern Railway Company to secure energy from the Georgia Railway & Light Company of Atlanta to operate its Inman yards shops. Electricity will be used for a signal system, air compressors, round house and lighting the yard.

BLAKELY, GA.—A two-story cold storage warehouse is being erected to be operated in connection with the municipal ice plant. E. R. Adams is superintendent.

COCHRAN, GA.—The town officials are considering extensions and improvements to the municipal electric-light plant and water-works system, to cost about \$5,000, this year. Nothing definite has been decided upon. C. W. Davis is superintendent.

CORNELIA, GA.—Preparations are being made by the Wofford Shoals Light & Power company to furnish electrical service in Parkville, consisting of twenty 100-watt street lamps and 50 meter customers. The company is also considering extending its transmission line to Lula, Ga., soon. J. A. Wells is secretary and treasurer.

ELBERTON, GA.—Improvements are being made to the municipal water and electric plant, including the installation of a 50-hp. centrifugal pump to replace the steam pumps. G. F. Cleveland is general superintendent.

KENNESAW, GA.—J. G. Lewis has contracted with the Georgia Railway & Power Company of Atlanta for electricity to operate the local system. An electric transmission line will be erected from Kennesaw to connect with the high-tension line of the company.

PORTLAND, GA.—The American Potash company has contracted with the Georgia Railway & Power Company of Atlanta, to

furnish energy to operate fuller mills for the extraction of potash for sericite. The contract calls for 200 kw.

WAYNESBORO, GA.—Improvements are contemplated to the municipal electric-light plant, including the installation of one 200-hp. boiler, one 100-kw., three-phase, 60-cycle, 2300-volt generating unit, directly connected, with switchboard complete. J. C. Andrews is superintendent.

ORLANDO, FLA.—The Orlando Water & Light Company is planning to install a 1000-kw. General Electric turbine this summer. Donald A. Cheney is general manager.

PRESSMEN'S HOME, TENN.—The Clinch River Hydro-Electric Company is building a hydroelectric plant on Richardson's Creek, near Clinch River, at a cost of about \$60,000. The plans provide for a development of about 1000 hp. and the erection of 9 miles of electric transmission lines. All contracts for machinery have been awarded. John N. Adams of Charleston, Tenn., is engineer. George L. Berry is president.

FORT MORGAN, ALA.—Contract has been awarded by the War Department to Jett-Muths Construction Company of Mobile for the erection of nine cantonment buildings for coast artillery companies, including electric lighting, sanitary plumbing, drainage systems, etc.; also for building railroad extension to cantonment.

GENEVA, ALA.—Plans are being considered by the Geneva Power Manufacturing Company for the construction of a hydroelectric plant on Double Bridge Creek. As yet definite plans have not been decided upon.

TUSCALOOSA, ALA.—The Tuscaloosa Railway & Utilities Company is building an engine room, 60 ft. by 95 ft., and a car barn, 44 ft. by 167 ft. I. W. Ross is vice-president and general manager.

COLUMBUS, MISS.—The trustees of the Mississippi Industrial Institute and College are considering a bond issue for the erection of a power house and other buildings, to cost about \$175,000. H. L. Whitfield is president.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company has been awarded a contract for furnishing an ornamental lighting system on Garrison Avenue for a period of ten years. The contract calls for the installation of 74 lamps of 400 cp. mounted on steel poles.

OSCEOLA, ARK.—The town officials are contemplating the installation of a 200-kva. generating unit in the municipal electric plant during the coming summer. Ed. Teaford is manager.

BLANCHARD, OKLA.—The City Council is considering the installation of an electric-lighting system.

DOVER, OKLA.—The installation of an electric-lighting system in Dover is reported to be under consideration by the City Council.

OKLAHOMA CITY, OKLA.—The International Cotton Picker Corporation, it is reported, is in the market for electric equipment for a cotton picker manufacturing plant. Fred W. Barnacio of Oklahoma City is manager.

WOODWARD, OKLA.—At an election held recently the proposal to issue \$20,000 in bonds for the installation of a municipal electric-light plant was carried.

Pacific and Mountain States

POT GAMBLE, WASH.—Preparations are being made by the Puget Mill Company for the installation of a 1000-kw. steam turbo-generator unit. Contract for machinery has been placed with the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. A. B. Pracna, of Seattle, is consulting engineer.

SEATTLE, WASH.—Plans are being prepared for the erection of a substation for the City Lighting Department at West Forty-ninth Street and Fourteenth Avenue. N. W. The building will be 66 ft. by 66 ft., one and two stories high, and will cost about \$75,000. Daniel Huntington is city architect.

SEATTLE, WASH.—Work, it is understood, will soon begin on the construction of an electrically operated steel mill on Puget Sound, near Seattle by interests connected with the Alaska Gastineau Mining Company, to cost about \$25,000,000, of which \$9,000,000 will be expended on the initial installation. B. L. Thane, S. F. B. Morse, W. H. Crocker, of San Francisco, and others are interested.

SEATTLE, WASH.—D. F. Houston, Secretary of Agriculture, in a communication to the City Council, states that if the city

of Seattle can give satisfactory assurances that it intends to and is in a financial position to make immediate development of the power site of the Skagit River in the Washington National Forest, about 100 miles from Seattle, the Department of Agriculture will give the city a permit to construct the plant. The maximum development is estimated at 200,000 kw. Although the present plans provided for in the \$5,000,000 bond issue, authorized by the Council recently, directs that the Board of Public Works shall call for bids for a completed project in some national reserve, anticipating that bids would be received on the Diablo project, when the city would acquire the rights from the government, in the event no bids are received on the project, the Board of Public Works is given authority to construct the plant by day labor. The Diablo Canyon power project is located on the Skagit River. To reach it a transmission line about 135 miles will be needed. The City Council is also considering the Stillaguamish River power site offered to the city for \$800,000 by the Skykomish Power Company.

PORTLAND, ORE.—The Northwestern Electric Company, Pittcock Block, has awarded contracts for the immediate construction of an additional plant in Portland, which will increase its output by 50 per cent. Wilber E. Coman of Portland is vice-president and general manager.

BLACKFOOT, IDAHO.—The City Council is considering the installation of an ornamental lighting system.

REDSTONE, MONT.—Plans are being considered for rebuilding the local electric-lighting plant, including the installation of new machinery. S. J. Dorothy is reported interested.

CASPER, WYO.—The power plant of the Natrona County Electric Company was recently destroyed by fire, causing a loss of about \$150,000.

ASPEN, COL.—The Roaring Fork Electric Light & Power Company is installing an additional generating unit, consisting of a 400-kv. General Electric, direct-current, 600-volt generator directly connected to a 700-hp. Pelton-Doble waterwheel. C. E. Doolittle is manager.

DENVER, COL.—The Denver Tramway Company is planning to equip the Gold Division from Gravel Spur, a distance of about 4 miles, for electrical operation, using the third-rail system.

Canada

FORT WILLIAM, ONT.—Tenders, it is reported, will be called for the construction of a tunnel under the Kaministiquia River for the purpose of carrying water mains, electric light, power and telephone cables. The cost is estimated at \$150,000.

MONTROSE, ONT.—The Hydro-Electric Power Commission is building a railway from the Welland River, near Montrose, around Niagara Falls City to the Niagara River near Queenston, a distance of about 12 miles, in connection with the Chippewa-Queenston power canal. About 8 miles, it is reported, have been completed at the northern end of the line. F. A. Gaby, chief engineer of the commission, has charge of the work.

WIARTON, ONT.—Estimates are being prepared by the Hydro-Electric Power Commission of Ontario of the cost of the installation of an electric-light and power system in Wiarton.

LUMSDEN, SASK.—The purchase of the local electric-light plant, at a cost of \$7,000, is under consideration by the Town Council.

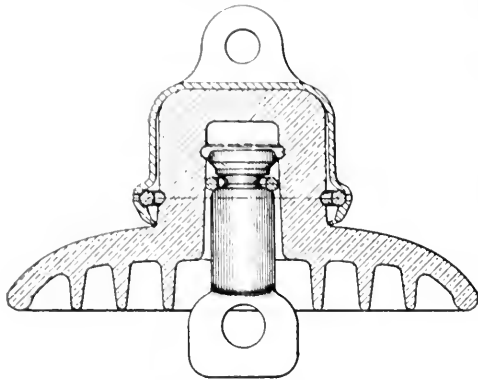
Miscellaneous

PANAMA.—Bids will be received at the office of the purchasing officer, the Panama Canal, Washington, D. C., until Jan. 24 for furnishing (under circular 1193) the following supplies: steel, iron, wire, steel cable, oil-burning ranges, electric griddles, refrigerating apparatus, etc. For further information address A. L. Flint, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 2 for railroad track scale, pressure gages, marine clock, thermometers, steam traps, air compressor, tandem, link pins, cable clips, pipe fittings (black, galvanized and brass), steam cocks, stop cocks, valves, etc. Blanks and information pertaining to this circular (1195) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

(Issued Dec. 26, 1917)

- 1,250,952 TROLLEY-WIRE HANGER; Floyd G. Hayward, Mansfield, Ohio. App. filed July 31, 1916. More particularly for lines where catenary construction is used.
- 1,250,961 TELEGRAPHY; William M. Bruce, Jr., Springfield, Ohio. App. filed Feb. 12, 1915. As applied to submarine cables or conductors of high capacity.
- 1,250,978 METHOD OF CHARGING AND UTILIZING STORAGE BATTERIES; John H. Crevellink, Auburn, N. Y. App. filed May 17, 1915. Improvements.



1,251,097—Strain Insulator

- 1,251,005. ELECTRIC BATTERY; Harry E. French, Fremont, Ohio. App. filed July 20, 1915. Arrangement for preventing upward displacement or bulging of the seal in a cell.
- 1,251,013. INSULATOR JOINT; Walter T. Goddard, Hamilton, Ontario, Canada. App. filed April 4, 1916. Pin-supported type.
- 1,251,023. AUTOMATIC TELEPHONE SYSTEM; Harry E. Hershey, White Water, Kan. App. filed Nov. 28, 1913. Means employed for selecting an idle trunk.
- 1,251,037. LIGHTNING-PROTECTIVE ATTACHMENT FOR OIL TANKS AND OTHER STRUCTURES; Francis B. Jackson, Tulsa, Okla. App. filed Aug. 5, 1915. Improvements.
- 1,251,060. HEATER; Joseph A. Lesperance, Montreal, Quebec, Canada. App. filed June 8, 1916. Adapted to be inserted into a body of water for raising the temperature of the water.
- 1,251,097. STRAIN INSULATOR; John M. Peck, Victor, N. Y. App. filed Jan. 25, 1917. High tension.
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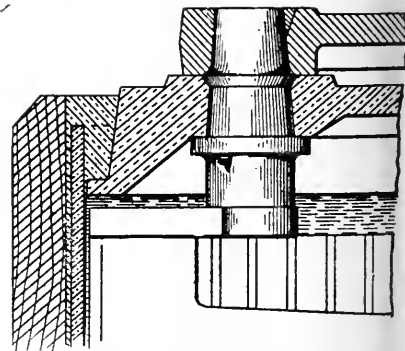
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- 1,251,219. TELEPHONE-CALL-CHARGE SYSTEM AND APPARATUS; Charles L. Goodrum, New York, N. Y. App. filed May 10, 1915. Automatic telephone systems.
- 1,251,224. CIRCUIT BREAKER; Carl K. Gustafson, Springfield, Mass. App. filed Dec. 3, 1913. Used in connection with an ignition system for a hydro-carbon engine.
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- 1,251,283. ILLUMINATING SIGN; George R. Pyer, Midvale, Utah. App. filed March 20, 1917. Sign is constructed with translucent portions which are illuminated from behind, members with rotating blades being mounted between the illuminating means and the translucent portions of the sign.
- 1,251,286. CONTROLLER FOR POWER-OPERATED DEVICES; Thomas H. Rodman, New York, N. Y. App. filed March 3, 1911. For printing presses.
- 1,251,294. SWITCHING APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed June 22, 1915. Applies particularly to apparatus for switching or controlling heavy electric currents such as are used in electric lighting and electric power practice.
- 1,251,302. ELECTRIC RECOVERY OF METALS FROM THEIR SOLUTIONS; Uryin C. Tainton, Johannesburg, Transvaal, South Africa. App. filed July 6, 1915. Improvements.
- 1,251,312. CIGAR AND CIGARETTE LIGHTER; Martha Wenzel, Jacksonville, Fla. App. filed Jan. 3, 1917. Improvements.
- 1,251,314. IGNITION SYSTEM; Ernest C. Wilcox, Meriden, Conn. App. filed Aug. 17, 1915. Relates to engines having a relatively large number of cylinders.
- 1,251,320. TELEGRAPH CIRCUIT-CLOSING AND SIGNALING SYSTEM; Frederick A. Anderson, Portage la Prairie, Man., Canada. App. filed March 2, 1917. Improvements.
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- 1,251,364. SIGNALING SYSTEM FOR MULTIPLEX TELEPHONE CIRCUITS; Bancroft Gherardi, Bayhead, N. J. App. filed Nov. 24, 1916. Improvements.
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- 1,251,377. METHOD OF AND MEANS FOR OBTAINING CONSTANT DIRECT-CURRENT POTENTIALS; Albert W. Hull, Schenectady, N. Y. App. filed Dec. 22, 1915. Improvements.
- 1,251,378. CRYSTALLINE OR LIKE DETECTOR FOR ELECTRIC WAVES; Horace Hurm, Paris, France. App. filed April 12, 1917. Consists in replacing the single contact by a device with multiple but independent contacts distributed over the surface of the detector substance employed.
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- 1,251,419. STATION INDICATOR; Earle H. Reynolds, Black Creek, N. Y. App. filed Nov. 9, 1915. For use in connection with street railways.
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- 1,251,440. CONDENSER SWITCH; Morton Sultz, Brooklyn, N. Y. App. filed Dec. 20, 1915. Device by means of which the number of condenser elements present shall be materially reduced, but which will still permit of a complete step-by-step adjustment between certain limits of capacity.
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(Issued Jan. 1, 1918)

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- 1,251,485. PROCESS OF TREATING SULPHIDE ORES OR LEAD; Robert De Luce, Oakland, Cal. App. filed May 8, 1917. Hydrometallurgical process.
- 1,251,497. FLOOR OUTLET BOX; James M. G. Fullman, Pittsburgh, Pa. App. filed Nov. 17, 1908. Permits the ready insertion and removal of the receptacle.
- 1,251,504. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Aug. 23, 1915. Provides means associated with the connector for instantly applying current from a ringing generator to the called line when the connector is set thereon.
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- 1,251,507. CURRENT-CONTROLLING MECHANISM FOR AUTOMOBILE LIGHTS; Wilbur A. A. Gray, Canonsburg, Pa. Headlights.



1,251,452—Storage Battery

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- 1,251,517. AUTOMOBILE SIGNAL; George L. Harris, Memphis, Tenn. App. filed Aug. 30, 1916. Improvements.
- 1,251,536. TELEPHONE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed Nov. 16, 1915. House or intercommunicating systems.

Electrical World

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Saving Fuel Supplies for the War

THE Fuel Administrator, with full confidence that it is necessary to the war, has issued an order abruptly closing industries for five days and for nine following Mondays. There is no disposition or desire to haggle over the question of his legal authority. At war, the industries patriotically comply with wishes or orders of the constituted authorities. Production is stopped, employees take enforced holidays. These are the surface facts that we see. What we do not know, because in war time all facts cannot be public, is the underlying condition which led Dr. Garfield to catapult this requirement into the intensified industrial activity of the nation. Part of it he has told, and no loyal man will raise a dissenting whisper against the explanation that coal must be provided for ocean steamships held in harbors by lack of fuel. Their needs are a first call.

In addition to this vital emergency of coaling the ships is the domestic railroad tangle, made far more serious by a succession of blizzards and zero temperatures in congested traffic districts. Until railroad and terminal are restored to normal flexibility we shall get 50 per cent result or less out of 100 per cent effort. If the arrest of industry order leads to a large degree of improvement in freight handling, it will be a wholesome return, well worth the sacrifice it costs. Let us pin hope to the prospect that raw materials and manufactured products will have better railroad transportation after the "workless" days are over.

With central stations, of course, the effect of the order is immediate. Filling their function as public utilities, they have no alternative but to continue to put energy on the lines, though generating in smaller volume. Compliance with the order is the duty of consumers and power will be cut off wherever violations are seen. The restriction upon manufacturing industries with its instant curtailment of power consumption automatically brings fuel saving, which is the paramount thing. It also cuts revenue, gross and net, of the electric utilities. How great a saving of coal will follow cannot be determined from the experience of any one company, it varies so widely with the load and the proportion of essential war industries. As indispensable industries, essential in both war activities and to the great body of consumers in other industries and in homes, public utilities are placed high on the list of those to whom more adequate coal supply is promised by the regulation. Many of them are suffering keenly from coal shortage, and to these relief is welcome.

The Fuel Administration has evidently abandoned, at

any rate for the time being, all thought of discriminating sharply between essential and non-essential industries. It is clear that a more drastic program, promising direct relief without delay, was regarded as necessary. Any measures which are in the national interest will be accepted patriotically. But, looking to the future, may we venture to recall to the Fuel Administrator that the energies of his organization, from first to last, have been directed more to cutting down consumption than to any other policy? There is another line of action which we respectfully submit for the thoughtful examination of the authorities. It is that less attention be paid to restriction of coal consumption, that more attention be given to stimulating coal production. Cannot the national Fuel Administration, with all of its great influence and power, turn earnest, resourceful vigor in 1918 to the question of stimulating production of coal; in brief, concentrate upon coal production, making that the major note in its policy and letting the limitation of consumption fall back to a secondary place?

A Genuine High-Pressure Steam Plant

ELSEWHERE in this issue is published an article on the design and construction of one of the first central generating stations in this country to operate at 300 lb. (21.1 kg.) steam pressure. This plant is feeding energy into the transmission system of the Public Service Company of Northern Illinois. It is one of about thirteen plants which are now serving thirteen counties. As it grows from its present rating of 10,000 kw. to its ultimate rating of 60,000 kw. it will no doubt absorb a greater and greater portion of the system load.

The efficiency of a plant with such a future facing it is a vital consideration, and so the efficiency of this Joliet plant is a matter of much interest. Tests to determine just how cheaply the plant will produce energy have not yet been made. The increase in efficiency gained by the high steam pressure is, therefore, as yet open only to estimate. It is considered quite probable, however, that the over-all boiler efficiency under operating conditions may exceed 80 per cent, a gain of 5 per cent over the best average practice to-day. In the turbine the 100-lb. (7-kg.) additional pressure should theoretically make possible a further gain of between 6 per cent and 7 per cent, giving a steam consumption that will compare favorably with that of the largest unit now in service. So, judging from facts that are known and allowing for the usual discrepancy between theoretical and obtainable economies, it does not seem

unreasonable to expect this new plant to produce a kilowatt-hour on 18,000 B.t.u.

Against this increase in economy must be charged the additional investment. It has been estimated that boilers for this high pressure cost about 20 per cent more than those designed for pressures close to 200 lb. (14.1 kg.). The increased cost of the turbo-generator was probably not so great as this. Owing to the small diameters, the piping valves and fittings are probably no more expensive than for pressure around 200 lb. An analysis of actual figures should show a net advantage to the plant well worth while. The final answer as to whether high steam pressure pays will probably be most easily obtained by watching for the advent of more plants of this general design after the engineers have had an opportunity to observe this plant in service.

In addition to operating at high pressure, this plant is one of the first to reach an operating steam temperature around 650 deg. At the Buffalo General Electric plant the steam temperature is 689 deg., obtained from a steam pressure of 275 lb. (19.3 kg.). In the present case the superheat is less by 50 deg., but the pressure is greater, being 300 lb. (21.1 kg.) at the turbine and enough higher at the boiler to insure the above density. It is probable that the boiler pressure will approximate 325 lb. (22.9 kg.), the design still allowing an additional 25 lb. (1.75 kg.).

There appears to be some difference of opinion as to the choice of pressure or superheat in making up the total steam temperature. Theoretically the advantage is on the side of higher pressures, but here mechanical difficulties place restrictions. To obtain a temperature range such as exists at Joliet a compromise is necessary. Pressure up to the present mechanical limits is employed, and the superheat to increase the initial temperature and add to the efficiency is used. Other factors influencing the degree of superheat are steam density and condensation during expansion. Superheat reduces the density and lessens friction. It also tends to prevent liquefaction in the turbine and should increase with the pressure. It is evident, then, that pressure and superheat must go hand in hand, the ratio to be determined by existing conditions and the results obtained from practice.

While little trouble is expected in the turbine, as up to a certain point it is merely a case of using heavier construction at the first stage and perhaps additional stages to cover the wider range, it is different with boilers and fittings. At Joliet the limit in pressure has been reached for the standard design of large boiler. Experimental work is being conducted to develop boilers for the higher pressures, but some time must naturally elapse before any new design is ready for practical application.

While the arrangement of boilers and economizers at Joliet has been used for several years in some of the leading stations in Europe, it is new to this country, as is the use of the all-steel horizontal economizer. To withstand the high pressure steel is more reliable than cast iron, but more subject to corrosion from low-temperature flue gases. Galvanizing the tubes should neutralize this action.

The design of the unit calls for height in the building, but not so much as for the individual detached vertical-tube economizer placed in the same location. The above-ground basement is another factor adding

to the height, but this is counterbalanced to some extent by small overhead bunker capacity, calling for no additional height and minimizing the steel requirements. One great advantage of this arrangement is the elimination of ash-handling equipment. Another feature is the economical use of floor space. With backs retreating to the rear of the bridge-wall, the boilers require less than 0.5 sq. ft. (0.046 sq. m.) per nominal horsepower based on 10 sq. ft. (0.92 sq. m.) of heating surface. Taken as a whole, the plant represents modern practice with such changes as are necessary to permit the use of high pressure.

Alternating-Current Networks

IN COMPARATIVELY few cases is a purely alternating-current distribution carried out with the same attention to detail which experience has proved necessary in direct-current service. Alternating-current apparatus was originally developed with the idea of providing for scattered service which could not efficiently be reached in any other way, with the result that the early alternating-current plants were worked out with house-to-house transformers of small size, with short secondaries and with no attention whatever to the finer points of efficient distribution at uniform voltage. As time has gone on one great plant after another has become a huge hodgepodge of alternating-current and direct-current practice, growing up without scientific adaptation of means to ends. That an extensive alternating-current distribution can be carried out on sound engineering lines has been over and over again proved, but many of the attempts which have been made have not met with entire success.

S. Bingham Hood's paper in the current issue gives a general view of the situation from the alternating-current standpoint, bringing to the front the necessary characteristics of successful alternating-current distribution. The fundamental principles underlying it are that the transformer should be regarded as the equivalent of a direct-current feeder and the primary network supplying the transformers should be regarded as the equivalent of a substation bus on the direct-current system. The advantage of comparatively extensive systems of secondary mains is almost self-evident. Such construction is necessary in order to get uniform distribution of voltage and insure reliable service in the case of a single transformer giving out, as well as the full advantage of the diversity factor in the regions supplied. Mr. Hood's preference is for ring mains in a secondary service system, each one including a suitable amount of territory and provided with transformer service enough to avert serious overloading in case one transformer should fail. As the transformer overload commonly allotted is about 50 per cent, no independent secondary system should be fed by less than three transformers, and preferably it should be fed by more. With such an arrangement the blowing of a fuse at one transformer will not seriously interfere with the service on its particular secondary mains. The additional recommendation is made that the units be fairly large; in other words, that the system should be organized on a considerable scale. The object of this is obvious from the better characteristics of the bigger transformers and the more stable load obtained where a large number

of consumers are supplied from a single set of mains. How far these separate ring secondaries should be capable of interconnection is a matter which depends on local conditions.

Mr. Hood calls particular attention to the fact that proper cut-out equipment for secondaries of considerable output is not readily obtained. This is a lack which should be remedied. In fact, until quite recently proper primary cut-outs for the primary system were difficult to find; but this situation has been already remedied. Mr. Hood's preference is strongly for a primary network feeding the various groups of secondary networks. All that applies to the advantages of network connection on the secondary side also applies on the primary side, with the difference that still further care must be taken with respect to the interconnection of the primary network so that one fault may not involve a serious amount of territory. Provision must also be made for cutting out sections of the primary network in case, for instance, a serious fire occurs in the territory served. This is perhaps the most notable difference between alternating-current and direct-current network service. With the former it is imperative that the overhead high-tension wires should promptly be segregated in case of fire. In the latter the low-tension feeders and mains are very generally underground and do not constitute a serious danger in any event. A proper system of automatic cut-outs for use on the primary network is greatly to be desired and has not as yet been very thoroughly developed.

How far a system initially three-phase should be split up into the single-phase components, worked either two-wire or three-wire, is not easy to predict. Much will depend on the relative amounts of lighting and power service to be utilized within a given region. The logical arrangement for the preservation of uniform voltage and convenient distribution would seem to be the continuation of the three-phase network rather than extensive splitting into single-phase groups. No hard-and-fast rule can be drawn in the matter, however, since the local conditions must inevitably be taken into consideration. In short, the alternating-current network, like any other, must be laid out with the utmost care respecting the conditions of present and future demand.

The comprehensive general principle, however, that the transformer is a feeder to the low-tension network and must be treated as such is the basis from which network design must start. No two stations will present quite the same situation with respect to their supply lines on an alternating-current system, any more than they do on a direct-current system. The fundamental factor, however, is that with anything like the same care spent in alternating-current design that has been employed for years in direct-current design a wonderfully flexible, efficient and reliable organization of the supply can be effected. The earlier direct-current stations were driven to extreme care by the im-

perative necessity of doing fairly efficient work at low voltage over considerable distances. Free from this particular requirement, the alternating-current systems have generally received much less attention than they deserve. Hence the old commercial struggle between alternating current and direct current has not had the opportunity entirely to die out in its detailed influence, despite the fact that the larger part of every great supply station must be, and is even to-day, operated on alternating current.

Electrical Properties of Vulcanized Fiber

ONE of the well-known insulating substances used at the present time is vulcanized fiber. It is tough, strong, easily drilled or formed, and can stand exposure without disintegrating. At the same time, unlike glass or porcelain, it is slightly elastic and it is not brittle. Such a substance has a large scope of application in the electrical field.

The results of a number of tests for dielectric strength in various thicknesses and qualities of vulcanized fiber are presented in this issue by William Eves, 3d. These tests show how complex a property dielectric strength is. One might at first thought suppose that if a slab of dielectric 1 mm. thick had a rupturing emf. of, say, 12 kv., a slab of similar material 2 mm. thick would have twice the rupturing emf., or about 24 kv. As a matter of fact, it would have perhaps less than 20 kv. It always happens with solid dielectrics that as the thickness of a slab increases the volts per millimeter diminish. Experiment shows, however, that if a number of thin slabs, with surfaces of tinfoil, are tightly superposed to form a thick slab with thin parallel metallic layers throughout, the diminution in dielectric strength with increasing thickness is much less. Apparently the forced distribution of parallel equipotential surfaces throughout the mass of the dielectric enables the slab to support the electric stress better, even although it is evident that the rupture of any component slab immediately short-circuits it throughout by the conductive action of its tinfoil surfaces.

With this acknowledged non-conformity of dielectric strength in slabs of different thickness, it is evident that, in the presence of residual moisture or traces of chemical in the material, the effects of temperature upon the rupturing emf. of the material are likely to be different in different specimens, or even in the same specimen at different times. The results presented in the article point to such a generalization. However, if a suitable factor of safety is allowed to cover wide accidental variations, and if attention is given to mechanical and chemical specifications, there should be enough dielectric strength left available to meet practical requirements. The specifications mentioned in the article are instructive from this point of view.

THE nation-wide prominence drawn to the coal crisis by the order of the Fuel Administrator gives special value to the series of articles on the coal problem of electric central-station companies, which will be continued in next week's issue

The Coming Issues

of the ELECTRICAL WORLD. Another feature of the Feb. 2 issue will be the development of a new transmission-line formula and a chart which, used together, simplify transmission-line calculations without sacrificing their accuracy.

Corrective Steps for Our Coal Problem

Central-Station Companies Operating Steam Plants, Deeply Concerned Over the Critical Question of Coal Supply and Cost, Make Constructive Suggestions for Handling It—Views on Railroad Unification

ALTHOUGH the Fuel Administration has taken drastic action by closing industries to conserve fuel, the basic conditions are not improved by arrangements of this nature, designed to give only temporary relief. Central stations are looking and hoping for permanent improvement in the underlying conditions of coal supply and transportation; they believe that remedial measures are necessary in those directions and that temporary restriction of consumption alone will not give the desired results.

The question of whether companies are near to or far from coal-producing districts, the possibility of buying coal in the open market for part or all of the requirements, the number of railroad lines accessible and, in general, the railroad facilities depended on for getting coal affect the policy of steam electric central stations on the issue of coal supply. Therefore uniform corrective measures would not solve all problems of the companies reached in the survey made by the ELECTRICAL WORLD, although there is almost general agreement that improvement in transportation is vitally necessary.

A number of suggestions have been made and are published by the ELECTRICAL WORLD herewith. Some of them deal with such corrective steps as are now being worked out by the railroads under unified government control. They also point out emphatically the importance of conserving fuel by closing isolated plants and diverting their energy requirements to the more economical central station. The canvass indicates that the companies are in very close contact with the local and state fuel administrators in their localities. It is also clear that they are prudently looking beyond the immediate situation to introduce corrective steps when the easier summer-time conditions prevail.

DIFFICULTIES WITH LABOR

The opportunity to overcome the unwillingness of labor in mines to continue to work steadily is discussed by one company. "Our experience is that one of the chief difficulties in the fuel situation is the failure of the miners themselves to work," says this company. "It appears to us that the railway companies have been doing all that they could in the matter of spotting cars at the mines and the operators are willing to turn out the coal, but with the present high scale of wages paid to miners they will not work more than three or four days out of a week; and, too, they have a custom of declaring holidays every time something unusual occurs in their communities."

Another company, which is not far from one great coal-producing area where miners are agitating for an increase, writes: "Should the government enforce an additional increase of wages to labor in this particular coal field, it is the consensus of opinion of the coal operators that it will be an error. They point out that the higher the wages miners receive in this territory the less the tonnage per man that is obtained."

An important interest sees encouraging promise of

an increase of possibly 25 per cent in available coal production as a result of railroad co-ordination:

The corrective steps that must be taken are being taken rapidly. The coal production of the country can be increased substantially, possibly as much as 25 per cent, by a steady, regular supply of empty coal cars to the coal mines and quick transportation from the mines when the cars are loaded. This problem will be partially met by the unification of control of the railroads under Mr. McAdoo and further as additional equipment can be added.

In many coal fields there are not as many miners as there should be and an increased number of miners would naturally increase production, but not until the car supply has become equal to the possible output of the miners now at work. Of course equipment, both locomotives and cars, must be added just as rapidly as they can be supplied.

There are many ways of economizing in the use of coal—by the elimination of uneconomical plants, substituting central-station service where the consumption of coal may not be one-half so great for the same result; by the elimination of non-essential industries and consumers, and by general economy, particularly in the operation of the railroads as one system, where nine locomotives may be able to do the work previously done by ten or even more.

BELIEF IN EFFECT OF RAILWAY POOL

Similarly, another company expresses faith in the helpful influence of railroad operating unification: "We believe the pooling of railway equipment by the various lines under the national operating board will relieve the shortage of cars and transportation facilities to a very great extent. The maximum relief will be obtained when the operating details are fully worked out under this plan, which will take a little time."

It is the unanimous opinion that the outlook as to coal supply for the rest of the present winter is shrouded in uncertainty. Conditions are indicated by the following:

The coal situation, in order to take care of our business, is extremely acute, but the Fuel Administrator has ordered certain mines to supply us with coal, and by more or less frequent trips we are able to buy some spot and have managed to keep in pretty fair shape.

We don't consider the outlook for the winter of 1917 and 1918 as being very much brighter; in fact, it may be even worse before it is better.

At present the outlook for coal supply is not very sanguine. Our shipments of coal within the last ten days have been very unsatisfactory.

The outlook for the winter of 1917-18 is not very promising, and practically all companies in the State are experiencing trouble in getting their coal supply and are compelled to accept any kind of coal that is obtainable, regardless of the quality. I believe all of the coal furnished is being furnished at government prices. However, the question of securing the coal is the serious problem, and it is a very difficult matter to locate where the trouble lies. A part of it, of course, is due to shortage of cars and transportation troubles. However, there also seems to be a shortage of coal, and operators claim that the labor condition is to blame for this.

If we have a mild winter, the chances are we will get through all right; if we have a severe winter, tying up river and rail shipments, the chances are we will experience a shutdown of greater or less duration.

From one company the suggestion is received that

"the existing deficiency in coal in the consumers' premises is in a measure due to the fact that they have not realized that the demands for coal are greater than ever before and have not appreciated that in every cold snap the railroads do not have the ability to handle coal as in warm weather; that the retailers, particularly, have not put in a supply of coal during the months when transportation can be easily handled, on account of the lack of transportation during intense cold. In other words, I do not see why the retailer should not endeavor to get coal during months when the railroads can move the coal and urge the domestic users to put in a supply during the warm months. With a little foresight on the part of every one and a little less agitation by the press, I really feel the coal situation would be very much improved, particularly if the government would force the miners to work a reasonable number of hours a week."

A company which is convinced that, in its district at least, the railroads are not wholly responsible for the coal famine and sees definite hope of improvement, says:

The practice of conservation by the coal consumers and the substitution of other fuel where possible will greatly aid the government and relieve the pending shortage. With transportation facilities provided, coal production right at this time should be at its maximum. The transportation companies, however, are not entirely to blame for the coal shortage, as during the summer months, when coal is generally stored for winter use, the mines were working only two and three days out of the week, on account of shortage of coal-handling equipment. At this time the coal-handling equipment was being used for transporting lumber and other material for the construction of army cantonments. It is a condition that, by the consumers practicing the utmost economy and the replacement of coal by other fuel, will soon correct itself, even with the increased demand.

One source of confusion, admitted as such by both the Washington authorities and the great industries of the country, is the multiplicity of priority orders. Efforts to reduce these and thereby to make the priority orders more effective when they are issued are under serious consideration now. "In our opinion," writes one company to the ELECTRICAL WORLD, "the greatest corrective step that can be taken by the government is to control more systematically the enormous number of

priority orders which are being issued to the railroads, which are handicapping very seriously the efficient movement of cars."

The question of price is regarded by some companies as constituting the factor which most demands corrective action. Officers of two of these write:

I do not believe the government can reduce the prices without bringing on a serious condition, owing to the fact of such a low reserve. I do believe, however, that next summer the demand for coal will slacken and the price will fall below the present government fixed prices. It may be possible, after a year's operation at the government's prices, that the Federal Trade Commission will be able to determine from records that profits are unduly large, and a slight reduction may come.

What I fear for the future is this: A large number of contracts for coal at high prices will expire March 31, 1918. It is likely that the government will not permit renewals of contract except at its price. This price, in my judgement, is hardly high enough to promote average production, let alone increased production. If conditions get worse, I fear even priority orders will not in many cases result in sufficient coal deliveries. Better co-operation is needed between the government coal producers and railroads.

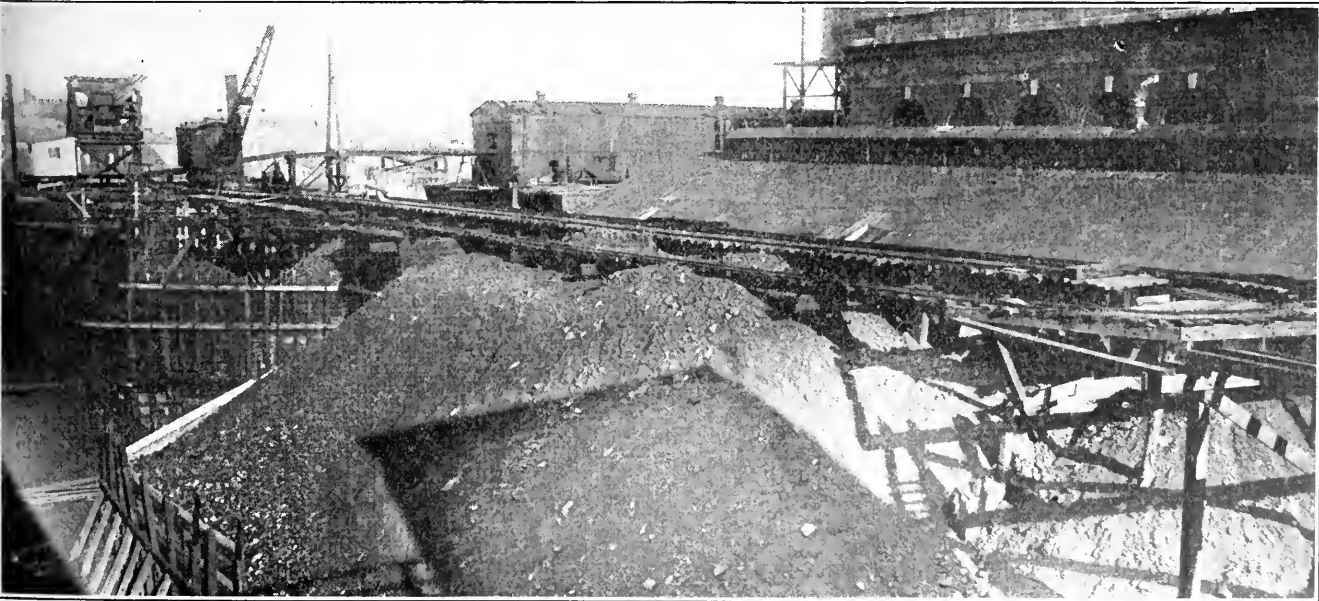
Other suggestions received by the ELECTRICAL WORLD the acceptance of which will help to restore normal conditions of coal supply and demand are as follows:

Greater care should be taken in the mining and shipping of coal to reduce the amount of ash, thereby reducing the amount of material that has to be transported on the railroads as well as transported through the streets of the city for the disposal of ashes by teams.

I would suggest that all power stations store as much coal as possible during the summer months; that the pooling arrangement for railroads be put into effect, and that all consignments of coal be unloaded immediately upon arrival at destination, so as to prevent the blocking of terminal yards by reason of their being used by coal companies as storage places. I believe another important factor would be to compel the use of central-station power by the small power users wherever it is available.

The greatest conservation of coal that could be made, in my judgment, is by the isolated or block plants taking central-station service. In the aggregate this would be a great saving in the country.

[A continuation of this article, to be published next week, will deal with other vital phases of the critical coal situation.]



UNDER ANTE WAR CONDITIONS COMPANIES KEPT LARGE RESERVE COAL SUPPLIES

Electrical Properties of Vulcanized Fiber

The Effect Exerted by Color, Thickness and Temperature on the Breakdown Value of This Material—Reasons for Performance
Noted—Specifications

BY WILLIAM EVES, 3D

Engineering Department American Vulcanized Fibre Company

CONSIDERABLE work has been done in the measurement of the electrical properties of vulcanized fiber, but not very much of the information that has been obtained on the subject has been collected. This is largely due to the fact that it is extremely difficult to compare values obtained by one experimenter with those obtained by another, because of the lack of standardization in testing methods.

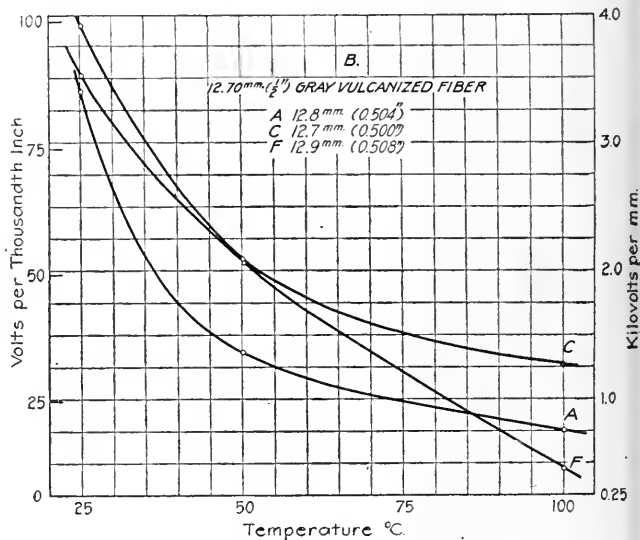
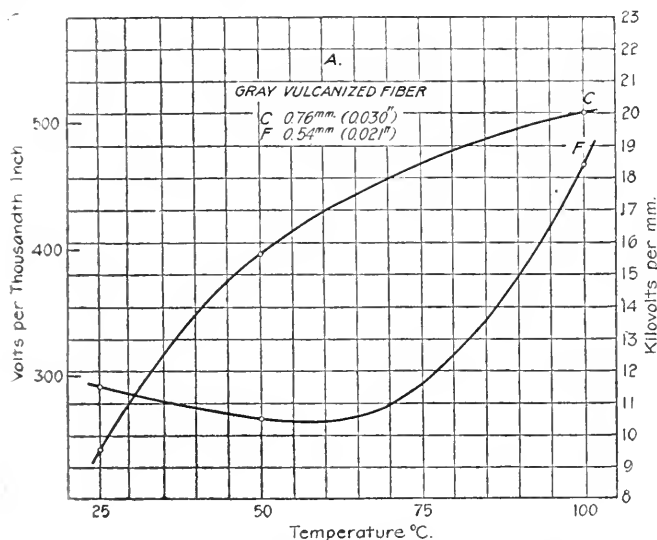
The specific resistance, surface resistance, specific inductive capacity and breakdown voltage, often called dielectric strength, are about the only electrical properties concerning which information is ever required by the user, and of these the breakdown voltage is by far the most important, as it is one factor which is considered in 98 per cent of the cases. Consideration will be paid here to this property only because the data available on the other three properties are so meager that their publication would not be warranted.

BREAKDOWN VOLTAGE

The breakdown voltage per unit of thickness of vulcanized fiber is a function of the thickness itself, the

chloride is a very deliquescent substance. This may happen in spots, and likewise any foreign material that would tend to reduce the breakdown voltage would naturally occur in a few places and possibly not at all in some samples. At these points leakage would occur between the electrodes of the testing set; local heating would result, reducing the resistance of the small amount of solution, and breakdown would occur before the true breakdown voltage of the fiber was reached.

As has been pointed out before in connection with tests of dielectrics, the method and conditions of the test will also affect the voltage at which the sample will break down. The shape of the electrodes, whether needle points, round-edge or flat-edge disks, or spheres, will affect the distribution of the electrostatic flux throughout the material, and the medium in which the terminals are immersed, oil or air, and the rate of application and the method of application of the voltage will determine the amount of heating due to corona loss, causing consequent drying and carbonization and premature breakdown. For these reasons due care must be taken that no peculiar conditions exist to distort the



CHARTS A AND B—BREAKDOWN VOLTAGES OF THIN AND THICK SAMPLES OF GRAY VULCANIZED FIBER

extent to which the gelatinization of the individual plies of paper has been carried, the temperature of the sample at time of test, and the color to some degree. Conditions of the material that are likely to affect the breakdown voltage are the quantity of chemical remaining in the fiber after its manufacture (which whenever present is extremely small), the moisture content, the homogeneity and density of the sample, and the physical shape of the sample.

Moisture to a certain degree is necessary for the life of vulcanized fiber. Zinc chloride is used as the gelatinizing agent in the manufacture of the fiber, and any that remains after the washing processes will be in solution in the natural moisture, because zinc

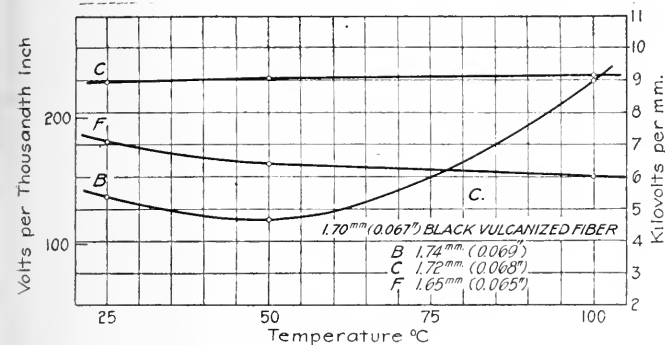
conclusions made and that a sufficient number of samples are taken to secure good average results.

CURVES SHOWING EFFECT OF TEMPERATURE AND THICKNESS

The variations of breakdown voltage with temperature for vulcanized fiber of various thicknesses and colors are illustrated by the accompanying curves. They were plotted from test data obtained at the Massachusetts Institute of Technology by Katzenstein and Burt. Each point on a curve represents the average of eight or nine tests on the same sample. Samples from four well-known manufacturers of vulcanized fiber were used in the investigation, and the results of those of approx-

imately the same thickness and color are compared. In all 4000 tests were made. They were all made with the same electrodes, and the voltage was increased at the constant rate of 1000 volts per second. At temperatures higher than room temperature the samples were prepared by heating in an oven for one hour for the thinner specimens and from four to five hours for the thicker.

Chart A, referring to gray fiber, shows an increase

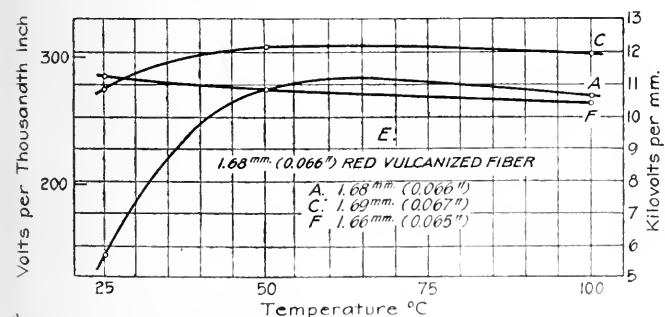


CHARTS C AND D—PROPERTIES OF BLACK AND THICK RED VULCANIZED FIBER

of approximately 80 per cent in breakdown voltage from 25 deg. C. to 100 deg. C., with a decrease in one case from 25 deg. C. to 50 deg. C. This dip in the curve probably would not occur in many samples of this thickness and cannot be explained without more knowledge of the chemical properties of the particular sample.

The results for thicker gray fiber, given in chart B, show an average decrease in the 25 deg. to 100 deg. temperature range of 77 per cent. Tests on pieces thicker than $\frac{1}{2}$ in. (1.27 cm.) are not very interesting, because the voltage required to break down a sample of such thickness is greater than most commercial voltages.

A comparison of results on black fiber is given in chart C. Here again one sample shows a decrease at 50 deg. and a considerable increase at 100 deg. It is interesting to notice that the breakdown voltage of one of the other two samples slightly increases with the temperature, while the other slightly decreases. The average increase is 12 per cent. It is at the thickness of these samples that the turning point occurs.



CHARTS E AND F—BREAKDOWN STRENGTH OF THIN RED VULCANIZED FIBER AND AVERAGE VALUES FOR ALL COLORS

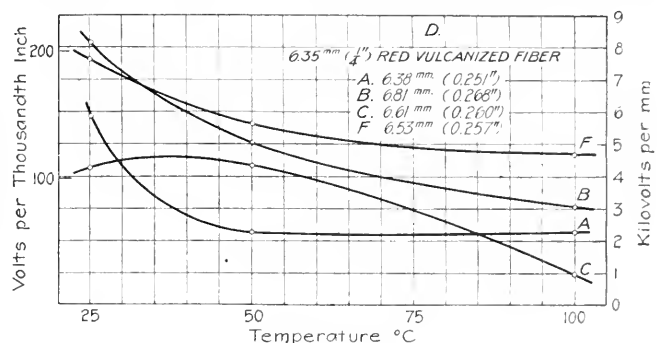
Greater thicknesses show a decrease in breakdown voltage with increase in temperature.

Chart D gives the results of tests with red fiber and is quite typical with the exception of one point at 50 deg. Here the average decrease in breakdown voltage in the range from 25 deg. to 100 deg. is 60 per cent.

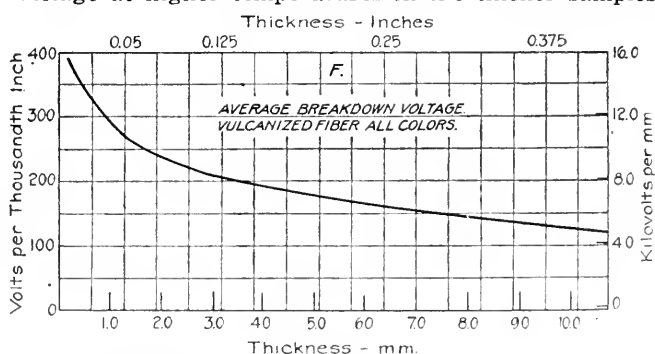
According to chart E, relating to thinner red fiber

voltage from 25 deg. to 100 deg. is approximately 20 per cent, although the increase from 25 deg. to 50 deg. is slightly greater. This shows that the conditions tending to increase the breakdown voltage and those tending to decrease it about neutralize each other in the range from 50 deg. to 100 deg.

The most plausible theory for the change from an increasing variable with temperature to a decreasing variable, as the thickness increases, is that two condi-



tions in the sample tend to offset each other. As stated before, fiber contains moisture to a certain extent and zinc chloride to an extremely small degree in solution. It is well known that the resistivity of solutions decreases with increase in temperature. On the other hand, fiber loses a certain amount of its contained moisture when it is heated, and the greater thicknesses do so much less rapidly than the lesser thicknesses, but not at all in proportion to the thickness. The thicker samples used in these tests were heated four or five times as long as the thin samples, but the thin samples would lose a far greater percentage of moisture in one hour than the thicker ones would lose in four or five hours. Hence in the case of the thinner samples the moisture content was probably less when tested at higher temperatures, the strength of the small amount of solution in the sample was greater and the resistivity greater. This was probably the controlling condition in the thinner samples, causing the breakdown voltage to be greater at higher temperature, while the temperature of the solution controlled the breakdown voltage at higher temperatures in the thicker samples.



The results of these and many other tests made with the fiber of five large manufacturers have been averaged, and the composite results are shown in chart F. This curve gives values for room temperature only. The tests were made under all conditions and with all grades of fiber.

Gray fiber is made from paper of the natural color,

small amount of lampblack or other coloring matter, and red is colored with a relatively large amount of various grades of oxide of iron. For this reason it would be expected that the colored fiber, and particularly red, would have a lower breakdown voltage than gray fiber. Although this is true in some cases, it is not always so. Here again other conditions affect the results.

Any loading material placed in the paper from which vulcanized fiber is made tends to interfere to some extent with the chemical treatment, and the result is a less homogeneous material. Coloring matter acts as a loading material and produces a slightly more "papery" fiber, which usually has a higher breakdown value because of the greater degree of lamination. Moreover, fiber is made from three grades of paper, which vary in the degree to which they are gelatinized by the chemical action. The paper from which $\frac{1}{8}$ -in. to $\frac{3}{4}$ -in. (3.175-mm. to 19.05-mm.) fiber is made is treated to the greatest extent by the zinc chloride, and consequently a more homogeneous material, with low breakdown voltage, results. In a large number of cases the loading factor of red fiber is so much more pronounced than the tendency for the small amount of solution of oxide of iron to lower the breakdown voltage that the dielectric strength of red fiber will be higher than that of gray fiber. However, in other cases the reverse conditions exist, but the difference is so small as to be commercially negligible. Black fiber is usually between the red and gray grades and nearer the gray in its breakdown voltage.

OTHER PHYSICAL AND CHEMICAL PROPERTIES

As vulcanized fiber loses its normal amount of contained moisture its pliability decreases and finally it becomes brittle. This is caused either by application of a sustained temperature of 80 deg. to 100 deg. C. (176 deg. to 212 deg. Fahr.) or to higher temperatures up to 200 deg. C. (392 deg. Fahr.) for shorter periods of time. At this latter temperature charring commences. It has the following strengths in pounds per square inch: Tensile, 9000-13,000; compressive, 33,000-43,000; shearing, 9000-13,000.

Vulcanized fiber is not waterproof. It absorbs water to a certain degree, but is not injured by either hot or cold water, for it returns to its original dimensions and properties when dried. Most dilute acids and alkalis cause no other effect than the effect of water, but concentrated acids cause disintegration. However, organic solvents and all oils have absolutely no effect and are not absorbed in the slightest degree.

GENERAL USES FOR ELECTRICAL INSULATION

Although vulcanized fiber was first used in 1873 for axle washers and railway-car-journal dust guards, it has been more widely known in late years as an electrical insulator. It was early used in large quantities for magnet bobbins, coil insulation, cleats, armature wedges, insulating blocks, gears and handles, etc. Since the development of the automobile industry another large electrical insulation field has been opened. It is of service for insulated staples and cleats, straight and bent wire conduits, flanged bushings for use wherever a wire passes through body or frame, timer rings and other insulating rings, insulating washers, switch bars and bases, switch panelboards, fuse tubes, and in gen-

eral where good machining and bending qualities are a necessity.

One of the largest uses of vulcanized fiber at the present time, either for electrical or mechanical purposes, is for railway signal insulation. The specifications for this application are quite severe. This is an instance where the material is subject to severe weather conditions and extreme mechanical strain, and yet the dielectric strength must be high even when it contains a fairly high percentage of moisture.

The Railway Signal Association's specifications require a specific gravity of 1.3 to 1.5; an absorption when immersed in water at 70 deg. Fahr. for twenty-four hours, not to exceed 45 per cent by weight for $\frac{1}{8}$ -in. (3.175 mm.) fiber, 30 per cent for $\frac{3}{16}$ -in. (4.76-mm.) fiber, and 26 per cent for $\frac{1}{4}$ -in. (6.35-mm.) fiber; a tensile strength of 5000 lb. per sq. in. (351.5 kg. per sq.

BREAKDOWN VOLTAGES* OF SEVERAL THICKNESSES OF VULCANIZED FIBER

Thickness (In.)	Breakdown Value (Volts per Thousandth Inch)
$\frac{1}{8}$	225 to 425
$\frac{1}{16}$	150 to 300
$\frac{1}{32}$	125 to 275
$\frac{1}{64}$	100 to 225
$\frac{1}{128}$	75 to 150

*Results higher than these have frequently been observed, but these limits will include the majority of cases.

cm.), and a dielectric strength of 32 volts per 0.001 in. (0.025 mm.) for all thicknesses, under the application of voltage for one minute between disk electrodes 1 in. (2.54 cm.) in diameter. The specifications require further that the fiber shall withstand bending into a circle of a radius ten times the thickness without cracking or splitting.

The absorption and specific gravity are very important, first because of the service conditions, and second because the higher the specific gravity the more homogeneous the material is and the more easily is it fabricated, punched, bent and worked into shape. Moreover, fiber with high specific gravity will have a higher tensile strength and will resist shear to a greater degree under all conditions.

To fulfill these requirements the manufacturer must pay particular attention to the stock from which he makes the paper and to the conditions under which the fiber is run up. Tests must be made on each lot in order to make sure that no conditions have entered the manufacture which might harm the properties which are so important. It can be safely said that more care must be taken with fiber made for this purpose than for any other, because, as stated before, the more homogeneous vulcanized fiber is the lower the breakdown voltage is likely to be.

CONCLUSION

When the breakdown voltage per thousandth of an inch, the specific gravity and the cost per pound of vulcanized fiber are compared with the corresponding values for other insulating materials, it will be found that the commercial insulation value of vulcanized fiber is very high. In fact, it can be used in many cases where no other material will answer, when its ability to be machined with great accuracy and to be bent, punched and formed to shape is taken into account.

Joliet Plant a Step Toward Higher Steam Pressures

Second Installment of Article Deals in Detail with Method of Handling Coal and Supplying Feed Water, Features of Turbine, Condenser and Circulating-Water Arrangements

GENERAL features of the new high-pressure plant of the Public Service Company of Northern Illinois at Joliet, Ill., were outlined in the Jan. 19 issue of the *ELECTRICAL WORLD*, and interesting details were given regarding the boiler and economizer construction employed. This issue will dwell on the remaining mechanical equipment.

THE FEED-WATER SYSTEM

Feed water for the boilers is mainly condensate which has been delivered through a pre-heater at the top of the condenser containing 1000 sq. ft. (92.9 sq. m.) of surface to the heater by either one of duplicate motor-driven condensate pumps. The heater is of the open type, having capacity to serve the two boilers of the unit. Either of two four-stage turbine-driven centrifugal pumps designed to deliver 300 gal. (1135 l.) per minute against a head of 375 lb. to 400 lb. (26.4 to 28.1 kg.) feeds the water to the boilers. The turbines are rated at 126 hp. and operate under full boiler pressure, their output being controlled by pressure-regulating valves. The water passes through the economizer and enters the boiler at both ends of the cross-drum.

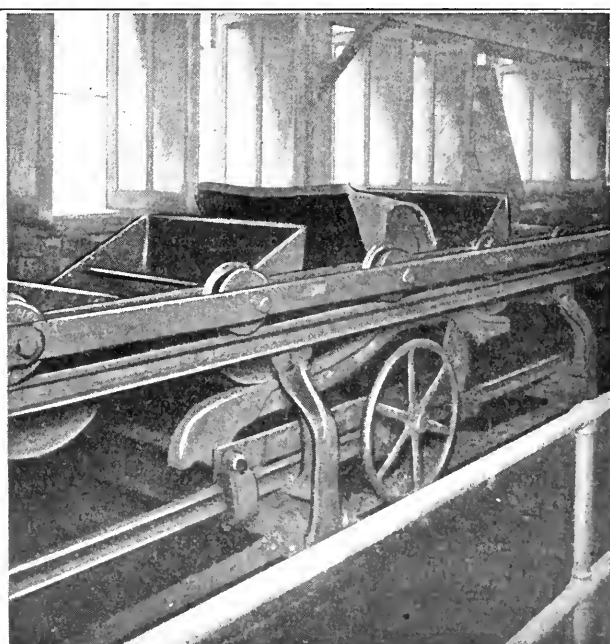
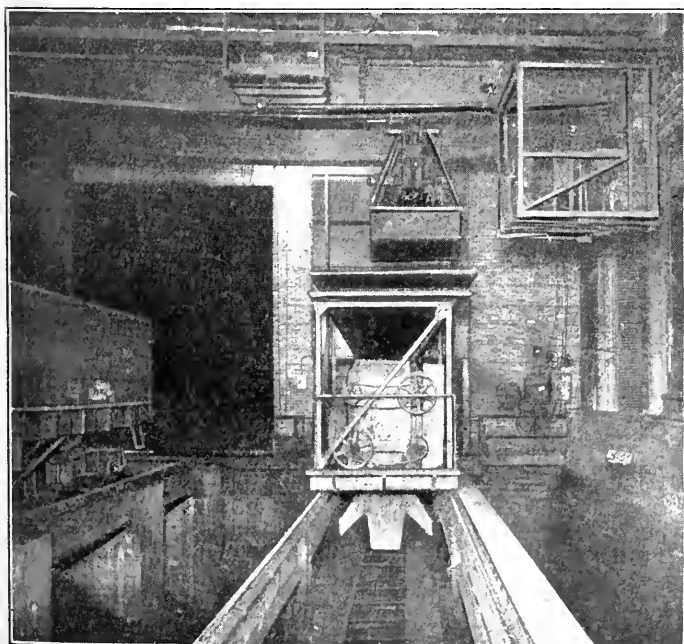
The make-up water comes from a fresh-water reservoir which collects the drips, heater overflow and other available condensed steam. Under float control it is also supplied with filtered service water. The house-service water supply is drawn from the condenser-intake tunnel by two 600-gal. (2271-l.) pumps, one driven by a turbine and the other by a motor. It is delivered to a service tank on the roof. From the pump discharge line several taps are taken off for transformer cooling and for various services where

raw water can be used. Return water from the tank passes through duplicate pressure filters which are cross-connected and used alternately. Each has capacity to filter 150 gal. (567.8 l.) per minute. Upon leaving the filter the water supply divides, part going to cool bearings and to the lavatory system and the rest as needed to the hot-water reservoir. The vacuum on the main unit is utilized to draw the water from the reservoir into the condenser, the amount being regulated by a float in the heater. It is removed by the condensate pump in the usual way and delivered to the heater.

With the exhaust steam available the water temperature in the heater under average load conditions will range from 100 deg. to 120 deg. Fahr. To maintain the temperature within this range, a bleeder connection under thermostatic control has been made to the fourth stage of the turbine.

COAL-HANDLING SYSTEM

Coal for the plant, Illinois lump and screenings, is brought in over the company's siding from the Chicago & Alton tracks at Plaines, about $\frac{3}{4}$ mile (1.2 km.) distant. The company has its own locomotive and coal cars and a yard at the plant containing five tracks. No. 1 is a storage track running past the south side of the building, Nos. 2 and 4 are ash tracks serving the two rows of boilers, No. 3 is the coal track and No. 5 serves the turbine room. Between these tracks there is space to store about 10,000 tons (9,070 t.) of coal inside the power house. Track No. 3, centering on the firing aisle, leads into the boiler-room basement over a concrete pit capable of storing 800 tons (635.6 t.) of coal. By a four-motor traveling crane with a 2-yd.



FIGS. 1 AND 2—MOVABLE CRUSHER OVER CONVEYOR THAT DELIVERS COAL TO OVERHEAD BUNKERS, AND PORTION OF THE CONVEYOR CHARGING BUNKERS IN PROCESS OF DUMPING COAL

(1.8-m.) grab bucket the coal is unloaded into a four-roll traveling crusher driven by a 50-hp. induction motor which discharges to a bucket conveyor delivering into the overhead bunker. The latter has capacity to hold 450 tons (408 t.) or 112 tons (101 t.) per boiler. The bunker is made up of steel plates, concrete-lined, and is divided up into compartments with double chutes

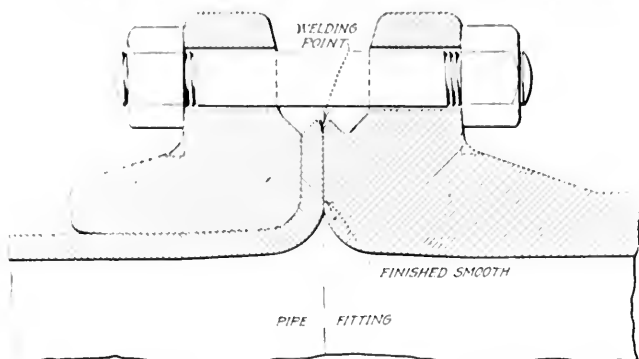


FIG. 3—SPECIAL HIGH-PRESSURE-WELDED JOINT FOR STEAM LINE

from each leading to the two stokers under their respective boiler.

Screenings are handled in the same way, with the exception that the rolls of the crusher are spread to allow the coal to pass through to the conveyor. On both sides of the crusher are by-pass chutes to the storage pit. The coal may be unloaded into the pit or onto the outdoor storage space. In the latter case a locomotive crane unloads the coal and loads it again when it is desired to remove it to the plant.

Under each boiler furnace are ash and fine coal hoppers. The former is lined with firebrick and is equipped with a sprinkling system to wet down the ashes. Through a manually operated sliding gate the ashes are passed directly to railway cars. Thus ash-handling apparatus is eliminated. Farther forward is the fine

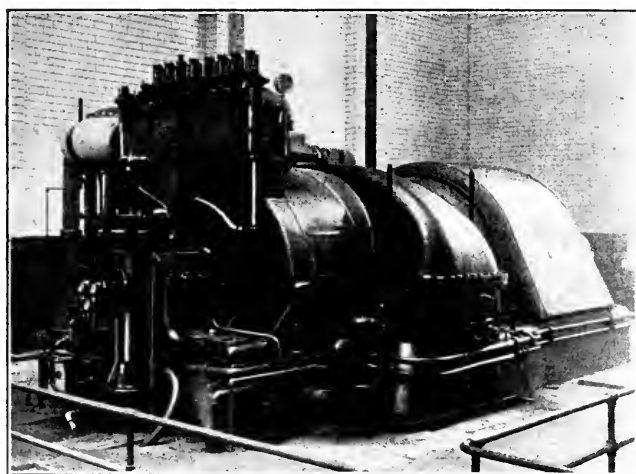


FIG. 4—ONE OF THE 10,000-KW. TURBO-GENERATORS DESIGNED FOR 300-LB. PRESSURE

coal hopper, which delivers its contents to the concrete storage pit. The outlet is controlled by a sliding gate operated from the boiler-room floor.

STEAM PIPING FEATURES

All high-pressure piping is double extra strong, with fittings of cast or forged steel. On pipes above

4 in. (10.2 cm.) diameter a special welded joint is used. Numerous bends are employed in the piping to care for expansion. From each end of the superheater there is a steam outlet, the leads from superheaters being joined

IMPORTANT DATA OF JOLIET STATION BOILER ROOM

Boiler.....	B. & W. cross-drum water-tube
Steam making surface, sq. ft.....	9,911
Active heating surface per kilowatt, sq. ft.....	1.43
Pressure for which boilers are designed, lb. per sq. in.....	350
Operating pressure, lb. per sq. in.....	321
Superheat, deg. Fahr.....	221
Steam temperature, deg. Fahr.....	651
Capacity boiler, lb. steam per hour (normal and maximum).....	60,000 to 94,000
Superheating surface, sq. ft.....	3,130
Economizer.....	All-steel B. & W. horizontal
Stoker.....	B. & W. chain-grate
Active area stokers per boiler, sq. ft.....	232
Ratio grate area to steam-making surface.....	1 to 43
Superheat surface (B. & W.), sq. ft.....	3,100
Floor space occupied by boiler per 16 sq. ft. of heating surface.....	0.472
Floor space per 10 sq. ft. of heating surface.....	0.59
Height of boiler from floor to top of economizer, ft.....	42
Induced-draft fan.....	Sturtevant multivane
Capacity of fan, cu. ft. gas per minute.....	75,000
Horsepower of motor.....	150
Stack.....	Unlined steel, one per boiler
Stack diameter, ft.....	7
Height stack above grate, ft.....	125
Coal.....	Illinois run-of-mine and screenings
Capacity bunker, tons.....	450
Concrete pit storage, tons.....	800
Yard storage, tons.....	10,000
Locomotive crane.....	Browning
Traveling crane.....	Whiting 2-yd. bucket, 150 tons per hour
Traveling crusher.....	Orton & Steinbrenner
Crusher capacity, tons per hour.....	125
Coal conveyor.....	Link Belt continuous bucket
Conveyor capacity, 45 ft. per minute, tons per hour.....	120
Boiler-feed pumps.....	Worthington, four-stage, 3-in. cent.
Horsepower of turbine drive.....	126
Pump capacity, gal. per minute against 375 lb. to 400 lb. head.....	300
Feed-water heaters.....	Warren Webster open type
Heater capacity, lb. per hour.....	150,000
Pressure filters, two per unit.....	New York "Jewel" Continental
Capacity each filter, gal. per minute.....	150
Service pumps, two, one turbine, one motor-driven, gal. per minute, each.....	600
Turbines.....	Horizontal Curtis, General Electric Company
Capacity, kw.....	10,000
R.p.m.....	1,800
Steam pressure, lb. gage.....	300
Superheat, deg. Fahr.....	225
Floor space per kw., sq. ft.....	0.0444
Condensers.....	Westinghouse two-pass
Surface in condenser, sq. ft.....	20,000
Surface per kilowatt generator rating, sq. ft.....	2
Pumps.....	
Circulating pump.....	Westinghouse centrifugal
Capacity of circulating pump, gal. per minute.....	18,000
Speed, r.p.m.....	690-720
Drive, induction motor (also drives Le Blanc air pump), hp.....	200
Air pump.....	Le Blanc, driven by circulating pump motor
Condensate pumps.....	Motor-driven centrifugal
Capacity, gal. per minute.....	360
Motor drive, hp.....	25
Traveling screens.....	Link Belt
Drive, G. E. induction motor, hp.....	5

by special Y-fittings at the boiler-room wall. A 10-in. (25.4-cm.) pipe supplies the turbine.

THE TURBINE AND CONDENSER INSTALLATION

The main generating units of the present installation are rated at 10,000 kw. at 80 per cent power factor. At the turbine the working pressure is 300-lb. (21.1-kg.)

gage. Over all the turbo-generator is 33.5 ft. (10.2 m.) long, 13.25 ft. (4.04 m.) wide and 12 ft. (3.7 m.) high, thus requiring a floor space of 0.0444 sq. ft. (0.0041 sq. m.) per kilowatt of rating. The turbine is served by a two-pass condenser containing 20,000 sq. ft. (1852 sq. m.) of surface.

Circulating water is supplied by a centrifugal pump having a capacity of 18,000 (68,136 l.) gal. per minute. In conjunction with a Le Blanc air pump, the circulating pump is driven by a 200-hp. slip-ring induction motor. Each condenser pump is rated at 360 gal. (1362 l.) of condensate per minute and is driven by a 25-hp. motor.

Cooling water for the condensers is drawn from the Desplaines River through a concrete tunnel and enters a forebay, where it first encounters an iron grid designed to keep back driftwood which may have escaped the log boom at the intake, and then passes through revolving screens. Each screen is driven by a 5 hp. in-

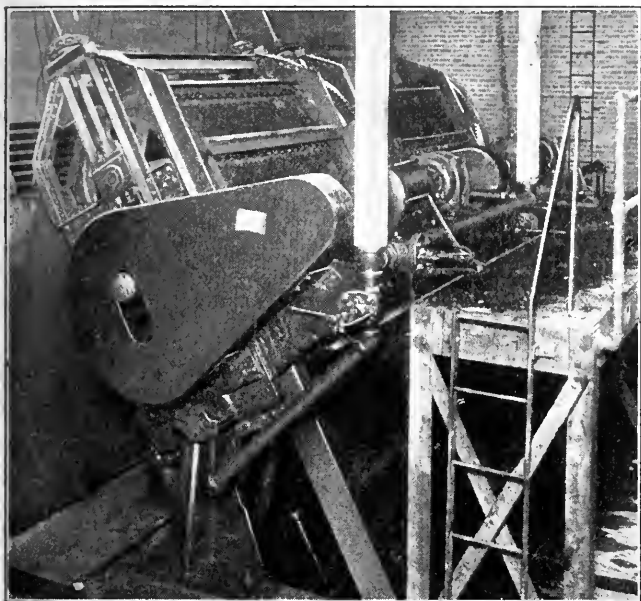


FIG. 5—TRAVELING SCREENS WHICH KEEP CONDENSING WATER FREE OF DÉBRIS

duction motor through reduction gearing. Provision is made for swinging the screens in to a horizontal position for inspection or repairs. Water from slotted pipes is forced through the screens at high velocity to clean them, the debris draining into a trough leading to the discharge tunnel.

Back of the traveling screens are double sets of sectional stationary screens having $\frac{1}{2}$ -in. (1.3-cm.) mesh to catch fibrous material, small fish or debris of any character remaining in the water. For cleaning they are removed by a hand-operated beam trolley. The discharge tunnel extends along the top of the injection tunnel as far as the river side of the railway. Here it turns downstream and discharges into a swampy tract bordering on the river. From the turn in the main discharge tunnel an extension leads to the intake, so that warm water may be discharged there to reduce ice formation during the winter season. A sluiceway valve regulates the amount of water drawn off for this purpose.

The electrical features of this plant will be described in a later issue of the *ELECTRICAL WORLD*.

CHOOSING LIGHTING UNITS FOR INDUSTRIAL PLANTS

Scientific Illumination More Important Than Ever—
Classification of the Principal Requirements
for Lamps and Reflectors

BY DAVIS H. TUCK

Electrical Engineer Holophane Glass Company

EVEN in times of normal activities manufacturers have found that scientific illumination increased the efficiency of their plants by making possible (1) greater output, (2) better workmanship, (3) less spoilage, (4) fewer accidents, (5) less sickness, (6) reduced labor turnover, and (7) reduced overhead by twenty-four-hour utilization of equipment. These benefits are of greater importance than ever before because every manufacturer is confronted with increased costs of materials, shortage of labor, and the problem of increasing production without reducing the quality.

While expert advice is necessary to secure the best illumination, owing to the different requirements in different places, observing the following suggestions will bring better results than not having consulting advice at all.

THE LAMP

Efficiency.—The lamp should give the maximum number of lumens (light flux) per watt.

Life.—The life of a lamp is its economic life and not the period which elapses from the time it enters service until it fails. The efficiency (lumens per watt) of a lamp falls off with use until finally a point is reached where the lamp has become so inefficient that it is advisable to throw it away and buy a new lamp. The best lamp is, therefore, the cheapest lamp which will burn the longest time with the least fall in efficiency (lumens per watt).

Color of Light.—The light should have a color suitable for the work to be performed.

THE REFLECTOR

Efficiency.—The ratio of total lumens from the combined lamp and reflector to the total lumens from the lamp alone should be high.

Distribution of Light.—It is principally the light in the 0-deg. to 65-deg. zone that is of use, therefore the light shown by the distribution curve of the reflector should fall as closely within these limits as possible. The greater the candlepower of the light in the 65-90 deg. zone the greater the glare, and the nearer the high candle-power is to the 90-deg. zone the more objectionable it is. Some light, to light upper portions of the room, should be contained in the 90 deg. to 180-deg. zone, as it causes a strain on the eyes to have too great a contrast between the lighting unit and its surroundings.

Shield Light Source.—The light-producing surface of the lamp should be shielded from the eye, as modern light sources are too intense for the eye to view with safety. Furthermore, the brightness of the lower surface of the reflector should be low.

Maintenance.—The reflector should be durable and the reflecting surface should not deteriorate with age, heat of the lamp or fumes of the shop. It should withstand frequent washing and after washing should present a surface equal to the surface which existed initially.

Fan, Blower and Air-Compressor Applications

Operating Characteristics of Different Types of Apparatus for This Service— Motors and Control Equipment Best Adapted Thereto and Methods of Connecting

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

This article takes up the application of the motor to a line of apparatus where the horsepower requirements vary in general as some function of the speed other than the first power. Characteristics relating to the power requirements of fans, blowers and air compressors are outlined, and attention is called to the types of motors and control apparatus which are usually employed for driving this line of machinery. The mechanical connection of the motor and the machinery to be driven is treated both from the viewpoint of the efficiency of the system as a unit and from that of such incidental items as the avoidance of noise, which is relatively important in some applications. Specific types of fans, blowers and air compressors are discussed somewhat in detail.

OF THE different types of apparatus available for impelling air or delivering it under pressure, the rotary blower is used principally for those cases where the air passages to and from the fans are unobstructed, as in some cases of ventilating, cooling and exhaust service. Blowers like those illustrated in Figs. 3 and 4, although not of the positive types, are adapted, because of their ability to develop some pressure, to those cases where a continuous supply of air is required for ventilating, blowing, drying or other purposes and in which there is some resistance to the flow of air which makes necessary the pressure produced by this type.

For many cases where large volume and relatively high air pressure is required, as in the blowers for oil and gas furnace work, in the burning of pulverized coal, for the blasts used with foundry cupolas, in ash and coal conveying, for the transmission of cash and mail pneumatically, for blast-furnace work and the like, air compressors are used. The centrifugal air compressor is a type which is widely used for the above purposes.

OPERATING CHARACTERISTICS

The variations of the horsepower and efficiency of fans and blowers with speed, dimensions of the outlet and density of the gas handled are important items in the operation of such devices. For a given area of the discharge opening the horsepower required to drive a fan or a blower depends on the cube of the speed. Hence it will be noted that at starting the torque required is negligible as far as the load is concerned, being due only to the mechanical friction and the inertia of the comparatively light revolving parts. As the fan or blower speeds up the horsepower rapidly increases according to this variation as the cube of the speed. Starting requirements are thus of little or no importance in such apparatus.

For a given area of the discharge opening and with constant speed the horsepower required by a fan or blower varies directly as the density of the gas handled. It is interesting to note that the efficiency of fans or blowers is unchanged by variations in speed, and in this respect they differ considerably from other machinery.

The efficiency does vary, however, with changes in the opening of the discharge area.

Leonard¹ gives the following information concerning the variation in the horsepower for fans and blowers for given driving speeds and with a decrease in the size of the discharge area. For a centrifugal fan the horsepower decreases with a decrease in the area of the discharge orifice. With a propeller fan, however, the horsepower increases as the area of the discharge orifice decreases. Thus in some designs the horsepower for a propeller fan with its rated orifice is one-quarter or less of the horsepower with a complete discharge restriction. In the case of positive blowers, owing to the very small clearances between the rotating element and the casing, the horsepower increases rapidly with decreasing values of the discharge orifice area.

TYPES OF MOTORS USED

The smaller types of fans and blowers, like those represented by Figs. 2, 3 and 4, are available with either direct-current or alternating-current motors and can

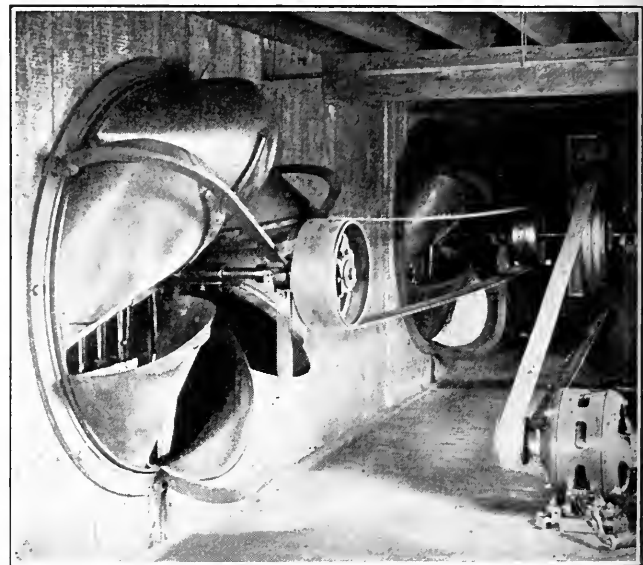


FIG. 1—LARGE EXHAUST FANS DRIVEN BY HIGH-SPEED MOTOR

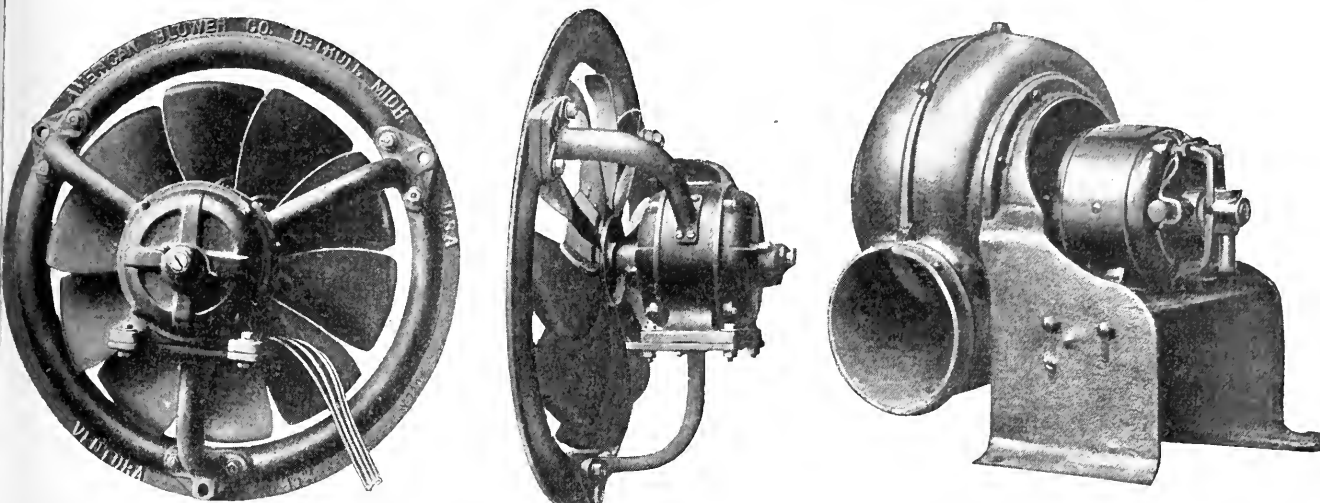
be operated from any ordinary electric light circuit without a starting rheostat. For fans of the kind shown in Figs. 2 and 3 single-phase alternating-current motors are employed, and when operated on direct-current supply circuits motors of the series-wound

¹See classification by M. S. Leonard, in "Standard Handbook for Electrical Engineers," fourth edition, page 1237. Frequent references have been made in the preparation of this article to this section by Mr. Leonard on "Fans and Blowers," and also to the section on air compressors by J. H. Brown, Jr., page 1235 of the "Standard Handbook," and to information and illustrations placed at the disposal of the writer by the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Crocker-Wheeler Company and the Wagner Electric Manufacturing Company.

type are used. For the blowers shown in Fig. 4 single phase alternating-current motors or shunt-wound direct-current motors are used.

A more comprehensive statement concerning the

This added flywheel effect tends to maintain the operation of the motor in case of an unusual momentary drop in the supply voltage. For the smaller compressors induction motors are usually employed because of the



FIGS. 2, 3 AND 4—SMALL FANS THE MOTORS OF WHICH DO NOT REQUIRE STARTING BOXES, AND A BLOWER ADAPTED TO CONDITIONS WHERE THERE IS SOME RESISTANCE TO THE FLOW OF THE AIR

types of motors to use for fans and blowers in general is as follows: With an alternating-current supply all types may be driven by induction motors. With a direct-current supply shunt-wound motors are best for centrifugal fans; for propeller fans either the shunt or the series motor may be used, although the latter is preferable. For positive blowers the shunt motor is recommended.

Fans of the type shown in Fig. 1 are made in a wide variety of sizes, and the speed of driving decreases with the increasing dimensions of the fan. Some idea of the speeds in r.p.m. of these fans for a number of different fan diameters together with the volume of air moved per minute may be gained from the accompanying table, which covers equipment for 115, 230 and 500-volt service.

Centrifugal air compressors of the single-stage type are driven from alternating-current supply circuits by squirrel-cage induction motors, in which case the motor is of course of the constant-speed type and the driving speed cannot be adjusted. It is necessary, therefore, in the application of such motors to specify a pressure high enough to take care of the range of the operating requirements. Where the supply is direct-current, shunt-wound motors are used, with commutating poles and a so-called shrunk-ring commutator for providing sparkless commutation.

For displacement air compressors self-starting synchronous motors or induction motors may be used, although the former type is recommended for direct-connected sets in the larger sizes. Among the advantages of the synchronous motor as now used for compressors of this type are their self-starting as well as self-synchronizing characteristics, continuous operation even with low line voltage or other power disturbances, high efficiency, absolutely uniform speed and high power factor.

Since the rotating element of a standard synchronous motor does not usually in itself possess sufficient flywheel effect to prevent undue fluctuations in the current with successive strokes of the compressor, it is desirable to use a flywheel on the compressor shaft.

lower cost for this type in the smaller sizes compared with that of the synchronous motor.

METHODS OF CONTROL

As pointed out above, the very small sizes of fans and blowers do not require starting rheostats, being merely connected to the line by an ordinary snap switch. In general, however, any direct-current motor-driven fan or blower which is to be operated at one speed only irrespective of the service conditions requires at least a starting rheostat with a no-voltage release, and in

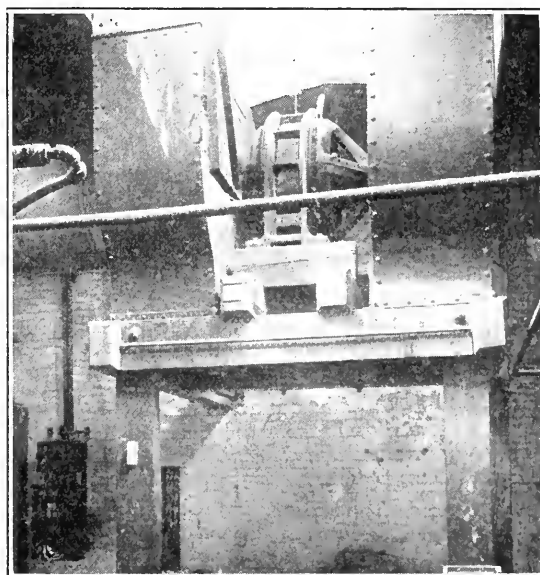


FIG. 5—THREE-PHASE INDUCTION MOTOR DIRECT-CONNECTED TO TWO EXHAUST FANS

case there is a likelihood of an extraordinary increase in horsepower an overload release will also be found essential.

Where speed adjustment is required two conditions may arise: (a) The motor operates for the most part at normal speed with occasional times when reduced speed is necessary, or (b) the motor operates for most

of the time at speeds below normal and is occasionally brought up to speed at or near normal. In case (a) armature resistance control may be used, while in case (b) field control is more economical. Values for the speed ranges usually met with in practice are for a decrease of, say, 50 per cent below normal for armature resistance control and for about 10 to 25 per cent in-

at 3700 r.p.m. Hence it is possible to operate the direct current motor-driven set at as much as 20 per cent overload for a period not to exceed two hours.²

METHODS OF CONNECTING THE MOTOR

Of the two methods of connection, by belt and by direct connection, the former is recommended where the elimination of noise is essential, as in auditoriums,

DATA ON FAN DIAMETERS AND PERFORMANCE

Diameter of Fan (In.)	R.P.M.	Cubic Feet of Air per Minute
18	900	2,700
24	700	5,000
30	600	8,400
36	500	12,000
42	410	15,400
48	400	23,000

schools, hospitals and the like. Lower first cost of high-speed motors is also an advantage in this connection. Since the desirable speed for fans is not likely to agree with the rated speed of an alternating-current motor, belt connection is often essential with motors of this type.

Where direct connection is employed various standard methods of mechanically mounting the motor and making the connection to the fan are used. In larger sizes of compressors direct connection is always desirable, and the more so because of the ability to design the larger compressors for low speed.

SPECIFIC TYPES

Fans of the type pictured in Figs. 2 and 3 are designed to draw the air directly from a room, for example, and

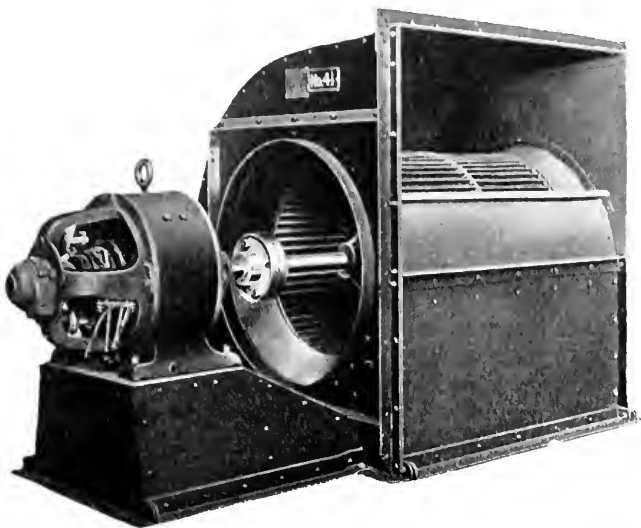


FIG. 6—LARGE MOTOR-DRIVEN VENTILATING FAN

crease in speed above the ordinary average operating speed by field rheostat control.

With alternating-current motor drive for fans and blowers the motor is usually equipped with a starter only, and necessary changes in the volume or pressure of the air or gas are produced by throttling rather than by changes in speed.

With centrifugal compressors the practice of one representative manufacturer is to furnish a standard starting compensator with a self-contained oil switch, low-voltage release and overload relays for all compressor motors of the induction type of 5 hp. and above. For induction motors of 5 hp. and lower an oil switch with overload relays is furnished. For the control of direct-current motor-driven compressors each motor is furnished with a suitable field rheostat so as to make possible adjustments in air pressure by changing the speed of driving. Motors of 50 hp. and less are furnished also with standard starters, and with the larger sizes standard panels are used. The panels are equipped with field and armature resistance and switches both for starting and for controlling the speed of the motor.

Centrifugal compressors, when driven by induction motors, are operated at constant speed, and from the control standpoint the pressure rise of the compressor cannot be regulated by speed changes. On the other hand, it is always possible to throttle the pressure, with, however, no change in the volume capacity of the compressor. In contrast, the direct-current motor-driven compressors are adapted to some slight speed variations which produce corresponding pressure changes. As an example, a centrifugal compressor rated at 4500 cu. ft. (126 cu. m.) of air per minute at a pressure of 1 lb. (70.3 gm. per sq. cm.) and speed of 3450 r.p.m. produces a pressure of about 0.87 lb. (61.2 gm. per sq. cm.) and 4200 cu. ft. (117.6 cu. m.) of air per minute at a speed of 3200 r.p.m., and about 1.15 lb. (81 gm. per sq. cm.) pressure and 4200 cu. ft. (117.6 cu. m.) per minute

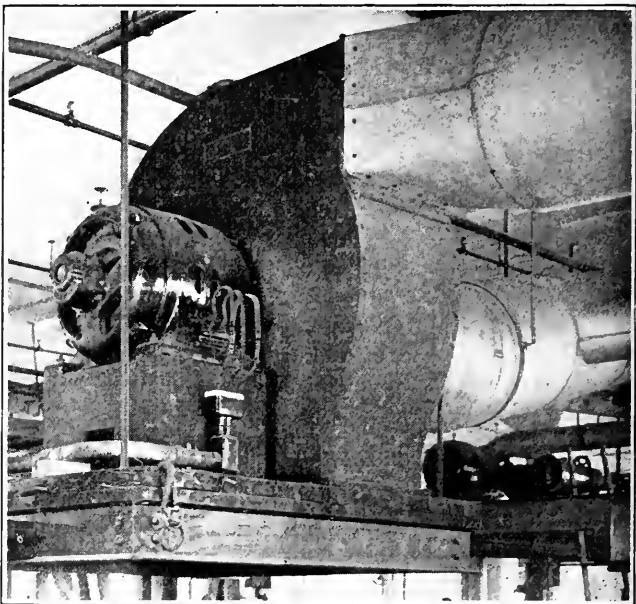


FIG. 7—LARGE BLOWER DRIVEN BY THREE-PHASE, SQUIRREL-CAGE MOTOR

to exhaust it into the open, and also for cases where the inlet and outlet pipes are sufficiently large and short so that there is little or no resistance to the passage of the air. The disk at the center prevents back flow and the

²Data based on Bulletin No. 48,609 (1917) of the General Electric Company.

turned-in ends of the blades give the fan a higher efficiency than older types. This type is made in sizes ranging from a wheel diameter of $18\frac{3}{4}$ in. to 32 in. (45.72 cm. to 81.28 cm.), with capacities ranging from 1860 cu. ft. to 6530 cu. ft. (52.0 cu. m. to 182.8 cu. m.) per minute.

The type of blower shown in Fig. 3, while capable of supplying air for ventilating and other purposes where there is some resistance to the passage of the air, is not a positive blower in the strict meaning of that term. This type is made in sizes ranging from a wheel diameter of $4\frac{1}{2}$ in. to 9 in. (11.4 cm. to 22.8 cm.), with capacities ranging from 175 cu. ft. to 700 cu. ft. (4.9 cu. m. to 19.6 cu. m.) per minute. Both types of fans just mentioned can be driven by small motors ranging from $1/20$ hp. to $1/8$ hp.

Centrifugal air compressors are used for a wide variety of applications and possess advantages over the displacement compressor in some cases. For example, in the pneumatic handling of cash in department stores, when the suction lines are opened to insert a cash car-

rier, the centrifugal compressor responds quickly by drawing in a large volume of air sufficient to pull the carrier along by the high air velocity thus produced. A positive pressure blower is more sluggish and in the ordinary sizes which would be employed for a given system would not respond to such quick changes.

Where direct-current motors are used for such compressors as pointed out above, increased speed produced by the adjustments which are possible with these motors creates increased pressure. However, since the volume of the air or gas which can be handled is limited by the rating of the driving motor, the volume must be reduced in proportion to the increase in pressure so as not to exceed the capacity of the motor used.

The foregoing notes point to some of the practical phases in the operation of these lines of equipment. The necessity for care in the selection of the motor for each individual case, particularly in the blowers and compressors of the larger sizes, is apparent from the numerous items which demand attention in the operation of such appliances.

Successful Operation of Secondary Networks

A Discussion of Various Important Points, the Neglect of Which Has Resulted in Many Failures in Attempts That Have Been Made to Operate Inter-connected Secondary Networks

BY S. BINGHAM HOOD

Superintendent of Distribution, Northern States Power Company

THE well-known reliability and flexibility of direct-current networks has resulted in many attempts being made to operate alternating-current networks along similar lines. These attempts have met with all degrees of success and failure, depending largely upon the amount of care and forethought that have been put into the design and construction of the network. In the vast majority of cases failures in continuity of service can be traced back to an absolute disregard of the underlying principles involved.

A secondary network is very similar to the direct-current system as regards the distribution of currents under both normal and abnormal conditions; consequently the basic principles governing the distribution of currents in parallel circuits can be applied to each. In the alternating network, fed by many step-down transformers of moderate rating, each transformer becomes the equivalent of a direct-current feeder. The primary network can then be considered as the equivalent of the direct-current substation bus. Having these comparisons clearly fixed in mind, the problem is at once greatly simplified.

THE FUSING PROBLEM

Each individual transformer unit feeding the network may be compared to a very short feeder having low resistance and must be protected on both the primary and secondary sides by fuses which will open in case of abnormal demands for current, or for faults within the transformer windings which would result in drawing exceedingly heavy currents from both the primary and secondary networks. For the primary side there are numerous makes of fuses that can be de-

pended upon to operate successfully under all conditions likely to be met in practical operation.

For the secondary side the problem is complicated by a lack of suitable fuse holders and fuses that are moderate in first cost and reliable when exposed to the weather for long periods of time. Since these fuses are so located that the fire hazard to nearby apparatus is very slight, it is not necessary or desirable to attempt to use any of the standard types of inclosed fuses whose cost and complications are those involved almost entirely by the necessity of furnishing protection from fire when the fusible element is ruptured. For this reason fuses for protection of the secondary of distribution pole transformers may be made of exposed non-corrodable metal links mounted in simple exposed metal clips and terminals. A type of fuse and holder which has proved successful for such use was described in detail in the Aug. 25, 1917, issue of the ELECTRICAL WORLD (Vol. 70, No. 8). The neutral wire of the secondary system must in all cases be permanently and effectively grounded and must be continuous without fuses throughout its length, including the neutral lead of the transformer secondary winding.

In fusing distributing transformers it is absolutely necessary to have both the primary and the secondary fused heavily, particularly when they are operated in parallel on a network. Fuses rated at from two and one-half to three times full-load current are none too heavy. Objection to such overfusing is generally based on the resulting danger of burning out the transformers from overloading. The maximum load on any transformer should be determined by a system of periodic tests and a record of loads connected in the period be-

tween tests. On any network there are numerous momentary demands for current which will result in unnecessary interruptions to the service if an attempt is made to limit the loading by means of fuses rated close to the normal capacity of the transformers feeding the load.

DESIGNING THE SECONDARY SECTIONS

In any interconnected network there is a definite section supplied by each individual transformer. Each of these sections should be so designed that the transformer is at the approximate center of the load on the section, being preferably so located that the current is distributed in a number of directions. This can be accomplished by locating transformers at junction points of the secondary mains. Generally speaking, however, it is not desirable to place transformers on junction poles owing to the already complicated wiring on such poles. It is, therefore, necessary to select a location as near as practicable to such junctions.

Having a group of such properly designed secondary sections, it is then only necessary to interconnect between them to form a network for parallel operation. In many systems the design has been carried out properly to this point, but has failed from other causes, as outlined below.

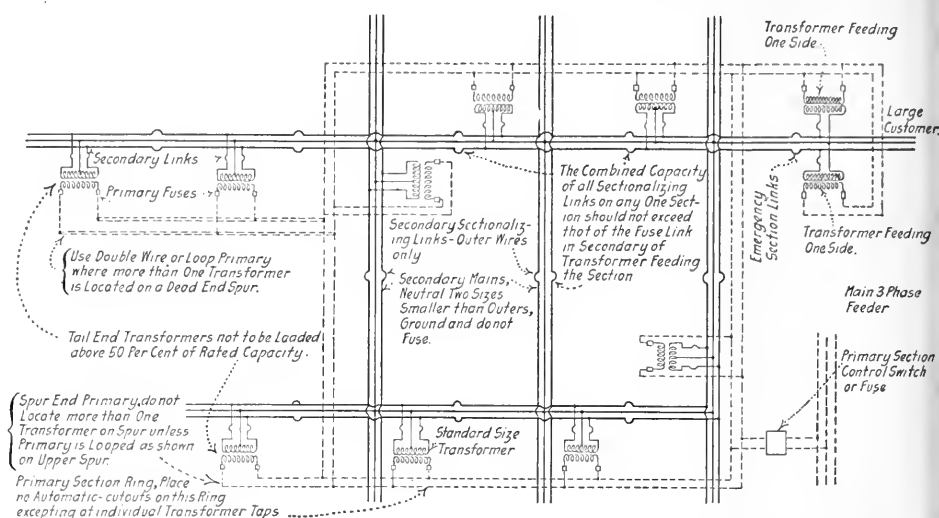
In the event of failure of any transformer on the network its load must be immediately taken up by adjacent transformers if continuity of service is to be maintained. As a transformer will safely carry a 50 per cent overload for a short time, it therefore follows that the minimum number of transformers operated in parallel is fixed at three. It also follows that the more transformers there are connected in parallel the smaller proportionate overload each will bear when any one unit fails. It also follows that all units feeding into any interconnected network must be of the same rating, otherwise a failure of any larger unit will disproportionately overload the smaller one adjacent thereto. This lack of uniformity in transformer sizes has been responsible for a large proportion of the failures.

Where a standard-size unit is used the transformer stock becomes simplified, and increases in load can be taken care of on the network at small cost by simply installing additional transformer units between those already existing, moving, where necessary, the adjacent units further apart.

In selecting the unit transformer for any district due regard should be given to the probable future development of the section to be served. In a district which is growing rapidly, as in many of the newer residential sections, a fairly large unit should be used, probably from 15 kva. to 25 kva. rating. This involves running moderately heavy secondary mains over considerable distances in order that the initial units

may be economically loaded. This practice is, however, the most economical in the long run, as it permits taking on additional load as the district develops, by adding transformer units at intermediate points on the existing mains. This practice is particularly desirable where an electric cooking load is increasing. If the old practice is followed of installing small secondary mains and small transformer units, the cost of continually increasing their size as new load comes on will mean a heavy ultimate expenditure and rapid depreciation on the original investment.

To secure the best results in network operation the secondary mains should be connected in a series of rings, each ring surrounding one or more blocks of the district served. With this layout there is no point at which the failure of one transformer will overload adjacent units more than the maximum allowance of 50 per cent. A further advantage is that of continuity of service, even if the secondary main should break at



A TYPICAL SECONDARY NETWORK DETAILING THE VARIOUS POINTS BROUGHT OUT

A study of this sketch will show clearly the reasons for the points taken and will show why their non-observance will result in frequent failures.

any point. In practice, however, there will generally be a tail-end section on the network, the failure of the transformer feeding which would result in placing a 100 per cent overload on the next unit. In order to avoid this condition, which in a long single-main secondary would result in a general blowout, it is imperative that the end transformer feeding any tail-end section must never be normally loaded more than 50 per cent of its rating. As this is not a very economical operation, it follows that these tail ends should be avoided wherever practicable. This can usually be accomplished by running an extra heavy secondary main from the nearest point on the network at which the interconnected ring system can be tapped.

RING-TYPE PRIMARY SYSTEM ADVISABLE

For the purpose of feeding the various transformers of the interconnected network the primary system requires special consideration. Having a backbone primary feeder with numerous tapped mains taken off to feed the various transformers, as is the practice with non-interconnected transformers, will not give safe operation on an interconnected network. The reason for this is that a break at any point on the primary system within the network area will result in those

transformers on the supply side of the break feeding the rest of the load beyond the break through the intermediate secondary-network section. The natural and inevitable result of this will be a general and wholesale blowout of the entire network. In order to overcome the possibility of such an occurrence, the primary system must be connected in a series of one or more closed rings. At no point must more than one transformer unit be located on a single spur taken off this primary ring. Such a ring system has many other marked advantages, such as equalization of voltage, minimum amount of copper for diversified loads, ability to cut out sections for repairs without interrupting service, etc. The primary ring-connected section should be independent from the general primary feeder and connected solidly, without automatic cut-outs, throughout the section served. This individual primary section should then be controlled by an individual switch or cut-out installed where the section taps off the main feeder.

Where the source of supply is a three-phase system it is good practice to divide the district served into three distinct sections, feeding each from one of the three phases of the feeder. This involves, in large systems interconnecting in each section, probably from 300 kw. to 500 kw. in local transformer rating. To those who have met with difficulty in parallel operation this may appear to be an abnormally large section on which to locate trouble, particularly if a total interruption occurs. With a properly designed network, however, such widespread interruptions will be so rare that the probability of such an occurrence can be neglected. In one large city where this sort of parallel operation has been operated for a number of years there has not been a single network interruption since the inception of the system. Moreover, the failure of individual transformers from lightning and other causes has been remarkably reduced, such failures now being so rare that their occurrence is considered quite an event in the operation of the system.

CONSIDERATION OF SPECIAL CONDITIONS

Where transformers are operated in parallel on a widespread network it is important that the customers served be encouraged to report poor service promptly and that such reports receive immediate attention. In a good system of secondary distribution the normal drop in voltage should not exceed 3 per cent of lamp voltage. With transformers properly spaced the failure of any single unit will then result in a drop of 12 per cent in lamp voltage for customers very near to the defective unit. Such a drop will result in customers' complaints of poor light as soon as the evening peak comes on. By having a troubleman go to the nearest transformer unit the trouble is at once located and can be corrected before further failures occur.

It frequently happens that heavy concentrated loads, such as those of apartment houses or large buildings, must be served in the same district as that covered by the secondary network. Such loads should not be considered as a part of the network, but should be treated as independent units. In serving these it is best to provide two transformers, each having its secondary connected for say 115 volts, the two being connected in series across the three-wire service line. A continuation of this service line should then be connected to the nearest point of the interconnected secondary network

through fuses of small capacity. The individual bank then becomes a reserve for the network, and the network can be used for emergency service during periods of light load. In the event of failure of either of the individual units the network emergency fuse will blow and one-half of the concentrated load will be deprived of its service. Under this condition service can usually be restored in a short time by having the troubleman advise the tenants to curtail their demands, after which he connects the two outside wires together on the transformer pole pending replacement of the defective transformer. If the character of the load is such that these infrequent interruptions are not permissible, then three units should be installed. If this be done, heavy choke coils must, however, be connected in the leads of each unit, otherwise failure of any one of the three will almost surely interrupt the remaining two owing to the heavy rush of current and very small difference in the time element of the protecting fuses.

Progress for the A. S. M. E. Boiler Code

A bulletin of the American Uniform Boiler-Law Society, dated Jan. 10 and signed by Thomas E. Durban, chairman of the administrative council, shows progress in the legal adoption of the A. S. M. E. boiler code. Prospects are reported in the following states in which legislatures convene during the present year: Georgia, Kentucky, Louisiana, Maryland, Massachusetts, Mississippi, Rhode Island, South Carolina and Virginia. The society is writing to prominent men in these states, including members of the American Society of Mechanical Engineers and the National Electric Light Association, requesting co-operation. The National Electric Light Association, through R. J. McClelland, has written the following letter to the society:

We wish to assure you that the National Electric Light Association indorses fully and heartily the work of the American Uniform Boiler-Law Society, and that you may rely upon our moral support in the various campaigns and representations which you are undertaking. Your work is a most valuable one, not merely to the engineering profession but to the welfare of the country in general. At a time when the industrial resources of the country are being subjected to the most severe test in their history, the measures of efficiency, uniformity and security for which you are working assume proportionately greater importance, and we shall be glad to supplement in any manner practicable the assistance which our small contribution may afford.

Electricity to Help Farm Production

The electrical engineering department of the Iowa State College is planning an extensive exhibit of electric appliances and farm lighting sets for the farm and home short-course week at the college, which will be held from Jan. 28 to Feb. 2. The farmer must help in speeding up production. Electric lighting, electric motor-driven machines and other electrical appliances will serve as important factors in this increased production. With these conveniences the farmer can do faster work with fewer mistakes. This is the belief of the electrical department, which is concentrating every effort to make the exhibit a success. F. D. Paine is electrical engineering representative of the winter short course.

Importance of Water Power Is Shown by War

Benefits of Cheap Power and Conservation of Fuel Far More Valuable to the Nation than Exact Solution of Question of Restricting Return on Capital to Irreducible Minimum

BY CALVERT TOWNLEY

As a representative of the Engineering Council Mr. Townley, who is assistant to the president of the Westinghouse Electric & Manufacturing Company, made the statement of which this is a summary before a special committee of the United States Chamber of Commerce at Washington on Jan. 14. The statement is not an expression of Mr. Townley's personal views, nor of those of any group, but has been submitted to and approved by the executive committee of the Engineering Council.

BEING empowered as it is to speak for the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers on matters of common concern to all of these bodies, the Engineering Council's official utterances concern only such underlying principles and economic facts as are indorsed by all engineers and beyond the field of controversy.

Accurate statistics are difficult to obtain, but some approximate totals may prove illuminating. It has been estimated by a careful engineer that in 1911 there was over 26,000,000 steam engine horsepower capacity in use (including railroad locomotives) in the United States. The aggregate water horsepower developed and undeveloped has been computed as around 60,000,000. Of this latter the United States Census of 1912 gives 4,870,000 as developed, and in a report of January, 1916, the Secretary of Agriculture estimates this total to have been increased to 6,500,000. Making liberal allowances for correction in these several figures, it seems probable that there is in service from four to five times as much steam as water horsepower and that there is still undeveloped water horsepower equal to at least twice all the steam power in service.

THE ELEMENTS OF COST

The price for service depends primarily on cost, and cost divides itself naturally into two main items, namely, operation (including maintenance) and fixed charges. As a hydroelectric plant consumes no fuel, its operating cost is less than that of an equivalent steam-driven plant. On the other hand, a steam plant costs usually only from one-fifth to one-half as much per unit of capacity as a hydroelectric plant, so that the latter must carry very much heavier fixed charges.

A power enterprise seldom comes into being with a market for its entire ultimate output. Therefore, when steam is to be the motive power, only such capacity is installed as initial demands require, and the cost per unit is fairly proportional to that of the ultimate development. In a water development, on the contrary, a large part of the cost is for riparian rights, for the dam, impounding reservoir, flume, forebay, etc., and for the transmission right-of-way, towers, etc., which must be at the start largely provided and constructed for the complete installation. In forecasting the commercial prospects of a power enterprise the possible market must be studied, and, of course, a sale price for power

decided upon. As this price is controlled by the cost of similar service from other sources, usually from steam, and as it must be attractive from the start, the additional burden of fixed charges on the initial part of a hydroelectric installation frequently forces the sale of its power below cost. The projectors then must rely for success on a sufficient subsequent increase in their markets.

RIISING COAL PRICE MET BY IMPROVED MACHINERY

The rising price of coal is a matter of record, but it is not so generally known that the improved efficiency of steam-producing machinery (boilers, engines, generators and auxiliaries) has more than kept pace, so that the net cost of producing electric power from coal has steadily declined. As applied to the pre-war period, it may be stated that over a period of ten years the cost of coal has risen on an average 1 per cent per year, while the cost of electric power produced from coal has fallen on an average $2\frac{1}{2}$ per cent per year.

In addition to these facts—still referring to pre-war conditions—the cost of steam-electric generating equipment has been greatly reduced. This fact is due partly to the introduction and subsequent improvement of the steam turbine and in part to the great increase in the size of the units now available. There is nothing to indicate that the limit of improvement in the design of steam prime movers has been reached or is even in sight. It is, therefore, a reasonable assumption that further advances in the art will continue to occur and to cut down both the fixed charges and the operating cost of steam power as a competitor of water. The largest modern steam turbine has now some twelve times the capacity which the largest reciprocating engine had fifteen years ago.

In addition to the development of steam prime movers, the Diesel or the internal-combustion engine is now coming largely into use as a further competitor of water power where fuel oil is available, as in the southwestern district of the United States. The efficiency of these engines is considerably higher than that of the small-size steam turbine and reciprocating engine. There has not been a like improvement in the efficiency nor a comparable reduction in cost of the small reciprocating steam unit, and a natural result has been expansion of the central stations.

The cost of producing power from either water or steam is a function of load. Fixed charges remain practically unchanged in both instances, whether the output in energy be large or small, but with a steam plant increased output means increased fuel consumption, while a water plant operates either with or without load with but little variation in expense. To illustrate by a concrete example representing not unusual conditions, suppose we assume a steam plant using $2\frac{1}{2}$ lb. of coal per kilowatt-hour at a price of \$3 per short ton and having a plant or output factor of 35 per cent.

Under these assumptions the cost of fuel per unit of installed capacity per year would be \$11.50, and if the other operating and maintenance charges be assumed fairly to offset those of a water installation of equivalent size, \$11.50 represents the additional fixed charges which the hydroelectric plant could carry and produce power at an equal cost. If the fixed charges (interest, taxes, insurance and amortization) total 11½ per cent, therefore, the hydroelectric investment per kilowatt capacity could exceed that of steam by \$100.

Stream flow is subject to seasonal variation, and therefore to complete or partial interruption by drought in summer and by ice in winter. Floods are a menace. Long transmission lines may break from wind or sleet or the service be disarranged by lightning. The losses on such lines vary with load and are frequently responsible for annoying pressure variations. On account of these and other reasons hydroelectric power cannot prevail against steam competition at the same or a slightly lower price. It must be materially lower.

THE UNDEVELOPED WATER POWER OF THE WEST

Of the estimated 55,000,000 undeveloped water horsepower in the entire country, approximately 40,000,000 hp. is situated within the boundaries of the thirteen so-called Western water-power states. In these same states the federal government still retains as proprietor 760,000,000 acres, or over two-thirds of the aggregate acreage of all these states taken together. In order to develop power in that section it is therefore nearly always necessary to use some part of this public domain, if not for the dam site itself, at least for flowage, for transmission right-of-way or for some other purpose. Existing law forbids such use except under permit issued by the Secretary of the Interior and revocable without cause, at any time, by himself or his successor in office. It was once believed that revocation would only follow gross abuse well established by evidence, but the drastic action of a one-time Secretary of the Interior some years since to the contrary disabused investors of this confidence. As funds for hydroelectric development must come from private sources, the unstable tenure thus imposed has constituted so great a hazard of loss that the private investor has been loath to assume it. The unfortunate—almost disastrous—result has been stagnation in water-power development.

The several remedial laws recently considered by Congress recognize the essential facts and agree that the remedy is a new law containing the following provisions, namely, an indeterminate permit irrevocable during fifty years except for cause judicially determined, and continuing thereafter unless and until the federal government either renews its permit on mutually agreeable terms or, for itself or through a new permittee, takes over at their fair value the hydraulic works and certain other parts of the development.

The Engineering Council does not consider itself expert in legal matters and will not undertake to discuss the relative merits of the different plans. It should be pointed out, however, that a hydroelectric enterprise being once successfully established, it is alike to the interest of the owners, of the government and of the public that it should continue indefinitely without interruption. There is no economic reason to be served by a cessation, and the only reasons for providing a legal means of recapturing the installation and the water

rights are, first, to preserve an additional measure of government control against possible abuse by the permittee, and, second, against a remote contingency which might make it desirable that the government would want to use the power for some other purpose.

FIFTY YEARS' GROWTH FIVEFOLD TO TWENTYFOLD

A successful power enterprise at the end of fifty years will have multiplied the capacity of its initial installation many times, variously estimated at from five to twenty. In nearly all cases steam plants as well as water plants are necessary to supplement hydroelectric power at periods of low water and in case of interruption, as well as in some instances to provide increased capacity. Modern practice is rapidly approaching that of providing steam capacity equal to 100 per cent of hydroelectric for the purposes stated.

Continuing growth makes burdensome and usually abortive any attempt to amortize the investment, while the investment in other water powers or in steam plants, or both, interconnected with and generally dependent for their economic operation on the original development, renders the right to recapture that development only very onerous and one which constitutes a serious impediment to the free and full development of an enterprise which is otherwise most desirable from all standpoints. With respect to power sites on the public domain and on navigable streams, the government is in the position of seeking to have its resources developed without assuming any business hazard and without contributing either capital or credit.

It would be unfortunate, in the light of past experience, if any new laws which may be enacted should put the government in the position of bargaining with capital and of offering just sufficient incentive not to induce capital to undertake the developments desired, thereby, while apparently providing a remedy, in reality insuring a continuance of the present undesirable condition. Hydroelectric enterprise must compete with the demands of other industries for capital. Experience has shown that even without the imposition of additional financial burdens many of them are not sufficiently attractive to secure development, and as the attractive prospects grade by imperceptible degrees into the unattractive ones, it is perhaps self-evident that every additional burden, however small, transfers a percentage of such projects from commercial into uncommercial prospects.

It is our belief that the benefits afforded the communities served by cheap power, and to the nation by the conservation of coal resulting from the substitution of a self-renewing for a non-renewable natural resource, are far more valuable than is the exact solution of the question of restricting the returns to capital to their irreducible minimum. The present emergency due to the progress of the war has forcibly illustrated the importance of having developed the greatest possible number of water powers as a source of industrial power supply. As it consumes no fuel, the substitution of water for steam power would release to other uses all the extensive railroad and water facilities now engaged in transporting coal. It would similarly release a corresponding volume of labor now occupied in mining this coal and in operating such transportation agencies as well and the boiler-room forces of the steam-power plants themselves.

STATION & OPERATING PRACTICE

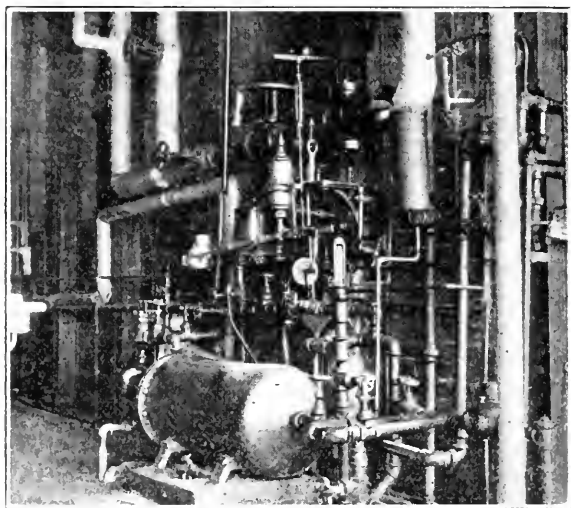
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

RESULTS OBTAINED BY USE OF FUEL-OIL REGULATOR

Supplies Larger Quantity of Fuel Oil to Grates, and by Its Use Oil Is Sprayed Properly and the Draft Is Increased

The Houston Electric Company of Houston, Tex., has recently installed in its plant a device for automatically regulating the amount of fuel oil fed to the furnaces under its boilers. The regulator is arranged to operate with the increasing and decreasing load. In fact, the device is more than merely a fuel regulator. It is an automatic draft, fuel oil and injector-steam regulator which absolutely controls the three essentials to boiler operation when crude oil is used for fuel.

When a sudden load is placed on the main generator of the plant it will naturally cause a drop in the main steam-pressure line. This causes a drop in the steam line which is used for spraying the oil over the grate, as



INSTALLATION OF AUTOMATIC FUEL-OIL REGULATOR

steam for this purpose is obtained through a reducing valve from the main line. This reduction in pressure causes the regulator to function. When this regulator acts, it performs three duties simultaneously: First, it supplies more fuel oil to the grates; second, a greater quantity of steam is released to cause the oil to spray properly, and, third, the draft over the fire is increased. These three operations make the steam come quickly up to standard practice.

The point at which the regulator will function has been selected by adjusting it according to the steam pressure desired and also taking into the account the CO₂ record produced by a Hayes automatic CO₂ recorder. This recorder is interconnected so that it can be used to take readings from any of the four boilers in the boiler room.

An average of the oil consumed from November, 1916, to August, 1917, showed that the plant used 2.1169

lb. of oil per kilowatt-hour. During September, October and November, 1917, since the CO₂ recorder and the automatic regulator have been placed in service, the oil consumption has amounted to 2.010 lb. per kilowatt-hour. These figures show that the automatic operation has effected a saving of 0.1009 lb. of oil per kilowatt-hour. This indicates a saving of 4.95 per cent in the amount of fuel used. Since the company's fuel bill in the average month is \$3,735, it may be seen that the saving effected is 4.95 per cent of \$3,735, or \$184. Since the automatic devices cost only \$390, it will be seen that one will virtually pay for itself at the end of two months.

NOZZLE FOR CLEANING SURFACE CONDENSER TUBES

Description of Outfit Used Which Can Be Operated by One Man—Improvements Over Other Types of Apparatus Used for This Purpose

A simple and efficient nozzle for cleaning surface condenser tubes, which is far more rapid, yet more thorough, than the usual form of rod and brush, may be utilized where air under pressure is available. The cleaning outfit consists essentially of a piece of 1/4-in. (0.6-cm.) pipe bent to shape, a reducer, a 1/2-in. (1.3-cm.) T, a pair of regulating valves and suitable lengths of air and water hose. Air is required under 60 lb. per sq. in. (4.2 kg. per sq. cm.) pressure or more. A check valve should be placed in the air line to obviate any chance of water getting back into the line. The head is taken off at one end of the condenser; at the other end only the hand-hole plates are removed. The nozzle is rapidly moved from tube to tube at the open end, and the dirt, consisting mostly of mud and seaweed, is expelled from the tube by the scouring action of the air and water. After the washing is complete, the ejected mud is scooped out through the hand-holes at the other end of the condenser. By this means one man can clean a 4000-kw., 10,000-sq. ft. (900-sq. m.) surface condenser, containing approximately 3400 15-ft. (4.6 m.) 27 1/8-in. by 3/4-in. (7.3-cm. by 1.9-cm.) tubes, in six hours, not including the time required for removing and replacing the condenser head and plates. The operator must wear a rubber coat and a helmet.

It is stated by the station operators of the San Diego Consolidated Gas & Electric Company, who utilize this form of nozzle, that this method of cleaning is a great labor saver. When the air and water nozzle was first used hollow cylinders of mud and sewage were ejected from many of the tubes, showing the new method to be a decidedly thorough cleanser. It is understood that some central stations use sand blasts for cleaning tubes. With the particular forms of sediment encountered in San Diego, no scale being present, sand appears to be unnecessary, and the wearing action which may result from the use of sand is not experienced.

CHECKING SYNCHROSCOPES FOR USE IN PHASING OUT

Dangers of Crossed Connections Must Be Eliminated—Method of Using Synchroscope for Phasing Out Apparatus

BY C. OTTO VON DANNENBERG

It is an interesting fact that while much valuable and useful information has been published covering various methods of phasing out generators, transformer banks and circuits, there seem to be few actual published data available covering the checking and putting into operation of the synchroscope. The following method is neither new nor original, but the writer does not believe that it has received the publicity and consideration that it merits:

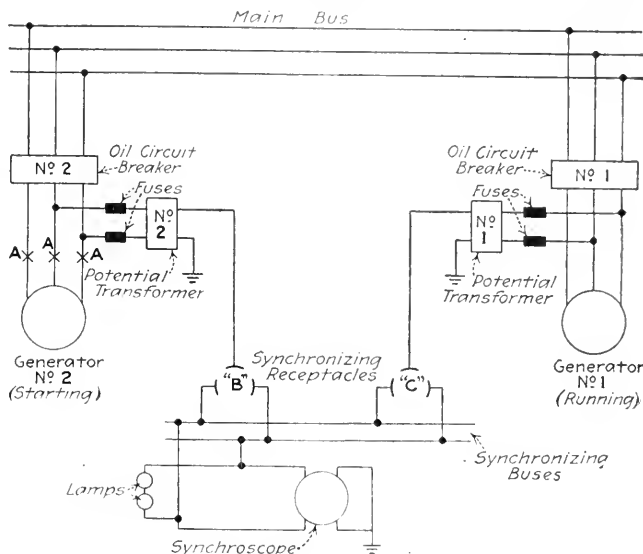
The synchroscope most universally used is of the single-phase type, and, assuming that the connections of the circuits under consideration have been checked, the wiring will be in general as in Fig. 1 for a three-phase circuit. Only the necessary connections under consideration have been indicated, and in this case it is assumed that two three-phase generators are about to be paralleled and that the phase rotation has been found by test to be correct. The generated voltage is assumed to be of such a value as to require the use of potential transformers to step down to the operating voltage of the synchroscope.

With the connections as indicated and the "machine-starting" and "machine-running" plugs inserted in receptacles B and C respectively, it might be assumed in general that the oil circuit breaker of the "starting machine," generator No. 2, could be closed when the lamps were dark and the synchroscope pointer was at rest just over the mark at the upper part or top of its scale. This would be in accordance with the general method in use in the United States. It so happens, however, that it is not an unusual or exceptional occurrence to find potential transformers, even of the same make, with terminals wrongly marked for polarity or leads wrongly brought out of the case, so that the connections of the different transformers would not be symmetrical. This condition would give crossed connections which would cause the lamps to be bright at synchronism and the synchroscope pointer to take a position exactly 180 deg. away from its correct location, so that closing breaker No. 2 with the lamps dark and the pointer at the top of the scale might cause serious damage to either or both generators, or at the least a considerable disturbance on the system, since it is seldom, except in the smallest stations, that one finds generator breakers set for automatic operation.

To obviate any difficulty of such a nature a positive assurance of the correctness of the connections may be obtained by first disconnecting the leads of No. 2 generator at its terminal board, or at a point such as A, and then closing the oil circuit breaker No. 2. The conditions then existing will be the same as at synchronism, and the lamps will be either bright or dark and the synchroscope pointer will assume either an upper or lower position.

If the pointer comes to rest in the lower position and the lamps remain bright and it is desired to have the lamps dark, the leads of the potential transformer of generator No. 2 should be reversed; if, however, it is

pointer of the synchroscope may be loosened on its shaft and shifted to its upper position. The No. 2 generator switch may now be opened, the leads reconnected and the machine put in service. While lamps are nowadays seldom used as a permanent synchronizing arrangement,



SYNCHRONIZING WIRING FOR TWO THREE-PHASE GENERATORS

they are usually an adjunct to a synchroscope, and the method described applies obviously as well when lamps alone are used for this purpose.

INSTALLATION OF MEASURING DEVICES HELPS GOOD FIRING

Recording Pressure Gage Assisted in Removing
Laxity of Firemen, and Orsat Machine
Helps Discover Air Leak

The one 550-hp. and two 410-hp. Edge Moor hand-fired four-pass boilers at the plant of the Iowa Falls (Iowa) Electric Company were being stoked in a more or less haphazard fashion when a new chief engineer was hired. The first thing he did was, in his own language, "to let things go blindly, as they had been going, to get a line on the firemen." This resulted in the discovery that firemen were piling a lot of coal into the furnaces, then sitting down leisurely while the steam ran up to the popping-off point and then dropped back 25 lb. or 30 lb. per square inch (1.75 kg. or 2.1 kg. per sq. cm.). At this stage they would "slug" the fire again. This was the cycle of operations day after day.

This resulted in the installation of a recording steam pressure gage. It required very little encouragement to create a friendly rivalry between shifts to see which could make the best charts. Now these same firemen have become so proficient that, with only an occasional glance at the chart, they keep the pressure range within 5 lb. per square inch (0.35 kg. per sq. cm.), which is very good for hand firing.

When this stage was reached the chief engineer, using a single Orsat machine, decided to look into the condition of the CO₂. The first samples taken from the first pass showed from 5 per cent to 6 per cent, indicating about a 35 per cent loss of fuel. The draft was then cut down over the fires and increased under

CO₂. While accurate draft-measuring instruments were not available, this procedure as a cut-and-try process was continued until the samples of CO₂ showed 13 per cent to 14 per cent and it was possible to carry the peak load without changing the draft. The draft is now about 0.3 in. (0.7 cm.) over the fires.

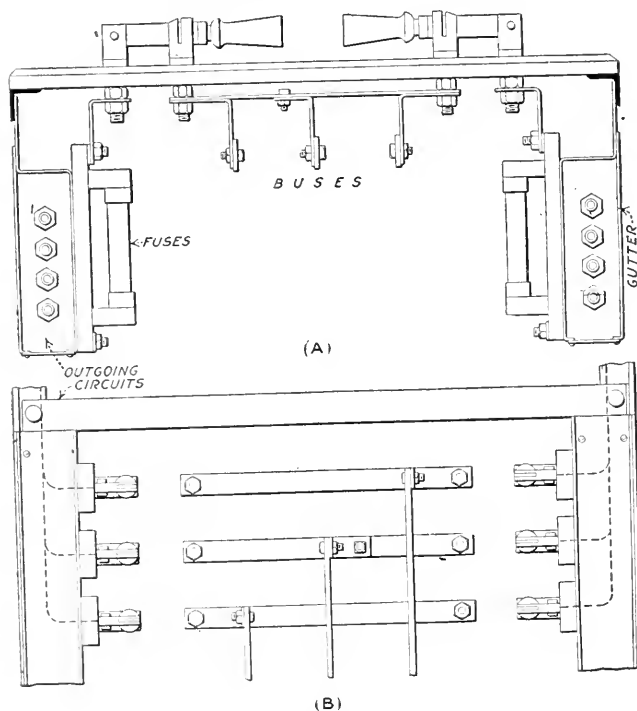
When the first pass showed this much improvement, samples were taken in the last pass. These showed 8 per cent CO₂. Experiments with the third pass gave the same results, showing that the baffling was all right. A search for air leaks was then started, which revealed a bad leak in the header. After this was stopped it was possible to get as high as 15 per cent CO₂. The boilers are now covered with a plastic cement which is very effective in keeping out air. On the whole, the plant is operating much more efficiently, owing to the installation and use of proper measuring instruments.

CONVENIENT ARRANGEMENT OF FUSES ON FEEDER PANELS

Fuses Are Mounted on Boxes Forming Side Inclosures of Rear of Panel—Details of Arrangement

BY H. BURT FOOTE

Considerable waste of space and an unsightly installation have usually been found to result from the design of feeder panels in which bus connections and fuses are a part. On several occasions the writer has found it necessary to design feeder panels for three-phase, 440-volt and 500-volt alternating-current circuits. As a result of some thought and consideration of the requirements the construction shown herewith has been



ARRANGEMENT OF FUSES AND DISTRIBUTION BOXES

worked out. Switches of 600-volt spacing in ratings of 30 amp. and 60 amp. combined with 600-volt fuses usually make an awkward arrangement.

Uniformity in the switches may be secured by using the 100-amp. size with 250-volt spacing, and this is

also permissible for 600 volts alternating current and adaptable to circuits up to 50 hp. This switch possesses enough mechanical strength to adapt it to general use, which is not true of the 30-amp. and 60-amp. size with 600-volt spacing. Placing fuses on the front of a panel increases its size, making additional expense and a waste of space. As ordinarily placed on the back of a panel, they cover a portion of the studs and bus connections, making it difficult to tighten up a loose joint and inconvenient to get access to the outgoing feeders. These difficulties have been overcome, and the fuses are so placed that they bear a direct relation to the switches and that the connection from switch to fuse is reduced to a minimum.

The distribution boxes on which the fuses are mounted are made of sheet metal fastened as shown to the panel supports and forming a side inclosure for the back of the panel. The conduit enters them in a neat manner at top or bottom, and the wires are led direct to the fuse blocks through a bushed hole. Where more than one panel is used the adjacent boxes may be combined in one. The front-connection fuse blocks make them interchangeable for any size of circuit. The busbar construction will be found to be very simple and accessible.

ELECTRIC PUMPING COSTS IN MIDDLE WEST STATE

Bulletin Issued by the Iowa Engineering Experiment Station States that Such Pumping Is Most Economical

According to H. W. Wagner, mechanical and electrical engineer for the Engineering Experiment Station at Ames, Iowa, in bulletin No. 46, entitled "Electric Pumping, with Results of Tests and Operating Records," in most Iowa cities and towns the first cost of municipal waterworks is between \$100 and \$150 per connected service. This report is based upon data and experience obtained in co-operation with the Iowa Section of the N. E. L. A. and many operators of pumping plants.

Many towns with as small a population as 300 to 500 have public waterworks. Only in exceptional cases does the municipality receive sufficient revenue from the sale of water to pay all operating expenses and legitimate fixed charges. A large part of the waterworks investment is due to fire protection. "A careful study and analysis of the average problem," the author states, "indicates that, with a reasonable rate for energy, pumping by electricity results in a lower total of fixed charges and operating expenses than does pumping by any type of engine."

The following is a summary of the information contained in several tables in the bulletin:

	Approximate Average	Approximate Range
Single-stage pumping:		
Daily pumpage, gallons.....	260,000	40,000-1,000,000
Total head or lift, feet.....	155	14-305
Kw.-hr. per 1000 gal. (eighteen plants)	1.08	0.50-1.82
Rate in cents per kw.-hr.....	3.58	1.5-6.0
Double-stage pumping:		
Daily pumpage, gallons.....	66,000	25,000-135,000
Total head or lift, feet.....	300	150-525
Kw.-hr. per 1000 gal. (six plants)...	4.39	1.16-9.00
Rate in cents per kw.-hr.....	3.15	1.7-5.0

The higher costs are in cases of the stage pumping when the air lift is used in the first stage.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

COMMENDABLE FEATURE FOR CENTRAL-STATION PUBLICITY

By Showing the Public the Way to Conserve Fuel
Through Lighting Economy Government's
Cause Is Helped

There seems to be a great opportunity to-day for the central station to emphasize in its publicity matter the service idea and how the electric lighting utilities can and do fit in with the government's war program.



Our Christmas War Message Economize On Electricity

So serious is the coal situation that we ask our clients to help us—and by helping us, to help the Government—by lessening their consumption of electricity.

Electricity is such a blessing,
and costs so little, the temptation
is to be extravagant in its use

If everyone will use only what they actually need,
the total amount saved will be considerable.

And be sure to keep your lamps
clean and in good order that you
may get full measure of service
from the electricity you pay for

United Electric Light Co

EDUCATIONAL PUBLICITY ON HOW TO CONSERVE FUEL THROUGH SAVING IN LIGHT

One of the greatest problems the country now has to face as a result of the war is the coal situation. In this matter the lighting companies have a definite part to play in educating the public to the necessity for economy when it will tend to conserve fuel. It is recognized that a saving in fuel will result from the economical use of electric light.

Particular and concrete ways are open to the utility in this educational publicity. The use of small units in bathrooms, halls, etc., where a high degree of illumination is not required and the use of only such units as are necessary are two such ways. There is a third way

on which considerable emphasis can now rightly be laid, and that is the elimination of the carbon-filament lamp. Using as it does about three times as much energy as the vacuum-type tungsten lamp, its waste of energy is considerable.

A CLASSIFICATION OF KILOWATT-HOUR SALES

Figures of Rochester Company Show the Relative
Percentages of Total Sales Utilized in
Different Types of Load

A classification of kilowatt-hour sales for 1916 has been made by the Rochester (N. Y.) Railway & Light Company, showing the sales to each industry. This classification shows that, aside from the energy sold to railways, which was 35.4 per cent of the total, the largest load was for miscellaneous industrial business, and next was municipal lighting.

BUSINESS CLASSIFICATION OF ROCHESTER COMPANY FOR 1916

Types of Load	Kw.-hr. Sales	Per Cent of Total
Apartment houses.....	405,366	0.337
Residences.....	4,224,457	3.510
Offices.....	710,493	0.590
Department stores.....	405,563	0.337
General corner-store lighting.....	5,937,616	4.925
Drug stores.....	329,214	0.273
Churches.....	251,501	0.209
Public garages.....	1,252,902	1.040
Private garages.....	352,881	0.293
Theaters.....	971,315	0.808
Eleemosynary institutions.....	208,298	0.173
Restaurants.....	644,522	0.535
Saloons.....	1,656,528	1.375
Hotels.....	1,515,226	1.260
Breweries.....	538,563	0.448
Printing establishments.....	824,345	0.685
Clothing manufacturers.....	1,155,358	0.960
Machine shops.....	4,571,574	3.800
Contractors.....	2,622,531	2.180
Cold-storage plants.....	874,144	0.726
Summer resorts.....	49,253	0.041
Bakeries.....	447,102	0.372
Shoe manufacturers.....	969,069	0.805
Candy manufacturers.....	288,886	0.240
Wholesale establishments.....	415,759	0.345
Woodwork.....	243,778	0.202
Manufacturing buildings.....	1,185,667	0.985
Stamping works.....	863,228	0.717
Greenhouses.....	20,411	0.017
Flour mills.....	203,560	0.169
Electric roof signs.....	52,093	0.043
Optical goods.....	2,997,363	2.490
Paper-box manufacturers.....	184,536	0.153
Colleges and private schools.....	76,638	0.064
Elevator service.....	90,396	0.075
Miscellaneous manufacturing businesses.....	10,847,799	9.020
Outside decorative lighting.....	161,509	0.134
Photo manufacturers.....	2,406,554	2.000
Public buildings.....	1,088,733	0.904
Clubs.....	473,873	0.396
Municipal lighting, general fund.....	9,013,204	7.490
Municipal lighting, additional.....	442,410	0.368
Fire boxes.....	118,280	0.098
Railroad corporations.....	4,356,823	3.620
New York State Railways.....	42,585,129	35.400
Electric corporations.....	8,356,188	6.950
Railroad & Lighting Company.....	2,936,802	2.440
	1,116	.....
Total kw.-hr.....	120,328,556	100.00

PUBLIC IS NOW BUYING MORE EXPENSIVE ARTICLES

View Expressed that the Day of Going After the Small Appliance Market Is Past—Selling Sweepers Rather than Flatirons

An interesting point of view on the trend of the electric appliance market is voiced by William J. Barker, vice-president and general manager of the Denver Gas & Electric Company, in the January *Doherty News*. Mr. Barker says:

The day of going after the market for small appliances, like flatirons, is past and the public has been educated to the point where it realizes perfectly the advantages of electricity in the home and consequently is buying the more expensive articles. Sales aggregate a larger sum per sale than ever before. A striking instance is the recent Hoover suction sweeper campaign, during which 510 machines were sold, totaling \$29,896, in a period of one month.

SALES OF WOOD WASTE PAY BILL FOR POWER

Little Rock Company Now to Make Effort to Connect Up Other Plants in Its Territory That Use Waste as Fuel

The Nowlin Lumber Company of Little Rock, Ark., which has an electric power installation of 125 hp. in motors ranging in size from 2 hp. to 30 hp., has just made an interesting statement to the Little Rock Railway & Electric Company. This company has been taking central-station energy for some time. In the past its very large amount of shavings and waste wood had been employed as fuel and there was no prospect of disposing of this by-product advantageously. Recently, however, Mr. Nowlin informed the lighting company that it had been successful in finding a market for this waste and that it is now selling enough of it more than to pay its entire bill for electric power.

On the strength of this the lighting company's commercial department is planning to make a special campaign among all industries which use wood waste or shavings, either partly or entirely, as fuel. The company believes that electric power offers unquestionable advantages in efficiency and naturally feels that it can safely undertake to find a market for the waste as a further inducement.

SELLING PREFERRED STOCK TO THE CITIZENS AT HOME

Portland (Ore.) Company Offers Its Securities to Residents of the Territory That It Serves and Its Own Employees

Under present financial conditions in the principal money markets of the country, the difficulty of securing funds is becoming a more serious matter every day to the utilities. One plan, however, that seems to produce results even when money is particularly tight is that of selling securities to the public in home territory.

Within the past three years a number of companies have tried out this scheme for raising funds, and in every instance, so far as records show, they have been more successful than was anticipated.

During the months of December and January the Pacific Power & Light Company of Portland, Ore., has carried on an active campaign for selling its preferred

stock. The principal reason for this campaign, the company states, is to secure a greater distribution of stock among residents of the territories it serves and its employees. It says:

The interest of our customers and the employees of the company is mutual. Our growth and welfare is closely interwoven with the advancement of each and every one of the communities we serve. Each customer who is a stockholder, we believe, will take a more active interest in our company, and it is this interest that every large company wants and must have to be a success.

For a given amount of stock, a large number of holders are desired in preference to a few large stockholders. The importance of making this campaign is great. Every employee, whether in the office, a lineman, a meterman or a power-department man, we hope will do all within his power to do his part in actually selling the stock.

LARGE INCREASE IN USE OF ELECTRIC APPLIANCES

Shortage of Domestic Labor and Higher Wages Are the Important Factors in Bringing This About

During the year just closed the sale of electric domestic appliances showed a tremendous advance. Almost all utilities found it easier to sell these goods in 1917 than ever before, in spite of the higher prices. It is well known that the manufacturers enjoyed a much increased business.

There are a number of factors that have entered into this situation. The greatest probably was the growing scarcity of domestic labor. Many households found that it was virtually impossible to secure help, while, owing to the high wages demanded, others found it to be too expensive. Another factor in the increased purchase of appliances has been the better earnings received by the wage earners generally.

In this connection a few reports from the Byllesby utility companies are of interest, as follows:

A total of 13,545 electrical appliances were placed on the Minneapolis General Electric Company's lines during the period from Jan. 1 to Nov. 1, 1917. Electric flatirons were the most popular of all devices sold, the total numbering 4601. Electric vacuum cleaners were next, the total being 3091. The other appliances in the order of number of sales ranged as follows: Toasters, 987; washing machines, 612; heating pads, 401; grills, 384; curling irons, 343; percolators, 324; ranges, 223; air heaters, 214; vibrators, 154; water heaters, 138; luminous radiators, 96; chafing dishes, 85; hot plates, 84; miscellaneous, 1807.

The compilation is interesting also from the standpoint of showing which months were the most popular appliance months. It indicates that May and September for 1917 at least were the heaviest ones in this respect, although August and November follow closely. January was the poorest month for appliance sales, owing no doubt to the fact that this month follows immediately after the holiday appliance campaign.

Without any special effort the Oklahoma Gas & Electric Company and the dealers of Oklahoma City were successful in selling 855 electric household appliances during the months of September, October and November. The list includes the following: Vacuum cleaners, 305; flatirons, 240; heaters, 91; curling irons, 48; toasters, 35; grills, 35; washing machines, 25; percolators, 24; heating pads, 18; sewing-machine motors, 15; water heaters, 10; fans, 9.

At San Diego, Cal., 3734 appliances were sold in the first ten months of the year. At Mobile, Ala., 1311 were sold in the same period. At Louisville, Ky., 3222 were sold. At Stockton, Cal., 2406 were placed on the company's lines through combined efforts of the company and the dealers.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Rational Theory of Closed Windings.—A. ILIOVICI.—A study of the theory of drum windings independently of ring windings, containing simple formulas and a new presentation of the subject applicable to all sorts of windings.—*Revue Générale de l'Electricité*, Dec. 1, 1917. (Abstracted from the *Bulletin de la Société Internationale des Electriciens*.)

The Electrical Generating Plant of Larderello.—P. GINORI-CONTI (*Elettrotecnica*, Sept. 15 and Sept. 25, 1917).—This plant utilizes the natural heat of volcanic steam jets for heating steam-generating boilers driving turbo-electric generators. The energy generated by this installation is furnished to the principal electricity-distributing companies of Tuscany. The favorable results obtained have encouraged the proprietors of the "soffioni," as the volcanic steam jets are called, to extend them. Investigations are being made for this purpose, the direct application of the natural steam to the driving turbines having been decided on. Many illustrations and numerous details of construction are contained in the article.—*Science Abstracts*, Section B, Nov. 30, 1917.

Lamps and Lighting

Control of Lighting.—By an order dated Dec. 24 the Ministry of Munitions has obtained extensive powers with regard to the control of lighting. The ministry may, "with a view to maintaining or increasing the supply of light, heat or power for the purpose of production, repair or transport of war material, or any other work necessary for the successful prosecution of the war, by order direct that lights of any specified class or description shall be extinguished or their use restricted to such extent, between such hours, within such area on such premises, and during such period, as may be specified in the order, and if any person having control of any light or occupying, or having control of, or managing, or being in charge of premises in or in connection with which any light is used, acts in contravention of any such order, he shall be guilty of a summary offence against these regulations."—*London Electrician*, Jan. 4, 1918.

Ideals and Near-Ideals in Lighting Units.—HAROLD W. BROWN.—The author brings out some of the important features which should be embodied in lamps and reflectors. Among them are amount of light, distribution of light, invisibility of the filament or other source, diffusion of light, diffusion of illumination, color of light, low cost of the unit, efficiency of the unit, durability of the unit and ease of cleaning.—*National Electrical Contractor*, January, 1918.

Historical Lighting of Independence Square, Philadelphia.—E. F. KINGSBURY.—The paper describes the new historical lighting recently installed in Independence Square. The units are described in detail and several photographs of different units are shown. Con-

siderable material of historical and educational interest is included, descriptive of early lighting installations in Philadelphia after which the equipments were copied.—*Transactions of Illuminating Engineering Society*, Dec. 31, 1917.

Generation, Transmission and Distribution

Determining Stray Power of a Transmission Line.—D. D. EWING.—In transmission lines operating at very high voltages, 60,000 or higher, losses over the insulators and through the atmosphere assume formidable proportions. These losses, or rather the cost of mitigating them, form a considerable factor in limiting the voltage. At high altitudes the loss is very serious, owing to the rarefaction of the air, which loses its insulating properties at low pressure. In this article the author presents the results of some studies conducted on an electric railway line in the Middle West. With the comparatively low voltage of 33,000 volts used on the line tested, the leakage losses are not serious, but the results clearly illustrate the principles involved.—*Electric Railway Journal*, Jan. 12, 1918.

Steam Turbines.—A symposium which describes different types and classifications of turbines, including vertical, horizontal, single-flow and double-flow, bleeder, mixed-pressure, exhaust and reversing turbines. Piping systems for various turbine arrangements, determination of proper sizes and shapes of turbine nozzles, blading, turbine wheels, blade rings, governors, cylinders and foundations are taken up. The effects of variation in steam pressure, superheat, vacuum and size upon economy of steam turbines are also discussed.—*Power Plant Engineering*, Jan. 1, 1918.

Air Pumps and Condensers.—A new application of the steam jet to vacuum production has recently been suggested by D. B. Morison. From the experiments carried out it appears that if a 25-in. or 26-in. (63.5-cm. or 66.0-cm.) vacuum will satisfy requirements, this can be obtained more cheaply and maintained more certainly by the use of auxiliary steam jets than in any other way. By interposing steam jets between the condenser and the pump, these jets, which, as is well known, have a great volumetric capacity, compress the air into the pump suction, so that a large weight of air can be abstracted with a very moderate pump displacement. The great advantage of this in the present shortage of brass and other copper alloys lies in the fact that the amount of cooling surface in the condenser can be reduced 20 per cent to 25 per cent without loss of vacuum, and the air pumps may also be much smaller than is called for in ordinary standard practice.—*London Engineering*, Dec. 21, 1917.

The Aluminum Transformer.—M. VIDMAR (*Elettrotechnik u. Maschinenbau*, July 8, 1917).—Scarcity of copper has led to the construction of transformers with aluminum windings, but the author contends that it is possible even in normal times to build air-cooled trans-

formers cheaper and lighter if aluminum be employed instead of copper. The ratio of the prices of insulated aluminum and copper wire is taken as 1.4:1.0. In the most economical design of transformer with copper windings it is necessary to leave considerable spaces between the coils in order to obtain adequate cooling. When aluminum windings are used this space can be conveniently reduced without prejudice to the temperature rise. Owing to the relatively greater proportion of the cross-section of the coils which is occupied by metal, the difference between internal and external temperatures is less with aluminum windings than with copper. The difficulty of making joints in the winding is rather serious. An example of an aluminum design is given—a 100-kva. transformer which has been built by the author.—*Science Abstracts*, Section B, Nov. 30, 1917.

Installations, Systems and Appliances

Power-Plant Installations for By-product Coke-Oven Plants.—GEORGE B. EVANS.—Factors taken into consideration when designing the power plant for the St. Louis By-product Coke Plant. The author calls attention to the types of drive and control desirable for such plants and the purposes for which steam is required. Three methods of securing the energy for operating such a plant are discussed and reasons are given for selecting the equipment used in the St. Louis plant. The electrical and steam demands on this plant are tabulated, the latter indicating that the cost of the power house would not have been much less if no electrical machinery had been installed.—*Journal of the Engineers' Club of St. Louis*, November-December, 1917.

Condenser for Power Circuits.—Description of commercial method of making static condensers for power circuits. It is said that the losses in these condensers are only about 0.3 per cent. For any particular frequency the capacity required to give a definite output in kva. varies inversely as the square of the voltage. At very low pressures—that is, less than 660 volts—the kva. output can be increased by using inductances in series with the condensers, thus increasing the pressure across them. In one case cited, furnishing 100 leading kva. to a 200-volt circuit at 50 cycles, 64 per cent less capacity is required by inserting inductances raising the voltage across the condensers to 550 volts. A chart is included indicating the amount of capacity required per kilowatt of load to raise the power factor from any value to any other value.—*London Electrician*, Jan. 4, 1918.

The Modern Cargo Crane.—CLAUDE M. TOPLIS.—The relative advantages of the electric, steam and hydraulic types of crane are first outlined and typical designs are briefly given. For the handling of cargoes speed is of first importance, and therefore this desideratum should be borne in mind in the equipment that is provided. Details are described for giving the various motions—hoisting, slewing and luffing—and reference is made to the wear of ropes.—*London Electrician*, Dec. 14, 1917.

Power-Plant Instruments as an Investment.—M. A. SALLER.—Seventh installment of a series on this subject. This particular article dwells on the benefits to be derived from the use of steam-flow meters.—*Power Plant Engineering*, Jan. 15, 1918.

Wires, Wiring and Conduits

Determination of Size of Wire for a Lighting Circuit.—HAROLD W. BROWN.—The author points out that it should be remembered that three matters are to be considered with reference to determining the best sizes of electrical conductors, unless past experience has shown that some of them can be omitted: (1) The wires should be strong enough for safety to life and property; (2) they should be of such size that the total annual expenses chargeable to the line are not excessive; (3) they should be large enough so that the line drop is not excessive. The author gives a simple method for finding the best size wire to use, taking into account the three above points.—*National Electrical Contractor*, January, 1918.

Electrophysics and Magnetism

Electrometallic Influences Exerted Across Very Thin Insulating Substances.—EDOUARD BRANLY.—A paper read before the Académie des Sciences recounting experiments made with a leaf of mica between 0.004 mm. and 0.005 mm. in thickness, where the lower disks were of pure silver and the upper disks in three different experiments were respectively of pure silver, of platinum of 32 mm. diameter, and of cobalt. The author concludes by saying that if unipolar conductivity does not in itself have much theoretical interest, it leads to the knowledge that metallic surfaces of different natures placed opposite each other exercise a specific exterior influence upon the intermediary substances under the influence of even a feeble emf. at distances great enough to be measured directly.—*Revue Générale de l'Electricité*, Dec. 15, 1917 (abstracted from *Comptes Rendus des Séances de l'Académie des Sciences*).

A Graphical Method for the Construction of Electrostatic Fields.—SYLVAN J. CROOKER.—A graphical method is explained which permits the construction of any electric field, or the solution of La Place's differential equation. As an example, the field for a thin wire strung through a circular hole in an infinite plane is given. This field is representable by $w = \cosh Z$.—*Journal of the Franklin Institute*, January, 1918.

Wet Condenser Suitable for Continuous High-Potential Service.—One-liter Pyrex glass beakers containing a nearly saturated solution of common salt were immersed to a similar depth in a solution contained in an earthen vessel. The place subjected to greatest danger of puncture and that which allows greatest leakage is where the exposed surfaces of the solution inside and out come in contact with the surface of the beakers. The effect can be reduced considerably by filling the beakers to a slightly different level from that of their containers. Care should be taken not to wet the portion of the beaker that is not immersed. To eliminate sparking the surfaces of the solution inside the beakers and that surrounding the beakers were covered with a layer of oil 5 cm. deep. For this purpose a 300-deg. mineral seal oil was used. The capacity of these condensers was estimated at 0.0092 mfd. A similar estimation of the capacity of two such beakers covered with tinfoil indicated that their combined capacity was very appreciably less than two beakers of the wet condenser. The capacities were 10 per cent higher using mercury than when using the salt solution.—*Science*, Jan. 4, 1918.

Units, Measurements and Instruments

Electrical Resistance of the Human Body.—Results obtained from measuring the resistance of the human body to electric currents vary from 500 ohms to 8000 ohms and even more. According to a note by Dr. Nixdorf of Berlin, appearing originally in *Elektrizität* of that city, these enormous differences are due to the employment of defective methods. When an excessive continuous voltage is used muscular contractions and nervous excitations ensue which falsify conclusions. Experiments made by Dr. Nixdorf and Professor Brandenburg have brought consistent results. They used both direct and alternating current—in the first case at 1 millivolt, corresponding to the action of the heart; in the second case replacing the slide-wire of a Wheatstone bridge by a trough filled with a solution of sulphate of zinc. The subject plunged his arms or his legs into salt water at the temperature of the human body and resistance was measured between the arms, between the legs and between one arm and one leg, the experiments being repeated after two weeks' time. The results are tabulated as follows:

	RESISTANCE TO DIRECT CURRENT, OHMS		RESISTANCE TO ALTERNATING CURRENT, OHMS	
	Arm to Arm	Leg to Leg	Arm to Arm	Leg to Leg
Healthy countryman (59 years)	1100	1400	233	350
Woman with nervous malady.....	1000	1200	255	455
Diabetic patient.....	1500	1700	284	434
Man (65 years) while in attack....	2000	3100	224	414
Man with softening of brain.....	1800	2800	299	414
Ditto.....	1400	1400	270	480

When the subject was apprehensive the resistance, measured with direct current, was found to be greater than when he was tranquil, 1700 ohms from arm to arm and 1500 ohms from leg to leg being recorded in the first state and 1000 ohms from arm to arm and 1200 ohms from leg to leg in the second state.—*Revue Générale de l'Electricité*, Dec. 1, 1917.

Standardizing Methods of a Modern Utility.—WILLIAM F. JOHNSON.—Description of the testing facilities of the Philadelphia Electric Company's standardizing laboratory. The policy followed in conducting tests is outlined.—*Journal of the Engineers' Club of Philadelphia*, January, 1918.

Telegraphy, Telephony and Signals

New Results on Testing Telephone-Switchboard Cables.—F. LANGE (*Elektrotechnische Zeitschrift*, Sept. 6, 1917; communication from the German Telegraphs Experiment Station).—With regard to the design of cotton and silk cable, two points especially need to be considered: (1) Limitation of space, (2) absorption of moisture by the insulating material. The first is met by making the cables flat and ribbon-shaped. In connection with the second, twin leads of 0.6, 0.5 and 0.8 mm. section, having capacities in the ratios 1:0.82:1.62, showed leakage in the proportion 1:0.72:2.1. Cable soaked in beeswax was very much less influenced by atmospheric moisture than any of the other cables tested; the core had been insulated in the

usual manner, dried in vacuum and plunged into hot beeswax, the whole being covered with cotton braiding.—*Science Abstracts*, Section B, Nov. 30, 1917.

Miscellaneous

Notes on the Electric Equipment of Machinery for the Handling of Materials.—Continuation of an article on the same subject. In this part a number of points are discussed in regard to what may be termed the details of electrical equipment. These include motors, speed regulations, electric braking, controllers, resistors and switchgears.—*London Electrician*, Jan. 4, 1918.

Hydroelectric Energy as a Conserver of Oil.—H. F. JACKSON and F. EMERSON HOAR.—Possibilities of further conservation of California petroleum by the more extensive and efficient utilization of hydroelectric energy that can be made available by the interconnection of the more important transmission systems.—*General Electric Review*, January, 1918.

Life of Impregnated Wooden Poles.—F. MOLL.—An article giving the results of treating wooden poles as they have been worked out in Europe and America during many years. The average life of treated poles, according to the statistics of the telegraph administrations, follows: Unprotected poles, five to seven years; poles covered with a coat of carbolineum, six to eight years; poles impregnated with chloride of zinc, twelve years; poles impregnated by the Boucherie process (sulphate of copper), fourteen to fifteen years; poles impregnated with sublimate (cyanization), seventeen years; poles impregnated with oil of goudron, twenty-three to twenty-five years.—*Revue Générale de l'Electricité*, Nov. 24, 1917.

Book Review

EMPIRICAL FORMULAS. By Theodore R. Running. New York: John Wiley & Sons, Inc. 144 pages, illustrated. Price, \$1.40.

The subject of empirical formulas is not of great importance in pure mathematics, and perhaps that is why its literature has never been greatly developed. In applied mathematics generally, and in engineering particularly, empirical formulas are often very important, because when a graphical relation has been established between two or more physical quantities it often becomes very desirable to discover what laws may be represented by that relation. A step in the process of discovery may be the determination of an empirical formula applying to the case. The author has made a distinct contribution to this important subject, especially from the standpoint of technology. The subject matter is divided into eight main chapters relating to topics that may be expressed as follow: Arithmetical series, arithmetical-series exponentials, geometrical series, special series, periodic series, least squares, interpolation, integration. The order of development is clear and logical. The text is abundantly illustrated by curves and graphs, which lend great assistance in the comprehension of the subject matter. The book will be found to be of very considerable value not only to the practising engineer and to engineering and technical students but also to all mathematically trained observers interested in its subject.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

CONFERENCE CLUB TALKS ON ADJUSTMENT OF WAGES

"Adjust Wages Periodically on Basis of 'Index Numbers' Showing Increase in Cost of Living,"
Proposed by L. K. Comstock

The Conference Club, the organization of the large electrical contractors doing an interstate business, met at Asheville, N. C., on Jan. 17 to 19. The feature of the program was an epochal paper on a plan for the automatic adjustment of the wages of labor by L. K. Comstock of L. K. Comstock & Company, New York.

Mr. Comstock's proposal related to the periodic adjustment of wages on the basis of the "index numbers" compiled by various authorities showing the rise in the prices of commodities that make up the cost of living. Mr. Comstock presented curves illustrating the close agreement of the index numbers, covering the last eighteen years, variously and separately compiled by Bradstreet, Dun, Gibson and the Department of Labor.

Assuming that three-quarters of the wage earner's outlay for the necessities of food, clothing and shelter follows the trend of these index numbers, Mr. Comstock suggested that if, for example, the accepted index number for April 1, 1917, was 190 and it rose to 220 by Oct. 1, 1917, an increase of 15 per cent, a corresponding increase should be granted on three-quarters of a given worker's wage.

Thus an electrical worker receiving \$5.20 a day April 1, 1917, would be entitled to an increase of 15 per cent on three-quarters of \$5.20 (\$3.90), or a cash increase of 60 cents a day, making his readjusted wage as of Oct. 1, 1917, \$5.80 a day. Such adjustment would preserve his relative earnings unchanged, compared with the rising cost of living.

Such a plan of adjusting wages has the merit of immediate practicability, declared Mr. Comstock. For years the United States Department of Labor has compiled and published an index number which would serve every purpose, while having the stamp of authority. The plan might be started by arbitrarily accepting wages now prevailing in each locality as the local base rate.

EMPLOYER AND MECHANIC NEED EACH OTHER

Mr. Comstock's proposal for scientific wage adjustment was introduced by a comprehensive review of the conditions surrounding the relation of employers and labor. He urged that both employer and mechanic frankly admit that neither can get along without the other and asked that, making a virtue of necessity, the employer study sympathetically the needs and requirements of his men, and likewise that the union see to it that its men work faithfully and sympathetically for their employers.

E. E. Van Cleef of L. K. Comstock & Company, Chicago, read a paper on "Co-operation with Labor."

He urged franker confidence between employer and mechanic, in the knowledge that their larger interests are identical. Mr. Van Cleef declared that much of the destructive "cheap" competition suffered by the reputable contractor would be avoided if electrical unions recognized that their best interests are served when electrical labor is secured through the electrical contractor. He urged further that the unions aid in correcting the situation by opening their doors to non-union workers who apply.

William L. Goodwin, New York, spoke on the desirability that the electrical contractors take trade acceptances from customers as well as give them in payment of purchases. Giving trade acceptances is evidence of ability to pay, said Mr. Goodwin, and he urged particularly that the strong companies put the acceptance plan into operation at once, even partially.

CONSTRUCTION CANTONMENT SITUATION IN WASHINGTON

The construction contract situation in Washington was presented in a report by Sullivan W. Jones.

It was shown that the lack of uniformity in these policies, the absence of co-ordination of departmental activities, the efforts of departments to preserve their prerogatives, the inherited prejudice against exchange of opinion and data between departments, had led to the overlapping of programs, confusion, congestion in the material market and delay. This phase of the situation was developed quite fully, although, as Mr. Jones said, many of the Conference Club members were familiar with it, because it suggested its own cure—the centralization of control and the adoption of a uniform policy.

The order issued by the Secretary of War on Nov. 5 transferring the control of all army construction work to the cantonment division of the Quartermaster's Department and the appointment of General Goethals as acting quartermaster general were pointed to as steps taken to effect such centralization. The belief was expressed that the government must and would undertake shortly the purchase of all materials required, in order to provide scientific distribution of work and fullest utilization of all forces of production.

The contractor, Mr. Jones stated, is an instrument of production, and the application of the same policy of control to the actual work of construction would unquestionably lead to a change in relations between the government and the contractor. It was prophesied that the time is not far distant, if the war continues, when the contractor as well as the manufacturer will come under government control and will be employed as an expert in a professional capacity for a stipulated fee, which would probably have no relation to the cost of the work.

L. K. Comstock was re-elected president of the Conference Club, W. C. Peet was re-elected treasurer, and Sullivan W. Jones was appointed secretary.

CONTRACTORS' ORGANIZATION IS LAUNCHED IN ST. LOUIS

W. C. Peet Is Elected First President of the New National Association of Electrical Contractors and Dealers

Representing twenty-two state associations of electrical contractors which adopted the plan of organization approved at the New Orleans national convention last October, members of the executive committee of the new National Association of Electrical Contractors and Dealers met at St. Louis on Tuesday, Jan. 22, and formally launched the organization.

Past-president Robley S. Stearnes, New Orleans, was elected temporary chairman, and after submitting his presidential report with suggestions for the new association in 1918 he appointed a nominating committee headed by J. A. Fowler, Memphis.

Reporting later in the day, Chairman Fowler paid a



PRESIDENT W. C. PEET

tribute to the untiring efforts and personal sacrifices of President Stearnes in bringing the association through the reorganization period, but declared the belief of the nominating committee that it would be necessary to choose a 1918 executive from New York City, the center of activity of other branches of the electrical industry with which the contractors will have to work. The nominations of the committee were:

President, W. C. Peet, New York; treasurer, Earnest McCleary, Detroit; secretary, Harry C. Brown. These officers were unanimously elected later.

On motion of Fred Adams, St. Louis, it was voted to move the association offices temporarily to New York in order that the president and secretary might work to closer advantage during the organization period. Authority was also given to hire an assistant secretary to handle routine work, leaving Secretary Brown free for broader executive duties in initiating a great membership campaign.

At the banquet tendered the executive committee by the St. Louis contractors J. A. Fowler acted as toastmaster, and there were addresses by W. L. Goodwin, James R. Strong, Earnest McCleary, Robley S. Stearnes and Chairman-elect W. C. Peet.

W. Creighton Peet, the new national chairman, is a well-known electrical contracting engineer of New York City. Born in New Orleans in 1871, he was educated at the Massachusetts Institute of Technology, later taking diplomas from Heidelberg and Darmstadt. He carried on engineering work for Schuckert & Company, Nuremberg, and, returning to America, joined the engineering staff of the American Telephone & Telegraph Company. Later, with Mr. Powers, he formed the electrical contracting firm of Peet & Powers, which handles large electrical construction work. Mr. Peet is also treasurer of the Conference Club and of the Institute of Electrical Contractors of New York City and has been the representative of the National Contractors' Association on the National Electrical Code committee.

WORK OF MANUFACTURERS OF WIRE AND CABLE IN WAR

Co-operating to the Fullest Degree to Meet the War Requirements of the National Government in Quick Time

A dinner-meeting of the wire and cable manufacturers who are co-operating in war service work for the government was held at the Yale Club, New York, on Jan. 17. Sixty-two men were present. The list of companies represented comprised forty-six properties in different parts of the country, and all are available for work for the government in prosecuting the war.

The large movement to further the war which culminated in this meeting had its beginning with the organization of the wire and cable committee as an outgrowth of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies. Le Roy Clark, Safety Insulated Wire & Cable Company, who presided at the meeting on Jan. 17, is the chairman of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies and became in turn the chairman of the wire and cable committee and then of the wire and cable group which has now been formed in connection with the General War Service Committee of the Electrical Manufacturing Industry.

The organization which is now being carried intensively into every branch of the electrical manufacturing industry will, it is hoped, include all manufacturers without regard to whether or not they are members of the associations in the industry.

Mr. Clark explained the purpose of the organization to serve the government by providing necessary manufacturing capacity to meet requirements of the federal authorities in the quickest possible time. Complete co-ordination and patriotic co-operation are yielding the results desired by the Washington authorities. The wire and cable group has already been instrumental in supplying millions of feet of the various kinds of cable and wire requested by the government.

Robert K. Sheppard, Simplex Wire & Cable Company, chairman of the General War Service Committee of the Electrical Manufacturing Industry, made a stirring patriotic address and showed clearly how the organization of manufacturers in the national interest is an effective and necessary part in the prosecution of the war to a successful peace.

Thorough sympathy with the objects outlined was expressed by others present.

General Compliance with Garfield Order

Regulation Designed to Relieve Railroad Congestion Causes Sharp Curtailment of Power Consumption and Some Saving of Fuel—Reports from Central Stations Show Necessity of Drastic Action in Some Cases

LACK of co-ordination in the work of the Fuel Administration and of the Director General of the Railroads has made it impossible to realize great saving from the order of Dr. Garfield.

It develops from interviews with the Fuel Administration that the chief purpose of the order was to relieve congestion on the railroads. Industries supplied with electrical energy generated from water power were shut down for the purpose of curtailing production which might add to the already serious freight congestion. Yet freight kept piling up from points west of the Mississippi, so that the congestion at this writing is as bad as ever. While it is true that shipping in New York Harbor received some coal, the scarcity because of lack of motive power on the part of the railroads coupled with adverse weather conditions is more acute.

At the end of the five-day restriction period no official could say on Wednesday just what were the effects of the industrial shutdown except that it had got coal to seaboard for ships. On Tuesday night the Fuel Administrator requested an embargo on all freight except food and fuel for the remainder of the week so as to obtain the maximum good from his previous order, and on Wednesday Director McAdoo issued the following statement:

On account of the extremely severe weather, which has particularly affected operations of railroads crossing the Alleghany Mountains, Director General McAdoo, upon the recommendation of Regional Director Smith, has authorized him to place an embargo upon all freight except food, fuel and such war munitions and war supplies as are specifically approved by the War Department upon the Pennsylvania Lines east of Pittsburgh, the Baltimore & Ohio east of the Ohio River, and the Philadelphia & Reading, for the purpose of enabling these lines, which are the heaviest bituminous coal carriers, to continue specializing upon coal for the double purpose of supplying the acute conditions in New England and the harbor of New York and elsewhere and in the provision of empty cars for mines and coke ovens. This embargo is a temporary one. It should last but a few days if the weather moderates.

It will be noted that the length of time the embargo is to be in force is indefinite, depending on the weather.

Reports to the ELECTRICAL WORLD from different parts of the country show that the percentage of curtailment in power consumption varied widely in individual properties. In many cases the sharp reduction on the first day was modified on succeeding days as more and more industries were exempt. The effect of the order was to bring relief to various central stations in which drastic action had become necessary.

Many electrical manufacturing companies engaged in war work were exempt in whole or in part.

The reports to the ELECTRICAL WORLD of central station conditions follow:

APPALACHIAN POWER COMPANY

The effect of the order of the Fuel Administration is to reduce our output approximately 20 per cent. The reason that we are not more affected by the order is that the

majority of our load is consumed in the mining of coal, the mines, of course, being operated as near full capacity as possible in so far as the labor and car supply will permit.

HYDRAULIC POWER COMPANY, NIAGARA FALLS

Practically all Niagara Falls plants are operated entirely by hydroelectric power, except a few that use coal for purposes of drying product, and it is apparent that continuous twenty-four-hour operation of plants on water-power systems will aid conservation of coal.

Our estimate of work shut down here on account of the Fuel Administrator's order is not in excess of 10 per cent.

We believe this to be a grand and absolute demonstration of the superiority of hydroelectric power over coal power in that it does not make demands on the transportation systems of the country in times of crises similar to the present one.

PENNSYLVANIA WATER & POWER COMPANY, BALTIMORE, MD.

The Pennsylvania Water & Power Company, being engaged only in the generation and high-tension transmission of hydroelectric energy, is not affected, as an operating company proper, by the recent order of the Fuel Administrator.

The Pennsylvania Water & Power Company supplies through independent local distribution companies the larger portion of the electric railway, lighting and power requirements of the cities of Baltimore, Md., and Lancaster, Pa., and their vicinities. The remaining portion of the Baltimore load requirements, which is supplied by steam, comes within the scope of the Fuel Administrator's order.

Present indications are that the power reduction of the combined system is approximately 15 per cent during the day. We expect that the cities of Baltimore and Lancaster, being two of the few cities in the East connected with a large hydroelectric system, will continue to be much less affected by present or future orders for restriction.

NIAGARA FALLS POWER COMPANY

Practically all of our output is delivered to public utilities and to electrochemical and electrometallurgical industries operating continuous processes, whose plants or their contents would be damaged by shutting down. We understand that customers are observing the Fuel Administration order and are either discontinuing or curtailing to the lowest limit the use of fuel for heating and other incidental purposes. The demand for our output is so great that any power whose use is discontinued is immediately taken up elsewhere. The order, therefore, has no effect on the quantity of our output, although it may have a very slight effect on the distribution thereof.

TENNESSEE POWER COMPANY

There are quite a number of textile mills operated by our power. These mills require heat for dyeing stock and for heating buildings. Some of them have shut down. Others are burning wood for such heat under temporary authority of the State Fuel Administrator; others are heating their building to approximately 40 deg. in order to avoid freezing, as permitted by general order, and allowing help to work or not as they see fit at this temperature.

Foundries are practically out of business, and other manufacturing is either partially running or wholly shut down, so that it is utterly impossible for us to make any intelligent estimate as to the effect on our system. We, of course, expect a considerable reduction in load during both the five-day and the ten Monday periods, but it is impossible to tell what this will be.

DETROIT EDISON COMPANY

Effect of the Fuel Administration order is to cut our daily output approximately 500,000 kw.-hr., or say 23 per

nt of output on week days except Saturdays. Fuel saving approximately 500 tons per day.

DAYTON (OHIO) POWER & LIGHT COMPANY

Effect of Fuel Administrator's order reduced load on generating stations approximately 60 per cent on Friday and Saturday, with slightly increased load on Monday.

CLEVELAND ELECTRIC ILLUMINATING COMPANY

Situation from our standpoint demanded drastic action. First day's order reduced load 50 per cent.

ROCHESTER RAILWAY & LIGHT COMPANY

As a result of the fuel order we are saving about 250 tons of steam coal per day in our electric plant and approximately 50 tons of coal and 2500 gal. of oil in our gas plant. The order is being lived up to in a way which is commend-

factories that formerly used electric power were not running.

MILWAUKEE ELECTRIC RAILWAY & LIGHT CO.

The order of the Fuel Administrator has caused a reduction in our power load of approximately two-thirds, but has had no noticeable effect on our lighting load. Reduction in railway load is very small. The operation of the order will cause a substantial decrease in gross revenues, with the only offsetting reduction in operating expenses represented by coal equivalent to the kilowatt-hours saved. The effect on net income will be serious. Measured in this way, the cost of saving the coal will exceed its value.

EDISON LIGHT & POWER COMPANY, YORK, PA.

There was a marked decrease in our output for the five days, and particularly on Monday. During the period we were able to operate on water power entirely, the only fuel used being that required for our steam-heating system. We have not benefited in the distribution of coal, but hope that the effect of the order in partially relieving the railroad congestion will result in a general improvement and at least prevent a complete tie-up.

WHEELING (W. VA.) ELECTRIC COMPANY

We will naturally suffer some loss of revenue, but as fuel conditions were getting desperate (in fact, we were anticipating daily the necessity of cutting off our power customers) the order worked to our advantage, permitting the storage of some fuel, which has not been done for two months, our storage being completely exhausted.

A number of our large power customers were permitted to operate, and in addition to these we are furnishing power for thirty coal mines, which, of course, are working.

Our power load loss for the days affected by the order will be about 50 per cent, but in the end we estimate that the loss will not be nearly so large because we believe the railroad situation will be relieved, permitting a number of our works to operate full, while at present some of them are closed down and others are working part time on account of their inability to get raw material in and finished products out.

The coal mines we are supplying power to are located in Ohio, which accounts for the difficulty of getting fuel from them. We do not have a shortage of fuel mined in this vicinity. The railroad sidings are full of coal. Hundreds of cars can be found on the railroad sidings that have not been moved for days and in some cases weeks.

American Citizens Will Obey the Order

Because hospitals, charitable institutions, municipal lighting, etc., are not affected by this order, gas, electricity and steam will be on our lines as heretofore. If you are in doubt as to how the order affects your business, phone "Bell, Main 3060, or Home, Stone 3060" and ask for any of the following representatives of this company:

R. M. SEARLE	E. L. WILDER
J. T. HUTCHINGS	J. P. MacSWEENEY
H. RUSSELL	E. C. SCOBELL
T. H. YAWGER	F. W. FISHER
I. LUNDGAARD	C. A. TUCKER
	C. G. DURFEE

Any of these men will gladly conserve your time by securing for you a ruling from the local fuel administrator.

Orders for the shutting off of light, heat or or power resulting from failure to obey the new order will be executed promptly by this Company.

Our Attitude

The order has been issued to relieve present suffering and prevent still greater distress. These conditions have been brought about by the war which must be won.

The order means financial loss to all—This is our opportunity to prove that we are first of all American Citizens.

Let's Do Our Duty Cheerfully

HOW THE ROCHESTER COMPANY TOLD THE PUBLIC

able to the citizens of Rochester and, if the people of this city represent the nation, the spirit manifested can mean but one thing, and that is that the war will be won.

We believe that the relief to the railroads will do much to help clear up transportation difficulties.

MAHONING & SHENANGO LIGHT & RAILWAY COMPANY, YOUNGSTOWN, OHIO

On Friday output was reduced 105,000 kw.-hr., or 19 per cent; load reduced 6800 kw.-hr., or 23 per cent. On Saturday output reduced 94,000 kw.-hr., or 19 per cent; load reduced 5400 kw.-hr., or 19.6 per cent.

ROCKFORD (ILL.) ELECTRIC COMPANY

The effect of the Fuel Administrator's order has been that we are reduced to 40 per cent of our normal load; also that window and sign lighting has been discontinued to even a greater extent than that required by the Garfield order.

People here are intensely patriotic and wish to aid the government in its conservation of fuel.

LOUISVILLE GAS & ELECTRIC COMPANY

On Friday, Jan. 18, the output of electricity from our plant was 169,500 kw.-hr. against 219,000 kw.-hr. for an ordinary day. The peak load was 14,800 kw.-hr. against 16,000 kw.-hr. for an ordinary day. The loss in output was almost entirely confined to the daytime hours, when the

Sharp Curtailment in Output in New England

Many New England central stations lost one-half to three-quarters of their day loads during the period covered by the Garfield order, but the situation improved as exemptions were announced in Washington. It is estimated that 1,200,000 factory workers were idle on Friday, but there was patriotic compliance with the order despite hardships. The amount of wages lost in thirteen idle days is estimated at \$38,000,000.

The peak load of the New England Power Company fell from 65,000 kw. to 25,000 kw. The company wasted no water and its reservoir system proved most valuable. This company expects that its load will increase on future Mondays through the exemption of war industries from the operation of the order.

The Turners Falls Power Company and other hydro-electric companies were authorized by the State Fuel Administrator to supply customers with water power.

It is understood that the effect of the order was not disastrous in the territory of the Edison Electric Illuminating Company of Boston.

There was a substantial reduction of load at Providence. The interconnection with the New England Power Company's system proved most valuable.

The Cumberland County Power & Light Company,

Portland, Me., met the load entirely with water power. Its output fell from 10,500 kw. to 8500 kw. The company shut down its two 1000-kw. steam plants, which burned 70 tons daily, and purchased 2000 kw. from hydroelectric plants of the S. D. Warren Paper Company, Westbrook.

The Cambridge (Mass.) Electric Light Company lost one-half of its load, but some exemptions increased consumption on Monday. The local Fuel Administrator has ordered a moonlight street-lighting schedule.

The Manchester (N. H.) Traction, Light & Power Company lost about one-quarter of its power load, saving about 60 tons of coal per day.

The New Bedford (Mass.) Gas & Edison Light Company was affected materially. Its output on Thursday, Jan. 17, was 207,971 kw.-hr. On the Friday following it was 63,273 kw.-hr. The peak loads were respectively 15,500 kw. and 4700 kw. The coal consumption of this company was 183 tons Thursday and 82 tons Friday.

The Worcester (Mass.) Electric Light Company load fell from 11,000 kw. to 2700 kw., and the consumption of coal decreased from 225 tons to 62 tons. Through exemptions 1000 kw. was added on Monday.

The day load of the Fall River (Mass.) Electric Light Company dropped from 6500 kw. to 700 kw. The output on Thursday was 112,300 kw.-hr. and on Friday 36,000 kw.-hr. The consumption of coal was 108 tons on Thursday and 50½ tons on Friday. The relative consumption per kilowatt-hour was 2.16 lb. on Thursday and 3.14 lb. on Friday. The night peaks were respectively 7700 kw. and 2650 kw.

The load of the United Electric Light Company, Springfield, Mass., fell from 12,000 kw. to 3000 kw. on account of heavy decreases in consumption by merchants and manufacturers. The company saved 100 tons of coal daily, and it has begun to discharge employees as a measure of economy.

The load of the Fitchburg (Mass.) Gas & Electric Light Company fell from 2500 kw. to 400 kw. Exemptions soon increased the latter to 600 kw. The New England Power Company supplied the entire Fitchburg load during curtailment.

The Lowell (Mass.) Electric Light Corporation and the Edison Electric Illuminating Company of Brockton, Mass., operated by Stone & Webster, lost in power loads, but munition plants lessened the reduction at Lowell. The Brockton load fell from 8500 kw. to 1200 kw. despite the army shoe contracts of local factories.

Maine utilities suffered less than other localities because of the available water power.

The Lynn (Mass.) factory of the General Electric Company was exempted; also the Terry Steam Turbine Company factory at Hartford, Conn.

The Hartford Electric Light Company load fell from 23,000 kw. to 10,000 kw. Two-thirds of the factories at Bristol, Conn., are operated by hydroelectric power from Falls Village, and it is expected that they will be operated on future Mondays. A similar hope is expressed in Willimantic, Conn.

The Salem (Mass.) Electric Lighting Company day load fell from 7500 kw. to 2000 kw. The Malden (Mass.) Electric Company plant was shut down for five days, and necessary requirements were supplied from Salem through a tie line. The total saving at Salem was about 35 tons per day; normal consumption is 85 tons; daily output dropped 50 per cent at Salem.

Effect of Order in Chicago and Central West

The central-station industry of the Middle West is in hearty accord with the Fuel Administrator's recent order. The necessity of such drastic action is appreciated fully.

The situation in the larger centers, Cleveland and Chicago in particular, had reached a stage where it was only a question of whether the industrial shutdown would be made in an organized manner or whether it would be made in individual cases as the absolute necessity became apparent. Since the latter method was open to so much chance for discriminatory practice the adoption of the former plan is hailed with satisfaction.

There is little sympathy, however, with the policy which permitted the country's fuel supply to get into its present state. Criticism of the Fuel Administration from that angle is heard regularly from central-station sources; but now that the situation exists the present method of solution is viewed as the best way out of a bad fix.

The cause of the situation, as seen by central-station executives of the Middle West, is almost wholly one of transportation. Had the public been made to realize ten years ago that a starvation system of revenue for the railroads would react against the national good ultimately, such a calamity as this fuel crisis could not have occurred. Furthermore, all during last summer the public was led to believe that coal would be cheaper in the fall so that many coal consumers put off purchases. It is believed that the government should have urged people to buy coal early in the summer and have shown that prices would probably go up.

The effect of the order on central-station outputs and revenues will not be so great as might be expected at first. Data which have been worked out show that heatless Monday is a better central-station day than any typical Sunday. The belief is expressed that the total effect of the Garfield order will be less than a 3 per cent reduction in output for January for a large Middle Western company.

WAR SERVICE WORK OF THE UTILITIES COMMITTEE

National Committee on Gas and Electric Service on
Duty in Co-ordinating Work of Utilities
with Government War Needs

The National Committee on Gas and Electric Service, of which John W. Lieb is chairman, has issued a report of its current activities. This committee is rendering a service in co-ordinating the work of electric and gas utilities with war needs. In part the report says:

This committee has placed at the disposal of the Fuel Administration two representatives who have their offices continuously in that bureau to handle the complaints of the public utilities and endeavor to obtain such relief as may be possible.

The Fuel Administration has recently added to its staff a public utility representative in the conservation department of that bureau, whose particular duties shall be to work out as much as possible the conservation of fuel in the operation of public utilities.

Another member has been added to the National Committee on Gas and Electric Service in the person of H. G. Bradlee of Stone & Webster. Mr. Bradlee, as is well known, brings to the committee a vast knowledge and experience along public utility lines.

TEXT OF THE REGULATION TO PROVIDE FUEL SUPPLY

A More Adequate Supply for Railroads, Domestic Consumers, Public Utilities and Other Uses Necessary to National Security

Following is the full text of the regulation of Dr. H. A. Garfield, United States Fuel Administrator, issued Jan. 17:

The United States Fuel Administrator, acting under the authority of an executive order of the President of the United States dated Aug. 23, 1917, appointing said administrator, in furtherance of the purposes of said order and of the purposes of the act of Congress therein referred to, approved Aug. 10, 1917, and finding it essential effectively to carry out the provisions of this act to make provision for a more adequate supply of fuel for railroads, domestic consumers, public utilities and for other uses necessary to the national security in certain parts of the United States, hereby makes and prescribes the following regulation:

Section I.—Until further order of the United States Fuel Administrator, all persons selling fuel in whatever capacity shall, in filling their contracts or orders now on hand, give preference to necessary current requirements of railroads, domestic consumers, hospitals, charitable institutions, army and navy cantonments, public utilities, by-product coke plants supplying gas for household use, telephone and telegraph plants, shipping for bunker purposes, the United States for strictly governmental purposes (not including factories or plants working on contracts for the United States), manufacturers of perishable food or of food for necessary immediate consumption, and municipal, county, or state governments for necessary public uses. Any tonnage remaining after the foregoing preferred shipments have been made may be applied in filling any other contracts or orders.

Section II.—On the following days, namely, Jan. 18, 19, 20, 21 and 22, 1918, the state fuel administrators and their accredited representatives in the various communities in the territory in which this regulation applies are hereby empowered and directed to divert such fuel as arrives in such communities in carload lots to meet the current requirements, and to provide an adequate and normal supply for such consumers of fuel as are specified in Section I hereof.

Section III.—On the following days, namely, Jan. 18, 19, 20, 21 and 22, 1918, and, also, on each and every Monday beginning Jan. 28, 1918, and continuing up to and including March 25, 1918, no manufacturer or manufacturing plant shall burn fuel or use power derived from fuel for any purpose, with the following exceptions:

(a) Plants which necessarily must be continuously operated seven days each week to avoid serious injury to the plant itself or its contents may use only such quantity of fuel as is necessary to prevent such injury to the plant or its contents.

(b) Manufacturers or plants manufacturing perishable foods or foods for necessary immediate consumption.

(c) Manufacturers of food not perishable and not necessary for immediate consumption may burn fuel to the extent authorized by the Fuel Administrator of the State in which such plant is located or by his duly authorized representative upon application by the United States Food Administrator.

(d) Plants necessary to the printing and publication of daily papers may burn fuel or use power derived therefrom as usual, except that on every Monday from Jan. 21 to March 25, 1918, inclusive, they may burn fuel or use power derived therefrom only to such extent as is necessary to print and publish such editions as such plants customarily print and publish on legal holidays other than the Sabbath; or, if such plants do not customarily print or publish any editions on such legal holidays, they may burn fuel or use such power to such extent as is necessary to issue one edition on the said Mondays.

(e) Printing establishments may burn fuel on Jan. 18, 19, 20, 21 and 22, 1918, to such extent as is necessary to issue current numbers of magazines and other publications periodically issued.

Section IV.—On each Monday beginning Jan. 21, 1918, and continuing up to and including Monday, March 25, 1918, no fuel shall be burned (except to such extent as is essential to prevent injury to property from freezing) for the purpose of supplying heat for:

(a) Any business or professional offices, except offices used by the United States, state, county or municipal governments, transportation companies, public utility companies, telephone or telegraph companies, banks, trust companies, physicians or dentists.

(b) Wholesale or retail stores, or any other stores, business houses or business buildings whatever, except that for the purpose of selling food only stores may maintain necessary heat on any of the specified days until 12 o'clock noon, and except that for the purpose of selling drugs and medical supplies only stores may maintain necessary heat throughout the day and evening.

(c) Theaters, moving-picture houses, bowling alleys, billiard rooms, private or public dance halls, or any other place of public amusement.

Section V.—On each Monday beginning Jan. 28, 1918, and continuing up to and including March 25, 1918, no fuel shall be burned for the purpose of heating rooms in which intoxicating liquor is sold or served on those days.

Nothing in this regulation shall be construed to forbid the heating of restaurants, hotels or other places in which meals are served but in which no intoxicating liquor is sold or served on the said Mondays.

Section VI.—No fuel shall be burned on any of the Mondays specified in the foregoing section for the purpose of supplying power for the movement of surface, elevated, subway or suburban cars or trains in excess of the amount used on the Sunday previous thereto.

Section VII.—Nothing in this regulation shall be construed to apply to or affect the operation of any mine or plant producing fuel, nor shall this regulation be construed to forbid the heating of such rooms or offices or such portions of buildings as are used in connection with the production, transportation or distribution of fuel.

Section VIII.—State fuel administrators and their representatives specifically authorized so to do are hereby empowered to grant such relief as may be essential to prevent injury to health or to prevent destruction of or injury to property by fire or freezing.

Section IX.—This regulation is effective throughout the United States east of the Mississippi River, including the whole of the States of Louisiana and Minnesota.

Section X.—Any person, firm, association or corporation which violates or refuses to conform to the above regulation may be liable to the penalty prescribed in the aforesaid act of Congress.

REASONS FOR THE ORDER

In explanation of his order, Dr. Garfield issued the statement given in part below:

The most urgent thing to be done is to send to the American forces abroad and to the Allies the food and war supplies which they vitally need. War munitions, food, manufactured articles of every description, lie at our Atlantic ports in tens of thousands of tons, while literally hundreds of ships, waiting loaded with war goods for our men and the Allies, cannot take the seas because their bunkers are empty of coal. The coal to send them on their way is waiting behind the congested freight that has jammed all terminals.

It is worse than useless to bend our energies to more manufacturing when what we have already manufactured lies at tidewater, congesting terminal facilities, jamming the railroad yards and sidetracks for long distances back into the country. No power on earth can move this freight into the war zone where it is needed until we supply the ships with fuel.

More than a shock was needed to make a way through that congestion at the terminals and on the docks so that the aid so vitally needed by the Allies could get through.

The incidental effect of this transportation situation on coal production has been disastrous. There is and always has been plenty of fuel, but it cannot be moved to those places where it is so badly needed while railroad lines and terminals are choked.

LARGE CALIFORNIA SYSTEMS

UNITE FOR PERIOD OF WAR

As War Measure to Economize Fuel Four Great Companies Agree to Joint Operation—Total Capacity 377,600 Kw.

For the period of the war and in the interest of fuel economy the Pacific Gas & Electric Company, the Great Western Power Company, the Sierra & San Francisco Power Company and the Universal Electric & Gas Company have agreed to operate their systems under one management. P. M. Downing, chief engineer Pacific Gas & Electric Company, electrical department, will have charge of the jointly operated systems.

Under this plan several standby plants can be shut down without endangering continuity of service as provided by the joined systems. By operating only those centrally located standby plants whose efficiency is highest a great saving of fuel oil will be effected and loads will be distributed so that water storage on each system can be used to maximum advantage.

This action was taken after joint conferences with State Fuel Administrator Schwabacher and the California Railroad Commission, and it is a development which followed the detailed consideration of the interconnection of transmission systems, a report of which appears following this article. The power companies have announced that the unified service will be continued as long after the war as such action may be deemed in the interest of the public. The combined systems serve about 40,000 square miles, believed to be the largest area yet administered by a single management. The total generating capacity of the combined system at present is about 377,600 kw., of which 240,000 kw. is hydroelectric power and the remainder steam.

A careful observer of California conditions makes the following comment to the ELECTRICAL WORLD on the new arrangement:

The consolidation of central California power systems for joint operation as a war measure is one of the long strides forward which are made from time to time in the West. It is not often, however, that so important a move is made literally overnight or is launched without precedent largely on faith that all concerned will do their part fairly. Much credit is due the several companies for the spirit shown in joining competitors without hesitation or limitation. The redistribution of load, it is understood, is to be made by one man, Mr. Downing, without let or hindrance, the determining factor always being the efficiency of the several systems considered as one unit and the minimum consumption of fuel.

Even if the attitude of the competing companies had been such that this move might have been made before, it would not have been feasible because the public would have resented and opposed it with all the vigor of the sentiment against trusts, but now in the emergency of war and facing fuel famine the economies of monopoly in public utility management have not only become apparent to the man in the street but are being urged on the companies themselves as patriotic duties.

One of the most important features of the move and one which there has not yet been time to work out in detail is the apportionment of income under the combined plan of operation. However, with all concerned in a co-operative rather than a competitive attitude, it will be simply a matter of agreeing upon that plan which seems fairest to all. With the rainfall in California thus far the least in sixty-nine years, a plan which contemplates utilizing water storage more efficiently cannot impair the interests of stockholders. No man could be found who has better qualifications than Mr. Downing as "power dictator" for the California systems.

Not only does his experience eminently qualify him to handle the complex problems of this work but he has the complete confidence of the several companies involved. The success of the plan under his administration may well establish a precedent that will be far-reaching in effect.

ADVANTAGES OF TYING IN THE CALIFORNIA SYSTEMS

Costs of Interconnection and Attendant Fuel Saving
Discussed by Representatives of the Companies
and Railroad Commission

A hearing was held by the California Railroad Commission on Jan. 14 to discuss with representatives of the various power companies ways and means for combining transmission lines and otherwise co-operating to reduce fuel consumption. The commission engineering department filed a preliminary careful study of interconnection possibilities. In this it was pointed out that the immediate requirements for 1918 of the four chief power companies supplying the San Francisco Bay region call for an increase of more than 200,000,000 kw.-hr. of energy and more than 50,000 kw. peak capacity, as compared with 1917.

There is a marked diversity between the several generating systems, the report stated, especially in low-water seasons, which can be employed to advantage to offset part of the increased demand. But in any event the concentration of load and rapid growth in the San Francisco Bay region necessitate an increase in transmission facilities. The present lines for bringing power into San Francisco are entirely inadequate, resulting in the unnecessary use of steam-produced energy and preventing what would otherwise be a saving in fuel oil. In fact, the future growth in power requirements of the companies operating in the bay region, the report stated, will necessitate expenditure of over \$5,000,000 annually by utilities to provide generating plants and transmission lines alone to meet the demand.

A large amount of unused hydroelectric power in northern California is practically ready to be marketed. Additional transmission lines must be built and existing lines reinforced to make this supply available at consumption points. If present methods of separate operation are allowed to continue, increased demand can be supplied only by steam-produced energy. This will require more than 1,000,000 bbl. of oil per annum more than is now consumed. If interconnections are made and power available in the north be added to the transmission network, saving at the rate of over \$200,000 per year in fuel oil, the report stated, can be begun at once.

The commission engineers stated that committees from each of the two natural divisions in the State have been appointed to co-operate in working out details of interconnection as follows:

Northern division: John A. Britton, Pacific Gas & Electric Company; Mortimer Fleischhacker and H. F. Jackson, Great Western Power Company; W. F. Detert, Northern California Power Company; J. D. McKee, California-Oregon Power Company; Samuel Kahn, Western States Gas & Electric Company; A. G. Wishon, San Joaquin Light & Power Company.

Southern division: R. H. Ballard, Southern California Edison Company; William Baurhyte, Los Angeles Gas & Electric Company; A. B. West, Southern Sierras Power Company; H. H. Jones, San Diego Consolidated Gas & Electric

pany; A. G. Wishon, San Joaquin Light & Power Company.

Reporting for the northern committee, H. F. Jackson said that careful consideration had been given to the possibilities of interconnecting the Northern California and California-Oregon transmission systems with the Pacific Gas & Electric, thereby bringing these companies into the northern division network. This interconnection would involve construction of two tie lines and an additional circuit on the present power line from Nicolaus to Cordelia. This construction would cost about \$1,700,000, he thought.

In considering additional power available for the northern division, it was pointed out that extension of the Drum development could add 12,500 kw. to the network. The Great Western Power Company reported 9,000 kw. additional power available for development and the Sierra Company has about 9000 kw. which could be developed economically. Committees were appointed to report on these connecting lines and the increased power possibilities.

Mortimer Fleishhacker foresaw considerable difficulty in raising the money necessary to carry out interconnection on a satisfactory scale. Most companies are hard pressed to secure money necessary even for routine operation, and with all costs increasing and rates stationary it would be practically impossible to induce capital to put money into power company extensions at present. Earning capacity of Pacific Coast companies has fallen off and stocks and other securities have decreased in value accordingly. He failed recently to raise funds in Eastern centers for extending the Great Western system because the profit was not sufficient to interest new investors. However, if rates were increased present stockholders could probably be induced to improve their investment by some further advancement of capital.

As a war measure Mr. Fleishhacker urged that something should be done to enable companies to finance hydroelectric development. Two or three shipyards are being constructed and other extensive industrial load is coming in the bay region. Meanwhile, power companies have stopped generating-plant extensions because of labor and material prices. With the rainfall thus far recorded this year the lowest in sixty-nine years, he predicted inevitable power shortage next season because of lack of stored water.

P. M. Downing, chief engineer Pacific Gas & Electric Company, classified the northern division interconnection problems under two heads—first, effectively bringing together three large companies for off-peak load, and, second, the best means of getting the Northern California and the California-Oregon systems economically tied in to the central network. An inexpensive solution of the first of these would be to tie the Great Western and the Sierra systems together indirectly, using Pacific Gas & Electric lines as the connecting link. He did not think sufficient energy would be transferred over a direct connection to effect an oil saving that would justify the cost of making the direct tie-in. As to getting power from the northern systems into the central group, he thought it would be necessary to construct several hundred miles of transmission line, bringing this power, approximately 12,500 kw., down to the Cordelia substation. This amount of power, on the basis of 200 kw.-hr. per barrel of oil, would be the

equivalent of 420,000 bbl. of oil, or a saving of \$500,000 per year. Cost of the transmission lines necessary to effect this tie-in would be about \$1,500,000.

R. H. Ballard, general manager Southern California Edison Company, submitted a written report for the committee which has been studying conditions in the South. He pointed out that the southern section is already well interconnected and that the next move should be development of more water power to reduce present oil consumption in auxiliary and standby plants. About \$600,000 per year, he thought, is the saving now secured as the direct result of interconnecting systems, and he expressed firm conviction that saving could be made in any part of the country where interconnection was at all feasible.

E. F. Scattergood, chief electrical engineer Los Angeles power bureau, presented a plan for decreasing oil consumption in that city, as part of the movement for conservation.

In closing the hearing, Commissioner Devlin said that he foresaw the possibility of great saving of fuel as a result of the action that could probably be taken and set Jan. 31 as the date for hearing sub-committee reports.

WATER-POWER BILL STEPS TAKEN IN WASHINGTON

Lower House of Congress Appoints Committee
Which Will Report on Administration Bill—
Senate May Stand by Shields Bill

The House of Representatives on Jan. 11 took the first step toward passing the new administration water-power bill expeditiously by adopting a resolution providing for appointment of a special committee to which all bills and resolutions introduced during the Sixty-fifth Congress, except those touching foreign affairs, which deal with water-power matters shall be referred.

The resolution adopted by the House discharges from further consideration the various bills on water power of the committee on interstate and foreign commerce and the committee on public lands, which have been before the House for some years, and the old bills are to go to the new committee.

The resolution in excepting bills and resolutions touching foreign affairs leaves in the hands of the House foreign affairs committee proposed legislation in regard to Niagara Falls water power.

Senators are studying the administration water-power bill. The Washington correspondent of the ELECTRICAL WORLD reports ground for the belief that those who feel that legislation of some definite character should be enacted at the present session would do well if they sent their views on the new bill to Senators immediately.

The fate of the new bill, so far as the Senate is concerned, is now hanging in the balance in that body. The long delays and wide differences of opinion which have prevented water-power development may continue, and there may be no legislation at the present session unless Senators can be made to see that agreement is necessary. It is still understood in Washington that President Wilson intends to have conferences with Senators as he had with House members, and he may persuade Senators to look upon the bill favorably.

But Senator Shields of Tennessee, who led the forces

which passed the Shields bill in the Senate, has pointed out to the Washington correspondent of the *ELECTRICAL WORLD* that the Shields bill as passed by the Senate was a compromise measure, and he said further that twenty Senators not present when the vote was taken would have voted for the Shields bill, he was informed, if they had been present. The Senate will not lightly rescind the stand it took when it passed the Shields bill as a compromise.

REORGANIZATION PLAN OF THE ORDNANCE DIVISION

Guy E. Tripp, Chairman of the Westinghouse Company, Among Those Who Serve as Civilian Heads of Divisions

General Wheeler, acting chief of ordnance, War Department, has announced the appointment of a number of civilians as heads of new divisions in the ordnance branch of the department, in addition to Samuel McRoberts, formerly executive manager of the National City Bank of New York, in charge of procurement work.

Guy E. Tripp, formerly chairman of the board of the Westinghouse Electric & Manufacturing Company, who has been given leave of absence by the directors of that company for the period of the war; Charles N. Black, engineer, of New York, and Ralph Crews, lawyer, of Chicago, whose practice in business has been of a large character, will join General Wheeler's staff as civilian

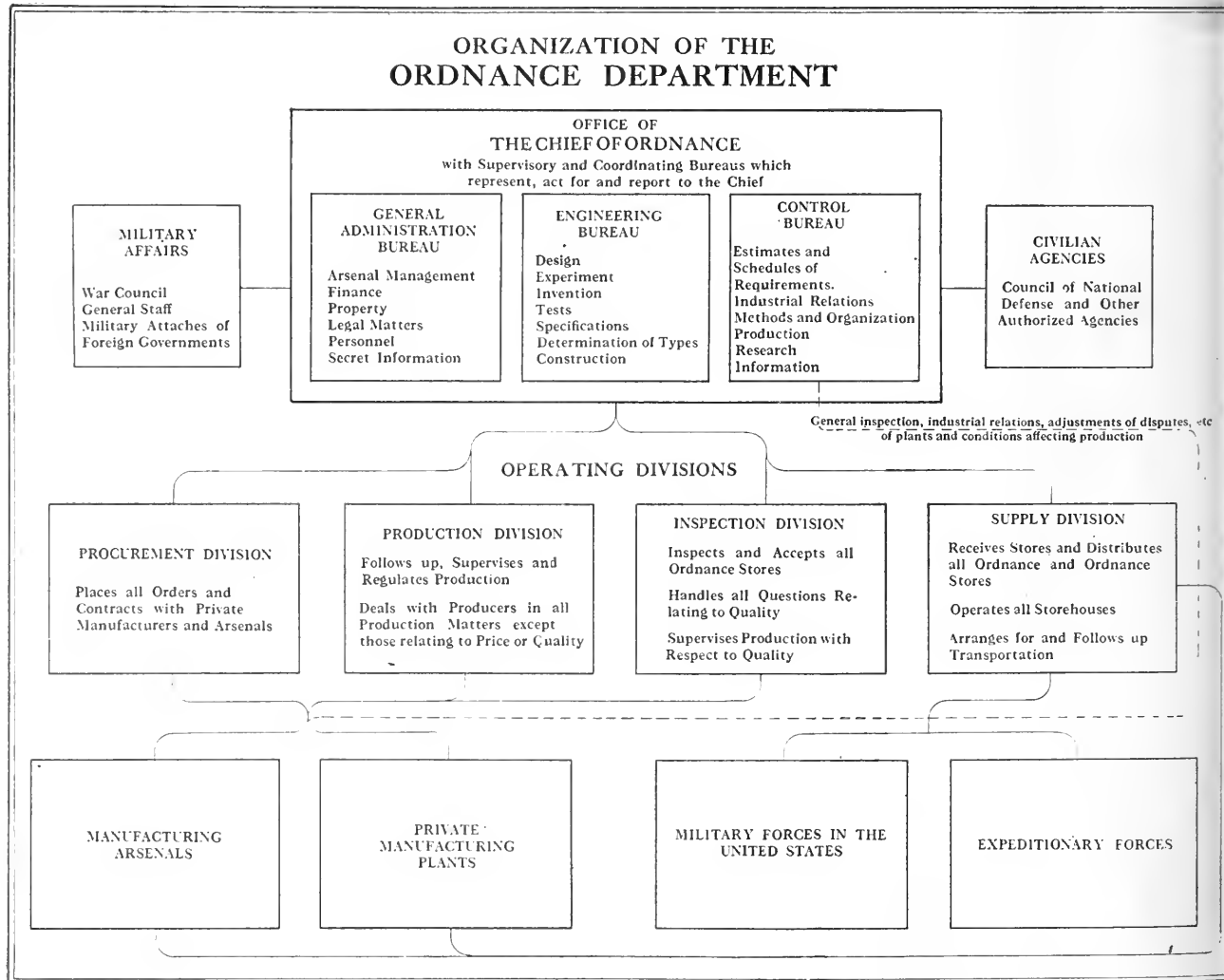
heads of divisions. Mr. McRoberts will be in charge of procurement work, but it is stated in Washington that the exact work to be done by the other civilians is not yet settled.

The ordnance division of the War Department has been reorganized by the creation under the chief of general administration bureau, an engineering bureau and a control bureau. Under these are a procurement division, a production division, an inspection division and a supply division.

The general administration bureau will deal with arsenal management, finance, property, legal matter personnel and secret information. The engineering bureau will deal with design, experiment, invention tests, specifications, determination of types and construction. The control bureau will deal with estimates and schedules of requirements, industrial relations methods and organization, production, research and information of a general character.

In the operating line the procurement division will deal with the placing of all orders and contracts with private manufacturers and arsenals; the production division with following up, supervision and regulation of production and with producers in all production matters except those relating to price or quality; the inspection division with inspection and acceptance of ordnance stores, and it will also handle all questions relating to quality and will supervise production with respect to quality; the supply division will receive

ORGANIZATION OF THE ORDNANCE DEPARTMENT



stores and distribute all ordnance and ordnance stores, will operate all storehouses and arrange for and follow transportation.

SUCCESSFUL MEETING

HELD AT DAYTON, OHIO

Several Papers Are Presented at Gathering of the Industrial Power and Heating Section, with War in the Foreground

The first meeting of the industrial power and heating section of the new-business co-operations committee of the Ohio Electric Light Association was held in Dayton on Jan. 16 and was attended by about 150 from various parts of Ohio and neighboring States.

Frank B. Steele, power engineer Dayton Power & Light Company and chairman of the section, presided. He referred to the fact that this was the first meeting and that the next meeting of the section would be held in Cleveland in May.

Judge E. P. Matthews, vice-president Dayton Power & Light Company, made the address of welcome. In addition to welcoming the out-of-town men, he referred to the opportunity of the central stations at this time to secure all the power business in their communities. He also spoke of the wonderful development that had been made in the industrial business of Dayton because the Dayton Power & Light Company had been in a position to take care of this business.

Dwight D. Miller, Society for Electrical Development, New York, presented his paper on "Low-Temperature Industrial Heating."

In discussing this paper C. D. Carlson, Cleveland Electric Illuminating Company, referred to conditions in Cleveland and stated that there are approximately forty electric ovens operating in that city at present covering twelve different uses, as follows: Auto parts, stove parts, vacuum cleaners, wooden handles, tools and wrenches, multigraph parts, toys, shrapnel varnish baking, jobbing and armature coil baking, drying lime in wire and metal furniture.

Mr. Carlson stated that every electric oven that had been installed in Cleveland had stayed and that the cost of operating compared very favorably with that of gas. The ovens in Cleveland vary from a capacity of 15 kw. to 212 kw., and the largest installation totals 800 kw. The paper was also discussed by C. I. Crippen of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, who stated that malleable iron is being annealed at present in Sharon, Pa.

Following luncheon, George C. Smith, chief of industrial surveys, Baltimore & Ohio Railroad, Baltimore, made an address on "Industrial Surveys for Intensified Service." Mr. Smith told what the railroad company is doing in making surveys of the various cities along its lines and how this information is used, not only in seeing that industries are located most advantageously for them, but also how the entire communities are benefited from the information that the Baltimore & Ohio company obtains through these surveys.

When the convention reconvened in the afternoon J. A. Winder, General Electric Company, Niagara Falls, N. Y., presented an interesting paper on "The Uses of Electricity for the Manufacture of Chemicals." In the discussion Mr. Winder pointed out the necessity for water-power development near the center of the mar-

kets of the United States. He stated that Far Western hydro developments will have little effect on commercial production of electrochemical products. Mr. Winder cautioned central stations against loading their lines with chemical industries which could not withstand competition after the war. The paper was also discussed by W. P. Whittington, Springfield Light, Heat & Power Company, and C. I. Crippen of the Mahoning & Shenango Railway & Light Company, Youngstown.

R. L. Yates, assistant manager Platt Iron Works Company, Dayton, presented his paper on "Water Pumping by Electricity." This paper was discussed by Dwight Miller, Society for Electrical Development, New York; F. H. Hooper, Northwestern Ohio Electric Light & Power Company, Van Wert; W. P. Whittington, Springfield Light, Heat & Power Company; Wirtt S. Scott, commercial heating engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, and C. I. Crippen, Mahoning & Shenango Railway & Light Company.

In the evening a banquet was held under the auspices of the Electric Club of Dayton in the Miami Hotel. Frank B. Steele, power engineer Dayton Power & Light Company, acted as chairman and introduced Judge Roland W. Baggott of the Court of Domestic Relations as toastmaster.

Capt. Paul M. Lincoln, consulting engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, in his address on "The Electrical Industry and the War," said that it was the business of every one connected with the industry to make the utmost effort toward winning the war.

Mayor J. M. Switzer had as his topic "The City and the Public Utilities" and pleaded for frankness on the part of both the city government and utility corporations, suggesting that the utilities frankly discuss the present difficulty with the public through newspaper advertisements. Mayor Switzer held that the Kaiser alone was responsible for the present coal shortage, and therefore the people should bear with the utilities in their effort to serve.

D. L. Gaskill, Greenville, the secretary of the Ohio association, talked along patriotic lines, but made a strong plea for public co-operation with utilities under the present stress and laid emphasis on the great difficulty of public utilities in securing fuel and meeting the extreme high cost of coal and all other commodities.

Charles F. Kettering, president Dayton Engineering Laboratories Company, in his opening remarks paid great tribute to the Dayton Power & Light Company and gave it the credit for solving all the power problems incident to the unusual industrial developments in Dayton.

Lee Warren James, president of the Greater Dayton Association, had as his subject "The Commercial Organizations and Public Utilities," and told how the Greater Dayton Association was endeavoring to co-operate not only with the city government, but also with the public utilities in serving the people of "dominant Dayton."

Edward R. Kelsey, governor of the district for the International Rotary Clubs and director of publicity Toledo Railways & Light Company, brought a message of war service for every electrical man. Mr. Kelsey has just been appointed chairman for Ohio for the "Smile-age" campaign.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Western Society of Engineers.—Officers of the electrical section of the Western Society of Engineers were elected at a meeting Jan. 14 as follows: Chairman, E. N. Lake; vice-chairman, J. R. Cravath; members of executive committee, Earnest Lunn and Charles H. Norwood.

Lynn Section, A. I. E. E.—The annual banquet of the Lynn Section, American Institute of Electrical Engineers, will be held this year on Saturday evening, Feb. 2. A number of prominent speakers are being considered for the main feature of the program. Ex-president Charles A. Coffin and President E. Wilbur Rice are to be invited.

Utah Contractors and Dealers Meet.—Members of the Salt Lake district of the Utah Society of Electrical Contractors and Dealers met at the Commercial Club on Jan. 4. Officers for 1918 were elected and the business of last year was reviewed. The new officers are: President, George R. Randall; vice-president, G. W. Forsberg; secretary-treasurer, F. C. Wolters; executive board, E. M. Dobb, R. C. Carter and James Swyers.

San Francisco Electrical Development League.—The league meeting on Jan. 9 was Ladies' Day, and Mrs. Aurelia Reinhart, president of Mills College, talked on "What Women Can Do in the Present Crisis." Mrs. Emerick, a noted lecturer on Mesopotamia, told about recent conditions there. Mrs. Robert Burdette, leader of women's activities in food conservation, spoke on that subject. The chairwoman of the day was Mrs. H. F. Jackson, wife of the president of the Pacific Coast Section, N. E. L. A.

Program of Western Association of Electrical Inspectors.—The program for the "win-the-war" meeting of the Western Association of Electrical Inspectors at Memphis, Tenn., Jan. 29, 30 and 31, has been arranged as follows: Address of welcome, Frank L. Lucas; president's address, Emil Anderson, Milwaukee; "Conservation," James F. Joseph; "Underwriters' Laboratories and the Great War," A. R. Small; address on "Safe Electrical Requirements for Oil Refineries"; general discussion of "The Use of Electricity in Winning the War"; general discussion of "Rational Economies in Grounding," led by Carl K. Chapin, Memphis; address by William F. Dunbar, Atlanta, Ga.; report of the committee on outside wiring by F. W. Derby; report of the committee on show-window and display lighting by F. P. McGough; report of the committee on installation and operation of induction motors by K. W. Adkins; report of the committee on architects' specifications by F. H.

Moore; report of committee on electric traction systems by F. R. Daniel; report of committee on demand factor by Guy W. See. There will also be an open discussion of inspectors' problems.

Meetings of the American Association of Engineers.—On Jan. 14 the Pittsburgh Chapter of the American Association of Engineers held a meeting at the Fort Pitt Hotel, P. B. Waldin, president of the Pittsburgh Branch, addressing the chapter on "Engineering as a Profession." The offices of the chapter are at 1312 Fulton Building. The Cleveland chapter, of which T. J. Brennan, 512 Columbia Building, is chairman, held a meeting on the evening of Jan. 15. The Philadelphia Chapter held a meeting on Jan. 18 at which the general secretary of the association spoke on the "Objects of the American Association of Engineers and the Receiving of Recognition for the Engineering Profession."

Cincinnati Electric Club and Jovian League Branch Merge.—The Cincinnati Jovian Electric Club was formally organized at a meeting of electric men of that city held Jan. 15 at the Hotel Sinton. The meeting was called for this purpose, following several steps taken by members of the Cincinnati Chapter of the Jovian League and the Cincinnati Electric Club looking toward the merger of the two organizations. The latter body was formed a year or so ago on account of the lack of interest which had become apparent in the senior organization, but both continued to exist, with a majority of local electric men holding memberships in both. The move for consolidation, to eliminate the dual membership with its attendant expense and waste of time and effort, began several months ago, and both organizations appointed committees with this object. W. W. Freeman, B. W. Down and Joseph C. Bowman were named for the Jovian League, and Thomas Creaghead, Mr. Wickham and O. B. Marsh for the Electric Club, with Mr. Downs as chairman of the joint committee and Mr. Marsh as secretary. The Jovian committee promptly reported favorably on the plan to consolidate, and the Electric Club took similar action on Jan. 7. The meeting of Jan. 15 was therefore a joint meeting of the membership of the two organizations to ratify the action of their executives and to elect officers for the new organization. The new constitution is virtually that of the Electric Club, so that a Cincinnati man interested in the organization may be a member without at the same time being a member of the National Jovian League. At the meeting the following officers were elected, following the unanimous ratification of the merger: President, F. D. Van Winkle; first vice-president, J. A. Brett; second vice-president, O. B. Marsh; secretary and treasurer, Joseph D. Bowman; directors, W. W. Freeman, W. A. Draper and William Hanley. Addresses were made by W. C. Culkins, Cincinnati, city street railway director, and Vice-president Walter A. Draper of the Cincinnati Traction Company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Massillon Announces Its Record Day.—The Massillon (Ohio) Electric & Gas Company closed the year 1917 by making Dec. 31 its record day in output having a net generation for that day of 104,490 kw.-hr., the output for the month of December being 2,786,000 kw.-hr. The output for the year ended Dec. 31, 1913, was but 1,898,374 kw.-hr. The output for December, 1917, was therefore one and a half times that of the entire year 1913.

Pacific Gas & Electric Passes Common Dividend.—In announcing a decision to pass the current dividend on Pacific Gas & Electric Company common stock President F. G. Drum says in part: "In the present circumstances of decreased net earnings and the necessity of conserving the company's cash resources your directors decided to omit any dividend on the common stock for the last quarter of 1917. During the past year our business has grown rapidly. Perhaps the best measure of this is the net addition of 26,699 customers in the eleven months to Nov. 30, 1917, as compared with a net addition of 16,147 in the first eleven months of the preceding year. The average new investment per customer has been steadily increasing since 1911, and is now greater than it ever has been owing to higher labor costs and the practical doubling of the cost of materials. War conditions which, on the one hand, have stimulated our growth and increased the necessity for new capital expenditures, have, on the other hand, made it practically impossible for corporations generally to secure new money except at prohibitive rates. In the eleven months to Nov. 20, 1917, compared with the same period of the preceding year, gross operating revenues increased \$1,096,617, expense increased \$1,661,813, and net operating revenues decreased \$565,196. In the twenty-three months covered by the foregoing comparison 43,949 additional customers have been connected to the company's lines. During the same period \$8,267,892 of additional cash has been invested, substantially all in productive properties, including new hydro electric installations. That this large additional investment, the increased number of customers and the large gross earnings in the conduct of the business have not added to the net income but have served merely to diminish the loss is due to the fact that, notwithstanding the extraordinary increase in the cost of our products, the selling prices of these products have, at best remained stationary and are still established on conditions that existed prior to the war. We confidently expect relief in the near future."

C. H. Sanderson has resigned as assistant chief engineer of the Havana Electric Railway, Light & Power Company to become manager of the auto and truck department of the Frank G. Robbins Company of New York and Havana.

L. E. Caldwell, who for the last five years has been manager of the Iowa City (Iowa) Light & Power Company, has resigned to become manager of the La Crosse district of the Wisconsin-Minnesota Light & Power Company. In this capacity he will have charge of the gas, electric and heating plants in La Crosse, Wis., and its suburbs. For the last two years Mr. Caldwell has been secretary and treasurer of the Iowa section of the N. E. L. A. Before going to Iowa City he was for eight years in the employ of H. M. Byllesby & Company of Chicago.

H. A. Hornor has recently resigned his position as electrical engineer of the New York Shipbuilding Corporation of Camden, N. J., effective Feb. 1. Mr. Hornor has been connected with this company for seventeen years, during which time he has greatly advanced the applications of electricity in the marine field. He is chairman of the marine committee of the American Institute of Electrical Engineers and has been active in various engineering societies. Mr. Hornor has been a frequent contributor to the journals of the electrical technical societies and is the author of the article on marine applications in the "Standard Handbook for Electrical Engineers."

M. C. Gilman, sales manager of the Toronto Electric Light Company, Ltd., has been appointed secretary of the Canadian Electrical Association to succeed Alan Sullivan, resigned. Mr. Gilman was graduated in 1907 from the electrical engineering course at Pratt Institute, Brooklyn, N. Y., and since that time has been employed in the central-station field. He has been assistant power engineer of the Edison Electric Illuminating Company of Brooklyn, assistant power engineer of the Public Service Electric Company, Newark, N. J.; power engineer of the Virginia Railway & Power Company, Richmond; power engineer of the Toronto Electric Light Company, assistant to the chief engineer of that company and for the last four years sales manager of the company.

John Hayes Smith, consulting engineer of Milwaukee, has closed his office to accept a position as assistant engineer to the Public Service Commission of Pennsylvania. Mr. Smith is a graduate of Cornell University. He associated himself with the Westinghouse Electric & Manufacturing Company shortly after graduation, remaining in their employ about six years. He was the first manager of the *Electric Journal*, from which he resigned to become editor of the *Electrical Age*, in which work he remained for four years, when he went to Milwaukee. For two years he was with the Milwaukee Electric Railway & Light Company, resigning as commercial engineer to take up con-

Men of the Industry

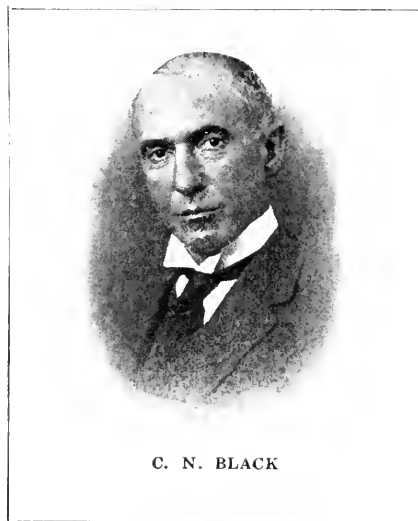
Changes in Personnel
and Position—
Biographical Notes

sulting work. For the last four years he has been actively engaged in consulting engineering work in Milwaukee, as well as in rate and valuation work in other states.

Harry F. Butler, formerly associated with the Consolidated Telephone Company, has been elected manager for the Leighton Electric Light Company, Leighton, Pa.

Charles Bulkley Hubbel has succeeded Major Henry W. Hodge, now in military service, as a member of the Public Service Commission for the First District of New York.

Charles N. Black of Ford, Bacon & Davis, New York, has gone to Washington to become assistant manager of the procurement division of the ord-



C. N. BLACK

nance department. Mr. Black is a past-president of the American Electric Railway Association, and up to about a year and a half ago was vice-president and general manager of the United Railroads, San Francisco, Cal. He was elected president of the American Electric Railway Association in 1913.

Guy E. Tripp, who, as noted in these columns, last week, has been appointed head of the division of production of the ordnance department of the United States Army, has received a commission as colonel.

H. B. Sewall, who has long been connected with Stone & Webster properties in the Central West and in the South and Southwest, has been appointed manager of the Whatcom County division of the Puget Sound Traction, Light & Power Company, with offices at Bellingham, Wash., succeeding Leslie R. Coffin, who has been ordered to report for duty at Philadelphia.

F. M. Nourse has joined the advertising department of the Cutler-Hammer Manufacturing Company of Milwaukee in the capacity of technical writer. Mr. Nourse is a graduate of the electrical engineering course of the University of Illinois, class of 1912, since which time he has been engaged in various branches of engineering work. After graduation, several years were spent with the Northern Illinois Utilities Company, after which he became a motor sales engineer for Roth Brothers, Chicago. In 1915 Mr. Nourse took charge of the Portage (Wis.) division of the Wisconsin Power, Light & Heat Company, and later became associated with the Electrical Engineers' Equipment Company of Chicago.

B. J. Denman, for many years vice-president and general manager of the Tri-City Railway & Light Company, Davenport, Iowa, has been elected president of the company. Before going to Davenport four and a half years ago, Mr. Denman was chief engineer of the power plants of the Detroit Edison Company. Mr. Denman entered the electrical field in 1892 as oiler, carshop helper and conductor with the old Toledo Railway Company. From 1895 to 1899 he was electrician for the Toledo & Maumee Valley Traction Company and the next year joined the instructional staff of Toledo University. With W. G. Clark he engaged in consulting engineering work in 1900 and 1901, and for three years following he acted as electrical engineer for the Toledo, Bowling Green & Southern Traction Company, in charge of power houses, shop and rolling stock and overhead lines. In 1905 he became connected with the Detroit Edison Company, and there in addition to being chief engineer he did a large amount of commercial engineering work besides doing practically all of the appraisal work for the Detroit companies and being retained as special engineer and supervisor of power-house construction. Mr. Denman is a graduate of the University of Michigan, where he has served as assistant professor of mechanical engineering and non-resident electrical engineering lecturer on power plants, substations and railway engineering.

Obituary

Frank N. Voshell, engineer at the power plant of the Public Service Electric Company, Camden, N. J., died Jan. 11, at his home, at the age of forty-two years.

Robb Mackie, assistant to manager of the supply department, Westinghouse Electric & Manufacturing Company, died at his residence in Pittsburgh on Jan. 5.

Lieut. Gordon Dale Cooke, who prior to entering the service of the country was a member of the field force of the McGraw-Hill Company, publisher of the *ELECTRICAL WORLD*, died of pneumonia at the base hospital, Fort Bliss, Tex., on Jan. 10. Lieutenant Cooke was a graduate of the University of Michigan.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

ANALYSIS OF SITUATION IN ELECTRIC SIGN TRADE

Opportunity Is Afforded to Collect Excellent Sales
Data Which Can Be Used to Good Advantage
When the Fuel Shortage Is Passed

In observing the effect of the Fuel Administrator's order with regard to electric signs, some unusual sidelights have developed. While this order did not exactly kill the electric sign business, it slowed it up to a considerable degree. Some signs, however, are still being sold, especially in water-power territory. The smaller sign-manufacturing concerns are finding it expedient to go into some other line of business which for the duration of the war will prove more profitable. Large concerns which feel that they can weather the storm are afforded an opportunity to collect sales data of a character positively unobtainable heretofore. Merchants with signs are now willing to give actual testimonials that days following "lightless" nights show a falling off in trade. These facts are not being overlooked by wide-awake central-station commercial men or by the more progressive sign manufacturers.

MANUFACTURERS URGE JOBBERS TO PURCHASE LIBERALLY

A Policy Not Altogether Acceptable—Staple Stocks
Ample—Temporary Squeeze on
Heating Appliances

Freight congestion, the responsible cause of the more backward delivery of electrical goods of every description, and also the reported variance in local haulage charges, have been upsetting to jobbing circles. Reports are circulating in the trade that jobbers are being insistently, even persistently, urged to cover their requirements on an unusually liberal scale. This attitude is explained on the ground of the uncertainty of obtaining needed raw material in sufficient quantity, the inadequacy of the labor supply and the continuing delays of shipping, now aggravated by the order for fuel conservation.

A jobber who is inclined to follow a conservative course in buying, but at the same time is almost always in a strong position in caring for his dealer trade, was of the opinion that manufacturers were pursuing a wrong course. He said his and other houses in the field were being induced to place big orders in fear of threatened complications likely to arise from present business conditions. The engagements entered into were to be promptly filled and shipped. The non-arrival of the goods, in the face of what several jobbers believe is a falling market, is causing anxiety. As against this, distributors operating on a large scale declare that, knowing that most factories are behind on orders, the securing of adequate stocks of staple electrical lines is becoming more difficult. Such a condition, it is averred, will therefore probably become even more acute.

Pursuing this line of argument, it is believed by representative houses that the safe course to follow is to allow suppliers all the time possible in filling orders. Prompt attention should be given to requirements for spring stocks, especially construction and line material for immediate use. As a fact, dealers are said to be buying with caution and not anticipating their needs adequately. Doubtless sales would be in larger volume if factories could supply more goods and better deliveries could be assured. Nevertheless, there seems to be a satisfactory movement of general lines.

TAKING THE LOST MOTION OUT OF BUSINESS METHODS

Jobbers Endeavoring to Educate Trade Along Lines
That Will Reduce Cost Incurred in Handling
Small Orders and Return Shipments

Some jobbers in the Middle West are using a direct-by-mail campaign to educate contractors and other customers to the advantages that accrue from ordering in larger quantities and to the necessity of making a service charge on return shipments. As indicating the character of these campaigns the following letter, recently sent to the trade by the Downing Electrical Company of Des Moines, is interesting:

"The big electrical jobbers have been making a very careful study of their orders and find that 55 per cent of them are for less than \$10. The average amount of all orders is \$28.59. The average cost of handling all orders less than \$10 is \$3.93 per order. The cost of handling return shipments is 30 per cent of their value.

"Our good friends can do much to help us hold down our expense in these days, when we are paying twice as much for all kinds of packing materials, cartage, labor, etc., by sending us as large an order as possible and eliminating the return of merchandise whenever possible.

"We realize that you are bound to order merchandise at times when so doing is an error on your part, and we give you this notice so you may know that when we charge 10 per cent service charge on return shipment we are absorbing the big end of the expense. We also want to impress upon you the fact that we are short of salesmen these days and shall appreciate your sending your orders by mail."

EFFECT OF THE WAR ON DEVICES FOR SAFETY

Opinion of Authority Is that the Trend of Events
Indicates that Greater Precautions than Ever
Will Be Taken to Protect Workers

As the result of the knowledge of the vast sacrifices of human life in the war the minds of business men in this country have undoubtedly become accustomed to and inured against shocks from reports of sudden death or physical disablement. Such a transition in mental processes might reasonably be expected to harden the industrial executive against movements for greater safety in the conditions surrounding plant employees. The facts are, however, that this is not the case. The exact opposite appears to be true. Undoubtedly the reason for this condition is the belief, now practically established, that safety movements are not a matter of sentiment but are a matter of good business judgment. It has been found a paying investment to spend money to prevent accidents.

That this is the case is evidenced by the increased business among concerns making safety appliances and concerns marketing consulting safety services. Likewise the increased interest in safety movements since the war brought about the present labor shortage is evident through the same channels. The safety device manufacturers generally are very busy. Some have more business than they can handle. When a group of these manufacturers recently met to discuss an annual convention and exposition for 1918 the interest in this event was intense. The National Safety Council of Chicago showed in its recent annual report that its membership had increased 68 per cent in the last year, which means that 1447 industrial and public utility concerns

subscribed for consulting safety service in that fiscal year and that the workmen reached by this body then had reached a total of 4,500,000. Shipbuilding plants and others engaged in government business are among latest groups to study and apply accident prevention methods.

In spite of this increased effort, accidents in the last year have slightly increased. This has been caused by the immense labor turnover, necessitating the employment of many "green" men. Leading authorities in safety work say, however, that the number of accidents would have increased at a more marked rate under the existing conditions had it not been for the continued effort to prevent them. This growth in accidents is another factor which has contributed to make the business of the safety-device manufacturer continue in a healthy state.

METHOD OF PAYING FOR GOVERNMENT ORDERS

Under Certain Conditions Manufacturers Will Be Reimbursed for Raw Materials Prior to Manufacture

It has not been particularly clear in the minds of some members of the electrical trade just how the government proposes to pay for the goods it buys. In a proposal recently issued for large quantities of electrical goods the General Engineer Depot made the following statement regarding payment:

"Payment will ordinarily be made for each item as soon as it has been inspected, accepted and delivered, properly packed, f.o.b. cars (or boat) at place stated in proposal. Under certain conditions, in the case of standard products the sufficiency of which in their completed form is already known from previous use, partial payments to the extent of a previously agreed-upon percentage of the total cost of each component part of the article to be furnished will be made when such component parts are known to be on hand in the factory ready for assembly. Such component parts will then become the property of the United States, and are to be safeguarded by the manufacturer in a way acceptable to the purchasing officer, in order to prevent loss to the United States through destruction or theft of same."

METAL MARKET SITUATION

The Producers' Desired Advance in Copper Not Realized—Other Metals Unchanged

With no advance in the price of copper such as the producers were aiming for, conditions have not changed from what were previously reported. The conference with the Board of War Industries in Washington adjourned a week ago without allowing the suggested advance to 25 cents, but continuing the present selling figure to June 1, stating its reasons therefor. The price will consequently remain at 23.50 cents for first hands and 24.67½ cents for industrial consumers. Wire is figured on a 30-cent base, and no further reduction is anticipated. No change of any consequence has taken place in connection with the other metals.

NEW YORK METAL MARKET PRICES

	Jan. 14			Jan. 21		
	f	s	d	f	s	d
Copper:						
London, standard spot	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	27.00*			27.00*		
Lead, trust price	6.75			6.75		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter	19.00			19.00		
Spelter, spot	7.82½		to 7.92½	7.82½		to 7.92½
Tin, Straits	85.00*			85.00*		
Aluminum, 98 to 99 per cent.	35.00		to 37.00	34.00		to 36.00

OLD METALS

Heavy copper and wire	21.50	to 22.00	21.50	to 22.00
Brass, heavy	13.75	to 14.00	13.75	to 14.50
Brass, light	10.00	to 10.50	10.00	to 10.50
Lead, heavy	6.25	to 6.37½	6.25	to 6.37½
Zinc, old scrap	5.00	to 5.50	5.00	to 5.50

*Nominal.

THE WEEK IN TRADE

NATURALLY the unusually severe cold weather and unprecedented snowstorms prevailing east of the Rocky Mountains to the Atlantic seaboard have been and are yet the influential factor in the week's business. Shipments were further interfered with and deliveries are slower than before. However, business is reported as not only in a satisfactory condition, but much better than a year ago, with a record breaker predicted for 1918 in electrical goods. Prices were announced on a higher level, averaging 10 per cent, on several staple lines, with a scarcity of merchandise in evidence. Refillable fuses are in demand, as well as flashlamps, motors and electric ranges for cantonments and hotels. Lamps, interior wiring and other articles used in small construction are also selling well.

Collections up to the arrival of the storms were reported from fair to excellent. A setback may follow, but this is only a surmise on the part of correspondents. There is no change in the extension of credits being made since the first of the year.

NEW YORK

Predictions are freely made that 1918 will develop a higher sales record on electrical goods, devices and appliances than has ever before been reached. January's record so far exceeds that of 1917 by a comfortable margin. Jobbers are reported as having liquid stock in ample supply, with a few exceptions, and it is expected to move easily. Buying is said to be on a careful basis, however. Business is especially strong in the coal regions, despite the snowstorms and inclement weather. Deliveries have not improved. Collections are found satisfactory, accounts being settled quite promptly. Caution continues to be exercised with credits.

FUSES.—An active market is anticipated for fuses in this field, particularly of the removable type, according to representative jobbing houses. The manufacturers are getting busy and their sales forces are initiating what promises to be a fruitful campaign. No price changes have been announced.

FLASHLAMPS.—An advance of 10 per cent was recently made by one of the leading flashlamp manufacturers. Business is excellent in this specialty and the demand is brisk.

SOCKET DEVICES.—Preparatory to a strenuous sales campaign during the entire year unusually large stocks of every household socket device are being ordered. This applies more directly to sewing-machine motors and washing machines, with other articles following in close order. It is believed that 1918 will be the greatest sales year in these goods that has ever been known. Studied attention will be given what is known as the "residential buyer" as a potential factor of the future. Current sales are somewhat checked by the curtailment and even refusal of energy by central stations, in obedience to the retrenchment order of the Fuel Administrator.

GLASS INSULATORS.—Within two weeks another advance of 10 per cent on glass insulators was made by one of the oldest manufacturers. A still further price increase is not improbable if present conditions continue. None of the factories is running for lack of fuel, and orders are filled from stock, which is reported as gradually reaching a pretty low stage. Shipments are made promptly from the glass plants when railroads will accept them or they are not prohibited by embargoes; deliveries are not guaranteed.

LINE MATERIAL.—Prices on line material, which have been abnormally high, have been reduced by an Eastern producer 10 per cent, effective Jan. 15. This manufacturer of hardware had accumulated a surplus stock, and reports

say he was obliged to lower his figures to reach a market. This reduction does not apply generally, and quotations are still high in other directions. Locust pins are still scarcer, with prices \$2.50 a thousand higher than previously quoted, also effective as of Jan. 15; but this, too, is an exceptional case. Different mills name varying prices, according to location and stock on hand. Rock-elm pins are being mentioned as coming into use as a substitute for locust, on account of the scarcity and cost of the latter.

COLLECTIONS AND CREDITS.—Prompt returns on collections are the average tenor of reports. Jobbers and distributors have opened the year with their books in better shape than is customary. No relaxation on credits is observed.

CONDUIT PIPE.—The market is reported as bare of conduit pipe in all sizes. A great quantity is in transit, but even the usually well informed on such matters dare not say when the goods may be found. Prices just now do not figure as much as delivery.

PORCELAIN INSULATORS.—High-voltage insulators were marked up 10 to 12 per cent within a few weeks, but the low-voltage type remains untouched. Stocks are none too plentiful and deliveries are slow. High-voltage goods are back four months, caused by slowness of production and delivery, but low-voltage insulators are in a slightly better position.

CHICAGO

During the past two weeks Chicago and the entire Middle West have undergone the most severe weather conditions in their history. Deep snows and severe cold have paralyzed transportation and slowed down industrial activity in every direction. The Garfield order, becoming effective this week, has made business additionally quiet.

Jobbers report orders coming in as usual, but deliveries are very much delayed. In compliance with the coal order business was practically suspended last Monday. Offices as well as factories closed. The general spirit has been to comply with the order as given, although personal opinion is almost unanimously critical of the ruling. Wire prices have not changed. In general there has been very little activity or change in conditions from last week.

A bulletin issued by the American Washing Machine Manufacturers' Association states that manufacturers have agreed to eliminate 171 distinct styles and models as a conservation measure but demonstrates that the washing machine is a labor-saving device and essential to winning the war. The total factory value of the machines produced during 1917 was \$10,000,000, an increase of 42.8 per cent over 1916. Practically all of the plants are situated west of Pittsburgh, and most of them are in the Mississippi Valley.

The entire incoming and outgoing tonnage of the 106 manufacturers was less than 10,000 tons per month. The total coal used during 1917 was only 20,000 tons.

MOTORS.—The motor price book issued Jan. 1 by the Emerson Electric Manufacturing Company, St. Louis, Mo., shows somewhat lower prices on repulsion-start-type single-phase motors, ½-hp. and larger; direct-current motors, ½-hp. and larger, and Davidson exhaust fans. There was no reduction, however, in the prices of other sizes and kinds of apparatus.

BOSTON

Electrical trade continues very brisk, despite the shutdown caused by the Garfield order. Jobbers closed Monday and salesmen on the road suspended work. Some Saturday afternoon work will be necessary partially to offset the curtailment. Jobbers cannot handle the present volume of business in eight hours daily, and as 75 per cent trade in some cases is government work no hope of exemption from the Monday order or short day enforced by the Massachusetts Fuel Administration is entertained. There is a tremendous reduction in central-station loads caused by the fuel order, many companies losing half to two-thirds the station output. The fuel saving is large, but not in proportion to the load reduction. Prices are holding firm; deliveries are temporarily worse because of railroad con-

gestion. There is little change in collections, and the curtailment will probably affect these adversely for a short time. Retail dealers have a rather quiet trade, many going over stocks and planning the year's business along labor-saving lines.

Large orders for switch and wiring material from the government have been given to switch factories, one maker reporting 1000 locking-type switches ordered. The government housing program is also leading to substantial wiring material orders. Porcelain is very scarce and high-priced. Copper is in fairly plentiful supply to electrical manufacturers. Labor is easier in the Connecticut Valley, 4500 men being discharged from munitions work in Bridgeport a few days ago.

The outlook is excellent for electric heating apparatus, especially for table appliances saving labor and conserving food through a better control of the cooking process. A reduced scale of living in smaller quarters predisposes many to purchase grills and small hot-plates. Factory stocks are low. Radiators are in heavy demand and deliveries are impeded by freight embargoes. It is hinted that prices may advance in high-class electric heating equipment for table service, though this is not certain.

Small turbines quote seven months' delivery on the non-condensing sets. There is some delay in getting generators for turbo units. Prices advanced about 10 per cent very recently. Skilled labor is scarce, but no serious effort is yet made to use women in the shops. Raw material is delayed by railroad difficulties, manufacturers state. Probably nine-tenths of the representative small turbine work is for the government.

Wire manufacturers are stocking up on the smaller sizes, and to a moderate extent prices are firm. There is a heavy government demand for power cable. A shutdown hampered production, as the factories on government orders are not generally exempted. The lamp situation is improving, and the entire stock of one manufacturer, wiped out by a fire Christmas week, is now replaced, involving about 500,000 lamps. Barring transportation delays, conditions should improve steadily. Manufacturers are making more lamps than ever before.

ATLANTA

A general rainstorm visited the South Friday and Saturday of last week and covered a wide area, which helped the water-power companies materially, but the precipitation was not sufficient in some sections to insure altogether against future curtailment from these sources. The timely rains, however, will permit the water-power companies to shut down auxiliary steam generating equipment during the present crisis and supply all power requirements from hydroelectric sources until the water gives out or, at least, until the five-day fuel-conservation period has expired. The sections using fuel for power purposes have calmly acquiesced in the disturbing industrial order, and the sections served from hydroelectric transmission lines are thankful for being allowed to continue operations. Although the industrial fabric has received a severe shaking, an undercurrent of optimism prevails in this section regarding future business activity.

Reports from authentic sources indicate that Americus, Ga., has been selected for an aviation camp, similar in type to the one being constructed at Montgomery, Ala., which will call for the expenditure of several millions. The government has definitely decided to locate a repair shop at Atlanta, Ga. This plant will cost in the neighborhood of \$2,000,000.

It is reported that General Crozier has arranged for the immediate construction of a powder plant, to cost \$60,000,000, at Hadley's Bend on the Cumberland River, near Nashville, Tenn. This plant will cover 4600 acres and employ 15,000 men.

STEAM-FLOW METERS.—The demand for this type of meter in the last year has been more or less sporadic, but the recent publication by the Fuel Administration of literature on fuel conservation has stimulated activity in this line and a number of equipments are being purchased for boiler rooms and slashers in the textile field.

SEATTLE

The week from Jan. 14 to 21 shows general business maintaining a steady and substantial volume, with both jobbers and retailers reporting gratifying sales far in excess of those experienced last January. Seattle jobbers report sales to shipyards, mills and other industrial plants very satisfactory, although there is no particular increase over last week. Seattle retailers, however, report a noticeable increase in sales, due primarily to increases along residence repair and building lines, over last week and a distinct increase in sales over January of last year. Portland jobbers report the placing of an extra large order for power apparatus, including motors, generators, turbines, panels, etc., for a million-dollar steel shipyard in Vancouver, Wash. This yard recently received a contract from the government for ten steel ships of 9500 tons capacity at a price of approximately \$17,000,000. The new plant will also manufacture boilers and machinery. Another four-million-dollar contract for steel ships was received last week by the Portland yard from the United States Shipping Board.

Portland jobbers as a whole report exceptionally heavy business with industrial plants so far this year. Retailers also report increasing sales of fixtures, wiring devices, lamps and other things used in small construction. Orders for cannery supplies for Alaska are being placed in large amounts more than a month earlier than was the case in previous years.

Buying will continue until April, when navigation to the north will be open. Cannery men are making space reservations with steamship companies and are not taking chances of a shortage of vessels in Alaska due to the war. Jobbers report that, while buying is heavy, the volume this year will not be so large as last year. While large orders are being placed for motors, generators and electrical accessories for new canneries, a large portion of the volume will be for repairs, maintenance and enlargements. Alaska electrical dealers are not buying nearly so heavily as last year, reporting business decreasing materially, owing primarily to the closing down of many mines on account of low-grade ores, increasing cost of labor and labor shortages, and secondarily to migration of Alaskans to Northwestern shipbuilding cities. Fisheries and canneries will continue activities as usual and government railroad work will proceed, otherwise Alaska is expected to be comparatively quiet.

Reported activities of small telephone companies in rural communities, looking toward some new construction and repairs, lead jobbers to believe small orders for wire, pole-line equipment, etc., will be placed shortly. Sales to telephone companies for the year past have been light, mostly for maintenance and repairs.

The contract for 500,000 incandescent lamps for Seattle's municipal lighting department will be let Feb. 1. The Board of Works of Seattle will open bids March 1 for the proposed five-million-dollar hydroelectric plant.

Steadily increasing demand for real estate has been a feature of the Seattle market since the beginning of the new year. Building permits for the first three weeks in January show an increase of 80 per cent over those for last year. Electrical permits in both Seattle and Tacoma since Jan. 1 show an enormous increase over same period last year.

During the first nineteen days of this month Seattle shipyards established a record that eclipses the industry's entire record for the year 1916. A vanguard of 20,000 skilled mechanics, who are to be sent to Northwest shipyards to carry on the gigantic shipbuilding program, arrived Monday. Owing to the enormous prices offered for timber products, many new logging firms are springing into existence. Machinery houses note increasing demand for machinery.

The freight situation remains very unsettled. Deliveries are bad, with no evident signs of immediate betterment. The government has not yet begun to insist upon maximum car loading. Intra-terminal switching is slowly being worked out, but the results expected have not materialized.

FUSES.—There is an increasing demand for refillable fuses, a large number of which are being used for repairs and maintenance work. Prices are steady and stocks are adequate.

HOUSEHOLD APPLIANCES.—Movement is quite slow as was to be expected following heavy holiday sales. How-

ever, irons, washers and sewing machines are selling better than could be expected.

WIRE.—A slight drop in price was noted early in the month. Stock shortage is no worse than heretofore reported. Deliveries are very unsatisfactory. The volume of sales shows a slight increase during past two weeks.

PORCELAIN.—The demand is increasing and shipments are hard to obtain and prices are on the increase.

SAN FRANCISCO

War-time activities or matters incidental thereto have steadily increased in their percentage of total business done, and changes that came with the new year have given this percentage large advances. Committees are effectively at work in relieving freight congestion and encouraging fuel economy. In the San Francisco "power dictator" is centered the control of more than 400,000 hp. Farm and factory are being made to serve war-time needs. New lumber mills are being laid out, primarily to supply material for shipbuilding and airplane plants. The mining of certain metals has been speeded up, while others are being neglected. In the bay region the construction of new yards for both steel and wooden vessels is so common as no longer to attract special attention. Collections are reported as very satisfactory, and practically no change in the extensions of credits has been made since the new year.

ELECTRIC RANGES.—Special attention is being given to hotel-type ranges and bake ovens. Installations of large size—that is, as many as six hotel-type ranges each—are being considered at some of the cantonments, and inquiries are being received from many organizations which provide food for large numbers of employees, guests or men in government service. Ranges of types for family use are not usually active at this season. Jobbers are holding off on 1918 range orders, apparently to see what effect the heating-appliance merger will have on the manufacture of ranges and because there have been rumors of a standardized range, but representatives of manufacturers in the merger affirm that three distinct types will be manufactured as heretofore. Family range sales in 1917 were 40 to 50 per cent more than 1916 sales, and an equal rate of increase over last year is predicted by manufacturers for this season. Power companies are less confident, but manufacturers point out that the business will be forced upon them because of the publicity.

METERS.—There is a steady demand for meters of switchboard type, and customers are becoming accustomed to taking substitutes in place of the exact type desired.

INTERPHONES.—One large company which has for some time solicited no business and refused orders for interphones has resumed the manufacture of this line and is now again actively in the market.

MOTORS.—The lowest rainfall on record in California has caused a rush for irrigation installations, and one company reports ten orders in rapid succession for motors of more than 100 hp., all for irrigation use. The demand for small sizes also continues steady, but no material change in delivery conditions is apparent. Several new irrigation districts will be completed and put in service this year, which will call for electrical equipment.

BUILDING CONSTRUCTION.—There is continued activity in the building line in the smaller towns, particularly in agricultural districts. The city of Sacramento has building construction totaling \$6,250,000 projected for this year. A considerable part of this is for Capitol extensions, but in part it reflects the generally prosperous condition of the agricultural areas in the Sacramento and San Joaquin valleys.

MOVING-PICTURE MACHINES.—A considerable trade in portable moving-picture projectors has been built up this winter, and the demand is increasing. The popular type are motor-driven machines costing slightly more than \$100. These are used for instruction purposes in training camps and schools and for demonstrations. The accessories, including lenses, are rheostats, carbons for lamps, lamp cord and fuses.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must

increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
B.&S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	
Less than coil.....	+10% to \$61.00
Coil to 1000 ft.....	+10% to \$59.17
No. 12 Solid	
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	—10% to \$68.87

Twin-Conductor

No. 14 Solid	
Less than coil.....	List to \$105.00
Coil to 1000 ft.....	—10% to \$70.00 to 10%
No. 12 Solid	
Less than coil.....	List to \$135.00
Coil to 1000 ft.....	—10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	
Less than coil.....	+10% to +20%
Coil to 1000 ft.....	—5% to —10%
No. 12 Solid	
Less than coil.....	+10% to +20%
Coil to 1000 ft.....	—5% to —10%

Twin-Conductor

No. 14 Solid	
Less than coil.....	+10% to +20%
Coil to 1000 ft.....	—10% to \$80
No. 12 Solid	
Less than coil.....	+10% to +20%
Coil to 1000 ft.....	—5% to —10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List to 10%
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	20% to list
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

No. 6 Regular	
Each Net	No. 6 Ignitor
Less than 12.....	\$0.40
12 to 50.....	.35
50 to barrel.....	.32
Barrel lots.....	.28 to .285 .29 to .295

CHICAGO

No. 6 Regular	
Each Net	No. 6 Ignitor
Less than 12.....	\$0.40
12 to 50.....	.35
50 to barrel.....	.3175
Barrel lots.....	.2875

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-60	35.00
2.....	25-60	45.00
2 1/2.....	25-60	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	
3/4-in. s. stp. Net to \$75.00	—12% to \$69.75
3/4-in. d. stp. +5% to 78.75	—9% to 72.00
1 1/2-in. s. stp. List to 100.00	—12% to 93.00
1 1/2-in. d. stp. +5% to 100.00	—9% to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	
3/4-in. single strip.....	\$75.00
3/4-in. double strip.....	78.75
1 1/2-in. single strip.....	100.00
1 1/2-in. double strip.....	105.00
	\$63.75
	71.25
	85.00
	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	
7/32-in. —	\$15 to \$60
\$25.00-\$55.00	\$20.50-\$24.75
1/4-in. —	\$60 to \$150
\$25.00-\$60.00	\$22.50-27.00
	\$20.00-\$24.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	
7/32-in. —	\$15 to \$60
\$36.67-\$55.00	\$25.00-\$37.50
1/4-in. —	\$60 to \$150
\$40.00-\$60.00	\$27.00-\$30.00
	\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	
Less than 2500 lb.....	4% to 6%
2500 to 5000 lb.....	6% to 9%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	
Less than 2500 lb.....	1.3% to 3.7%
2500-5000 lb.....	3.3% to 5.7%
(For galvanized deduct six points from above discounts.)	

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.....	\$5.00 to \$5.75
1/5 to std. pkg.....	4.50
Standard package, 500. List, each,	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.....	\$6.25
1/5 to std. pkg.....	6.25
Standard package, 500. List, each,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List.
Regular, clear:		Each
10 to 40-watt—B.....	100	\$0.30
60-watt—B.....	100	.35
100-watt—B.....	24	.70
75-watt—C.....	50	.70
100-watt—C.....	24	1.10
200-watt—C.....	24	2.20
300-watt—C.....	24	3.25

Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25.....	50	.53
25-watt—G 25.....	50	.55
40-watt—G 25.....	50	.55

Round bulbs, 3 3/8 in., frosted:		
60-watt—G 30.....	24	.77
Round bulbs 4 1/8 in., frosted:		
100-watt—G 35.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.....	Net
Std. pkg.....	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	Net
Std. pkg.....	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$24.90 to \$31.00
Coil to 1000 ft.....	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$29.00 to \$35.60
Coil to 1000 ft.....	21.50 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100.....	\$20.00 to \$29.00
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CHICAGO

Net per 100.....	\$19.25 to \$25.75
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OUTLET BOXES

Nos.	List,
	per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2,	
4 S.....	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.....	25%-37%	20% 32%
\$10.00 to \$50.00 list.....	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.....	40%	35%
\$10.00 to \$50.00 list.....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$20.00 to \$38.00
1/5 to std. pkg.....	19.00 to \$20.00
Standard package, 2200. List per 1000	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000.	\$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net
Std. Pkg. 3500 Std. Pkg. 4000	
5 1/2 N. C.—Solid Nail-it—N.C.	

Less than		
1/5 std.		
pkg.....	\$27.50 to \$29.00	\$30.75
1/5 to std.		
pkg.....	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net
Std. Pkg. 3500 Std. Pkg. 4000	
5 1/2 N.C.—Solid Nail-it—N.C.	

Less than		
1/5 std.		
pkg.....	\$11.85	\$30.75
1/5 to std.		
pkg.....	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push		
sockets.....	500	\$0.33
1/2-in. cap keyless socket.....	500	.30
1/2-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	Net
1/5 to std. pkg.....	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.....	\$25.00 to \$45.00
1/5 std. pkg.....	23.00 to 42.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:

30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34

30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00

30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00

Low Grade:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70

30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02

60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.....	List to + 5%
\$10 to \$25 list.....	11%
\$25 to \$50 net.....	14% to 15%

	Low Grade
Less than \$10 list.....	5% to 10%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.....	+ 5%
\$10 to \$25 list.....	10% to 11%
\$25 to \$50 list.....	14%

	Low Grade
Less than \$10 list.....	5%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.54
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	50	.76
10-amp. three-point.....	50	.76
10-amp. 250-volt, D. P.....	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List
1/5 to std. pkg.....	15%
Std. pkg.....	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+ 20% to list
1/5 to std. pkg.....	List to —15%
Std. pkg.....	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List
Union and Similar—	Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00		
list.....	List	Net to +10%
\$2.00 to \$10.00		
list.....	10% to 20%	5% to 10%
\$10.00 to \$50.00		
list.....	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than		
\$2.00 list.....	25%	15% to 20%
\$2.00 to \$10.00		
list.....	25%	20%
\$10.00 to \$50.00		
list.....	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price.....	\$5.00 to \$7.50
Discount.....	25% to 30%

CHICAGO

List price.....	\$4.50 to \$6.00
Discount.....	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net.
No. 18, less than full spools.....	\$0.44 1/4 to \$0.65
No. 18, full spools.....	0.43 3/4 to 0.55

CHICAGO

	Per Lb. Net.
No. 18, less than full spools.....	\$0.60 to \$0.65
No. 18, full spools.....	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net
	Less than 500 to 1000 to
	500 Ft. 1000 Ft. 5000 Ft.
No. 11.....	\$15.00-\$18.00 \$13.00-\$14.00 \$11.00-\$11.50
12.....	23.25- 25.41 21.30- 21.78 15.97- 19.35
10.....	32.40- 35.21 29.70- 30.18 22.13- 27.00
8.....	45.70- 49.12 41.90- 42.12 30.88- 38.00
6.....	72.40- 77.84 66.35- 66.72 48.93- 60.30

CHICAGO

	Price per 1000 Ft. Net
	Less than 500 to 2500 to
	500 Ft. 2500 Ft. 5000 Ft.
No. 14.....	\$18.00 \$13.00-13.50 \$11.50-12.00
12.....	25.33-25.69 22.02-25.33 18.35-20.40
10.....	30.48-33.04 27.94-30.03 22.86-28.33
8.....	42.54-48.97 38.99-41.98 31.90-39.42
6.....	66.46-67.38 56.15-62.05 50.53-56.39

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$33.25 to \$35.25
25 to 50 lb.....	31.25
50 to 100 lb.....	34.25 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.....	\$35.50 to \$40.35
25 to 50 lb.....	34.35 to 39.35
50 to 100 lb.....	32.50 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Induction Motors

A line of two-phase and three-phase induction motors is now being offered the trade by the Phoenix Electric Company, Mansfield, Ohio, which has been standardized in construction. The stator or stationary part of these motors has a solid cast-iron frame into which are built the thin steel punchings which make up the magnetic circuit of the stator. The stator slots are partly closed, thus obtaining greater starting torque, it is pointed out, than with the open-slot type, and thereby reducing the inrush of starting current. The starting coils are carefully wound and taped and thoroughly impregnated with insulating varnish, making them waterproof.

Special attention has been given to the rotor to make it as durable as possible. The laminations are assembled directly on the shaft between malleable-iron heads, and heavy copper rings are securely riveted to the rotor bars and soldered, making a construction that is practically indestructible. With motors of $7\frac{1}{2}$ hp. and larger a starter is provided which is of standard design of resistance type, without no-voltage release.

Louvers for Ventilating Fans

Louvers that are especially designed to prevent back draft and provide weather protection to fan openings when the fan is not running are made by the Batterman Truitt Company of Chicago. They consist of a number of semicircular vanes connected together in series. These vanes are pivoted slantingly with respect to a vertical plane and are inclined to drop



PREVENTS BACK DRAFT AND WEATHER PROTECTION

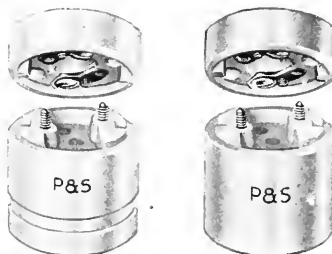
into a closing position without exerting an excessive resistance against their opening movement caused by air directed against them from the opposite side. The vanes when open or in partly open position occupy a dihedral angle with respect to the plane of

opening and thereby, it is pointed out, afford a better passage of air from the fan that will parallel vanes operating transversely with respect to their opening.

These louvers operate with practically no restriction on the fan. They are so designed that, the area of the center bridge being calculated and allowed for in the total outer frame dimensions, no restriction is caused by the center bridge. These louvers, it is said, are not affected by moisture, heat or by ordinary vapors.

Two-Piece Porcelain Sockets for Reflectors

P. & S. 1233, a two-piece porcelain socket without shade-holder groove, and its companion piece, P. & S. 1234, with shade-holder groove, have been placed on the market by Pass & Seymour, Inc., of Solvay, N. Y., for heavy-duty sockets for medium or normal base type "C" lamp fixtures. These receptacles have ample wiring room or clearance for a



SOCKETS WITH AND WITHOUT SHADE-HOLDER GROOVE

single or double pair of wires in the terminal hood, which may be supported by substantial machine screws spaced $1\frac{3}{16}$ in. (3 cm.) on centers.

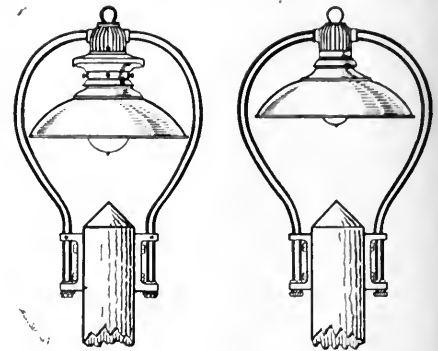
These receptacles are entirely front-connected, and the socket body is easily positioned by the aid of heavy porcelain tenons. All live parts, where necessary, are sealed in with a special compound which will successfully resist the extreme temperature to which the devices may be subjected in use.

Electric Log

The Majestic Electric Development Company, 1705 Allegheny Avenue, Philadelphia, is making an electric log for use in home fireplaces. Three elements of 6.15 watts each are mounted in front of a polished copper reflector. A regulating switch gives combinations of one, two or three units. The complete log weighs 35 lb. (15.8 kg.) and measures 19 in. by 12 in. by 10 in. (48.3 cm. by 30.4 by 25.4 cm.)

Lyre-Top Fixtures

Lyre-top fixtures designed for use in railroad yards and similar places have been designed by the Wheeler Reflector Company, 16 Pearl Street, Boston, Mass. The fixture on the right



DESIGNED FOR USE IN RAILROAD YARDS

has a canopy with ports cast in the side into which the arms are screwed for forming the frame of the bracket. This canopy has a copper screw ring rolled inside which engages the threaded collar on the reflector, making a rigid support. The lyre top shown on the left is used with a high-tension series porcelain receptacle head and the same reflector shown on the right.

Inclosed Switches

Safety steel-inclosed switches that will operate in either a horizontal or perpendicular position, or may be reversed end for end, are being marketed by the Leonard-Bundy Electric Company of Cleveland, Ohio. The door of the cabinet cannot be opened without tripping the switch, which makes it impossible to fuse a live switch. The switch cannot be partly closed and left there, giving insufficient contact and heating of receptacle springs, because this switch is so arranged that if it is not fully closed it will fly open again.

A quick-break action is provided so that no arcing occurs at the contacts. The lever and toggle principle is embodied in the handle, and an easy pull will close the switch, while a slight blow is all that is necessary to open it, the switch in fact opening itself after being once started.

The switch and cabinet are built very substantially and are designed to stand up under very severe usage. The cabinets are made of No. 12 gage steel and are reinforced with angle iron throughout, while the switch is not only rugged and durable but will stand 50 per cent to 100 per cent overload without heating, it is said.

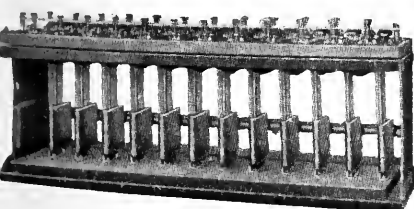
Luminous Indicator for Pull-Chain Sockets

A small luminous bulb which contains radium and glows in the dark is now being made by the Eastern Luminous Indicator Company, Inc., Waltham, Mass., for attachment to pull-chain sockets. This company is using the same radium compound in these small bulbs as has heretofore been used on dials and hands of watches, cages, clocks, compasses, etc., which it manufactures.

Charging Apparatus for Miner's Lamps

For the multitude of miner's electric lamps used in the mines a standard easily extensible charging rack has been developed by the Cutler-Hammer Manufacturing Company of Milwaukee. Each charging rack is designed to hold ten batteries, and as each rack is a unit an equipment may be laid out for a large number of lamps, or a small equipment can be purchased at the start and subsequently extended when additional lamps are purchased.

The racks are arranged to hook on brackets clamped on vertical $1\frac{1}{4}$ -in. (3.2-cm.) iron pipe supports. Two of these brackets are furnished with each rack, and they are so designed that in adding to an equipment it is not necessary to disturb the brackets which are already in place. The racks are built with a substantial steel frame which carries slate slabs on which the batteries are placed for charging. The batteries are placed in the racks edge-wise like books in a bookcase, which makes the apparatus very compact. Partitions are provided which prevent the battery cases from making contact with one another, and their design is such that a battery cannot be placed in the rack with the polarity reversed. On the top of the frame is mounted a slate slab carrying the contact parts. An inverted mushroom-shaped contact piece projects below this slab and is pressed in contact with the battery terminals by a substantial coiled spring. This is the only contact which is below the slab, all other current-carrying parts being mounted on the top, where they



UNIT CHARGING RACK CAPABLE OF ACCOMMODATING TEN BATTERIES

are out of the way of any discharge from the battery vents.

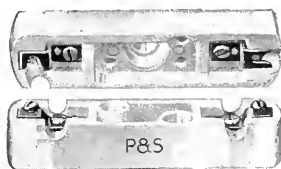
The circuit through the rack is laid out so that the batteries are charged in series, but provision is made by means of interpolating resistances so that one or any number of batteries can

be removed from the rack without appreciably affecting the charging current through the remaining batteries. It is thus possible to remove or add batteries to a rack during the charge at will without the necessity for adjusting the rheostat. The contacts are all interchangeable, and it is a simple matter to remove the mushroom contacts for inspection or cleaning should this be found necessary.

Equally spaced contact plates are installed on the front of the frame and connected to the contacts for the battery terminals, making it possible to read the voltage across any battery in the rack while it is on charge without interfering with the charging circuit. A rheostat panel is used with each set of charging racks. The number of charging racks that can be used with one rheostat is governed by the voltage of the charging circuit end.

Pivoted-Cap Cleat Rosette

A cleat rosette of special rugged construction, designed to carry the wires fully $\frac{1}{2}$ in. (1.27 cm.) from the surface wired over, has been brought out by Pass & Seymour, Inc., Solvay, N. Y. The terminals are arranged to separate the wires by a space of $2\frac{1}{2}$ in. (6.35 cm.), and the binding screws which secure the cap to the base are so arranged that the cap may be pivoted on one end while the other end of the cap, when the binding screws are released, swings in



AMPLE WIRING ROOM IN BASE

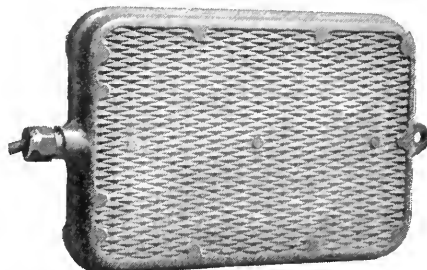
or out of position and is thereby made easy to wire on a step-ladder or at the bench. Ample wiring room will be found in the base, and provision is made in the cap for a practical knot in the drop-cord to relieve the strain on the terminals. This rosette has been designated P. & S. 565.

Insulating Tubing

A line of insulating tubing is now being made by the Fibro Products Company, New Bedford, Mass., which is fibrous in structure and not so dense as vulcanized fiber. The maker points out that its structure is between that of ordinary paper tubing and a vulcanized fiber tube. It is claimed that it is extremely strong and possesses the advantages of being waterproof, of high dielectric strength and retaining its size and shape. The material lends itself to the processes of manufacturing tubing and makes it possible to produce a tubing with little variation in size. The company mentioned is now equipped to produce fibro tubes in any practical diameter, wall thickness and length.

Foot Warmer for Outdoor Service

To minimize the discomfort of long standing outdoors in severe weather, an electrically heated foot warmer has just been placed upon the market by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. While designed primarily for look-



GIVES UNIFORM DISTRIBUTION OF HEAT

outs stationed in the bow and crow's nest of vessels, the device is applicable to the use of watchmen, sentries, door-men, traffic policemen and others whose work requires them to be out of doors continuously with little chance for exercise. It has been found that if the rest of the body is adequately clothed, a foot warmer will insure comfort at any temperature.

The device consists of a casting 14 in. by 20 in. by 25 in. (35.6 cm. by 50.8 cm. by 63.5 cm.), with diamond-tread top. This is of cast iron or of a non-magnetic metal when desired, as in ship service. Against the under service of this the heater element is clamped. The heater is a slotted ribbon clamped between two plates of built-up mica so arranged as to give uniform distribution of heat. A sheet-steel plate fastened by screws and sealed with high-melting gum renders the entire unit waterproof. The resistance is divided into two parts, which may be connected to draw 200, 100 or 50 watts at 125 volts. A three-conductor cable 7 ft. (2.1 m.) long is provided. By using the lower heats in mild weather there is no danger of causing chilblains.

Attachment Plug

A solid attachment plug, called the "Jiffy Junior," has just been put on the market by the Best Electric Company of Pittsburgh, Pa. The "Jiffy Junior" is made in one piece (with separate tip) of asbestos composition. The terminals are molded into the plug, and the brass screw shell is die-stamped permanently into place, giving a most substantial construction. By loosening one screw, the tip is removed and the plug is open for wiring. The wires are then cut to even lengths. No knots are necessary, as the right-angle strain reliefs securely hold the wires. This plug has the advantage of being quick and easy to wire. It is wired in the open, and one screw holds the plug together securely. Being made of asbestos composition, the plug, it is claimed, is indestructible and safe to use with any device.

Trade Notes

W. G. ARTHUR REID has been appointed general manager of the Bryant-Marsh branch of the National Lamp Works of the General Electric Company, centering at Detroit, Mich. This will be a separate division.

THE FIRST NATIONAL BANK of Boston, Mass., assisted by its branch in Buenos Aires, Argentina, is in a position to furnish exporters and importers with dependable and credit information and reliable statements of market conditions in the Argentine.

THE VULCAN STEEL PRODUCTS COMPANY of New York City is publishing a spirited illustrated monthly house organ entitled *Vulcan*. It is a journal of co-operation and help for the Vulcan company's interests, particularly in its rapidly developing export trade.

THE MOLONEY ELECTRIC COMPANY, LTD., of Toronto, Can., announces that it has opened a branch office and warehouse at Halifax, N. S., for the Maritime Provinces. E. A. Seath, who has been transferred from the Montreal office, will have charge of that territory.

JOHN D. STOUT has been appointed Chicago representative for the Terry Steam Turbine Company, Hartford, Conn. Mr. Stout was at one time assistant engineer of the Terry company and was recently transferred from the New York office, where he was assistant manager.

BURTON FRENCH, who has been associated with the Insull organizations in Chicago for the last eighteen years, has opened an office at 492 Continental and Commercial National Bank Building, as a consulting engineer, to engage in the preparation of appraisals, examinations, investigations and reports upon public utility properties for financing and operation.

THE IRVING NATIONAL BANK of New York City has issued for general distribution a pamphlet entitled, "Practical Questions and Answers on the Trade Acceptance Method." Besides the clearly presented information contributing to the campaign of education in the more general use of this species of commercial paper, it contains the improved trade acceptance form approved by the American Trade Acceptance Council. This body embraces committees of the Chamber of Commerce of the United States, American Bankers' Association and National Association of Credit Men.

THE ROBBINS & MYERS COMPANY of Springfield, Ohio, has appointed Edgar A. Wilhelm, manager of its export department, with offices at 30 Church Street, New York City, in connection with the company's domestic quarters at the same address. Therefore, the concern's export business was looked after by Mr. Wilhelm as president of Edgar A. Wilhelm, Inc., which handled the foreign trade of several other manufacturers. The new appointee has made seven trips around the world, traveling in Europe, the South and Central American countries and the West Indies; consequently he is familiar with the details in connection with handling foreign business.

THE AMERICAN CHAMBER OF COMMERCE of Paris, France, desires to bring to the attention of American manufacturers who are sending copies of their catalogs to France the advisability of printing on such catalogs the date of their issuance. While catalogs sent to chambers of commerce and consulates are stamped with the date of their receipt and therefore an approximation of when they were issued is possible, if a business house or other recipient does not so stamp an incoming catalog there is a great chance of confusion of dates, with consequent misunderstandings between the foreign buyer and the American seller as to price, patterns, etc. The chamber has recently established a catalog file, and now possesses catalogs of more than 500 American firms. Owing to the ever increasing demand for American products and devices, members of the chamber as well as all American manufacturers interested in export trade are invited to send their catalogs to the chamber. These catalogs, after being properly indexed, will be open to all inquirers.

A NEW WESTINGHOUSE DEALER MAGAZINE.—To stimulate dealer interest and co-operation, the Westinghouse Electric & Manufacturing Company has just begun the issuance of a monthly publication. This paper is to be known as *Contact* and is the same size as the *Saturday Evening Post*, to permit effective display of its contents and full-scale reproduction of advertisements in

national mediums. The new magazine will replace the Westinghouse company's monthly *Merchandising Calendar* and also the special publications distributed on merchandising campaigns which are issued from time to time through the year. The intention is to make *Contact* a clearing house of ideas for Westinghouse distributors. Whether these ideas cover window display, stock accounting, stock arrangement, canvassing or any merchandising problem, they will be welcome in its columns. New sales ideas, successful campaigns, plans for more business, for bigger net profits, for better service from employees, are being solicited by Westinghouse representatives throughout their trade. The first issue contains articles on getting rid of after-Christmas stock, bigger profits by better planning of advertising according to a definite schedule, sales letters that "bring home the bacon," and the value of the proper spending of our money in winning the war. *Contact* is sent gratis to dealers in Westinghouse supplies and appliances.

THE LYONS FAIR will be held at Lyons, France, March 1 to 15, 1918. It will be the third annual event, the first two fairs having been held in 1916 and 1917 in the full tide of war. The press has recorded an almost unhopd-for success. The amount of business transacted was 57,000,000 francs in 1916 and 180,000,000 francs in 1917. The last figures do not include the business done by means of catalogs in the United States bureau. The amount of this business alone totaled \$42,000,000. Numerous and lasting business relations have been created between parties who were entirely unknown to each other before the advent of the fair. In 1916 no American concern was represented at the fair, and last year, in spite of extensive publicity, only thirty-three firms were represented. It is hoped, however, that this year the United States will be well represented. American business men should realize that the Lyons Fair will give them contact not only with French buyers but with buyers from Spain, England, Holland, Italy and all the other exhibiting countries. This fair is not an exhibition but a commercial proposition. No goods can be sold at retail, orders being booked in wholesale quantities from samples exhibited. Particulars concerning rules and regulations may be obtained from George B. Van Cleve, 1790 Broadway, New York City, who is chairman of the American committee of the Lyons Fair.

Trade Publications

MILLIVOLTER.—The Pyroelectric Instrument Company of Trenton, N. J., has issued circular No. 9, descriptive of its Northrup millivoltmeter.

PORTABLE TOOLS.—The Stow Manufacturing Company of Binghamton, N. Y., is distributing a bulletin entitled "Portable Tools of Proven Value."

STOKERS.—Leaflet 3986, descriptive of underfeed stokers, has been issued by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

LIGHT CONTROLLER.—The Barrett automatic light controller for Ford cars is described in a leaflet prepared by the American Sales Corporation of Pittsburgh, Pa.

SECOND - HAND MATERIAL.—The Walter A. Zelnick Supply Company of St. Louis has issued a bulletin, No. 230, in which is listed its material on hand for immediate delivery.

RAILWAY DATA.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing Vol. 1, No. 3, of "Railway Engineering Data." A reprint from the *Electric Journal* on "Problems Confronting the Electric Railway Industry" is also being distributed.

HEAT REGULATOR.—The Western Electric Company of New York has prepared a folder in which is described the new heat regulator recently offered to the trade. This circular points out the prominent features of this device, how the contractor can sell it, what it does and how it works.

HEATING DEVICES.—The Simplex Electric Heating Company of Cambridge, Mass., has prepared eighteen bulletins, inserted in one folder, in which are described and illustrated the heating devices of this company. The devices described are soldering irons, household devices, glue pots, baking ovens, water heaters, hotel appliances, immersion coils, disk stoves, fry kettles, ranges, radiators, hot closets, laundry and tailor equipment and instrument sterilizers.

SPACE HEATER UNIT AND AIR HEATER.—Two small six-page circulars have just been published by the Cutler-Hammer Manufacturing Company of Milwaukee. One folder is entitled, "C-H Electric Space Heater Unit" and describes a steel-jacketed unit which is approximately the size of a 2-ft. rule. The circular describes a number of applications of this unit, giving several suggested ways of mounting it. The circular also makes note of the fact that these heater units are now put up in standard packages of ten each, carrying a label at each end so that the boxes can be easily identified when carried on the shelves of the stockroom. The rating of each unit is 500 watts, and they may be used on either alternating-current or direct-current circuits. The other circular is entitled, "C-H Electric Air Heaters." These heaters are divided into a number of groups, several being for industrial or mill use, made with ratings of from 2 kw. to 10 kw. Other heaters are illustrated and are particularly desirable for offices, bedrooms, bathrooms, etc., and have a better appearance than the mill or industrial type of heater. The dimensions, ratings and prices are given in the folder.

New Incorporations

THE ROCK RIVER POWER COMPANY of Watertown, Wis., has been chartered with a capital stock of \$5,000 by George E. Man-shot, A. M. Keniston and Pulius Podolski.

THE DAVISON ELECTRIC COMPANY of Tulsa, Okla., has been incorporated by Frank S. Davison, Jay Collis and James E. Hotham of Tulsa. The company is capitalized at \$10,000.

THE AJAX ELECTRIC COMPANY of Jersey City, N. J., has been incorporated with a capital stock of \$100,000 by W. C. Banks, H. Shippen and D. C. Roberts, all of Hoboken, N. J.

THE TIDEMAN ELECTRIC MANUFACTURING COMPANY of Cairo, Ill., has been chartered with a capital stock of \$650,000 by Henry Tideman, Charles M. Roos and James H. Galligan.

THE DIX-KELLY ELECTRIC SHOP of Fort Wayne, Ind., has been incorporated by Robert E. Kelly and Frank Dix. The company will do a general electrical service and supply business.

THE LUCKEY (Ohio) LIGHT & POWER COMPANY has been incorporated with a capital stock of \$5,000 to generate and distribute electricity. The incorporators are: Chester C. Martin, George Weiling, William Aspacher, William L. Hoelter and William H. Schwane.

THE R. I. ELECTRICAL INSTRUMENT COMPANY of Providence, R. I., has been incorporated by Claude R. Branch, Edson K. Smith and Herbert J. Humphrey of Providence. The company is capitalized at \$50,000 and proposes to do a general manufacturing business.

THE WHITEWATER POWER & MINING COMPANY of Wilmington, Del., has been incorporated under the laws of the State of Delaware with a capital stock of \$500,000. The company proposes to do a general mining business, distribution of power by steam, electricity, etc.

THE AMERICAN SYNDICATE OF INDUSTRIAL ENGINEERING of New York, N. Y., has been organized with a capital stock of \$180,000 to do a general electrical engineering and contracting business. The incorporators are George V. Reilly, S. B. Howard and A. W. Britten, 65 Cedar Street, New York, N. Y.

THE AUTOMATIC ELECTRIC LIGHT COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at \$1,000,000 and proposes to manufacture electric lamps, globes, etc. The incorporators are: A. W. Britton, S. B. Howard, G. V. Reilly, all of New York, N. Y.

THE MESSER & ZUBER MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$200,000. The company proposes to manufacture automatic signal lamps for automobiles, etc. The incorporators are: S. N. Messer, L. F. Zuber and F. J. Rocks of Brookville, Pa.

THE BRASSIE-BOWERS ELECTRIC COMPANY of Indianapolis, Ind., has been incorporated by Ralph E. Bowers, Lloyd M. Bowers and Ralph A. Brassie. The new company will take over the fixtures, merchandise and lease of the office at 637 Main Street of the Decker-Chadbourne Electric Company, which recently went into the hands of a receiver.

New England States

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has purchased the water rights connected with the United States Bobbin & Shuttle Company, giving the company all the water privileges that are desirable from the mouth of the river in this city, where it empties into the Merrimac River and the village of Goffstown.

CHICOPEE, MASS.—The Turners Falls Power & Electric Company will install at once an additional 750-kw. motor-generator set at its local plant.

GREAT BARRINGTON, MASS.—The Great Barrington Electric Light Company has petitioned the State Gas and Electric Commission for an approval of an issue of \$180,000 in capital stock to pay for additions and extensions to its plant and system.

GREAT BARRINGTON, MASS.—A joint petition has been presented to the State Gas and Electric Commission by the Great Barrington Electric Company, the Lenox (Mass.) Electric Company and the Stockbridge Lighting Company for approval of the consolidation of the three companies.

LEOMINSTER, MASS.—The City Council has accepted a contract with the Leominster Electric Light & Power Company for lighting the streets of the city. The contract provides for a franchise permitting the company to erect a transmission line through Florence, Howard, Lancaster and Litchfield Streets and Elm Hill Avenue, to connect a substation with its main line from Still River.

PALMER, MASS.—Plans have been filed by the Wright Wire Company for the construction of an addition to its local plant, for which contract has been awarded to the Eastern Bridge & Structural Company, 88 Crescent Street, Worcester.

STOCKBRIDGE, MASS.—The Stockbridge Lighting Company has applied to the State Gas and Electric Commission for permission to issue \$8,500 in capital stock, the proceeds to be used for extensions and improvements to its plant.

TURNERS FALLS, MASS.—During the present year the Turners Falls Power & Electric Company will put into operation a new station, known as the Hampden station (steam generating), which will be equipped with eight 652-hp. Edge Moor boilers, two 15,000-kw., 13,200-volt, three-phase, 60-cycle turbines, six (two banks) 6250-kva., single-phase, 66,000/13,200-volt Westinghouse transformers, and H-6 and KO-26 oil switches.

WOBURN, MASS.—The City Council is considering compelling the Edison Electric Illuminating Company to place its wires underground on part of Main Street.

Middle Atlantic States

ALBANY, N. Y.—Three bills have been introduced in the State Legislature by Senator Gibbs of Buffalo, providing for the construction by the State of a hydro-electric plant on Goat Island, Niagara Falls, to develop 50,000 hp. If the measure should be approved by the voters, provision would be made for a bond issue of \$3,000,000. Under the terms of the proposed bill the plant would be operated either under the management of the State or by lease.

BROOKLYN, N. Y.—Plans are being prepared by the Interborough Rapid Transit Company, 165 Broadway, New York City, for the erection of a one-story transformer station, 50 ft. by 100 ft., on Livonia Avenue, near Rockaway Avenue, Brooklyn, to cost about \$40,000.

ELMIRA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 14, for installing a conduit and lighting system in the United States post office at Elmira, N. Y. Drawings and specifications may be obtained at the above office or at the office of the custodian at Elmira.

MECHANICSVILLE, N. Y.—The City Council has authorized the commissioner of public works to prepare specifications for bids for lighting the streets and public buildings of the city of Mechanicville, to be opened not later than Jan. 28. Two forms of bids are to be submitted, one for a straight five-year contract from Feb. 1, 1918 to Feb. 1, 1923, the other to be subject to cancellation at any yearly period after Feb. 1, 1919.

MIDDLEPORT, N. Y.—The capital stock of the Middleport Gas & Electric Company has been increased from \$30,000 to \$50,000.

OGDENSBURG, N. Y.—The Oswegatchie Light & Power Company of Gouverneur, it is reported, is contemplating extending its electric transmission line into Ogdensburg

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way.

SCHENECTADY, N. Y.—J. C. Aitkin, 216 South Centre Street, is contemplating the construction of an extension (one story) 50 ft. by 80 ft., to his storage battery works.

SPRINGVILLE, N. Y.—Power lines of the municipal electric-light plant will be entirely rebuilt this summer. About 2 miles of line has been completed and probably as much more will be erected during this year.

UTICA, N. Y.—Plans have been filed by the Utica Steam & Mohawk Valley Cotton Mills, 1000 Broad Street, for the construction of an addition to its power plant, 30 ft. by 70 ft., one-story, to cost about \$11,000. Contract has been awarded to George Hopp, 1022 Seymour Street, Utica.

BURLINGTON, N. J.—A section of the power plant and laundry building of the Masonic Home, located outside of the city limits, was destroyed by fire on Jan. 14, causing a loss of about \$12,000.

JERSEY CITY, N. J.—Plans have been filed by the Public Service Electric Company for an addition to its plant at the foot of Duffield Avenue, to cost about \$4,000.

JERSEY CITY, N. J.—A bill has been introduced in the Legislature providing for an issue of \$150,000 in bonds for the proposed improvements and extensions to the Hudson County electric plant, to enable the plant to furnish electricity for lighting the county institutions, streets, etc.

KENILWORTH, N. J.—The Borough Council has voted to enter into a contract with the Public Service Electric Company for lighting the streets of the borough. The contract calls for 58 lamps.

KEYPORT, N. J.—Application has been made to the City Council by the New York Telephone Company for permission to install new underground conduits in a number of additional streets in the city.

LAMBERTVILLE, N. J.—The Lambertville Public Service Company has announced that, due to the shortage of coal, the electric street-lighting system will not be operated until further notice.

LODI, N. J.—Bids will be received by the Mayor and the Borough Council until Feb. 11 for the construction of an auxiliary pumping plant and extension to the water distributing system, consisting of brick structure and chimney, boiler, feed pump, etc., and cast-iron pipe. Copies of plans and specifications may be obtained from Thomas F. Bowe, consulting engineer, Association Building, Rutherford, N. J., or 95 William Street, New York, N. Y., upon deposit of \$15, of which \$12 will be refunded.

TRENTON, N. J.—The Public Service Corporation has announced that all arrangements have been perfected for the early installation of an electrolysis mitigation system.

HARRISBURG, PA.—The Harrisburg Light & Power Company is contemplating the installation of four new stokers at its plant in connection with the proposed improvements. C. M. Kaltwasser is general manager.

KUTZTOWN, PA.—The Borough Council is considering calling an election to submit the proposal to appropriate \$15,000 for the completion of the municipal electric-light plant.

SCRANTON, PA.—Plans have been prepared for the erection of the Johnson School, Richmond Hill, Scranton, a three-story school building, 40 ft. by 160 ft., to be used for manual training work. Fred Nelson, Connell Building, is architect.

BALTIMORE, MD.—Contract has been awarded by the Consolidated Gas, Electric Light & Power Company to the Cowan Building Company, 106 West Madison Street, Baltimore, for the construction of a substation on Post Office Avenue.

MARLINGTON, W. VA.—The municipal electric-light and water plant was recently destroyed by fire, leaving the city without electrical service. The plant, it is understood, will be rebuilt. Frank King is manager.

SWITCHBACK, W. VA.—The central power plant of the Appalachian Power Company, which has been supplying electricity to approximately 81 mines in the Pocohontas and New River coal fields was recently destroyed by fire. The company, it is understood, will rebuild the plant.

WASHINGTON, D. C.—The erection of a three-story building on F Street near Seventeenth Street has been authorized by the War Department for use of telephone system of the department. A. D. Scovel will be in charge of the service.

WASHINGTON, D. C.—Bids will be received by the United States Reclamation Service, Department of the Interior, Washington, D. C., until Feb. 5 for furnishing electrically-operated drag-line excavators for the North Platte, Neb., project.

WASHINGTON, D. C.—Bids will be received at the office of the chief of Bureau of Yards and Docks, Washington, D. C., until Feb. 11 for furnishing under specification (2786) electrically-driven capstans at the Norfolk and Philadelphia navy yards. The cost is estimated at \$110,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval station supplies as follows: Brooklyn, N. Y., Schedule 1665—Miscellaneous plain interior-communication cable; Schedule 1664—15,000 ft. single-stranded, rubber-covered wire. Puget Sound, Wash., Schedule 1663—16,000 ft. single-conductor lighting and power wire, 13,000 ft. two-conductor lighting and power wire.

North Central States

DETROIT, MICH.—A permit has been granted to Esselstyn, Murphy & Hanford to erect a power house on Livernois Avenue for the Lincoln Motor Company, to cost about \$100,000.

EATON RAPIDS, MICH.—At an election held Dec. 31 the proposal to issue \$30,000 in bonds for the purchase of the water power at Eaton Rapids and Smithville on the Grand River, 2 miles distant, was defeated. This is the second time the voters have defeated the bond issue.

MARQUETTE, MICH.—Arrangements have been made by the City Commission to employ an engineer to prepare plans and estimates for the construction of an addition to the hydroelectric power plant on Dead River, to cost approximately \$75,000. Charles Retaillic is superintendent of the municipal light and power plant.

PIQUA, OHIO.—Owing to the request of the government to conserve fuel, Mason H. Lytle, local manager of the Dayton Power & Light Company, has asked the City Council either to revoke or hold the contract on file for the proposed ornamental lighting system in Piqua until conditions are changed.

YOUNGSTOWN, OHIO.—The Ohio Public Utilities Commission has granted the Mahoning & Shenango Railway & Light Company permission to issue \$2,000,000 in bonds, the proceeds to be used for improvements to be made to its system during 1918.

HODGENVILLE, KY.—The Hodgenville Lighting Company is planning to install an ice plant this spring. C. L. Herrin is president.

MAYFIELD, KY.—The water and light plants of the Mayfield Water & Light Company have been purchased by the city of Mayfield, which will take over the property March 31. C. A. Orr is superintendent of the Mayfield company.

STURGIS, KY.—The Sturgis Electric Light Company has recently installed a 200-kw. Westinghouse synchronous motor-generator set, 2200 volts, alternating current, 250 volts, direct current. Sherman Melton is electrical engineer.

WHITESBURG, KY.—The Kentucky River Power Company of Hazard is contemplating extending its electric transmission line from Hazard to Whitesburg.

AKRON, IND.—The Akron Light, Heat & Power Company is contemplating building an automobile storage battery charging and repair station. Karl B. Gast is secretary.

AURORA, IND.—The Indiana Public Service Company has erected 9 miles of 33,000-volt transmission line to connect with the line now being erected by the Union Gas & Electric Company of Cincinnati. The company expects to purchase energy for its system in Aurora and close down the local plant. C. B. Hanna is manager.

GARY, IND.—The Gary Heat, Light & Water Company, controlled by the United States Steel Corporation, is building a new 300-kw. substation and transmission line. F. W. Van Sise is superintendent.

HOPE, IND.—Improvements are contemplated to the Pulse & Porter electric-light plant, including resetting boilers, repairing engines, installing Fairbanks-Morse oil en-

MARION, IND.—The Marion Lighting & Heating Company contemplates enlarging its plant during 1918. O. M. Drischel is general manager.

ORLAND, IND.—The Orland Light & Power Company expects to establish an 18-hour service in the near future and to erect some rural transmission lines this summer, and also to improve the water power to its highest efficiency as soon as possible. L. W. Jacob is owner.

ZIONSVILLE, IND.—The motor in the power house of the Zionsville Water & Electric Light Company was recently burned out, leaving the town without electrical service.

CHESTER, ILL.—The office and sales-rooms of the Salline Electric Company were recently destroyed by fire.

CULLOM, ILL.—The Cullom Electric Company is rebuilding all its distribution lines, on which work is about one-half completed. A. G. Walter is manager.

MATTOON, ILL.—The Central Illinois Public Service Company has petitioned the Public Utilities Commission for authority to issue \$500,000 in bonds.

PRINCETON, ILL.—The City Council is considering the purchase of an additional generating unit for the municipal electric-light plant or buying energy from the hydroelectric plant at Marseilles. Clarence Anderson is city clerk.

VERMILION, ILL.—The Town Board is considering the advisability of granting an extension of the lighting franchise of the Terre Haute, Indianapolis & Western Traction Company which has expired.

AKELEY, MINN.—The Cuyuna Range Power Company is installing a 200-kw. three-phase, 60-cycle generator connected to a cross compound, condensing Corliss engine. When improvements are completed (about May 1) the company will establish a 24-hour service in both Akeley and Walker. Series 6.6-amp. lamps will be used for street lighting. M. D. Stoner is president and manager.

BRAINERD, MINN.—The City Council contemplates a new water supply this season, including a new pumping station and equipment and laying approximately 14 miles of new water mains. William Nelson is secretary of water and light board.

GLENWOOD, MINN.—The Glenwood Electric Light, Heat & Power Company is planning to extend its high-tension transmission line to Cyrus this year. E. O. Burrow is superintendent.

HAWLEY, MINN.—The city of Hawley has a two-year contract with the Hawley Milling Company to furnish energy to operate the municipal electric-light plant. At the termination of the contract the city will probably install a steam plant. J. P. Roach is superintendent.

KEEWATIN, MINN.—Plans are being considered for replacing the arc lamps on three city blocks with an incandescent system, using type "C" lamps. A. Bodoh is superintendent of the municipal electric-light plant.

MAYNARD, MINN.—The transmission lines of the municipal electric-light system are being extended within the village limits furnishing electrical service to farmers along the lines. Lawrence A. Sanner is manager.

NEW PRAGUE, MINN.—Improvements are contemplated to the municipal electric-light plant, including the construction of a 100-ft. chimney, 40 in. in diameter at the top, one 80,000-gal. steel water tank to be built on the present tower, which is 80 ft. high. Joseph T. Rynda is superintendent.

BRITT, IOWA.—The Britt Light & Power Company contemplates the purchase of a 100-hp. horizontal return tubular boiler during 1918. L. M. Goodman is president.

DANBURY, IOWA.—The Durst Light & Power Company is considering extending its electric transmission lines toward Mapleton this summer. Mark Durst is manager.

DES MOINES, IOWA.—Bids will be received by the city of Des Moines until Feb. 13 for the construction of a municipal building, including steam heating, electric wiring, one electric passenger elevator, vacuum cleaner, plumbing, etc. The building will be 83 ft. by 172 ft., three stories and basement, and will cost about \$350,000. Frank Jeffries is city clerk.

EARLHAM, IOWA.—The town officials are considering the extension of the municipal electric transmission lines into the farming sections and will require equipment, including poles, wire, transformers, etc. M. A. Thorp is superintendent.

EARLING, IOWA.—The Stinn Implement Company is erecting an electric transmission line into the country, 5 miles out, and will furnish electrical service to country residences in the spring. The company has recently completed a new power station and

the erection of an electric transmission line to Westphalia, a distance of 5½ miles. A. C. Stinn is manager.

HAWARDEN, IOWA.—The municipal electric-light plant was recently damaged by a loose flywheel, causing a loss of about \$4,000.

SIoux CITY, IOWA.—The city clerk has been authorized to ask for bids for an air-lift pumping system for the Main Street pumping station, consisting of nine air-lift pumps, booster, piping, air compressors, engines, etc. The cost is estimated at about \$50,000.

WINTERSSET, IOWA.—Improvements will be made to the municipal electric-light plant, including the installation of a 150-hp. boiler and the erection of a smokestack 125 ft. high. L. O. Klein is manager.

KANSAS CITY, MO.—Initial steps have been taken by the Kansas City Light & Power Company for the construction of its proposed power plant on the Missouri River at the foot of Brooklyn Avenue. The present plans provide for an ultimate generating capacity of 150,000 kw., which with the necessary distributing lines will cost approximately \$15,000,000. The initial installation will consist of two turbines with a rating of 25,000 kw. each and will cost about \$5,220,000. Two intake pipes will be built, each of which will supply the condensers with 200,000 gal. per minute. Each turbine will be equipped with a condenser.

ST. LOUIS, MO.—Contract, it is reported, has been awarded by the Wagner Electric Manufacturing Company for the erection of a new plant, 130 ft. by 500 ft., one story.

ST. LOUIS, MO.—The Union Electric Light & Power Company has applied to the Public Service Commission for permission to issue \$1,500,000 in bonds and \$1,000,000 in additional capital stock.

ST. LOUIS, MO.—Plans are being considered by the St. Louis Malleable Castings Company, Conduit Avenue, for the construction of a new plant, consisting of a machine shop, forge shop, foundry, electric power plant and other buildings. The cost is estimated at \$50,000.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service, City Hall, St. Louis, until Jan. 29 for the installation of four 425-hp., Heine type, water tube boilers, eight automatic chain grates and stokers, coal and ash-handling machinery, erection of brick and concrete stack, 250 ft., with smoke flue connections. Plans and specifications may be obtained at the office of E. E. Wall, water commissioner.

WELLSVILLE, MO.—The electric plant of the Blattan Poultry & Manufacturing Company was recently destroyed by fire. The company also supplied electricity in the town.

BAYARD, NEB.—Bonds to the amount of \$5,500 have been authorized for the installation of a lighting system.

MURRAY, NEB.—The City Council has contracted with the Nebraska City (Neb.) Utilities Company to furnish electricity for commercial purposes for city distribution system.

ASHLAND, KAN.—New equipment, consisting of an 80-kw., three-phase, 60-cycle, 2300-volt generator and a 100-hp. De La Vergne gas engine is being installed in the municipal electric-light plant. O. M. Chinn is superintendent.

BELOIT, KAN.—Improvements are being made to the municipal light and water plant, including the installation of a new filtration plant and erection of an addition to power house. A Custodis radial brick chimney has recently been completed and a 150-hp. boiler installed. New pumping machinery, which has been ordered, will soon be installed. F. A. Darst is superintendent.

CANEY, KAN.—The Kansas Light & Power Company, which recently took over the local plant, contemplates building a new plant this spring. Steam power will probably be used. L. R. MacConnell is president and general manager.

DIGHTON, KAN.—At an election to be held Feb. 4 the proposal to issue \$10,000 in bonds for extensions to the municipal water and light plant will be submitted to the voters.

GARDEN CITY, KAN.—Improvements are being made to the municipal electric-lighting system, including the erection of 1½ miles of power line; installing one 50-hp. and two 25-hp., 2300-volt motors and pumps, to pump the city water. S. E. Austin is superintendent.

GYPSUM, KAN.—The Central Kansas Power Company is extending its electrical service to Kipp. J. F. Keys is secretary and manager.

LINCOLN, KAN.—The City Council is considering the installation of a 250-hp. Diesel engine-driven unit in the municipal

light and water plant soon. A. W. Seng is superintendent.

MCPHERSON, KAN.—New equipment, including a 312-kva. generating unit, directly connected, driven by a Skinner millflow engine and a Union Iron Works 250-hp. water tube boiler is being installed in the municipal electric-light plant. C. F. Kasmussen is superintendent.

NESS CITY, KAN.—The installation of a new 100-hp. Snow oil engine in the municipal electric-light plant is under consideration. A 24-hour service will be established about March 1. Claude Baker is superintendent.

WILSON, KAN.—The town officials are considering taking over the plant of the Wilson Electric Light Company and consolidating it with the municipal electric-light plant.

Southern States

RALEIGH, N. C.—The installation of an additional 200-hp. boiler in the steam heating plant of the North Carolina State College of Agriculture and Engineering is under consideration.

ATLANTA, GA.—The United States government has definitely decided to locate a repair shop at Atlanta, Ga., to cost about \$2,000,000. The Mackie Construction Company of Atlanta will build the plant. Col. Stayer, Forsythe Building, is in command.

PENSACOLA, FLA.—The Pensacola Electric Company is contemplating the erection of a 13,200-volt transmission line to the Pensacola naval station. Thomas J. Hanlon, Jr., is manager.

ALEXANDER CITY, ALA.—At an election to be held Jan. 21 the proposal to issue \$10,000 in bonds for extensions to the municipal electric-light plant will be submitted to the voters.

ATMORE, ALA.—The W. M. Carney Mill Company is contemplating the installation of a 10-ton ice plant, to be operated in connection with the electric plant. Ward Converse is manager of the electrical department of the company.

FOLEY, ALA.—Bonds to the amount of \$3,000 have been voted to build or purchase an electric-light plant.

SOUTH FLORENCE, ALA.—Plans have been prepared by the War Department for the construction of another dam (No. 2) at Muscle Shoals on the Tennessee River, 5 miles from Florence. The plans include a hydroelectric development, the erection of electric transmission lines, etc., to cost approximately \$13,500,000. This development is for the purpose of furnishing electricity to operate the proposed \$30,000,000 ammonium nitrates plant of the government. Contract for dam has been awarded to the J. G. White Engineering Company, 43 Exchange Place, New York, N. Y. M. T. Thompson and P. J. Davis, resident superintendents, South Florence.

CANTON, MISS.—The installation of a surface condenser for a 200-hp. engine and spray equipment for cooling in the municipal electric-light plant is under consideration. John T. Sharp, Jr., is manager.

CLARKSDALE, MISS.—The Water and Light Commissioners contemplate the installation of a 1000-hp. water-tube boiler and a 1000-kw. turbo-generator; boring now a 13-in. well furnishing 1000 gal. per minute, equipped with a motor-driven Layne pump. W. W. Pointer is superintendent.

CLEVELAND, MISS.—The Home Light & Ice Company contemplates installing a 75-hp. boiler this spring. E. J. Nott is president.

GREENWOOD, MISS.—Estimates are now being secured by the Light and Water Works Commissioners on a turbine and centrifugal pumps. Roy Stott is manager.

HOUSTON, MISS.—The city of Houston expects to install a new plant complete. The equipment will consist of an 80-hp. crude oil engine, directly connected to a 60-kva., three-phase, 2300-volt, revolving field motor and switchboard. A. G. Atkinson is superintendent.

POPLARVILLE, MISS.—The municipal electric light plant and water works system has been leased to the Poplarville Light & Water Company. New equipment, including a 60-hp. Remington oil engine and a 16 by 12-in. Chicago Pneumatic Tool Company compressor, is being installed in the plant. Crude oil and distillate will be used as fuel. F. F. Kidwell is manager.

WIGGINS, MISS.—The City Council is contemplating improvements to the electric-lighting and water-works systems.

BLYTEVILLE, ARK.—The Missouri & Southeastern Utilities Company contemplates replacing all 16-cp. street lamps with

100-cp. lamps. J. G. Fisher is superintendent.

HOPE, ARK.—The installation of crude oil engines in the municipal electric-light plant is under consideration. Charles M. Richards is manager.

DE RIDDER, LA.—Orders have been placed by the De Ridder Light & Power Company for a 150-kva. General Electric generator to be directly connected to a 16-in. by 16-in. Corliss-Ball engine. The company has been granted a 25-year franchise. W. F. McCammon is secretary.

DONALDSONVILLE, LA.—The Water and Light Commission is building reservoirs and drilling deep wells for the water supply. J. W. Byrnes is manager.

NEW IBERIA, LA.—Improvements contemplated by the City Council this year include the installation of an ornamental-lighting system and the purchase of oil engines for the municipal electric-light plant. Lawrence F. Villermin is manager.

NEW ROADS, LA.—Improvements are contemplated to the municipal electric-light plant in the near future, consisting of the installation of a crude-oil engine to replace steam power and drilling a deep well. R. Vignes is superintendent.

BARTLESVILLE, OKLA.—The Crystal Ice & Storage Company is planning to rebuild its plant soon, which was destroyed by fire some time ago. The new plant will have three times the capacity of the old one.

CANADIAN, OKLA.—The City Council is considering calling an election soon to submit the proposal to issue bonds for the installation of an electric-lighting plant and water works system.

MIAMI, OKLA.—The capital stock of the Empire District Electric Company of Oklahoma has been increased from \$30,000 to \$200,000. The company is controlled by the Empire District Electric Company of Missouri.

PRAGUE, OKLA.—The City Council contemplates calling an election to vote on the proposal to issue bonds for improvements to the municipal electric-lighting system.

SEMINOLE, OKLA.—Bids, it is reported, will be received by the city of Seminole until Feb. 4 for the construction of an electric-light plant. L. M. Hammon is city clerk.

TULSA, OKLA.—Plans have been prepared by the Southwestern Bell Telephone Company for the construction of an addition to its telephone exchange building at Fourth and Boston Streets, to cost about \$75,000.

AUSTIN, TEX.—The Austin Power Company (Guy A. Collett, receiver), it is reported, will petition the Federal Court for permission to repair the Austin dam. The cost is estimated at about \$100,000.

DALLAS, TEX.—The contract providing for the exchange of power between the Dallas Power & Light Company and the Texas Power & Light Company has been approved by the City Commission. The contract as originally submitted to the supervisor of utilities called for an expenditure of \$350,000 for transmission lines and transforming apparatus, but concessions have been made which will save the local company a total of \$150,000. The contract covers the purchase of 3000 kw. with an increase to 5000 kw. Under the agreement the Dallas company will furnish energy to the Dallas Railway Company for the Oak Cliff and East Dallas lines, which is now supplied by the Northern Texas Traction Company.

DENISON, TEX.—The Texas Electric Railway Company is planning to erect a passenger station and repair shop.

TEXARKANA, ARK.-TEX.—Bids will be received in duplicate, one addressed to J. H. McLain, secretary of board of public affairs, Texarkana, Ark., and one to W. J. DeFee, city secretary, Texarkana, Tex., until Feb. 5, for the construction of a joint sewage disposal plant, consisting of two settling tanks, two sprinkling filters, two sludge beds, two pumping stations, together with necessary appurtenances. Plans, specifications, bidding blank may be obtained on application to L. T. Peden, consulting engineer, 2204 Chartres Street, Houston, Tex.

Pacific and Mountain States

CHEHALIS, WASH.—O. E. Anderson has petitioned the City Council for a franchise to supply electricity for lamps and motors in Chehalis for a period of 30 years. The ordinance has been given its first reading and provides for the installation of the new plant within nine months after the franchise is granted.

work is being done by the Inter-Mountain Power Company toward the immediate erection of a high-tension transmission line from the Long Lake plant of the Washington Water Power Company in the north-east corner of Lincoln County to the Milwaukee Railway, at a point about 12 miles south of Odessa. The Inter-Mountain company has the contract for furnishing energy to the Milwaukee Railway for operating its lines between Othello and Puget Sound cities.

PORT ANGELES, WASH.—The Parafine Companies, Inc., of Port Angeles, which are constructing the Crescent Card factory, at a cost of \$200,000, have announced that the plant will be operated entirely by electricity, supplied by the Washington Power & Manufacturing Company from its plant located on the Elwha River, 7 miles from Port Angeles.

SEATTLE, WASH.—A permit has been granted to the Erickson Shipbuilding Company, 4200 Iowa Avenue, for the erection of a power house, to cost about \$5,000.

SEATTLE, WASH.—Specifications submitted by J. D. Ross, superintendent of lighting, for incandescent lamps for the year 1918, have been approved by the Board of Public Works. Approximately 500,000 lamps will be purchased this year.

SEATTLE, WASH.—The Board of Public Works has approved the revised specifications submitted by J. D. Ross, superintendent of lighting, for the development by the city of Seattle of the Diablo Canyon power project on the Skagit River, which call for separate bids, instead of a lump sum for the plant and transmission lines. The original ordinance has been amended and now authorizes an expenditure of \$5,000,000 instead of \$3,000,000, and confines the plant to federal domain. The transmission lines have been changed from steel tower construction to wooden pole lines. The date for opening bids for the construction of the \$5,000,000 hydroelectric plant has been set for March 5 by the Board of Public Works.

NORTH BEND, ORE.—The Oregon Power Company is negotiating with the City Council relative to replacing the arc lamps now in use with 100 and 60-watt lamps, which would be extended over the intersections on 8-ft. arms.

SALEM, ORE.—The Mountain States Power Company, organized under the laws of the State of Delaware, has received a permit to operate in Oregon. The company is capitalized at \$5,000,000. Richard Shore Smith of Eugene is representative for this state. The main offices of the company are located in Wilmington, Del.

DURHAM, CAL.—The Durham Light & Power Company is contemplating the installation of a distribution system in about 60 days. J. A. Foster is owner and manager.

GLENDALE, CAL.—Negotiations are under way with the Southern California Edison Company to purchase the Edison system in Tropic and merge with the Glendale system. Tropic has consolidated with Glendale.

LOMPOC, CAL.—The Continental Securities Company, which controls the Lompoc Light & Power Company, has submitted a proposal to the Board of City Trustees offering to sell the property to the city for \$30,000.

LOS ANGELES, CAL.—Additions are being erected to the local shops of the Los Angeles, San Pedro & Salt Lake Railroad Company, consisting of a new pattern shop and structures for coach, engine and tank car repair work. The cost is estimated at about \$100,000.

PALO ALTO, CAL.—At an election held Jan. 5, bonds to the amount of \$66,000 were voted for improvements to the electric-light plant, including the installation of a 500-hp. Diesel engine and a 350-kw. (approximately) electric generator, for which contract will be awarded at once. Frank Kasson is city clerk.

QUINCY, CAL.—The Quincy Electric Light & Power Company is contemplating the purchase of an engine before the next low-water period, to be used as an auxiliary to water power. A. L. and O. P. Payne are managers.

SAN BERNARDINO, CAL.—The construction of a new hydroelectric power plant in Little Bear Valley is under consideration by the Arrowhead Reservoir & Power Company. The plans provide for an initial development of 12,000 hp., to cost about \$2,000,000.

BONNERS FERRY, IDAHO.—The Bonner Water & Light Company contemplates the installation of a Rumsey triplex 375-gal. per minute pump. F. T. Berger is manager.

BOVILL, IDAHO.—Bonds to the amount of \$5,500 have been voted for the installa-

The proposed plant will be installed in the pumping station in which an engine and other necessary equipment will be placed.

JULESBURG, COL.—The Council expects to build a new electric-light plant within the next two years. J. R. Aldrich is superintendent.

MEAD, COL.—The Supply Irrigating Company is reported to be considering the construction of a reservoir in connection with an irrigation project, to cost about \$250,000.

SALIDA, COL.—The Colorado Power Company, it is reported, is contemplating doubling the output of its local plant.

SILVERTON, COL.—Arrangements are being made by the Silverton Electric Light Company for replacing the arc lamps now in use with type "C" nitrogen lamps of 250 cp. Material has already been purchased.

STERLING, COL.—The distributing lines of the municipal electric-light plant are being rebuilt and extended into the suburbs. C. H. Love is assistant superintendent.

WRAY, COL.—The Wray Electric Light & Power Company is contemplating pumping water for the town, using two motors of 15 hp. each, and erecting a transmission line on the country road, about 3 miles, to furnish electrical service to the farmers. The company is now completing the installation of a 140-hp. boiler. M. Williams is owner.

Canada

CALGARY, ALTA.—Bids, it is reported, will be received by the Alberta Hydro-Electric Company of Calgary for the construction of a series of dams for power development along the Bow River. Z. Malhoit, box 1480, Calgary, is consulting engineer.

NIAGARA FALLS, ONT.—Contracts have been awarded by the Hydro-Electric Commission of Ontario for the construction of a 13½-ft. wood-stave flume with turbines and generators for the development of 50,000 hp. (additional) at the plant of the Ontario Power Company. Of this 20,000 hp. will be available in August and the remainder in October.

OTTAWA, ONT.—Bids will be received by John A. Pearson, architect, and J. O. Marchand, associate, Centre Block, Parliament Buildings, Ottawa, until Feb. 5 for elevators and hoist equipment required in the reconstruction of the Parliament Building. Plans and specifications can be obtained at the office of P. Lyall & Sons Construction Company, general contractor, Ottawa.

Miscellaneous

PEARL HARBOR, HAWAII.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for construction of a combined post exchange and gymnasium, 50 ft. by 90 ft., and quartermaster's storehouse building, 40 ft. by 94 ft., including the installation of all conduits, wiring, cables, fixtures, necessary for a complete lighting and power system, plumbing, etc. Drawings and specifications (No. 2758) may be obtained upon application to the above bureau or to the commandant of the naval station named.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 11, for furnishing steel pipe, transformers, meters, copper cable and wire, conduit, electrical fixtures, slate, brass stuffing boxes, red lead, tackle blocks, etc. Blanks and information relating to this circular (1196) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

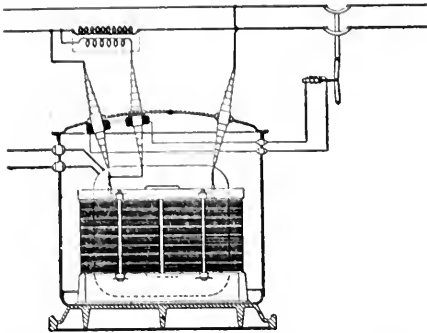
MANILA, P. I.—Extensive improvements are contemplated to the power plant and street railway system of the Manila Electric Railroad & Light Company, involving an expenditure of \$4,000,000 during the next five years. The proposed plans include the installation of an additional 5000-kw. turbo-generator and other special plant equipment, which will increase the generating capacity of the plant approximately 50 per cent; the construction of new tracks and new track terminals and the reconstruction of old tracks; reconstruction of the overhead trolley system, building 15 new cars and rebuilding old cars, erection of new and additional electric light and power lines and the re-arranging and improving existing lines. The company has decided to enlarge the present steam plant instead of developing a water power on the Caliraya River. The plant is operated by the J. G. White Management Corporation, 43 Exchange

(Issued Jan. 1, 1918)

- 1,251,461. TRANSMISSION-LINE CONNECTOR; Robert A. Becker, Poughkeepsie, N. Y. App. filed Nov. 27, 1916. Improvements.
- 1,251,473. WIRELESS TELEGRAPHY; William M. Bruce, Jr., Springfield, Ohio. App. filed Dec. 8, 1915. Provides means whereby the signals which are usually received on a telephone receiver can be relayed to an ordinary telegraph instrument, such as a sounder or recording device.
- 1,251,475. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 13, 1916. Apparatus for

Record of Electrical Patents

Notes on United States Patents



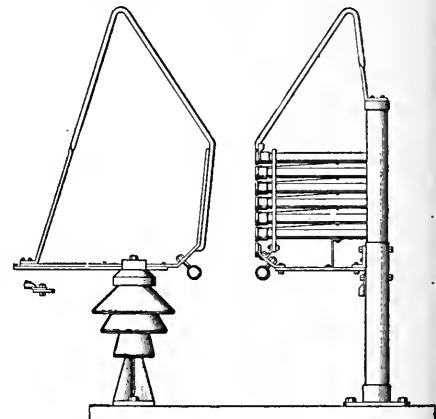
1,251,738—Protective System for Transformers

making peg counts in an automatic exchange.

- 1,251,479. CAR-LIGHTING SYSTEM; John L. Creveling, New York, N. Y. App. filed Aug. 7, 1911. Generator may be automatically governed.
- 1,251,495. IMPULSE-SENDING MECHANISM; Oscar F. Forsberg, Yonkers, N. Y. App. filed July 19, 1917. Specially adapted to be set into a wall set or into an operator's keyboard so that it will be flush with the surface of the wall set or the keyboard and thereby a smooth, even surface may be procured.
- 1,251,503. TWO-WIRE MULTIPLE AUTOMATIC SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed June 21, 1915. Provision of a controlling relay or relays common to a group of lines which are arranged to control the operation of any one of a group of switches having access to the lines of the group.
- 1,251,543. AUTOMATIC TELEPHONE SYSTEM; Jacob W. Lattig, Glenside, Pa., and Charles L. Goodrum, New York, N. Y. App. filed April 25, 1916. System in which a calling subscriber can hold a connection which has been connected to a busy line, the talking strands of which are maintained open, and be automatically connected to said line for conversation when it becomes idle.
- 1,251,544. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; Allen E. Lundell, New York, N. Y. Application filed April 26, 1916. Finder having a primary and secondary movement, a circuit arrangement is provided for extending the starter wire to the next wire finder upon the termination of the primary movement of such finder in seeking a calling line, instead of upon the termination of the secondary movement of such finder.
- 1,251,545. TELEPHONE SWITCHING SYSTEM; Frank A. Lundquist, New York, N. Y. App. filed Nov. 15, 1916. Improvements.
- 1,251,562. VACUUM REGULATION FOR RECTIFIERS; Harold A. Newcomb, Wilkesburg, Pa. Improvements.
- 1,251,568. ELECTROPLATING APPARATUS; Louis Potthoff, Flushing, N. Y. App. filed Dec. 14, 1916. Wherein a rotatable barrel supports the articles to be plated in the electrolyte.
- 1,251,569. ELECTROPLATING APPARATUS; Louis Potthoff, Flushing, N. Y. App. filed May 12, 1917. Improvements.
- 1,251,572. ELECTRICAL PROTECTIVE APPARATUS; Charles S. Price, Rutherford, N. J. App. filed Nov. 13, 1916. Improvements.
- 1,251,578. SHAPING MACHINE; William E. Riecken, N. Y. App. filed Nov. 1, 1916. Relates to the shaping of parts of solid conducting material, and more especially to the shaping thereof while heated to facilitate working.
- 1,251,594. RHEOSTAT AND OPERATING MEANS THEREFOR; William A. Turbayne, Niagara Falls, N. Y. App. filed Aug. 19, 1914. Variable resistance having operating means for bringing the resistance into operation under conditions which may be accurately predetermined.

- 1,251,595. GENERATOR-REGULATOR; William A. Turbayne, Niagara Falls, N. Y. App. filed Nov. 23, 1912. For variable-speed generators which will maintain constant potential under wide ranges of speed.
- 1,251,596. ELECTROPNEUMATIC BRAKE; Walter V. Turner, Wilkesburg, Pa. App. filed Dec. 6, 1916. Improvements.
- 1,251,604. RINGING CONTROL SYSTEM FOR TELEPHONE EXCHANGES; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Dec. 28, 1915. Improvements.
- 1,251,618. PLUG FOR ELECTRIC CONDUCTORS; Otto Bahls and Theodore Siebert, Jr., New York, N. Y. App. filed June 6, 1914. Improved plug and receptacle therefor.
- 1,251,628. VAPOR APPARATUS; Wilfred T. Birdsall, Montclair, N. J. App. filed May 4, 1915. Provides a cathode, in apparatus of the character specified, which has a low negative-electrode reluctance so as to be self-exciting.
- 1,251,637. TELEPHONE-EXCHANGE SYSTEM; Warren W. Carpenter, Newark, N. J. App. filed Oct. 21, 1915. A register relay circuit for use in telephone-exchange systems of the semi-automatic type.
- 1,251,644. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 29, 1916. For recording calls.
- 1,251,645. REVERSIBLE BRUSH HOLDER FOR USE WITH DYNAMOS; John L. Creveling, New York, N. Y. App. filed Aug. 19, 1911. Improvements.
- 1,251,651. CORE FOR MAGNETIC COILS; Lloyd Espenchied, Hollis, N. Y. App. filed Sept. 17, 1917. Loading coils and the like.
- 1,251,658. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 25, 1914. Motor may be accelerated in a uniform and gradual manner, a plurality of efficient operating speeds may be obtained with the use of but few controlling switches, and sparking at the commutator may be obviated at all speeds.
- 1,251,659. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 23, 1915. Phase regulation.
- 1,251,660. CONTROL SYSTEM FOR ALTERNATING-CURRENT MOTORS; Rudolf Hellmund, Pittsburgh, Pa. App. filed Nov. 29, 1915. Substantially sparkless commutation.
- 1,251,665. ELECTRIC RIVETING TOOL; Leo Hirsh, Chillicothe, Mo. App. filed July 31, 1916. Provision of a riveting tool, including an impact-receiving riveting head operated by a plunger, which in turn is operated by co-operating solenoid coils, the plunger including a core common to both solenoids.
- 1,251,666. MUNICIPAL TRAFFIC-CONTROL SYSTEM; James B. Hoge, Cleveland, Ohio. App. filed Sept. 22, 1913. Improvements.
- 1,251,669. STROBOSCOPIC DEVICE; Gunnar Jensen, Swissvale, Pa. App. filed Oct. 9, 1915. Used to determine the percentage slip of alternating-current dynamo-electric machines.
- 1,251,682. DOOR RELEASE; Christian Miller, New York, N. Y. App. filed April 15, 1916. Improvements.
- 1,251,688. CONTROL SYSTEM FOR FLYWHEEL MOTORS; John S. Peck, Altringham, and Siegmund Eckmann, Walley Range, England. App. filed Jan. 15, 1913. Improvements.
- 1,251,695. CUT-OUT DEVICE FOR TELEPHONE TRANSMITTERS; Leon E. Rennells, Albany, Ore. App. filed March 31, 1917. Improvements.
- 1,251,700. SHIELD FOR MAGNETIC COILS; Thomas Shaw, Hackensack, N. J. App. filed Sept. 17, 1917.
- 1,251,706. AUTOMATIC REGULATOR; William A. Turbayne, Buffalo, N. Y. App. filed Sept. 25, 1912. Improvements.
- 1,251,707. REGULATOR FOR ELECTRIC GENERATORS; William A. Turbayne, Niagara Falls, N. Y. App. filed April 20, 1914. Railway car lighting.

- 1,251,708. REGULATOR FOR ELECTRIC GENERATORS; William A. Turbayne, Niagara Falls, N. Y. App. filed May 13, 1914. Improvements.
- 1,251,711. STARTER FOR INTERNAL-COMBUSTION ENGINES; George R. Wadsworth. App. filed May 24, 1912. Motor vehicles.
- 1,251,728. TELEPHONE-EXCHANGE SYSTEM; Frederick V. Young, Newark, N. J. App. filed Feb. 17, 1917. Prevents click in the answering operator's receiver.
- 1,251,738. PROTECTIVE SYSTEM FOR TRANSFORMERS; Allan P. Bender, Wilkesburg, Pa. App. filed Dec. 29, 1915. Improvement.
- 1,251,739. ELECTRIC-LAMP SOCKET; Reuben B. Benjamin, Chicago, Ill. App. filed Dec. 9, 1914. Rigid support.
- 1,251,750. TESTING ARRANGEMENT; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 24, 1916. Telephone.
- 1,251,751. SELECTIVE SWITCH; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 29, 1916. A reduction of the trunk-hunting interval.
- 1,251,752. TELEPHONE; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 29, 1916. For facilitating the rapid hunting over a large number of contacts in the making of connections.
- 1,251,754. LIGHTNING ARRESTER; Nicholas J. Conrad, Chicago, Ill. App. filed March 30, 1917. Horn-gap type.
- 1,251,762. CONSTANT-TEMPERATURE-RECORDING INSTRUMENT; John W. Esterline, Indianapolis, Ind. App. filed June 8, 1916. Provides a heating coil which is controlled by a thermostat responsive to the temperature within such case, so as to maintain such temperature substantially constant.
- 1,251,764. ELECTRIC WELDING; Charles H. Florandin and Alan M. Bennett, Westfield, N. J. App. filed Oct. 5, 1917. Arc.
- 1,251,768. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, Brooklyn, N. Y. App. filed Sept. 11, 1916. Makes it unnecessary to release a connection when the desired line at the connector is busy.
- 1,251,771. ELECTRIC SNAP SWITCH; Monroe Guett, Hartford, Conn. App. filed Oct. 12, 1916. Improvements.
- 1,251,795. SELECTOR SWITCH; Maurice K. McGrath, New York, N. Y. App. filed June 12, 1916. For use in automatic telephone systems.
- 1,251,797. ELECTRICAL SIGNALING SYSTEM; J. L. McQuarrie, Montclair, N. J. App. filed Nov. 15, 1916. Code signaling in telephone-exchange systems.
- 1,251,825. MAGNET THERMAL ELECTRIC LIGHT FLASHER; Michael C. Ryan, Phoenix, N. Y. App. filed June 29, 1914. Automatic.
- 1,251,827. BRUSH FOR ELECTRICAL MACHINERY; Edmund O. Schweitzer, Chicago, Ill. App. filed Feb. 8, 1915. Improved



1,251,754—Lightning Arrester

brush and holder for securing a maximum bearing surface between the brush and the moving surface.

- 1,251,835. BRUSH-RAISING DEVICE; William Strutt, Pittsburgh, Pa. App. filed Dec. 18, 1914. Applies particularly to means for temporarily raising brushes out of engagement with the commutator cylinders thereof.
- 1,251,845. BRUSH-HOLDING DEVICE; Lawrence W. Turnbull, Wilkesburg, Pa. App. filed Nov. 6, 1914. Permits of relative adjustment of the pressures on opposite sides of the brush to prevent tilting thereof with its consequent bad results.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

New York, Saturday, February 2, 1918

Number 5

Remove Not the Ancient Landmarks

FAILURE to uphold the traditions of an industry, especially if they constitute the foundation on which success of the industry depends, can lead to but one thing—disaster. This is a truism generally recognized throughout the central-station industry and manfully upheld by the industry in this time of great distress and uncertainty. One public utility, as the nation knows, has been remiss in its duties, and its example may serve as an object lesson to central stations. Railroad congestion has been laid at the door of railroad officials by the president of the Brotherhood of Railroad Trainmen, who maintains that if the road companies had directed their efforts toward keeping trains over the roads there would not have been such congestion as is in effect now on all of the roads and particularly at the Eastern terminals. There is one part of his statement, however, which tops all the rest, and this should serve as a beacon to warn other utilities of the rocks and shoals which might wreck them. Indifference of the railroad operating heads, coupled with an apparent desire to teach the public an object lesson concerning the need for increased rates, had been noticed by seasoned railroad employees for months, according to their leader, and general opinion prevails among them that the object lesson which the railroads attempted to teach got out of their control. Whether or not this is a fair assessment of the case we do not presume to say, but if it represents the mature opinion of old railroad employees it is a severe arraignment. It also brings into relief the fact that if in slighting service the purpose was to show the necessity of increased rates the railroads were playing with fire. The lesson which this situation brings home to the central-station industry is immediately apparent. We do not believe that electric utilities contemplate detracting by one iota from their tradition of excellent service. To do so would be suicidal. But if there be any who contemplate such a thing we commend to their prayerful consideration the example of the railroads.

Planning for Wider Markets After the War

WHILE we must ever keep in the forefront the vital necessity of winning this war, we ought not to be unmindful of the day when nations shall beat their swords into plowshares and their spears into pruning hooks. To short-sightedness and unpreparedness we owe much of our present muddle. We have had object

lessons enough; shall we employ them to our profit and the nation's gain? If our wheels of industry are to be kept turning after peace is declared, we shall need a fair share of the world's trade. This is as patent as it is potent. Ships we will have, and American manufacturers should see to it that they shall have the markets and freight to keep these ships always on the high seas. Germany, the arch enemy, somehow finds money and time to plan for business conquests. England, despite her enormous war burdens, retains her grip on foreign markets. The Scandinavians and Dutch ply their overseas trade assiduously, and shall we be found wanting in the crucial commercial test of coming worldwide competition? We are enormous producers and also users of electrical equipment, but we also need to spread the gospel of electricity to other lands. It is a duty we owe to civilization. It is also an obligation we owe to our industry. If we are to succeed, plans must be made at once, for the task is not easy, although the reward is great. Moreover, the plan need not and should not interfere with the successful prosecution of the war. England has established an intelligence system to supply her industries with trade information from all parts of the world. We should do likewise.

Calibration of Power-Factor Meters by Direct-Current Methods

THE polyphase power-factor meter of switchboard type is an instrument designed to indicate the instantaneous power factor of the polyphase system to which it is connected. As ordinarily constructed, its series coil is connected in one line only of the system, and its indications are only to be regarded as correct so long as the system remains balanced. A considerable degree of unbalancing is likely to affect prejudicially the accuracy of the indication.

When such an instrument is assembled and brought to the testing table for either calibration or check, there is usually no difficulty in providing a non-inductive resistance load for the 100 per cent indication, so that this point on the scale is readily determinable. When, however, some other definite point on the scale, such as the 80 per cent point, has to be checked, it is not so easy to provide the load of just this power factor, so that a good deal of adjustment and computation may be needed to bring about the right condition.

An ingenious method for making the calibration test for a well-known type of power-factor meter, using direct currents, is described this week by T. W. Varley. The direct-current strengths in the two movable coils are adjusted according to a definite schedule, so as to provide the same deflecting torque as the corresponding

phase relations in the normal use of the instrument with alternating-current supply. The technique of the calibration should therefore be made relatively very simple and definite, provided that the construction of the dynamometer is such as will produce the proper phase relations of design in alternating-current use.

The English Power Supply Situation

A REPORT recently published in England of the coal conservation sub-committee of the reconstruction committee sets forth in unmistakable terms the reforms necessary in power generation and distribution if the full advantage of electric supply is to be realized. The situation in England is different only in degree from that which exists here, and hence the conclusions of the committee may be taken seriously to heart. In the United States there have grown up a number of great hydroelectric networks which are very important sources of power supply. There have also been organized central-station enterprises on an unprecedented scale which do within areas as yet somewhat limited and with steam as the chief motive power much the same valuable work that the hydroelectric systems can accomplish. But, admirable as all this is, much more remains to be accomplished. The hydroelectric systems need to be developed still further. They must take in all the available water powers within the area covered, including those on the public domain which we hope will soon become available, and must make their distributions so complete and far-reaching that there shall be small excuse for fuel consumption within the areas served. The great steam-supplied systems must go on, as they are now indeed doing, to bigger things, to the building of what the British committee calls superstations, to the abandonment of those which are inefficient, to the consumption of coal when possible at the mine's mouth, and to the more complete development of their service so that no small and inefficient plant shall find economic opportunity for existence.

The British situation as disclosed in this report is in some respects a very unfortunate one. The total supply is divided, despite the modest area involved, between some 600 independent private and public undertakings having an average capacity in power stations of only about 5000 hp., hardly a quarter of that which can well be utilized in a single generating unit. The situation has been rendered more difficult by the large number of municipal plants, some of them very well handled within their limitations, but organized without sufficient reference to the securing of good conditions of generation. There has been an unhappy tendency, brought about by municipal enterprise, toward building plants in most unsuitable places merely to get them within the jurisdiction of the respective municipal authorities. The result has been that not a few large plants, supplying cities of several hundreds of thousands of inhabitants and large industrial needs, have been located where there is no proper supply of water for condensing purposes and have been driven to the use of cooling towers. The large number of municipal enterprises has hampered the development of those under private management, thus still further complicating a bad situation. The unification of existing systems is no easy matter, for the local plants vary greatly in character, distri-

bution voltage, facilities for linkage with distribution lines, and, even when these exist, in the fundamental matter of frequency. There is in Great Britain little such tendency toward standardization of frequency as is found in this country, no less than ten frequencies actually being in use in the British plants.

It has been repeatedly proposed in England that bodies should be created to deal with bulk supply, which the existing undertakings would draw for anything beyond their present capacity. This is a step in the right direction, but the tendency for local bodies to cling to their pet stations will stand in the way of rapid reform, and unless existing stations could be operated on a comprehensive plan they would not be of much use for standby and peak-load service. In other words, for gaining the advantages of bulk supply common control is a fundamental necessity. The logical answer to the grave economic questions involved is the organization of a unified power system at least for each industrial district, probably ultimately involving interconnection over the whole of England. The recommendations of the committee are that there should be a single authority for each of the districts, of which a tentative distribution of interests would indicate sixteen, each controlling a single plant. These plants should be placed on important waterways, on agricultural sites and with good transport facilities. Furthermore, these sites should be large enough to allow the installation of by-product plants to secure the salvage of valuable material from the coal and to accommodate the electrochemical industries which year by year will require a larger and larger supply of cheap power. The "super-power" plants should be erected, with capacities of not less than 20,000 hp. and very likely up to 50,000 hp. These great stations would ultimately take over the whole electric supply in their respective districts.

To the end that some progress may at once be made the committee recommends the appointment of a board of electricity commissioners with full powers to deal with the electricity supply situation throughout the country and authorized to stop the extension or multiplication of uneconomical stations; to arrange for taking over the generation, transmission and main distribution system in each of the districts, putting in charge of a new district body; to standardize for each district frequency and voltage, and to settle for each district what form of undertaking should be charged with the actual administration of the work. This is a large and serious program, not to be carried out without many difficulties of detail. There is one fortunate circumstance in the situation, however, in that there is one authority—to wit, Parliament—which stands supreme in administration. Many minor questions have to be settled by cautious deliberation over all circumstances, but the fundamental proposition is thoroughly sound. If carried out, the committee estimates that the saving in fuel alone would be more than 1,000,000 tons per annum based on the present use of power. This quantity must rapidly increase as industrial development goes on after the war is over and it is well that the problem is being now taken earnestly in hand. We in this country may well heed the lesson of this preliminary investigation, for much as we have done we have as yet gone but a little way toward the general distribution of power on a scale commensurate with the needs of the future.

Power and Compressor Service

OTHER of Professor Clewell's useful papers appeared in the last issue, giving some of the characteristics of the power requirements of fans and other apparatus for producing movement of air. Apparatus of this kind varies very radically in type with the service for which it is applied. The actual characteristics of the service vary enormously with the requirements to be met. Ordinary fans of the type familiar to every one have for their special function the movement of a large bulk of air at relatively very low pressure. For low static pressure blowers of the familiar centrifugal type are commonly used, and for high pressures the two- or three-stage units built along the general lines of the reciprocating steam engine. It is to the first class of apparatus that Mr. Clewell has particularly directed attention. All such apparatus has one common characteristic in that the power required varies very much with the speed, practically as the cube of the speed for a given area of discharge opening. Consequently the starting torque is very slight, which separates blower service from almost every other variety of motor drive. The efficiency of the apparatus does not vary to any material extent with variations in speed, but has an almost unique characteristic. The light starting torque greatly simplifies the equipment of motors and lessens the severity of their sudden requirement for full power at the moment of starting.

Almost any sort of motor is, therefore, available for blower service, and in particular single-phase alternating-current motors, often looked at askance on account of their low torque at starting, serve admirably in driving fans and blowers. Induction motors of the squirrel-cage kind are entirely adequate for this service. If the supply is direct-current either shunt or series motor may be used, the former being generally preferred. The control of fan and blower motors is obviously a very simple matter, the smaller sizes requiring no more than a connecting switch. Large machines should have at least a starting rheostat and, and then under exceptional conditions an overload relay. Only in high-duty compressors is there special reason for any elaboration of the starting equipment, such as is common with other motors. As the speeds required for rotating blowers of every sort are rather high, the connection of the motor is very often practicable through the best speed of fan may not agree well with the quasi-synchronous speeds of alternating-current motors. Large blowers should generally be planned for direct connection, while belting is very often convenient in the smaller sizes. It is perfectly practicable to use either method, and either can be made silent. An important characteristic in much ventilating work is that all machines have some advantage in this respect

when the fan speed is relatively low. It takes a good deal of finesse on the part of the designer to secure a silent fan of respectably large output and advantageous speed, but the trick can be turned successfully. It must be seen that the requirements for fan and blower motors are easy, but rather highly specialized, and Professor Clewell's article gave a very comprehensive view of the general conditions which must be met.

Simplifying Transmission-Line Calculations

IT IS now well recognized that in the theory of the transmission of electrical energy over wires of any length, whether they are merely carried across a street or whether they are carried across a continent, the fact that the resistance, inductance, capacitance and leakage of the wires is ordinarily distributed with reasonable uniformity causes the impedance, voltage, current and power at any point along the line to be proportional to simple functions of a certain hyperbolic angle which applies to that point. The magnitude of this angle depends not only upon the frequency of the alternating current supplied to the line but also on the load or loads which may be applied at the motor station or stations. For the low-frequency power transmission and distribution the hyperbolic theory has very little practical importance unless the line is very long and the ordinary Ohm's law computations are nearly enough applicable for practical purposes. At telephonic frequencies, however, lines of ordinary length have to be treated in theory by the use of hyperbolic functions, if the numerical results are to remain simple and easily obtained. At the very high frequencies of radio operation even the shortest lengths of line come under the natural dominion of these functions.

The article in this issue by T. A. Wilkinson on "Simplifying Transmission-Line Calculations" presents certain diagrams in an "exponent chart," with the aid of which the computation of the voltage and current along the transmission line may be determined with ordinary tables. The method employed differs in interesting details from those which have thus far been presented. The relative advantages of the different methods for arriving at an assigned set of required results are always a matter for discussion. The method presented by Mr. Wilkinson is applicable to determining the electrical conditions at any point along the power-transmission line. If, however, only the conditions at the two ends of such a line are desired, it seems likely that the computation of the equivalent π of the line would be swifter. It would be interesting to have comparisons presented as to the brevity of the various methods now known for determining the electrical working conditions of a given long line at a known terminal load and at a known frequency.

COILS of wire are used for so many purposes in electrical engineering applications that H. B. Dwight's article on the self-inductance of long coils, which will appear in the next issue of the ELECTRICAL WORLD, should be of interest to many readers. The writer develops a formula which is very simple to apply. Another feature of the Feb. 9 issue will be an article on a bulk-supply generating sta-

The Coming Issues

tion situated at the mouth of a coal mine and operated jointly by two electric service companies. Arrangements which have been made to make joint operation successful will be outlined and particular attention will be directed to the mechanical features of the plant. Other articles which will appeal to different types of engineers will also be presented next week.

Rate Increases to Follow High Cost of Coal

Prospect of Permanent Higher Level of Fuel Cost Leads Companies to Plan Ahead
So That Advances in Rates May Offset Increase in Production
Expense—Other Factors in the Outlook

THE final outcome of tremendous coal demand upon the market price of that commodity has a direct bearing upon rates of electric central stations. As shown in the ELECTRICAL WORLD, many companies have advanced rates to reimburse themselves in part at least for increased coal cost. They asked the consumer to share the heavier operating expense. In some cases the feeling of executive officials has been that acute coal conditions were temporary and that when they became normal again electric rates could be restored to their former level. This is in part the theory underlying the coal clause which has been introduced by many properties to raise or lower rates automatically with increases or decreases in coal cost. This general idea that coal conditions were temporary has led certain companies to refrain from advancing rates.

In many properties, however, and particularly the small stations which have limited business and earnings and limited possibilities for expansion, the burden of coal cost is too heavy to be taken into the accounts without an increase corresponding in some degree in rates. These properties lack the diversity of business of the large systems and they are without reserves to withstand a sharp enlargement of operating expense; unless they can definitely transfer such expenditures as those the industry faces for coal they are compelled to write red-ink balances in their accounts or show a reduced surplus.

WHAT OF THE FUTURE?

Beyond the immediate meaning of higher coal cost and the higher rates established in a large number of cities throughout the country is the question of what the future holds. Most companies reached in the ELECTRICAL WORLD canvass are of the opinion that the great upheaval in coal conditions will cause a permanently higher price level for that necessary commodity. The steam central stations relying on coal for fuel are not alone in this conclusion; it is held also by companies using other forms of fuel in whole or in part, such as crude oil or natural gas. From this premise the conclusion of many companies is that future electric rates will undoubtedly be higher. Against this there is, of course, the possibility of more efficient generating apparatus and practices, but that raises also the question of the economic desirability under existing conditions of scrapping existing plants to provide for the possible new inventions. It brings up the question of financing expenditures of this nature, which is serious at this time and will probably so continue.

"The coal situation," writes one general manager in a statement which effectively presents the views of many companies, "in my opinion is going to affect operating conditions, rates, etc., for a material time. Even though the war should cease to-morrow, the era of low prices for coal and labor is past for some time to come. The result is going to be greater operating costs and a necessity for the increase of rates to match those costs.

Coal and labor are not going to be the only determining factors in this matter, as I feel it will take a considerable time for all of the other forms of material which we use in our work to return to anything comparable in price with that which prevailed before July 1, 1914."

The following opinions also point to future higher rates:

We are of the opinion that operating expenses of utilities will be seriously affected in the future by the increase of coal, and that the only answer is to proportionately advance the rates.

In our opinion, unless central stations get some relief being allowed to increase their rates, they will be in a serious financial condition before the end of 1918. The advance in cost of coal has been tremendous. Where there is not a state regulatory body the federal government should give the companies relief by allowing rate increases. The companies believe these results should come indirectly through the state and federal fuel administrators.

We believe that the coal situation will necessitate substantial rate increases of a temporary nature and that the rates will have to carry some permanent increase. We believe that the central-station operators will be able to finance these increases with comparative ease and also without undue risk.

It would seem to us that while the government is endeavoring to control the fuel situation and since it cannot increase the price that we are compelled to pay, it should also authorize the state public utility commissions to raise temporary increases to all utility companies in the form of a surcharge or war tax, until such time as appraisal hearings could be had in each case, when final adjustment could be made.

We are arranging to ask for an increase in all our rates, based on the increased cost of production. The outlook for the winter is serious. Being located in the vicinity of a number of mines, our plant is especially well supplied with coal, but if the government continues to increase the price, as it has been doing, we do not know where we will land.

One manager, feeling that it is difficult to forecast the future coal situation, is "more or less of the opinion that after the severe strain has passed coal prices will necessarily drop, but under the present tension it will be necessary for many plants to increase their rates either temporarily or permanently, in order to take care of increased cost."

Two companies cite the need of making rates high enough to give a return attractive to capital:

The price of coal affects our conditions so seriously that radical changes in all rates will be necessary if the company is to live and expand. No new money can be obtained by extensions or improvements at this time.

In the indefinite future, operating expenses will be much higher, and rates must be increased proportionately in order that service is to be given the public and the necessary proper rate of return on investment obtained, so that the necessary new capital can be secured.

The probable necessity of reducing maintenance outlay as well as of increasing rates is seen by one executive:

"Owing to increased costs of coal, it will be necessary to reduce other costs," he writes, "with probably reduction in maintenance and a general advance in rates. In the long run the former can be brought back normal, but the higher rate charges will probably last for a considerable period until the entire country reaches the general readjustment period after the war."

Closely allied to this thought is the expression of opinion of another manager, who urges the "most economical use of the plant and proper rates."

Similar suggestions, bearing on increased efficiency and economies, follow:

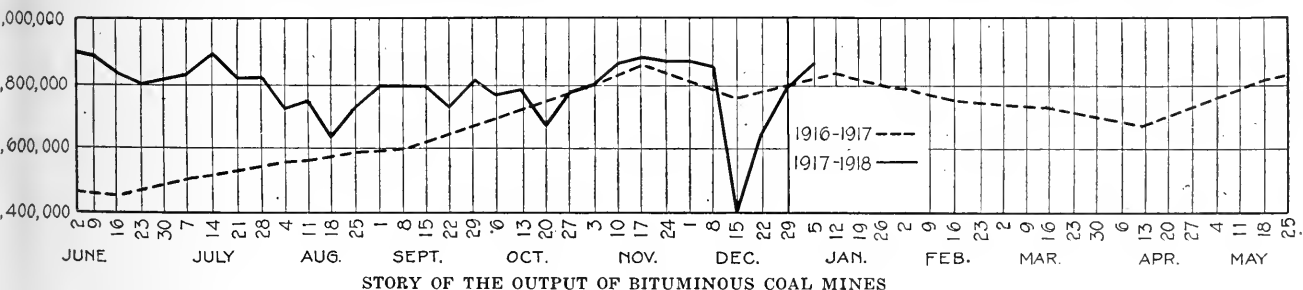
The cost of coal will increase our operating cost in the future. However, this increased cost of fuel will be somewhat offset by the increase in efficiency which will be sure to come with higher-priced coal.

Central stations will simply have to raise the price of their service to consumers in order to meet the increased cost of fuel. Conditions no doubt will be abnormal during the war and for some time after the war. Central stations must meet these conditions with economies, increases in rates and otherwise, quickly changing operating methods, etc., to keep pace with the times.

Development of more economical production methods is the only alternative to a permanent increase in rates in the judgment of one company: "It is our opinion that the price of coal will never decrease as much as it has increased and that in the future coal will remain much higher than it has been in the past, and that rates for electricity will be permanently increased to some extent, unless cheaper methods of production can be obtained."

A general manager, whose great difficulties with shortage make him feel that the fuel outlook for the entire present winter is very gloomy, expresses the hope that the lessons which the country is learning will turn the negligent national water-power policy into positive action. He writes:

There can be only one effect on operating conditions, rates, etc., in the future—that of increased rates for service rendered.



red. This condition emphasizes the need for legislation by our national government providing for the development of water powers. In many instances the development of the water powers throughout the country will control the flow of erratic streams and thereby reclaim hundreds of thousands of acres of the best farming lands in our country. It is quite evident that our government should aid in the development of these streams, as by so doing capital will be attracted for financing these developments and a long step will be taken toward the conservation of our fuel resources.

A president, who believes that many companies cannot continue to operate under present trying conditions, suggests that "a reduction in the number of cars operated by the electric railways is the best solution for reducing expenses and conserving the coal supply."

It is admitted without contradiction that the crisis in the coal situation has given the fine economy of the central station a new prominence. It has given greater recognition to the advantage of large-scale production as a powerful influence in the conservation of coal. Therefore the companies, looking even beyond the widespread acceptance of the economy of the central station as contrasted with the less efficient isolated plant, anticipate still further development of the large producing and distributing units. Significant of the outlook in this direction are the following:

I don't think the price of coal will ever return to the old level, consequently, all utility operating ratios are going to reach a higher average. The net possibly can be increased over former years by the increased volume of business. As all other fuel-using industries are affected by the high cost of fuel, it is going to be easier for the central station to obtain power contracts than heretofore. This will mean the building of larger and more economical plants by the central-station people, and in the end I believe the utilities will be better off.

The present coal situation and the indicated coal situation for the duration of the war is bound to increase the demands upon central stations and upon hydroelectric plants to the extent of capacity of the central stations. They can be loaded up and with proper management can retain the load thus obtained, adding to their capacity later on when prices for machinery are more normal, thereby much more cheaply and quickly increasing the available capacity for generation of electrical power and being able to supply it with much smaller consumption of coal than is possible with isolated plants.

THE WINTER'S PROSPECTS

The prospects for adequate coal supply in the present winter continue to be very precarious, and companies express grave apprehension. Curtailment of activity through the Garfield suspension days will give slight temporary relief. The following expressions of opinion deal with the general conditions of the current winter and do not take into account the Garfield days:

The outlook for 1917-18 was fairly good for our coal supply until the advent of the cold spell during the last eight days and the consequent demoralization of the railroads.

Unless some vigorous steps are taken to stop the accumulation of coal at railroad junctions and terminal points, we can expect to have serious trouble, as, from what information I can gather, the trouble is in the transportation. The railroads cannot handle the traffic and consequently cannot deliver empties to the mines. Pooling will probably greatly relieve the situation.

The outlook for the winter of 1917 and 1918 is anything but pleasant. I do not know what we will do unless central stations have priority of coal.

In our judgment, the outlook is far from encouraging; in fact, we feel that the outlook is a very serious one.

[A continuation of this article to be published next week will deal with other vital phases of the critical coal situation.]

Electrical Features of Joliet (Ill.) Station

Concluding Installment of Article Regarding the High-Pressure Steam Plant of Public Service Company of Northern Illinois—List of the Most Important Equipment

GENERAL and mechanical features of the new high-pressure steam station of the Public Service Company of Northern Illinois were discussed in the issues of the ELECTRICAL WORLD for Jan. 19 and 26. This concluding section will dwell on the electrical features.

In the electrical end of the station there are no radical departures from standard practice like those in the steam end, but the design is interesting nevertheless as representing a studied selection and arrangement of apparatus to give the most efficient and economical operation under the conditions. The fact is that the high economies of the station as a whole will open up a new field for the sale of energy. Many industries which could not be economically served before will now find their own electricity-producing equipment so far inferior in economy to central-station service that it will pay them to buy power. It was the desire to provide for this condition that made the engineers provide for a number of feeders leaving the station at the generator voltage. Just how the ultimate installation of feeders will be divided between 12,000-volt and 33,000-volt is not yet definitely decided. The station is laid out for considerable flexibility along this line.

The fact that the station is really a bulk supply station, so situated with regard to its customers that 12,000-volt and 33,000-volt energy must be sent out, is perhaps the greatest single controlling factor underlying the design. The rating of each of the first two generators is 12,500 kva., 12,000 volts, three-phase, 60-cycle, 1800 r.p.m. This rating is based on a maximum temperature in the armature of 100 deg. C. and in the field of 135 deg. C. with cooling air entering the machine at 40 deg. C. Twelve thousand volts was chosen as generator potential because this is standard in the company's newer plants. The generator windings, which are designed to give each machine 13 per cent inherent reactance, are Y-connected, the neutral point of each being connected through a non-automatic oil switch to a common grounding bus which is earthed through one grounding resistance. Each generator is equipped with a signal indicator and with signal stands. Direct-connected to each machine is a 100-kw., 250-volt shunt-wound interpole exciter. One 100-kw. steam-turbine-driven exciter is also installed as a reserve. Voltage regulation of the generator is controlled by an automatic voltage regulator.

LOCATION OF SWITCHING EQUIPMENT

Most of the electrical equipment for the station is installed adjacent to the turbine room in what is termed the main switch house. It is built integral with the remainder of the station and has equipment on four levels, namely, the basement floor, the main floor, which is on the same level with the turbine room, the second floor and the roof. The basement contains the step-up and step-down transformers, generator field rheostats and auxiliary power bus structures. The switchboard, the

operating room and the brick and concrete 12,000-volt bus structures are on the main floor. The 33,000-volt switching equipment is on the second floor, and the A-frame supports for outgoing lines and the four-tan-sphere-gap electrolytic lightning arresters are on the roof. This arrangement, shown in the cross-section diagram printed in the first part of this article, works out well to keep all leads as short as possible and to keep the heavy transformers at a level where they can be easily handled to and from cars.

From the wiring diagram it will be observed that a double-bus system is employed throughout the station. Each generator may feed through either of a pair of 800-amp., 15-kv. oil switches to a set of sectionalized

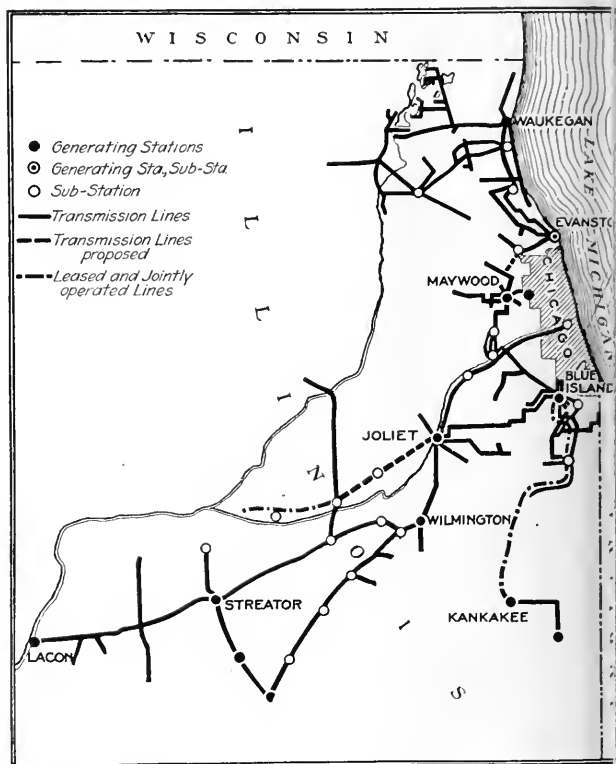


FIG. 1—THE JOLIET STATION IS SITUATED AT THE LOAD CENTER OF THIS SYSTEM

12,000-volt double buses. From these buses two classes of leads are taken off—one, 12,000-volt feeders, and the other, leads to the low-tension side of the step-up transformer. Thirty motor-operated oil switches of the E3 type, ranging from 300 amp. to 500 amp. each in rating, are used to connect these leads to the double bus. From these switches the eight 12,000-volt feeders, which are identical in layout, mostly go into ducts. The other 12,000-volt leads will go to two banks of 12,000/33,000-volt transformers. One bank of three 3000-kw. delta connected single-phase water-cooled transformers is already installed. It is noticeable in this arrangement that no provision is made for spare transformers, it being the belief that open-delta operation can be

successfully resorted to if emergencies arise. The high-tension leads from these transformers go to another double bus through two 45,000-volt, 300-amp. solenoid-operated G-B type oil-circuit breakers. The arrangement of the 33,000-volt circuits is practically identical with that used for the 12,000-volt lines.

The selection of breakers with liberal rating is one of the outstanding features of the electrical design.

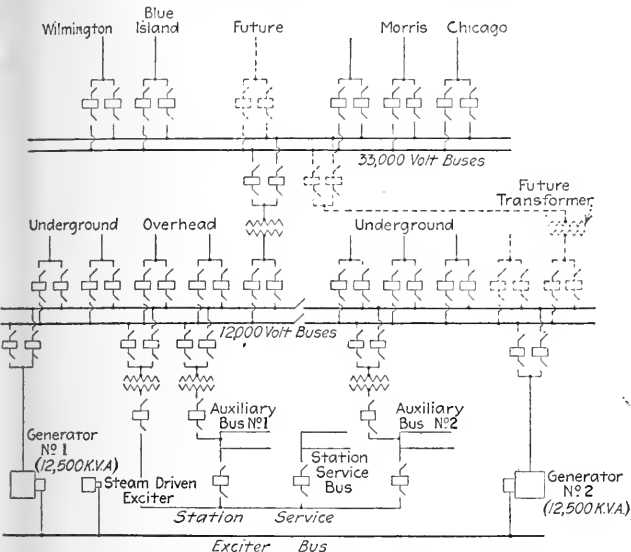


FIG. 2—SCHEMATIC OUTLINE OF PRINCIPAL CIRCUITS IN STATION

This course was followed because it is foreseen that the station will some day be a large one. It is not necessary so far, however, to go to current-limiting reactors to keep within the switch ratings, but space is provided so that reactors can be installed in the future if necessary. Space is provided for sixteen three-phase 33,000-volt switches. The present provision for outgoing 33,000-volt lines will accommodate six. Each of the thirty 15,000-volt and the sixteen 45,000-volt oil switches is arranged so that it can be isolated by six disconnecting switches. Three of each group of six switches are of a special design, which must lock in the open or the closed position before the operator can release the operating rod from the blade. This group of three switches will, of course, be operated first in isolating an oil switch. As a further safety factor, all disconnects are installed in sub-compartments and are hinged on the oil switches so that when the switch is open the blade will be dead.

CENTER OF CONTROL

The control of all electrical equipment, except the auxiliary power, is effected from the operating room, which is in the switch house on the turbine-room floor level. When the building is extended this room will be nearly opposite the middle of the turbine room and separated from it only by a glass partition. From it the operator has a view of the generators and the 12,000-volt switching equipment. Control for the generator is centered in a benchboard, and outgoing feeders are controlled from vertical boards arranged with the benchboard somewhat in the form of a hollow square. The generator circuits are equipped with overload relays, which are ordinarily connected in circuit only during synchronizing. Each outgoing line is equipped with induction-type relays and a polyphase watt-hour meter. Rather liberal use of watt-hour meters has been made

INFORMATION REGARDING MOST IMPORTANT ELECTRICAL EQUIPMENT

GENERATORS (make and rating), 10,000 kw. (80 per cent power factor), 12,000-volt, 60-cycle, three-phase, 11,800-r.p.m. General Electric.

EXCITERS:

Mounted on shaft 110-kw., 250-volt
Turbine-driven reserve unit 100-kw.

OIL-SWITCH EQUIPMENT:

12,000-volt General Electric
45,000-volt Westinghouse

SWITCHBOARD (main) Westinghouse

LIGHTNING ARRESTERS General Electric

Control for the auxiliary power is centered in a vertical board in the turbine room. From this board, which carries the handles of mechanically operated, remotely situated oil switches in the basement of the switch house, any important electrically operated auxiliary can be controlled. The energy for the motor-driven auxiliaries is supplied by three 900-kw., three-phase, 60-cycle, 12,000/480-volt water-cooled transformers in the basement. One of these is a spare. In fact, any one transformer has sufficient rating to carry the entire auxiliary load. The other two transformers each feed a 440-volt bus. These 440-volt buses, of which there are four, are also arranged for emergency interconnection. Each important auxiliary is served by a separate circuit from these buses. The mechanically controlled oil switch is inserted in each of these circuits at the point where the circuit leaves the bus, and the

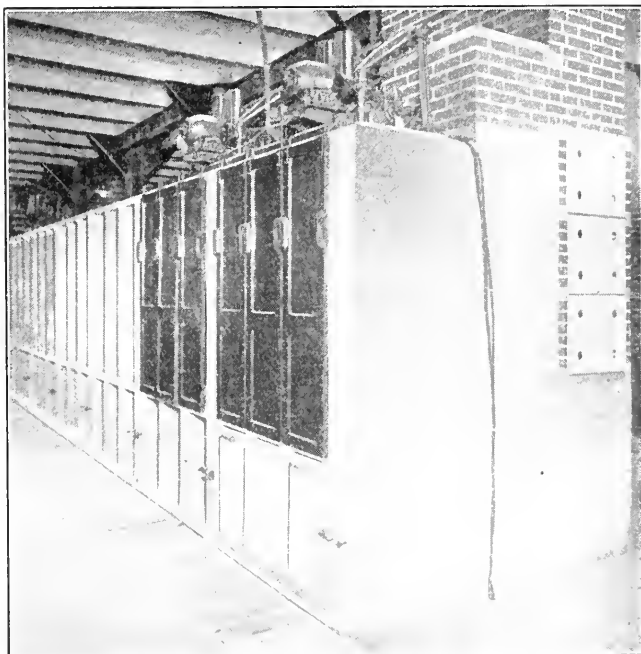


FIG. 3—TYPE OF SWITCH CELL USED WITH OPERATING MECHANISM MOUNTED OVERHEAD

starting apparatus is located immediately at each individual motor. A 40-amp. (eight-hour rating) storage battery installed for emergencies will have rating enough to take care of pilot lamps, motor and solenoid operated oil switches and a few emergency lamps which are switched on automatically in different parts of the building in case of a failure of the alternating-current

source. This battery is charged by a 15-kw., 110-175-volt motor-generator set. The regular source of energy for lighting is a 40-kw., 440-110-220-volt transformer installed in connection with an automatic voltage regulator to insure long life of lamps. The fixtures are of a gooseneck type.

Safety of the employees and congenial surroundings were features which received special prominence in the design of the station. The turbine-room walls are lined with white and green tile. The engineer has a large, roomy office. Shower baths and locker rooms are provided for the employees and excellent drinking water

is piped from a nearby spring. Houses are being built near the plant for some of the operating force. In addition to the usual equipment, the station contains a machine shop, a storeroom and a fuel engineer's office in which coal, the big factor in power-plant operation will receive close attention. The station was designed by Sargent & Lundy, consulting engineers, assisted by Von Holst & Fyfe, architects. Of the operating company, Samuel Insull is president; Frank J. Baker is vice-president in charge of operation and construction; George H. Lukes, general superintendent, and J. I. Hecht, mechanical engineer.

Simplifying Transmission-Line Calculations

High Accuracy Not Sacrificed Within Extreme Range of Practical Conditions—Method Involves New Equations and Chart Based on Rigorous Formula—Numerical Example

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THE accurate determination of the voltage, current and power at different points along a transmission line requires, in principle for short lines and necessarily for long lines, the taking into account of the distributed nature of the resistance, inductance and capacity of the circuit. The difficulty and tediousness of the numerical calculations required in using the rigorous formula, involving hyperbolic functions of complex quantities or their equivalent convergent series, have proved a great deterrent to its use, and approximate methods of varying degrees of accuracy have been devised and largely depended on in the solution of practical problems. The simpler approximations are applicable only to quite short lines of moderate voltage, while of the more elaborate methods suitable for longer lines it can only be said that they are somewhat less cumbersome and tedious in application than the rigorous formula.

In the following is presented a new transmission-line formula developed by the writer, by which, with the aid of a simple chart, the calculations are greatly simplified and shortened and the results of the hyperbolic formula obtained in a few minutes, with about the accuracy of a four-place logarithm, for any conditions within the conceivable limits of practical operation. In addition to its simplicity, accuracy and convenience for numerical calculations the formula is inherently instructive and, owing to its unique form, possesses a number of advantages for practical design of circuits and the general investigation of transmission-line characteristics.

DERIVATION OF THE FORMULA

The hyperbolic formula giving the exact relation between the voltage and current at two points along a transmission line, expressed in the form most convenient for the present discussion, is as follows¹ where the conditions at the receiving end are known:

$$E_l = E_o \cosh lx + I_o \times z_o \sinh lx \quad (1)$$

$$I_l = I_o \cosh lx + E_o \times 1/z_o \sinh lx \quad (2)$$

where l = distance between the two points in any unit (miles),

$$\alpha = \sqrt{(r + jx)(g + jb)},$$

$$z_o = \sqrt{(r + jx) \div (g + jb)},$$

r = resistance of conductor (ohms per mile)

x = reactance of conductor (ohms per mile),

g = leakage conductance of conductor (mhos per mile),

b = capacity susceptance of conductor (mhos per mile),

E_l and I_l = voltage and current at the sending end
 E_o and I_o = voltage and current at the receiving end

Where conditions are known at the sending end the formula becomes

$$E_o = E_l \cosh lx - I_l z_o \sinh lx \quad (3)$$

$$I_o = I_l \cosh lx - E_l / z_o \sinh lx \quad (4)$$

Assuming the conditions of the first formula, the quantities E_o and I_o in (1) and (2) may be regarded as simple numbers. (I_o in general is not a simple number but this may be disregarded for the present). The other quantities are vector quantities and are to be expressed by complex numbers. For simplicity and brevity in demonstration equations (1) and (2) may be written graphically, as follows, in which form their meaning can be interpreted in terms of simple geometry:

$$E_l = E_o \times \begin{array}{c} \text{Cosh } lx = A \\ \text{---} \end{array} \begin{array}{c} a_2 \\ a_1 \end{array} + I_o \times \begin{array}{c} \text{Z}_o \sinh lx = B \\ \text{---} \end{array} \begin{array}{c} b_2 \\ b_1 \end{array} \quad (5)$$

$$I_l = I_o \times \begin{array}{c} \text{Cosh } lx = A \\ \text{---} \end{array} \begin{array}{c} a_2 \\ a_1 \end{array} + E_o \times \begin{array}{c} \frac{1}{Z_o} \sinh lx = C \\ \text{---} \end{array} \begin{array}{c} c_2 \\ c_1 \end{array} \quad (6)$$

From (5) and (6) the hyperbolic formula, in complex notation, may be written:

$$E_l = E_o(a_1 + ja_2) + I_o(b_1 + jb_2) \quad (7)$$

$$I_l = I_o(c_1 + jc_2) + E_o(c_1 + jc_2) \quad (8)$$

¹See Kennelly, *Transactions A. I. E. E.*, Vol. XXVIII, 1909, p. 695.

The vectors A , B and C and their components a , b , etc., are functions only of the length of line and the quantities r , x , g and b as defined above. When, therefore, the distance l and the frequency and conductor conditions (material, size and spacing) are fixed the vectors and their components become constants which are independent of the voltage and current. The determination of these constants is the troublesome part of transmission-line calculations, and when they are once determined for a given case the calculation of the voltage, current and power at one end of the line for any assumed conditions at the other end is a simple and elementary one.

An approximate algebraic solution for the determination of the line constants has been given by Dr. C. P. Steinmetz.¹ This solution, while quite simple as compared with the rigorous formula, still involves a considerable amount of calculation and the use of trigonometric functions. With the aid of a chart each of the six components, or line constants, a_1 , a_2 , etc., in (7) and (8) can be expressed separately and calculated, independently of the others, by a very simple expression of one term, derived from the hyperbolic formula, as follows:

The coefficients of E_0 and I_0 in equations (1) and (2) may be expressed in the form of convergent series, as follows:

$$\cosh l\alpha = A = 1 + ZY/2! + Z^2Y^2/4! + Z^3Y^3/6! \text{ etc.} \quad (9)$$

$$\sinh l\alpha = B = Z + Z^2Y/3! + Z^3Y^2/5! + Z^4Y^3/7! \text{ etc.} \quad (10)$$

$$\cosh l\alpha = C = Y + Y^2Z/3! + Y^3Z^2/5! + Y^4Z^3/7! \text{ etc.} \quad (11)$$

in which Z and Y are the impedance $(r + jx)l$ and the admittance $(g + jb)l$ respectively for the whole line.

Denoting the total resistance rl , reactance xl , leakage gl and susceptance bl of the line by R , X , G and B_s , respectively, and substituting for Z and Y in (9), (10) and (11) their complex values, it is possible, by developing the series, to express the coefficients in terms of R , X , G and B_s .

Leaving out the intermediate steps in the calculation, the first two terms of the series for each of the component constants are shown below, equation (12) being transposed to show the value of $(1 - a_1)$.

$$1 - a_1 = (XB_s - RG)/2 - [(B_s^2 - G^2)(X^2 - R^2) - 4RXGB_s]/24 + \text{etc.} \quad (12)$$

$$a_2 = (RB_s + XG)/2 - [RX(B_s^2 - G^2) + GB_s(X^2 - R^2)]/12 + \text{etc.} \quad (13)$$

$$b_1 = R - [2RXB_s + G(X^2 - R^2)]/6 + \text{etc.} \quad (14)$$

$$b_2 = X - [B_s(X^2 - R^2) - 2RXG]/6 + \text{etc.} \quad (15)$$

$$c_1 = G - [R(B_s^2 - G^2) + 2XGB_s]/6 + \text{etc.} \quad (16)$$

$$c_2 = B_s - [X(B_s^2 - G^2) - 2RGB_s]/6 + \text{etc.} \quad (17)$$

Leakage is rarely considered in practical power transmission problems, and consideration of its effect will be left for a later supplementary analysis. Letting $G = 0$ and noting that the sum of the second and following terms of (12) to (17) is in each case a function of R , X and B_s , also that $R = rl$, $X = xl$ and $B_s = bl$, equations (12) to (17) may be written as follows:

$$1 - a_1 = (xb/2)l^2 - f_{a_1}(r, x, b, l) \quad (18)$$

$$a_2 = (rb/2)l^2 - f_{a_2}(r, x, b, l) \quad (19)$$

$$b_1 = rl - f_{b_1}(r, x, b, l) \quad (20)$$

$$b_2 = xl - f_{b_2}(r, x, b, l) \quad (21)$$

$$c_1 = -(rb^2/6)l^2 - f_{c_1}(r, x, b, l) \quad (22)$$

$$c_2 = bl - f_{c_2}(r, x, b, l) \quad (23)$$

The line constants are, to a first approximation, equal to the first terms of equations (18) to (23). Now, by varying the exponent of l in any of the equations the first term can be given any value desired. Then by finding the proper exponents in the six equations the first terms can be made to express the exact values of the respective constants for any assigned values of r , x , b and l . The determination of the exponent, when the constant is known, is simple. Thus, assuming $(1 - a_1)$ to have been determined from given conditions, and letting N_{a_1} equal the corresponding exponent,

$$1 - a_1 = (xb/2)l^{N_{a_1}} \\ \log(1 - a_1) = (\log xb/2) + N_{a_1} \log l \\ N_{a_1} = [\log(1 - a_1) - (\log xb/2)] / \log l \quad (24)$$

The exponents for the other constants can be found in a similar way so the values of the constants can be expressed by the following equations:

$$1 - a_1 = (xb/2)l^{N_{a_1}} \quad (25)$$

$$a_2 = (rb/2)l^{N_{a_2}} \quad (26)$$

$$b_1 = rl^{N_{b_1}} \quad (27)$$

$$b_2 = xl^{N_{b_2}} \quad (28)$$

$$c_1 = -(rb^2/6)l^{N_{c_1}} \quad (29)$$

$$c_2 = bl^{N_{c_2}} \quad (30)$$

in which N_{a_1} , N_{a_2} , etc., are variable exponents of the distance l , to be determined for the given conditions in any particular case.

The above equations constitute the new transmission-line formula, and for its practical application it is necessary to find a simple means of determining the various exponents. These are taken directly, without calculation, from the exponent chart presented herewith.

THE EXPONENT CHART

The sole purpose of the exponent chart is the determination of the exponents to be used in equations (25) to (30). Its construction is deduced as follows:

Assuming a circuit with a given material, size and spacing of conductors, the values of resistance r , inductance L and capacitance C per mile of circuit become fixed. This circuit may be called, for convenience, the standard circuit. Assuming, further, a definite frequency and length for this circuit, the quantities x , b and l also become fixed and the component line constants a_1 , a_2 , etc., can be calculated, for the given conditions, from equations (9), (10) and (11). The corresponding exponents N_{a_1} , N_{a_2} , etc., in (25) to (30) can then be calculated as in equation (24). Similar calculations can be made for other frequencies and lengths of circuit within any desired range.

By calculating the exponents for a sufficient number of lengths and frequencies at proper intervals and plotting the results, curves can be drawn from which the exponents for the standard circuit can be determined graphically for any length and frequency desired.

In the exponent chart, here published, the distance curves are straight lines radiating from a common center. The left-hand, or 60-cycle, ordinate in each diagram is a straight line. Mathematically the other

frequency lines are curves, but the curvature in all cases is so slight as to be scarcely measurable. There is also a slight divergence of the frequency lines toward the higher exponent values. This is hardly noticeable.

In making the numerical calculations it was noted that the exponent N_{c_2} for any condition up to 700 miles and 60 cycles is identical within 0.00005 with the decimal part of N_{a_2} . This permits combining the diagrams for these two exponents, the decimal part only of N_{a_2} being the value of N_{c_2} .

THE STANDARD CIRCUIT

The conditions assumed for the standard circuit were chosen with a view to representing intermediate values between the practical extremes that might occur within the intended range of application of the formula. With a view to giving it the widest practicable range of application and usefulness and making it available for the analysis of long and unusual lines, the exponent chart has been constructed for distances up to 700 miles and frequencies up to 60 cycles.

Seven hundred miles was chosen as the logical limit of distance, being approximately a quarter-wave length at 60 cycles, and thus permitting the peculiar characteristics of this particular type of line to be conveniently analyzed. Furthermore, this was the length proposed for the Victoria Falls transmission line in South Africa, which is, as far as the writer is aware, the longest line that has been discussed or investigated as a commercial proposition. Based on these considerations, the values $r = 0.1$ ohm, $L = 2.11$ millihenries, $C = 0.0145$ microfarad, were assumed for the linear constants of the standard circuit per mile of wire, corresponding approximately to a 575,000-circ. mil copper conductor with a spacing of 17.5 ft. (5.3 m.).

ACCURACY OF THE FORMULA

The formula is rigorous for the conditions of the standard circuit, and the exponent chart on which its application depends is accurate to within an exponent value of 0.00005. For other line conditions the exponents are affected to a small extent by changes in the linear constants, r , L and C . The effect on the exponents is very slight for any conceivable changes within the limits of practical design and where not entirely negligible is capable of easy correction by means of the supplementary diagrams on the chart.

The exponents have been calculated for the extreme conditions of every change or combination of changes that can occur in the values of r , L and C , within the following range of materials, size and spacing of conductor.

Material	Copper and aluminum
Size, maximum	2,000,000 circ. mils.
Size, minimum	Varies with l ; fixed by condition
	$R_{max} = 100$ ohms
Spacing, maximum.....	33 ft.
Spacing, minimum.....	Varies with l ; fixed by condition
	$L_{min} = 1.92$; equals 8 ft. at 700 miles, decreasing to 2 ft. at 50 miles

While the detailed analysis and calculations are too long to be included in the present article, the following interesting and practical results are found:

1. The maximum effect on exponents N_{a_2} , N_{b_1} , N_{c_1} and N_{c_2} of any possible variation in line conditions within the above limits is 0.00032, corresponding to a maximum effect on constants a_2 , b_1 , c_1 and c_2 of 0.21 per cent.

2. The maximum effect on exponents N_{a_1} and N_{b_2} of any possible changes in L or C , as affected by size of spacing of conductor, is 0.00050, corresponding to a maximum effect on constant $1 - a_1$ and b_2 of 0.27 per cent.

3. The maximum effect on exponents N_{a_1} and N_{b_2} due to changes in r , is 0.0015 and 0.0035 respectively, corresponding to a maximum effect on $1 - a_1$ of 0.3 per cent and on b_2 of 1.4 per cent.

4. The effect of changes in r on exponents N_{a_1} and N_{b_2} is practically independent of the frequency.

The effect of changes in r on exponents N_{a_1} and N_{b_2} is shown, and correction made therefor by means of the supplementary diagrams on the exponent chart. The effect of and correction for any value of r is found on the bottom scale vertically below the intersection of the value of r on the left-hand scale and the curve for the distance. With this correction provided for, the limit of error is reduced to 0.3 per cent for any condition within the range of the exponent chart.

EFFECT OF LEAKAGE

Leakage being variable and uncertain in value, refinement in calculations of its effect is unnecessary. It is determined with sufficient accuracy by the first terms of equations (12) to (17) in which it occurs, except in the case of c_1 , where two terms are needed for a satisfactory approximation.

From a series of calculations made by the writer the following results are summarized to show the effect of leakage in per cent on the constants of the standard circuit under various conditions. The value of g assumed in the calculations was 0.2725 micromho, or 1/20b.

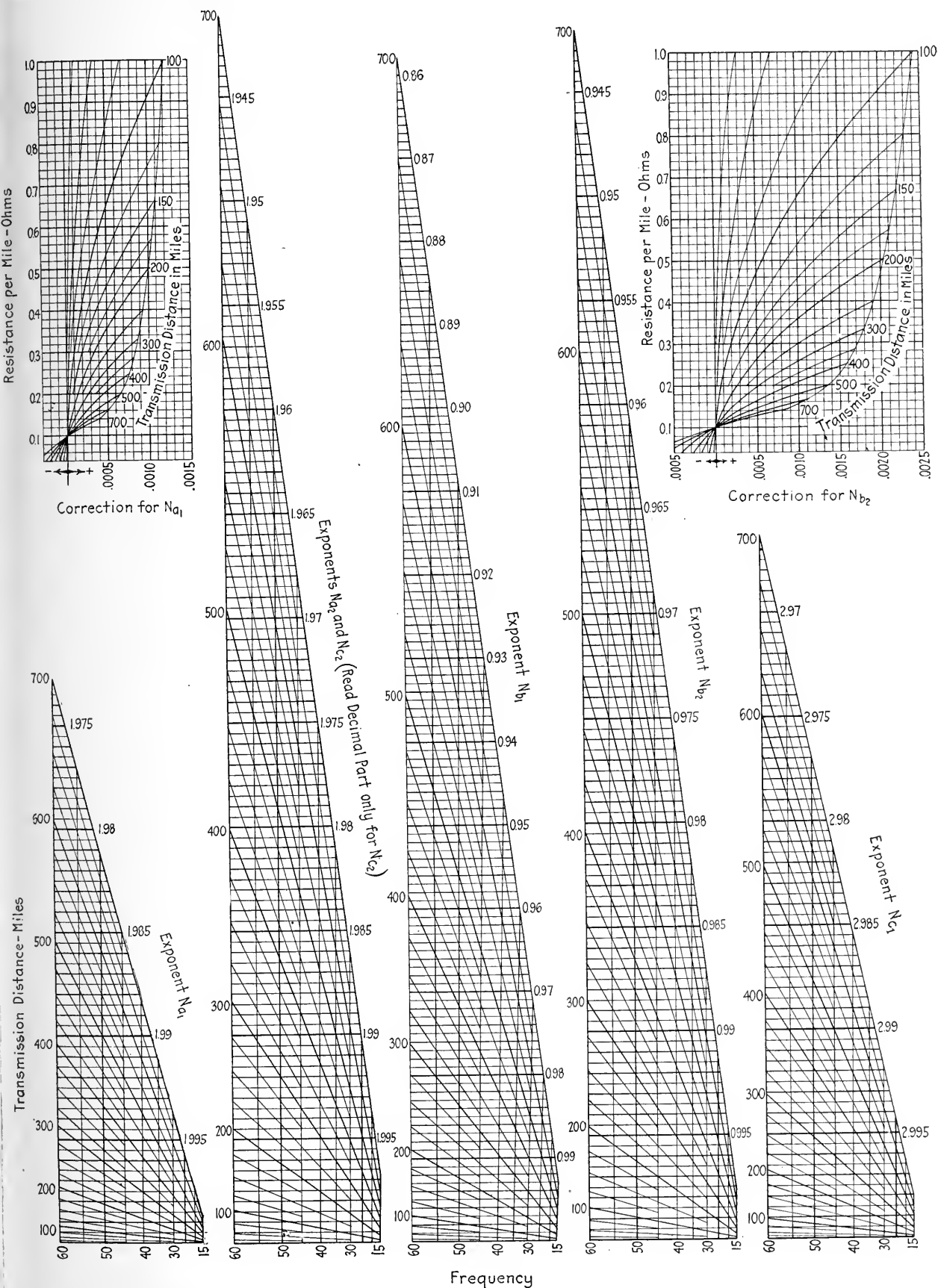
	$1 - a_1$	a_2	b_1	b_2	c_1	c_2
700 miles—60 cycles	-0.25	+40.3	-28.8	+0.45	-55.0	+0.5
700 miles—30 cycles	-2.12	+40.3	-3.9	+0.45	-to +	+0.5
100 miles—60 cycles	-0.62	+40.1	-0.3	+0.01	-to +	+0.0

From the above it will be seen that leakage affects principally constants a_2 , b_1 and c_1 , its effect on the other constants being negligible under all conditions. Its effect on a_2 is seen to be practically independent of frequency and distance, while the effect on b_1 is only important at maximum distance and frequency. The relatively large effect on c_1 is numerically unimportant owing to the small value of this constant, the most important result in this case being the change in sign at low frequencies and short distances.

With the exception of c_1 the first terms of (18) to (23) are identical with the values of the line constants as calculated by two of the simplest approximate methods that take account of capacity by assuming it to be concentrated at the center or ends of the line. The integral exponents 1, 2 and 3, therefore, correspond to the assumption of lumped capacity, and the differences between these and the actual exponents represent the effect on each component constant of the distributed nature of the resistance, inductance and capacity of the circuit. The relative effect on each exponent is shown by the height of the respective diagrams on the exponent chart (allowing for the different scale of N_{b_1}).

NUMERICAL EXAMPLE

The following example will illustrate the use of the exponential formula in determining the line constants



for a particular case. The solution of complete transmission line problems will be given in a later article.

Assume: Distance, 275 miles; frequency, 60 cycles; conductor, 250,000-circ. mil. stranded copper; spacing, 8 ft.

From wire tables:

$$\begin{aligned} r &= 0.228 \text{ ohm,} \\ x &= 0.753 \text{ ohm,} \\ b &= 0.00000581 \text{ mho.} \end{aligned}$$

From exponent chart:

$$\begin{aligned} N_{a_1} &= 1.9956, & N_{b_2} &= 0.9909, \\ N_{a_2} &= 1.9901, & N_{c_1} &= 2.9941, \\ N_{b_1} &= 0.9798, & N_{c_2} &= 0.9901. \end{aligned}$$

From logarithmic tables:

	CONSTANT					
	$1-a_1$	a_2	b_1	b_2	c_1	c_2
log exponent	0.3001	0.2989	1.9911	1.9960	0.4763	1.9957
lolog 275	0.3873	0.3873	0.3873	0.3873	0.3873	0.3873
lolog 1^N	0.6874	0.6862	0.3781	0.3833	0.8636	0.3830
log 1^N	4.869	4.855	2.390	2.417	7.305	2.415
log r	1.358	1.358	1.358	1.358	1.358	1.358
log x	1.877	1.877	1.877	1.877	1.877	1.877
log b ($\times 2$ for c)	6.764	6.764	6.764	6.764	11.528	6.764
log $1/2$	1.699	1.699	1.699	1.699	1.699	1.699
log h	1.222	1.222	1.222	1.222	1.222	1.222
log constant	1.209	2.676	1.748	2.294	5.413	3.179
constant	0.162	0.0474	56.0	197.0	-0.0000259	0.00151
d_1	0.838	0.838	0.838	0.838	0.838	0.838

Find conditions at the sending end when the above line is delivering 30,000 kw. at 150,000 volts, with unity power factor. Letting P_o and P_i equal kilowatt at receiving and sending ends respectively, the following conditions exist for one phase:

$$\begin{aligned} E_o &= 150,000/\sqrt{3} = 86,600 \text{ volts.} \\ P_o &= 30,000/3 = 10,000 \text{ kw.} \\ I_o &= 10,000/86.6 = 115.5 \text{ amp.} \\ E_i &= 86,600(0.838 + j0.0474) + 115.5(56 + j197) \\ &= (72,600 + j4105) + (6470 + j22,750) \\ &= (79,070 + j26,855) \\ &= 83,500 \\ I_i &= 115.5(0.838 + j0.0474) + 86,600(-0.0000259 \\ &\quad j0.00151) \end{aligned}$$

$$\begin{aligned} &= (96.8 + j5.47) + (-2.24 + j131) \\ &= 94.6 + j136.5 \\ &= 166 \end{aligned}$$

$$\begin{aligned} P_i &= 79,070 \times 94.6 + 26,855 \times 136.5 \\ &= 11,146 \end{aligned}$$

At no load:

$$E_i = (72,600 + j4105) = 72,700 \text{ volts.}$$

$$I_i = (-2.24 + j131) = 131 \text{ amp.}$$

$$P_i = -162.6 + 537.7 = 375.1 \text{ kw.}$$

$$\text{Regulation} = (72,700 - 83,500)/86,600 = -12.5\%$$

$$\text{Efficiency} = 10,000 \div 11,146 = 89.7\%$$

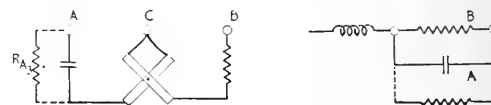
D. C. Calibration of Power-Factor Meters

Resistance Ratio Method Employed to Eliminate Errors Caused by Variations in Voltage, Current and Phase Angles When Alternating Current Is Used

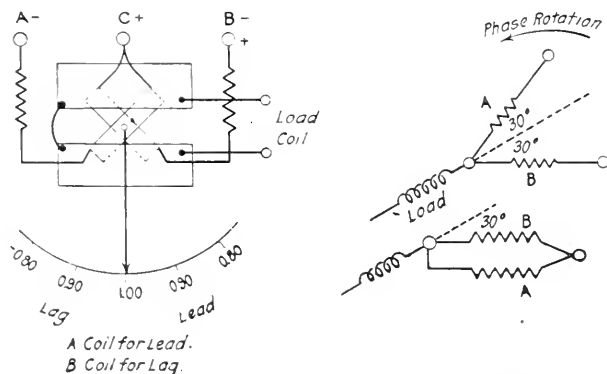
BY THOMAS W. VARLEY

WHEN a three-phase power-factor meter is calibrated by actually adjusting the power factor, it usually requires two voltmeters, one ammeter, one wattmeter and five men to take readings. With variations in voltage and current it is almost impossible to check any point on the scale. These difficulties are easily overcome by using direct current and adjusting the total resistance in the movable-coil circuits so that they will have the relation indicated in the accompanying table. The values given in the table

Without knowing the phase advance of the condenser used in conjunction with the single-phase power-factor meter to be calibrated it is impossible to give the ratio of total resistances which should exist for checking



FIGS. 4 AND 5—SINGLE-PHASE METER CONNECTIONS AND METHOD OF SIMULATING EFFECT OF CONDENSER



FIGS. 1, 2 AND 3—THREE-PHASE POWER-FACTOR-METER CONNECTIONS AND PHASE RELATIONS WITH NORMAL CONNECTIONS AS WELL AS WHEN MOVABLE COILS ARE IN PARALLEL

apply to two-phase and three-phase power-factor meters of the dynamometer type.

given points on the instrument scale. The phase advance caused by the condenser alone is usually over 89 deg., but combined with the coil A may change to 85 deg. Furthermore, single-phase power-factor meters are subject to frequency errors due to the capacity or inductance in the circuit.

The values given in the accompanying table are based on the fact that the deflection of a dynamometer-type power-factor meter is equivalent to the combined torques of the movable coils A and B in the field of the load coil. The torque of each of these coils is proportional to the voltage impressed across it and the cosine of the angle between the load current and the applied voltage. Hence, at 100 per cent power factor the two torques balance. In other words, by adjusting the relation between the currents in the movable coils the resultant torque with direct current can be made to equal any obtained when the instrument is connected to a polyphase circuit with any power-factor load.

For instance, to determine the resistance ratio which should be obtained to indicate 90 per cent power factor (equivalent to cosine of 20 deg. 50 min.) consider the relation between the current in the movable and load coils for a three-phase dynamometer-type power-factor instrument (Fig. 2). In this case the vector positions of the currents in coils A and B (Fig. 2) would be shifted 25 deg. 50 min. clockwise, making the angles between the currents in the movable coils and that in the load coil 4 deg. 10 min. and 55 deg. 50 min. for coils A and B respectively. Under these conditions the torques of the individual movable coils would be proportional to the cosines of these angles, or in the relation 0.9974 to 0.5616. Thus to simulate these torques with direct current, assuming that the normal resistance of circuit CB is R_b and that of AC is R_a , the resistance of circuit CB should be changed to $R_b \times 0.9974 = 0.5616 = 1.77 R_b$.

The ratio of the total resistances of circuit AB and B to obtain other power-factor deflections with direct current can be obtained in a similar manner. However, it will be found that the current through one of the circuits will have to be reversed in addition to changing the resistant ratio to obtain deflections corresponding to power factors of 70 deg. and less (two-phase) and 40 per cent and less (three-phase). This can be done without altering the instrument connections by joining A and B in series, making the current through

TOTAL RESISTANCE* NECESSARY IN MOVABLE COILS TO GET DIFFERENT POWER-FACTOR DEFLECTIONS WITH DIRECT CURRENT (Use about full-load current and about normal voltage to get a good torque. Alternating current or direct current can be used.)

Figures in bold-face type indicate value of shunt needed to produce required current in circuit.

POWER FACTOR		THREE-PHASE		TWO-PHASE	
Lead	Lag	A	B	A	B
100		+ R_a	+ R_b	+ R_a	+ R_b
95		+ R_a	+1.46 R_b	+ R_a	+1.97 R_b
	95	+1.46 R_a	+ R_b	+1.97 R_b	+ R_b
90		+ R_a	+1.77 R_b	+ R_a	+2.78 R_b
	90	+1.77 R_a	+ R_b	+2.78 R_b	+ R_b
85		+ R_a	+2.11 R_b	+ R_a	+4.25 R_b
	85	+2.11 R_a	+ R_b	+4.25 R_a	+ R_b
80		+ R_a	+2.53 R_b	+ R_a	+7.02 R_b
	80	+2.53 R_a	+ R_b	+7.02 R_b	+ R_a
70		+ R_a	+3.87 R_b	+ R_{a1}	0.0101 R_{b1}
	70	+3.87 R_a	+ R_b	0.0101 R_a	+ R_b
60		+ R_a	+7.66 R_b	+ R_{a1}	0.167 R_{b1}
	60	+7.66 R_a	+ R_b	0.167 R_{a1}	+ R_{b1}
50		+ R_a	Open circuit	+ R_{a1}	0.366 R_b
	50	Open circuit	+ R_b	0.366 R_{a1}	+ R_{b1}
40		+ R_{a1}	0.162 R_{b1}	+ R_{a1}	0.835 R_{b1}
	40	0.162 R_{a1}	+ R_{b1}	0.835 R_{a1}	+ R_{b1}
30		+ R_{a1}	0.407 R_{b1}	+ R_{a1}	1.09 R_{b1}
	30	0.417 R_{a1}	+ R_{b1}	1.09 R_{a1}	+ R_{b1}
20		+ R_{a1}	0.917 R_{b1}	+ R_{a1}	1.95 R_{b1}
	20	0.917 R_{a1}	+ R_{b1}	1.95 R_{a1}	+ R_{b1}
10		+ R_{a1}	2.39 R_{b1}	+ R_{a1}	4.49 R_{b1}
	10	2.39 R_{a1}	+ R_{b1}	4.49 R_{a1}	+ R_{b1}
0		+ R_{a1}	- R_{b1}	+ R_{a1}	- R_{b1}
	0	- R_{a1}	+ R_{b1}	- R_{a1}	+ R_{b1}

* R_a is the normal resistance of coil A. R_b that of coil B. and R_{a1} and R_{b1} the

OUTLINE OF CALCULATIONS FOR RESISTANCE RATIOS NECESSARY IN CALIBRATING SINGLE-PHASE METERS WITH DIRECT CURRENT

POWER FACTOR* = 0.90 = cos 25° 50'

Leading:

A

89° - 25° 50' = 63° 10'

cos 63° 10' = +0.4515

Change resistance for A to

$R_{a2} \times (0.9000/0.4514)$.

Lagging:

A

89° + 25° 50' = 114° 50'

cos 114° 50' = -0.42

B

0° - 25° 50' = -25° 50'

cos 25° 50' = 0.9

R_b = normal

The current through circuit A becomes negative and the case is similar for power factor 0.40 leading, with a three-phase indicator. Call the resistances for circuits A and B, R_{a1} and R_{b1} .

Shunt R_{a1} by

$R_{a1} \times (0.42/0.48)$.

R_{b1} normal

POWER FACTOR = 0 = cos 90°

Leading:

A

89° - 90° = -1°

cos -1° = 0.9999

R_{a1} normal

B

0° + 90° = 90°

cos 90° = 0

R_{b1} open circuit

Lagging:

A

89° + 90° = 179°

cos 179° = -0.9999

R_{a1} on alone and reversed

B

0° - 90° = 90°

cos 90° = 0

R_{b1} open circuit

*Similarly for power factors 0.80, 0.70, 0.60, 0.50, 0.40, 0.30, 0.20 and 0.10.

B negative, and connecting a shunt across the circuit, which is to have the higher resistance. Thus, if BC is to have 0.1108 ÷ 0.8047 normal current in the negative direction (as required at 40 per cent power factor), the shunt will have to carry (0.8047 - 0.1118) ÷ 0.8047 of the total current, or its resistance will have to be 0.1118 ÷ 0.6929 × R_{b1} = 0.162 R_b , where R_b is the normal resistance of circuit CB. The values of the shunts for different deflections are given in the table.

CALIBRATION OF SINGLE-PHASE METERS

To calibrate a single-phase power-factor meter using a condenser to advance the phase of the current through coil A, substitute a resistance for the condenser sufficient to give an indication of 1.00 on the scale (Fig. 5). The resistance R_{a2} will be found to be very high, as the condenser for which it is substituted has a large angle of advance for its current, and hence an apparently high resistance. With coil B alone connected the pointer may be deflected slightly on the lag side of 100 per cent power factor, whereas with coil A alone the pointer may show a large angle on the lead side of 100 per cent power factor. Call the first point zero and the second 90, thus forming a quadrant. The position of the pointer with both coils energized gives the true angular advance of the condenser in terms of 0 and 90 as found. For convenience in presenting the accompanying calculations this angle will be considered as one degree. The real resistance for circuit A will then equal $R_{a2} \times \cos 89 \text{ deg.} = R_{a1}$. The angle of 89 deg. advance for the condenser is used to simplify the explanation, but the real angle, found by testing, should be used.

Employing the resistance ratio method calibrating power-factor meters, only one man is required to mark the scale and no attention need be paid to variations in

Application of Motors to Steel-Mill Operations

Limitations to Speed of Mills—Power Requirements and Types of Motors Adapted Thereto—Control of Reversing Mills and Relative Economy of Steam and Electric Drive

BY C. E. CLEWELL

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Some important operations in steel mills to which motors have been applied are touched upon in this article. Notes on the arrangements of mill machinery, items which affect the power requirements of the motors, the principal types of motors used and features of the control apparatus are included. Economies which may be effected by the motor in comparison with steam-driven rolls are discussed, and reference is made to several interesting applications which are illustrated from practical cases.

A COMPLETE study of motor applications in steel-mill work would include the operation of such machinery as cranes, reversing and non-reversing stationary tables, manipulators, screw-downs, the operation of lift tables to include the lift motion as well as driving the rollers, and the field of general reversing and non-reversing applications. Obviously it would be impracticable, in a limited article of this kind, to attempt to treat completely each of these special applications. As a consequence the present discussion will be limited to one or two specific cases where the motor has resulted in a successful use of the principles on which the industrial applications of electric power have been based in recent years.

ARRANGEMENT AND DRIVE OF MILLS

Mills are arranged in various ways. Where small sections of metal are handled by a series of stands they may be arranged in one line and the power applied either at one end or at the center of the line. However, where roughing and finishing stands are included in one group, the roughing stands are usually operated at reduced speed, and the power is sometimes applied to wheels through rope drive, whereas the finishing stands may be directly connected to the motor for higher-speed operation. Such a scheme means, however, a fixed relation between the speed of the roughing rolls and that of the motor which is used also for the finishing rolls. With separate motors for each set of rolls the speeds of each may be adjusted independently to suit the best production conditions.

Various methods of mechanically connecting the motors to the rolls are employed, notably direct connection, gearing and rope drives. Where direct connection is considered it is necessary that the mill speed be adapted to the motor speed which is possible with the size of motor used. Sykes, in the "Standard Handbook for Electrical Engineers," gives the following speeds for 25-cycle motors as a minimum: 250 hp. to 500 hp., 125 r.p.m.; 500 hp. to 1000 hp., 100 r.p.m.; 1000 up to 2000 hp., 85 r.p.m.; 2000 hp. and upward, 70 r.p.m. These values indicate the necessity for certain limitations of the speeds of the mills if direct connection is to be employed.

To use motors with these minimum speeds implies a relative high first cost for the motor so that the geared connection is sometimes resorted to for the operation of small low-speed rolls by motors of higher

speed ratings than would be possible with direct connection.

The table, which indicates a number of typical motor applications to the main rolls of steel mills, shows the preponderance of alternating-current motors, this type being used in a majority of cases. However, alternating-current motors are not adapted to the reversing mills, and in this case the direct-current type must be used on account of its greater flexibility of control.

Modern mill motors are designed to withstand the high temperatures which often occur at the points where the motor must be installed. Improvements along this line have resulted in a motor for which the maintenance is greatly reduced over that which was experienced with earlier types.

CONTROL FOR THE REVERSING-MILL MOTOR

Some criticism has been made of the developments in the control of direct-current motors in recent years, due to the practice of inserting resistance in the arma-

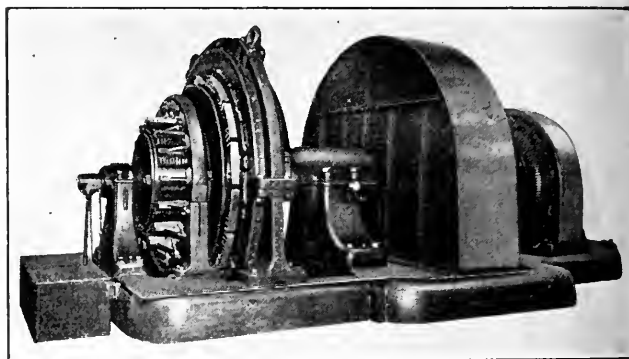
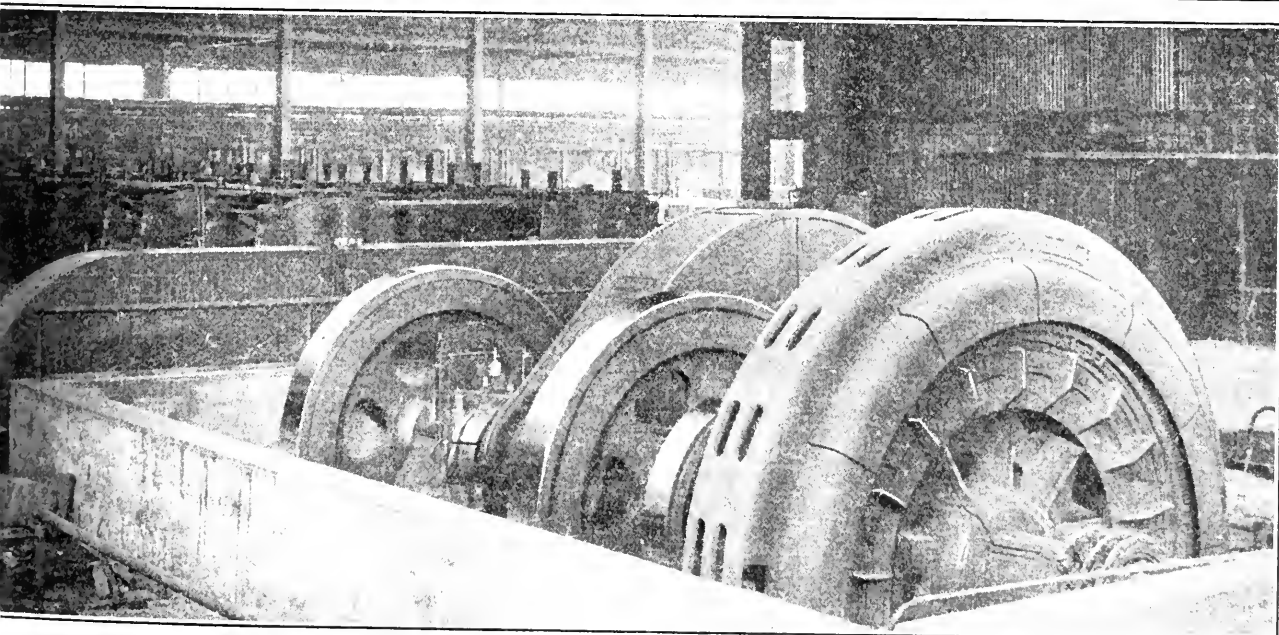
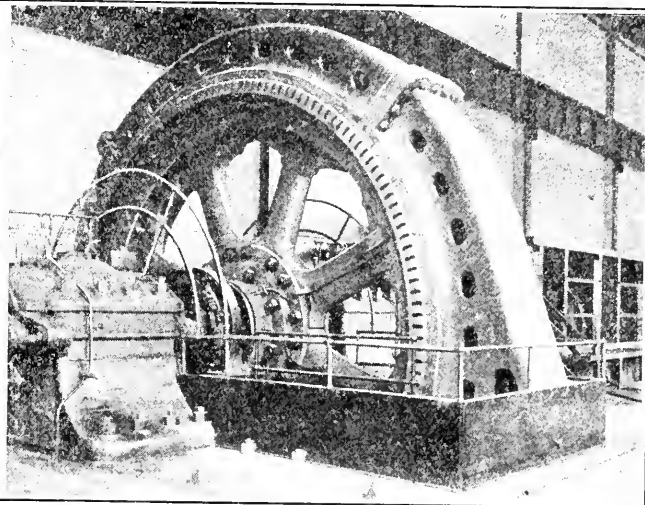
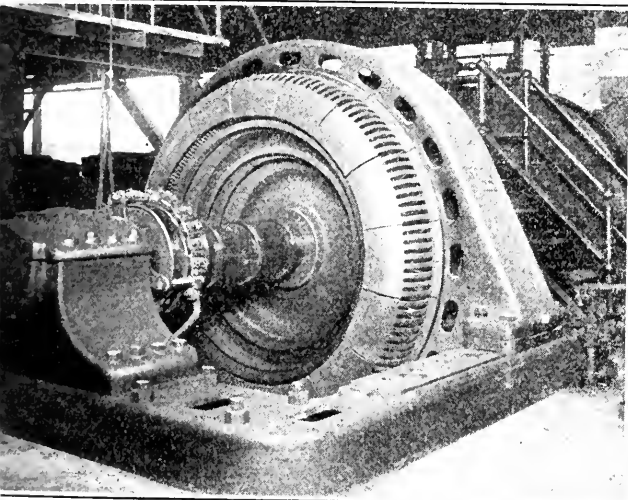
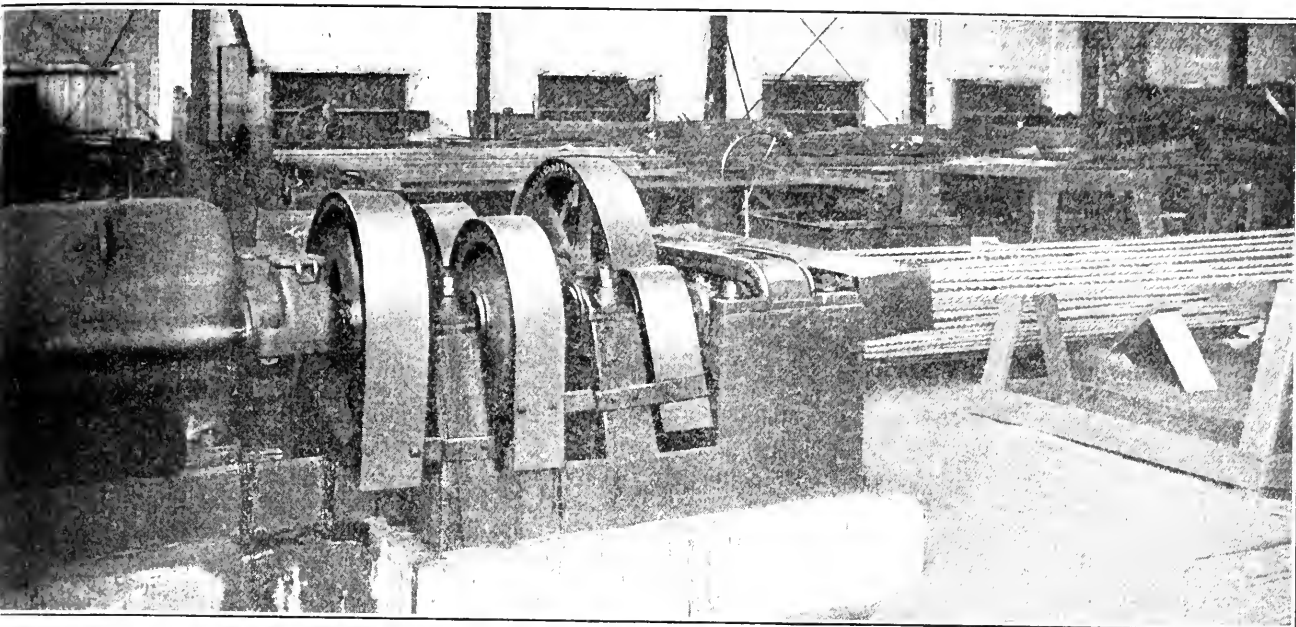


FIG. 1—FLYWHEEL MOTOR-GENERATOR SET SUPPLYING POWER TO REVERSING MILL

ture circuit, which in itself represents very little or no advance over the methods of ten or twenty years ago. A notable example of a departure from this method, however, is in the control of the large direct-current motors used with reversing rolls. Here, a motor generator set (Fig. 1) is employed for the supply of each driving unit, the generator supplying adjustable voltage to the driving motor for the speed variation of the latter. Reversal of the driving motor is accomplished by a reversal of the supply voltage from the generator, which is brought about in turn by a reversal of the generator-field excitation.

With increased loads on the driving motor, the emf. of a second exciter termed the "series" exciter increases, since the driving-motor armature current passes through the field winding of this series exciter. This results in increased excitation for the driving motor, consequently reduced speed and less mechanical strain on the equipment, with some increase in driving torque.

With the master controller now thrown toward its



FIGS. 2, 3, 4 AND 5—MOTORS APPLIED TO SEVERAL DIFFERENT STEEL MILL MACHINES

Fig. 2 shows a 75-hp. mill-type motor driving bar-twisting machine at works of Inland Steel Company; Fig. 3 is a 1500-hp. motor applied to...

4 illustrates a 6000-hp. induction motor driving a sheet-bar mill at works of Indiana Steel Company, and Fig. 5 is a 1200-hp. motor applied to...

off position, the excitation of the generator field is reduced and the driving motor returns electric power to the generator, thus operating the latter as a motor for the time. This results in an increase in speed for the motor-generator set with consequent storage of energy in the flywheel of the set (Fig. 1). In this way the speed of the driving motor is quickly reduced to zero and a large part of the energy required for acceleration is conserved by the flywheel and used in turn for the succeeding operation.

Among the items which determine the power requirements imposed on the driving motor of the motor-generator set, the flywheel will apparently have a considerable bearing, its tendency being to equalize the load on the main supply circuits. As for the loads throughout the duty cycle of the reversing driving motor, extreme variations follow as a consequence of the differences in the reductions of the material which is passed through the rolls and also because of the heavy requirements at the instant the material enters the rolls. The size of motor for driving must be such that it will supply these varying requirements without excessive heating, and the design must be such that the maximum torques and horsepower demands, which are very large at times, may be met successfully.

The practice has been to rate reversing mills on the maximum peaks of the operating load rather than on continuous capacity based on heating. The limitations

ECONOMIES IN THE USE OF THE MOTOR

A number of excellent papers have appeared recently which have dealt more or less fully with the advantages and economies of the motor-driven reversing mills in contrast with steam-engine power applications. As an example, an article in these columns² recently explained in considerable detail the comparative costs and performance of different types of drives, and for this reason it has been thought best to include at this point merely a brief statement of the factors involved in the way of a review or summary of the present attitude toward the electrically driven reversing mill, with an appended note on the more important papers, which may be consulted where greater detail is desired.

While the first cost of the reversing engine is set forth by the engine builders as only a small fraction of the total cost of the electric drive, carefully compiled figures on both kinds of equipment, when based on the total costs chargeable against the reversing-mill equipment, show that electric drive with purchased power has a lower first cost than, and the electric drive with power generated at the plant has a first cost comparable with, that of the steam drive. It is of course highly necessary in arriving at such a conclusion to include for the steam drive not only the reversing engine, but also the condenser equipment, foundations, boiler, piping and the like.

Messrs. Sykes and Hall³ give as the first cost

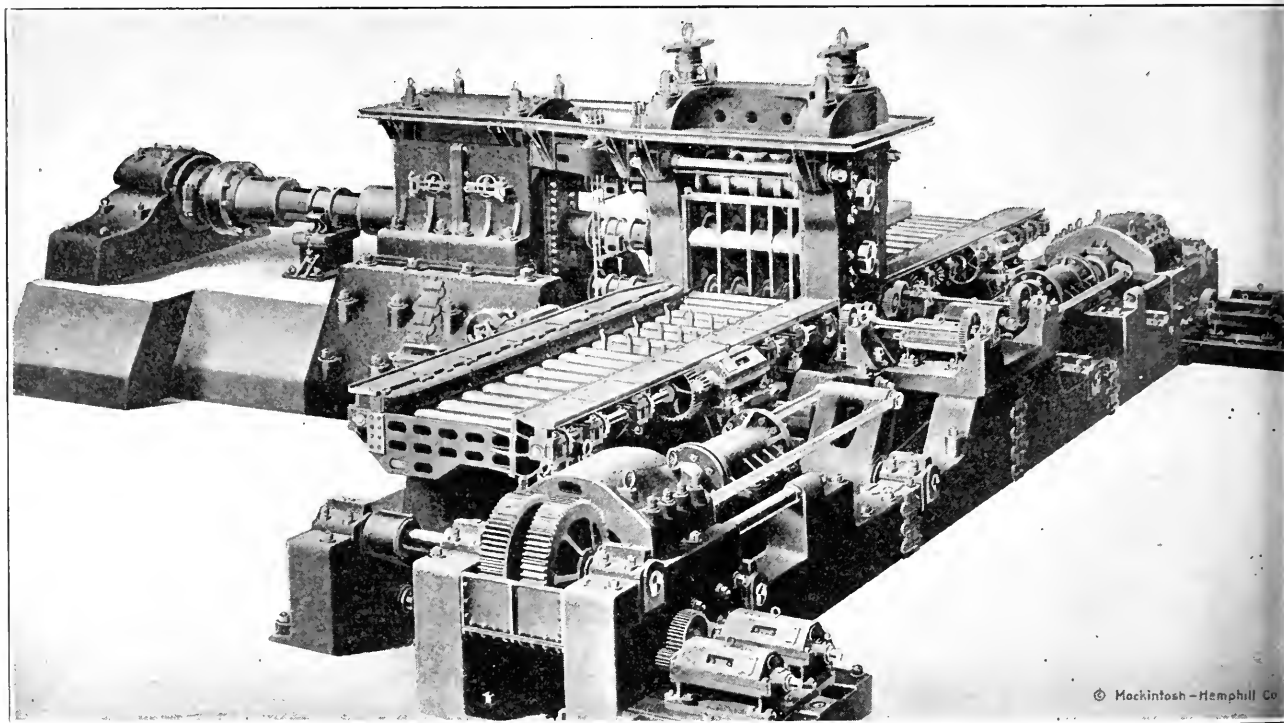


FIG. 6—BLOOMING MILL USING FOUR 100-HP. MOTORS FOR LIFTING TABLE, TWO 50-HP. MOTORS FOR FEED ROLLERS AND FOR 50-HP. MOTORS FOR THE ROLL TABLES

of this article prevent a detailed treatment of the design features which have been included in motors for this service, but in a supplementary note at the end of this article a number of references are given to comprehensive papers on various phases of the subject, to which the reader is referred for additional information.

¹A more complete discussion related to the use of flywheels for such purposes will be given in a subsequent article dealing with this specific subject.

equipment for driving a 40-in. (101.6-cm.) blooming mill with a capacity of 60,000 tons of steel per month for reducing from 24 in. by 24 in. (61 cm. by 61 cm.) to 8 in. by 8 in. (20.3 cm. by 20.3 cm.), the following figures: (a) Electric drive with purchased power,

²By William Knight on "Advantages of Electrified Rolling Mill" Vol. 70, No. 21, p. 998.

³Paper on "Electric Drive for Reversing Rolling Mills," by V. Fred Sykes and David Hall, *Trans. A. I. E. E.*, Vol. XXXV, p. 5. References have been freely made to this excellent treatment of the reversing mill in the development of these economic relations.

95,000; (b) electric drive with power generated at the plant, \$325,000; (c) steam drive, \$300,000. The reader is referred to the paper of Sykes and Hall and to the ELECTRICAL WORLD article by Knight for further details on costs.

The argument that the reversing engine uses no more steam than the electric drive has been met³ on a basis of actual tests on a modern engine of this type and corresponding data on electrical equipment. Fig.

INFORMATION REGARDING A FEW TYPICAL INSTALLATIONS OF MOTORS FOR THE MAIN ROLLS OF STEEL MILLS
or classification of mills see "Standard Handbook for Electrical Engineers," fourth edition, page 1248)

Name of Plant	Motor				Method of Drive
	Kind and Size of Mill	Hp.	R.P.M., Full-Load Speed	General Description	
Carnegie Steel Co. Painters' mill...	Finishing std. 9-in. mill	500	435	440-v., 3-ph., 60-cy.	Belted
Carnegie Steel Co. Painters' mill...	Finishing std. 10-in. mill	500	435	440-v., 3-ph., 60-cy.	Belted
Union Steel Co.	12-in. Morgan mill and 10-in. merchant mill	1,200	292	2200-v., 3-ph., 25-cy.	Direct-connected to 10-in. mill rope drive to 12-in. mill
Union Steel Co.	18-in. tandem mill	870	292	2200-v., 3-ph., 25-cy.	Direct-connected
Union Steel Co.	8-in. merchant mill	700	365	2200-v., 3-ph., 25-cy.	Direct-connected
Union Steel Co.	Finishing std. 10-in. mill, item No. 50	670	485	2200-v., 3-ph., 25-cy.	
Pittsburgh Steel Co.	35-in. blooming mill	12,000	45-90	600-v., d. c. in 2 units	Direct-connected
Carnegie Steel Co.	10-in. merchant bar mill	1,500	182 to 162	6300-v., 3-ph., 25-cy.	Rope drive and direct
Carnegie Steel Co.	16-in. merchant mill	500	184	2200-v., 25-cy., 3-ph.	Direct-connected
Carnegie Steel Co.	10-in. merchant mill	500	244	2200-v., 25-cy., 3-ph. (12-pole)	Direct-connected
Carnegie Steel Co.	8-in. merchant mill	300	365	2200-v., 25-cy., 3-ph.	Direct-connected
American Steel & Wire Co.	Roughing train-rod mill	2,600	81.5	6600-v., 25-cy., 3-ph.	Gear drive
American Steel & Wire Co.	Finishing train-rod mill	1,600	500	6600-v., 25-cy., 3-ph.	Rope drive
American Steel & Wire Co.	Finishing train-rod mill	1,300	500	6600-v., 25-cy., 3-ph.	Rope drive
Illinois Steel Co.	Roughing rolls, structural mill	3,000	91	2200-v., 25-cy., 3-ph.	Gear drive
Illinois Steel Co.	Finishing rolls, structural mill	1,000	133	2200-v., 25-cy., 3-ph.	Direct-connected
American Rolling Mill Co.	Sheet mill	1,500	10	2200-v., 25-cy., 3-ph.	Rope drive
American Rolling Mill Co.	Sheet jobbing mill	1,000	245	2200-v., 25-cy., 3-ph.	Rope drive
American Sheet & Tin Plate Co.	Finishing rolls, 84-in. plate mill	1,100 to 1,500	91	6600-v., 25-cy., 3-ph.	Direct-connected
Crisp-Bailey Steel Co.	Cold-roll mill	350	5	440-v., 60-cy., 3-ph.	Gear drive
Illinois Steel Co.	8-in. merchant mill	400	400 to 450	220-v., d. c., cp.-wd. adj. speed	Direct-connected
Carnegie Steel Co. Painters' mill...	Merchant mill	500	435	440-v., 3-ph., 60-cy.	Rope
Pittsburgh Steel Products Co.	Piercing mill, seamless tubes	800 to 300	200 to 300	500-v., d. c., cp.-wd. adj. speed	Direct-connected
Wool Iron & Steel Co.	84-in. plate mill roughing rolls	1,600	244	2200-v., 3-ph., 25-cy.	Gear drive

shows, for example, the horsepower hours per ton of steel rolled with electrically driven reversing mills⁴ and the pounds of steam required per ton rolled with steam apparatus. From the first curve and with known values of the pounds of steam required per horsepower-hour for large steam turbines the pounds of steam required by electrically driven mills per ton of steel rolled may be determined. Figures derived on this basis show that the steam consumption for the electric drive amounts only to about one-half of that required by the

reversing engine for the same material handled by the mill.

The conservation of all the energy required for acceleration in engine-driven equipments is given³ little or no weight, since such a claim is based largely on theoretical operating conditions of the engine-driven mill and, moreover, since the reduced energy consumption of the electric drive as outlined in item (2) is obviously the point to be considered in this general

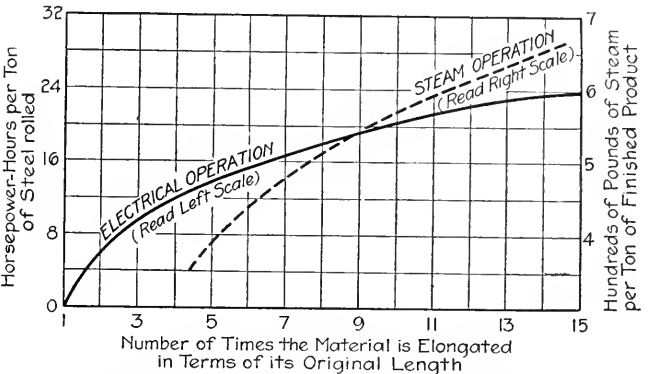


FIG. 7—RELATION BETWEEN INPUT TO ELECTRIC AND STEAM-DRIVEN REVERSING MILLS AND ELONGATION OF THE STEEL ROLLED

connection. In other words, even if the engine drive does save more of the accelerating energy, its gross energy consumed per ton is so much greater than that of the electric drive that this feature is of little or no consequence.

As to reduced efficiency of the motor drive at partial loads, it is pointed out³ that while the electrically driven mill does suffer some reduction in economy with reduced loads on account of the continued windage and friction losses of the flywheel motor-generator equipment, the net power, without considering these more or less constant losses, per ton of material handled is essentially independent of the quantity which passes through the rolls, and, furthermore, that, owing to the constant losses in an engine equipment, the conditions surrounding its operation are somewhat like those of the motor drive at partial loads.

Concerning the time required for the operation of the two kinds of equipment, tests³ on each indicate that the electrically driven mill can be operated as rapidly or more so than with engine drive. Besides a number of secondary advantages, such as the ease of control and the like, materially favor the electric drive.

The foregoing discussion has reviewed briefly certain information which is available on steel-mill motive power. Owing to limitations imposed on the discussion by the space available, the reader is referred to the papers and articles mentioned in the bibliography printed below for further information on various phases of the subject.

BIBLIOGRAPHY.—"Modern Types of Direct-Current Machines," by David Hall, *Electric Journal*, Vol. XIII, No. 11, p. 534; "Electrically Driven Reversing Mills," by Wilfred Skyes, *Transactions A. I. E. E.*, 1911; "Operation of a Large Electrically Driven Reversing Mill," by Wilfred Skyes, *Transactions A. I. E. E.*, 1912; "Electrification of a Reversing Rolling Mill of the Algoma Steel Company," by B. T. McCormick, *Transactions A. I. E. E.*, 1912; the three papers on controllers in *Transactions A. I. E. E.*, 1915, by J. S. Riggs, G. E. Stoltz and W. D. Lunn, and Arthur Simon; together with the paper and articles referred to

⁴Fig. 7 is based on information found in the paper by Sykes and Hall, and on an article by W. R. Runner, Figs. 1, 2, 3 and 4 are shown by courtesy of the General Electric Company, and Figs. 5 and 6 by that of the Westinghouse Electric Company.

Central-Station November Operations

Compilation of Returns Made to the "Electrical World" Covering November, 1917, Indicates Increase of 15.3 per Cent in Gross Revenue and 17 per Cent in Kilowatt-Hour Output

CENTRAL-STATION company returns compiled by the ELECTRICAL WORLD still apply to the period last year when industrial activity was at a high point. The reports of operations in November, 1917, show close to the same increased volume of output and gross earnings, as compared with the corresponding month of 1916, indicated in the preceding months.

The available statistics, covering nearly one-half of the industry, show gains of 15.3 per cent in gross revenue from energy sales and of 17 per cent in kilowatt-hour output, in November, 1917, as compared with November, 1916. Although output increased at a greater percentage rate than the gross revenue therefrom, the

difference between the two was much smaller than during most of the months in the year covered by the returns. This indicates that apparently the increase rates resulting from the higher cost of operation had a perceptible effect in making the percentage increase in gross revenue more nearly commensurate with the percentage increase in kilowatt-hour output.

Generally the statistics continue to reveal the large rate of growth which has been significant of electric

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	INCOME FROM THE SALE OF ENERGY			Kw.-Hr. OUTPUT		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
Dec.....	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
1917		1917	1916		1917	1916	
Jan.....	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.....	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March....	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April.....	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May.....	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June.....	63	23,279,000	20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July.....	63	22,768,000	19,680,000	15.8	1,397,482,000	1,159,410,000	21.5
August....	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.....	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
Oct.....	62	25,630,000	22,248,000	15.4	1,515,501,000	1,273,528,000	18.9
Nov.....	49	21,055,000	18,249,000	15.2	1,034,193,000	885,424,000	17.0

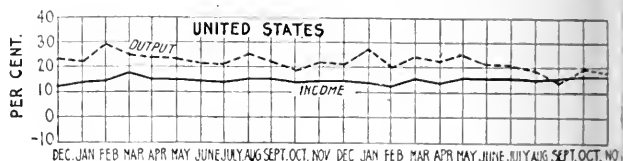


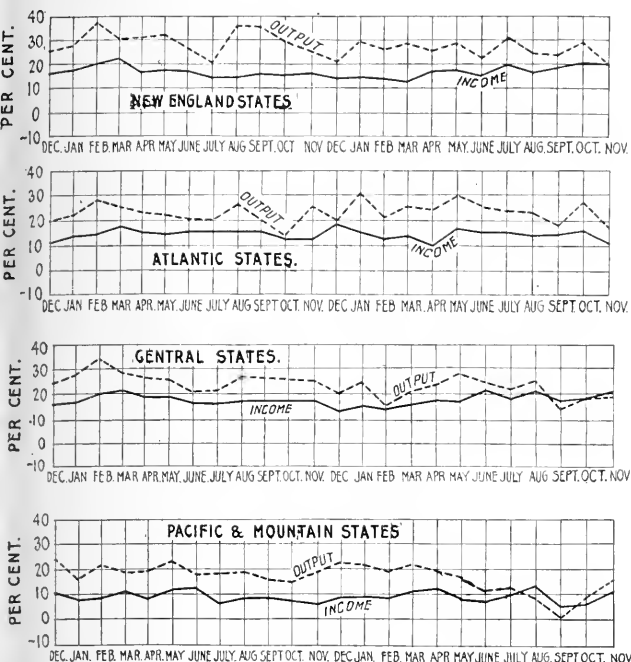
FIG. 1—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

central-station operation for many months. As some time is required for the compilation of the statistics by individual companies and then for their collection and tabulation by the ELECTRICAL WORLD, they necessarily refer to a period which, though recent, does not reflect current conditions. Not for some time will the effect of the Garfield order be apparent in the returns. It should be kept in mind also that the returns for the months of 1918 will be compared with the very high figures of 1917 and may not present the same record of increase on top of increase which has characterized the reports for many months past. In any event, however, the totals of gross output are large.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
December	65	\$3,203,000	\$2,814,000	14.0	66	\$11,059,000	\$9,348,000	19.6	56	\$7,898,000	\$6,997,000	13.0	75	\$2,987,000	\$2,735,000	9.2
1917		1917	1916		66	1917	1916		56	1917	1916		75	1917	1916	
January...	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	14.5
February...	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.1
March.....	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	3,780,000	3,780,000	11.1
April.....	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	17.0	86	4,282,000	3,821,000	12.2
May.....	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.7
June.....	64	2,641,000	2,290,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
July.....	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.1
August....	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	12.2
September.	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.6
October...	65	3,049,000	2,523,000	20.8	65	10,598,000	9,107,000	16.3	53	7,361,000	6,259,000	17.6	85	4,571,000	4,315,000	6.0
November.	62	3,118,000	2,608,000	19.6	47	8,076,000	7,250,000	11.4	68	7,082,000	5,881,000	20.3	62	2,722,000	2,458,000	10.6
December	65	117,763,000	97,357,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,833,000	23.8
1917		1917	1916		66	1917	1916		56	1917	1916		75	1917	1916	
January...	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
February...	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
March.....	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.1
April.....	64	108,968,000	87,237,000	25.0	65	449,443,000	362,752,000	24.0	56	390,103,000	317,503,000	22.9	86	368,557,000	309,474,000	19.1
May.....	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.1
June.....	64	106,817,000	87,345,000	22.4	65	496,784,000	396,508,000	24.8	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	12.2
July.....	64	109,399,000	83,451,000	31.4	65	494,963,000	392,905,000	26.5	53	379,087,000	311,931,000	21.5	86	412,655,000	366,237,000	12.6
August....	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.1
September.	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,885,000	1.6
October...	65	121,497,000	94,685,000	28.3	65	582,893,000	467,135,000	26.9	53	415,381,000	350,561,000	18.5	85	393,735,000	359,661,000	9.1
November.	62	120,248,000	100,596,000	19.5	47	399,350,000	342,287,000	16.9	68	368,490,000	316,479,000	16.5	62	146,011,000	124,453,000	17.3

Taking the actual returns as received and applying them to the estimates for the central-station industry



FIGS. 2 TO 5—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

as a whole, the totals indicated for November, 1917, are: Gross revenue, \$42,900,000; output sold, 2,110,000,000 kw.-hr.

ELECTRIC FANS FOR FUEL CONSERVATION

By an Agitation of the Air, Which in a Still Room Is of Different "Temperature Strata," Less Heat Is Required

BY CHARLES CATLETT

The statement made above is not strictly true, any more than the statement that an electric fan "cools the air." If an electric fan were started in a closed room, the friction from the fan as well as some of the converted electricity would actually add some heat to the room. But in hot weather an electric fan does cool the body and does give a sensation of coolness by the more rapid evaporation of the visible and invisible moisture which is always forming on the surface of our bodies. In an analogous way the use of an electric fan in winter may, by making more available the heat in a room, make us warmer than we would otherwise be and reduce the total amount of heat which by the ordinary methods of heating must be added to a room.

A moderate-sized room, which at the time was overheated by a low-pressure radiator, was tested with an accurate chemical thermometer and the air was found to be in more or less distinct layers, with a very marked difference in temperature between floor and ceiling:

Distance Above Floor, In.	Temperature, Deg. Fahr.	Distance Above Floor, In.	Temperature, Deg. Fahr.
124.....	83	44.....	74
108.....	80	31.....	68
93.....	80	4.....	66
64.....	76	0.....	62

The total amount of heat in the room was sufficient to make the whole room approximately 74 deg., greatly

in excess of what is necessary or desirable. A person sitting down would occupy about 50 in. to 54 in. (about 1.3 m.) between his feet and his head inclusive. His feet would be about 4 in. (10 cm.) above the floor, and the center of his body about 26 in. (65 cm.). If he stood up, his head would be between 65 in. and 72 in. (about 2.2 m.). If a person were sitting down in this room, his feet would be at a temperature of about 64 deg., the center of his body about 67 deg. and his head about 75 deg. If he stood up, his head would be about 77 deg. Above his head would be a mass of highly heated air which would be performing no useful service.

It will be noticed that the difference between the temperature of the room at the center of the body and at 9 ft. above the floor was 13 deg. A great many tests showed that when a small 8 in. (20.1-cm.) electric fan was operated diagonally toward the ceiling the temperature near the ceiling was quickly reduced, and that at 26 in. (65 cm.) (the center of the body when sitting down) it was increased so that the difference was reduced to 7 deg. or less. The only way to realize how great is the difference commercially and from a heating standpoint is to remember that three or four degrees mark the difference between comfort and discomfort and between a healthful temperature and an unhealthy temperature.

These conditions are accentuated when a relatively small amount of highly heated air is expected to heat a large building. This heated air rushes to the ceiling. In a room 20 ft. (6 m.) high, for instance, the entire space occupied by a person sitting down would only be a little more than one-fifth of the total height, while the center of the body would only represent a little more than one-tenth. It is perfectly easy to understand that nine-tenths of such a building may be heated greatly above what would be comfortable or desirable, while the occupant of a choir or a pew may be cooler than is necessary for health and comfort.

There can be no question that if an electric fan or some other means were used to agitate and thoroughly mix the air previous to the occupation of the building a more uniform, economical and satisfactory heating would be secured. Anything that would cause a considerable movement or draft while the building was occupied would not be satisfactory, because the draft, by increasing the evaporation from the body, would feel cool. But probably in all large halls which do not have a positive fan system of heating and ventilating the use of an electric fan when heating a building for occupancy would be found a valuable assistance.

Furthermore, as pointed out in the above statement regarding different temperature levels of a still room a constant agitation of the air might easily produce a room temperature that would admit of a smaller heat supply and thereby conserve coal. At the present time, of course, more than the usual importance attaches to this phase of the matter.

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STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

ECONOMY IN OILS AS PRACTICED IN GERMANY

Notices in Factories and Plants Tell Workmen How to Avoid Wastage in the Use of Lubricating Materials

Notices are now displayed in German workshops and power plants giving hints to the operatives on economy in the use of lubricants. These notices should be valuable in any country. Their provisions are as follows:

Use only closed oil cans, with spouts that will deliver drops, or at most only a thin stream.

Use all lubricating apparatus strictly according to the instructions and put the oil only where it will actually lubricate. If a machine has automatic droppers, shut off the supply while machine is standing.

Do not use cylinder oil on shafting or elsewhere when cheaper oil will answer.

Keep all rubbing surfaces in good condition. Rough surfaces and too-tight boxes consume more oil. Worn and leaky bearings waste oil.

Always use drip pans and arrange to filter and cleanse the oil so caught. It is as good as new.

Collect all greasy waste and wiping cloths, so that the oil may be recovered. Never burn them.

Be careful about using lubricating oil for cooling a bearing. Water will often do as well.

Be careful about using oil for cleaning and polishing. Never clean the hands with oil. A greasy cloth will do as well.

POINTS TO CONSIDER IN THE DESIGN OF TERMINALS

Weak Links That May Gain Inclusion in the Design of Terminal Points in Switching Apparatus Are Pointed Out

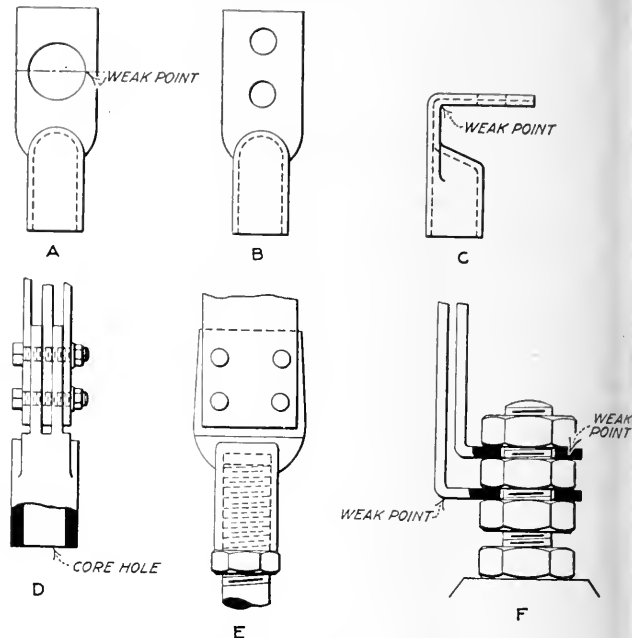
BY FERDINAND BECHOFF

The aim of this article is to try to point out some of the weak links to be found in electrical systems, especially in connection with electrical switching apparatus. Experience has shown that many breakdowns have occurred which were due not so much to faulty apparatus, such as oil circuit breakers, etc., as to neglected connecting links between the apparatus and the generator or buses. The fault in such cases is much more with the designer of the switching arrangement than with the manufacturer, because by proper selection of even existing devices the breakdown could have been avoided.

The heating up of terminal points is one of the most common reasons for breakdowns, and this danger becomes more and more pronounced with the installation of large power-plant units and the consequent use of larger oil circuit breakers and other switching devices. It seems that the selection of suitable terminals has not been emphasized enough to the electrical designer of switching apparatus, because so many cases of faulty terminals are still to be found in electrical layouts. While everything is being done to calculate the required amount of copper in regard to conductivity and contact

surfaces of the buses, only scant attention is paid to the terminals themselves. Investigation has shown that in most cases the contact surfaces are too small and the fastening bolts too large.

In designing switching arrangements a terminal with a bolt hole as in A should not be considered, as the



WEAK AND STRONG TYPES OF TERMINAL POINTS

contact surface and conductivity in this case have been reduced to a minimum. In B is shown the proper drilling for such a terminal. It is pointed out that care should be taken not to make the fastening bolts larger than $\frac{1}{2}$ -in. (1.37-cm.) diameter. The use of brass bolts and nuts is preferable, and all nuts should be locked by means of lock washers or similar means. If the width of the terminal end is 3 in. (7.6 cm.) or more, four bolts should be provided, in order to insure a good contact. The quantity of fastening bolts is one of the most neglected points in terminal design, although offering no difficulties. The general rule for determining the quantity of fastening bolts consists in treating the terminal end in a similar way as a copper bar to be fastened to a busbar, and the design laid down for the latter purpose should be the rule to be followed.

If the holes in the terminals are drilled, they should be slightly countersunk on both sides to remove the burr. Punched terminal holes require a grinding over of the contact surfaces. The design should furthermore avoid as far as possible the use of punched terminals bent at 90 deg., as shown in C. Care should be taken to bend the terminal end with a radius of at least $\frac{1}{2}$ in. (1.27 cm.) to avoid breaking at the bend.

Cast or forged terminals are sometimes preferred to punched terminals, especially in connection with laminated studs and with copper rods or tubes. A threaded

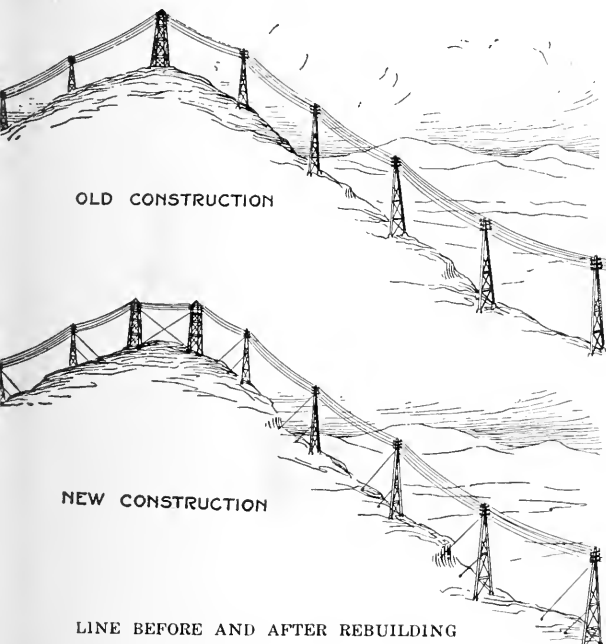
contact, as in E, is better than a soldered connection, and is made safer by the use of a lock nut or similar means. In order to avoid scrapping of cast copper terminals due to blow holes a core hole, as illustrated in D, is often helpful.

Oil and carbon circuit breakers, disconnecting and lever switches with ratings of 2000 amp. and above should be provided with laminated studs, in which case the use of laminated terminals is the most practicable. Even when such large capacity breakers or switches have round studs the laminated terminal can be used to great advantage, as shown in D and E. Copper bars connected in this way to the switch stud give better contact and are easier and cheaper to construct and assemble. Copper bars fastened to the round stud according to the method commonly used, as shown in F, form one of the weak links in electrical installations.

REBUILDING TOWER LINE DAMAGED IN SLEET STORM

Measures Taken to Prevent Recurrence of Failure of Transmission Line Operating Under Severe Climatic Conditions in Mountainous Country

Sixty-five towers in a two-circuit, three-phase, 60-cycle, 33,000-volt line were broken down not long ago by an extraordinarily heavy accumulation of sleet. The line in question traversed a mountainous territory so that it was necessary in making the repairs to carry channel iron into the mountains, rebuild and repair the



towers, and re-erect them on the site formerly occupied. The point at which the failure of the line started was a four-legged tower on the summit of one of the peaks over which the line stretched. This tower failed in compression, and this, of course, permitted all of the remaining towers to go down. The sketch shows how the line was rebuilt in order to guard against a recurrence of the disaster. A double set of four-legged towers was placed on the summit of the mountain, and each tower on the side of the mountain was guyed toward the summit. The cost of repairing this line with steel at 1914 prices was in excess of \$20,000.

DATA FOR ANALYZING

BOILER-FEED WATER

Necessary Information Required by the Chemist to Carry Out Properly an Analysis of Boiler-Feed Water

BY T. W. REYNOLDS

Instructions to be followed to insure that any sample of boiler-feed water received by the laboratory is a true specimen were presented on page 99 of the Jan. 12 issue of the ELECTRICAL WORLD. The following lists the information required by the chemist for analyzing the boiler-feed water:

1. Date sampled.
2. Source of sample, such as well, creek, lake, reservoir, etc. Give proper name or owner's name.
3. If a well, state kind, depth and diameter. If a well has been deepened by bore holes or otherwise, give dimensions of both parts.
4. Give suction head of pump. Give suction head when running at full speed.
5. State character of soil and water-bearing stratum.
6. Does sample present the usual appearance of water?
7. Does the water change in appearance at different seasons or after violent storms?
8. Are there any possible sources of pollution, such as coal mines, coal heaps, cinder heaps, factories, slaughter houses, stockyards, stables, sewers, cesspools, privies, foul pastures, refuse dumps, etc.? If there are any, describe fully on the back of the blank, giving distances, directions, relative elevations and character of pollution.
9. Has there been any considerable rain or melting of snow during the two weeks just previous to taking sample?
10. Is the water at present unusually high or low from any cause?
11. Is the quantity satisfactory at all seasons?
12. State distance of the supply from boiler. If a city, give the distance of nearest main from boiler.

CORRECTING POWER FACTOR IN DISTRIBUTION CIRCUIT

Static Condensers Are Used to Raise Power Factor from 60 per Cent to 90 per Cent on a Heavily Loaded Feeder

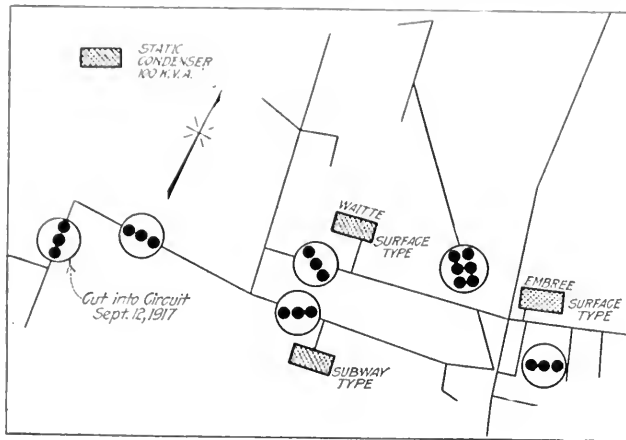
BY J. F. DUBOIS

Manager Electrical Department Lynn Gas & Electric Company, Lynn, Mass.

To take on an additional load of 160 hp. in a 550-volt secondary network system, where the primary feeder, switchboard panel and transformers were operating at over capacity, 570 kva., at a power factor averaging 60 per cent and at times running as low as 50 per cent, was the problem which confronted the engineers of this company about three years ago. The company was supplying energy to the neighborhood containing the factory by a 550-volt secondary network, shown herewith in single-line diagram, banks of transformers being connected in at various points.

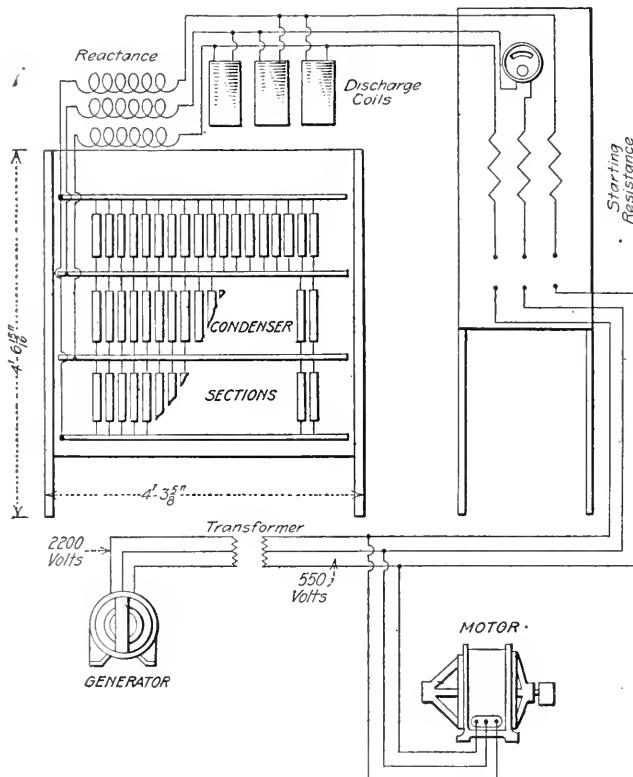
Two courses appeared open—first, to improve the power factor of the operating circuit, and second, to install a new circuit with the necessary transformers, etc. The matter was discussed with engineers of the General Electric Company, who suggested that static condensers might be utilized, although no equipment of this kind for outdoor work had been developed at that time. It appeared that if the second plan of dividing the existing network and installing the necessary transformer and three-conductor cable from the station, to-

gether with switchboard panel and instruments, was followed, the operating conditions would not be improved, but that existing troubles would be increased. The generators would still be supplying the cables and transformers, with the transmission of a large wattless current. On the other hand, by the use of the static



LOCATION OF TRANSFORMER BANKS AND CONDENSERS

condenser the overload on the cables would be reduced. Generator and transformer capacity would be released for other service and the power factor would be improved along the whole system back to the generator. No excitation or operating labor would be required for this form of apparatus.



ARRANGEMENT OF STATIC CONDENSER EQUIPMENT STATIONS

Early in 1915 two static condensers rated at 100 kva. each were installed and connected to the secondary network. Space not being available at the factory first mentioned, one unit of 100 kva. was located in a machine shop across the street. At another point, between banks of transformers shown in circles in the illustration, a portable galvanized-iron building was erected to

house the other condenser. The company found itself able to take on this factory of 160 hp. in motors without the addition of a single transformer or the changing of the circuit in any way except in the installation of the condensers. The power factor of the circuit at the station was raised to about 78 per cent. The results were so satisfactory that in the present year another unit, of the subway type, was installed in an ordinary transformer manhole on Munroe Street, Lynn. In this case the cells are inclosed in two tanks, the accompanying reactance being inclosed in a smaller tank about the size of a 5-kva. transformer. An oil switch and contactor are inclosed in another tank, and an ammeter with transfer phase switch and push-button control are placed in a pedestal on the sidewalk. This equipment is working perfectly at present and in a recent test it raised the power factor of the circuit at the station from 60 per cent with the condensers all off to 90 per cent with all the units in, the present load being about 440 kva.

DEVICE FOR TESTING SERIES STREET-LIGHTING CIRCUITS

Homemade Motor-Driven Magneto Used for Testing Circuits—Method of Making Tests to Locate Faults

Many central stations have a rule requiring the testing of series street-lighting circuits during the daytime in order to permit trouble hunting during daylight hours should trouble develop. Often a series circuit will become open-circuited or grounded during the day because of an accident or the carelessness of a patrolman or repair crew, and if the circuit is not repeatedly tested the difficulty will not be discovered until it is time to turn on street lights, at which time the location of the trouble becomes more difficult and a lengthy outage results. It is good practice to test series circuits for open circuits, grounds and crosses at two-hour intervals during the day, particularly after noon.

A device which will be found very useful in the testing of series circuits is a motor-driven magneto. A home-made outfit can be readily rigged up with a telephone magneto and a fan or other small motor ordinarily available about a station. These are attached to a wooden base and mounted near the constant-current transformer panels. A coil spring between the motor and magneto makes a good flexible coupling. A snap switch completes the outfit.

A pair of plugs with insulated handles are attached to the magneto terminals. Then with the plug switches on the series circuits pulled to the outer position the operator may quickly test for open circuits by passing down the panels, touching each pair of plugs with the magneto terminals. In testing for grounds one magneto terminal is grounded and the other is touched to the circuit terminals in succession. The magneto is to be preferred to testing out with lamps, and the motor drive permits the testing to be conveniently done by one man. Crosses are tested for by grounding each circuit. As all secondaries in the system will ordinarily be grounded, a secondary cross will show up in this manner. A primary cross (the primaries being normally ungrounded) will cause a flow of current due to charging or leakage current.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

PREPARE HONOR ROLL FOR UNINTERRUPTED SERVICE

Idea Stimulates Competition Between Various Properties of One Organization and Could Probably Be Applied to District Offices Also

An honor roll is being compiled for those Doherty properties which give uninterrupted service. The names on the list are obtained from the weekly reports of the various properties, in which they state the number of interruptions to service during the week just past. Seven companies are on the honor roll for giving perfect service for the two weeks ended Dec. 10. They are the Cumberland & Westernport (Md.) Electric Railway Company, the Durham (N. C.) Traction Company, the Hattiesburg (Miss.) Traction Company, the Lincoln (Ib.) Gas & Electric Light Company, the Lorain County (Ohio) Electric Company, the Massillon (Ohio) Electric & Gas Company, and the Montgomery (Ala.) Light & Railway Company.

This information is sent to all of the properties in the organization and helps to promote competition in the matter of service. The same idea could undoubtedly be applied still further in some degree to district offices of electric light and power properties.

WORK OF NEW-BUSINESS DEPARTMENT IN NEW YEAR

What Will Guide the Sales Activities of Central Stations Engaged in Merchandising Energy and Electrical Goods

In 1918 the central-station man who wants to spend a good deal of his company's money and charge it to capital account will have to show his superiors how that money will come back, not in three, four or five years, as in normal times, but in three, four or five months. That situation changes the aspect of new-business solicitation. In fact, it very nearly reverses what is considered normal procedure in that the salesman will need to become adept at dodging business, especially if it is a "peak," instead of being alert to secure new contracts.

But, despite this apparently dark outlook, most companies desire to hold their sales organizations together. What are these men going to do? That is the question executives have been asking themselves in the Middle Western States, and within the last few weeks the answer has begun to be apparent. It is, of course, desirable that these men shall apply themselves to some sort of sales work which will increase the company's revenue without increasing its investment. It is, therefore, desirable to increase the consumption of present customers. One way of increasing the business from existing customers is to make it increasingly convenient for them to use the installation they have. Hence

among residential customers campaigns will be started to sell "more sockets for more service." Baseboard and other appliance receptacles are the things that make for this increased convenience.

The demand for this sort of thing is already here, as is demonstrated by the following incident: The manager of an electric shop moved into a new apartment in which there was only one baseboard outlet, and that was in the living room. As a condition to signing the lease the landlord was induced to add five more outlets. The manager became acquainted with six other families in the building. When they called at his home and saw the extra outlets they wanted some for their apartments. The landlord, besieged with requests, refused to grant any, and then the tenants had the extra receptacles added at their own expense.

Another means of creating more revenue from existing installations is, of course, by selling more domestic appliances. There will probably be more than the usual number of flatiron campaigns. Other appliances, including ranges, will be pushed in some sections. It is probable that in the larger communities electric ranges will not be pushed so actively, because plant capacity must be conserved for the power business which must be taken on account of government work. All tendencies seem to indicate, however, that electric ranges will be sold in the smaller communities. In the cities the proved labor-saving appliances will probably enjoy ready sale on account of the increasing acuteness of the servant problem.

It seems, therefore, that in 1918 the commercial departments' activities will be centered on selling things which build revenue without increasing demand. Drives to get "more sockets for more service" and appliance campaigns will be the order of the day.

BILLING BY MACHINE

MAKES LARGE SAVING

One Lighting Company Found a Saving of 20 per Cent in Billing Expense, Besides a Considerable Shortening of Time

About one year ago the Commonwealth Edison Company of Chicago made a trial installation of twelve Elliott Fisher adding typewriters. With these machines the company handled 20 per cent of its accounts. In using these machines the operator, working directly from the meter-reading book, makes out the bill, posts the ledger, and makes a recapitulation sheet, all at one operation, the entry in the ledger and on the recapitulation sheet being a carbon copy of the bill. On each machine there is a totalizer, or adding machine, on each column. For instance, there is one on both the present and previous wattmeter reading; there is one on the kilowatt-hours used, on the gross bill, discount, net bill, etc., and in addition there is a cross-footing mechanism and total-

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Extinguishing Fires in Large Totally Inclosed Generators and Motors.—M. A. SAVAGE.—This article recommends the use of steam for extinguishing fires in windings of large motors and generators where the construction permits of its application. The results of tests show that steam is quite as effective as other substances, such as carbon tetrachloride and carbon dioxide, and is free from their objectionable features.—*General Electric Review*, January, 1918.

Electrical Laboratory Apparatus for Educational Institutions.—J. J. LAMBERTY.—For the instruction of engineering students college laboratories should be equipped with practically all types of electrical apparatus, but the cost of separate units of each type is prohibitive for most institutions. This difficulty has been largely overcome by the apparatus described in this article, which incorporates in one design, by substitution in some cases of interchangeable rotors, a great variety of machines. For instance, the alternating-current generator may be operated as a synchronous motor, a squirrel-cage induction motor, a phase-wound induction motor or a frequency changer by using the proper one of three rotors. Similarly the synchronous converter may be used as a direct-current generator, an alternating-current generator, a direct-current motor, a synchronous motor or an inverted converter.—*General Electric Review*, January, 1918.

Lamps and Lighting

An Oxygen-Filled Tungsten Lamp.—According to a recent German patent, beneficial results follow the burning of a tungsten filament in an atmosphere of oxygen at low pressure. This, it is claimed, prevents discharges through chlorine vapors evolved from anti-blackening materials introduced into the bulb. The oxygen at low pressure does not appreciably attack the incandescent tungsten filament, but in the colder regions of the lamp vaporized tungsten is oxidized to tungsten trioxide. The pressure of the oxygen present is, however, extremely low, being less than 0.005 mm. of mercury. The small amount of oxygen initially introduced into the lamp would be quickly used up, and the author therefore proposes to include within the bulb certain oxygen-yielding substances, such as the oxides, nitrates, chlorates, etc., of suitable metals. Manganese oxide in small quantities is found very beneficial.—*London Illuminating Engineer*, November, 1917.

Transformation of Tungsten Crystals Into Filaments for Incandescent Lamps.—By a new method tungsten filaments, to which a small quantity of oxide of thorium is applied, can now be made without drawing, laminating or hammering. The article gives a brief description of how they are fabricated from crystals—a method subject to many German patents.—*Revue Générale de l'Electricité*, Dec. 22, 1917 (abstracted from *Elektrotechnische Zeitschrift*, April 26, 1917.)

Testing Arc Lights Under Pressure.—Wilhelm M. thiesen, a German electrical engineer, recently conducted a series of tests with arc lights under different pressures of the two gases composing the atmosphere (oxygen and nitrogen). The first tests showed that the brilliancy of the light increases with increased pressure, while the specific consumption decreases, although the total amount of energy used is greater. The brilliancy itself, as well as the rate of increase, depends also upon the kind of salts mixed with the carbons. The second series of tests showed that the brilliancy of the arc can be increased by simply increasing the pressure of the gas, without increasing the consumption of energy. The rate of increase depends upon the gas used (air, oxygen or nitrogen). If calcium fluoride is mixed with the carbons and the resulting gases are permitted to accumulate, the brilliancy of the arc diminishes rapidly.—*Schweizerische Bauzeitung*, Dec. 1917 (abstracted from *Elektrotechnische Zeitschrift*).

Generation, Transmission and Distribution

Report of the Advisory Committee on Brown Coal (State of Victoria), September, 1917.—Among the conclusions reached by the committee as the result of investigations are the following: With present prices the brown-coal fields offer a supply of much more economical fuel than black coal for the production of electrical energy. The demand for electrical energy in Melbourne is sufficient to form the nucleus for an industrial electrical supply system. For a demand of 50,000 kw. delivered at Melbourne at 20,000 volts the total cost per unit supplied from power houses situated respectively at Melbourne, burning black or brown coal, and at Morwell, burning brown coal, are as follows:

	Total Costs per Unit at a Load Factor of 43.2 per Cent, Pence	
Power house in Melbourne using—		
Newcastle coal	0.353	100
Wonthaggi coal	0.348	(84)
Brown coal (Altona)	0.328	(28)
Power house at Wonthaggi using black coal....	0.350	(91)
Power house at Morwell using brown coal:.....	0.267	(54)

Electricity Supply Restrictions in Germany.—It is reported from Berlin that the Imperial Coal Commissioner issued an order on Nov. 2, 1917, placing an immediate restriction on the electrical consumption of both customers of electric supply undertakings and persons or organizations who possess their own generating plants. The consumption is limited to 80 per cent of that which prevailed in the corresponding month of 1916, although the commissioner reserves the right of curtailing the consumption by more than 20 per cent in particular cases. The restriction also applies to establishments engaged on war work, although preferential treatment can be meted out in exceptional cases. Consumers on a small scale are exempt from the restrictions, provided that their individual use does not exceed

250 kw.-hr. per annum, but the communal authorities are permitted to fix a lower limit. New connections and extensions of existing connections can only be made on obtaining special consent. It is stipulated that consumers who receive a supply from a public utility must pay an increase of 12 cents for every kilowatt-hour used in excess of the fixed limit. If, despite special warning, consumers do not restrict their consumption in the prescribed manner, they will be liable to imprisonment for a period up to one year, or a fine of up to \$2,500. Sixty truckloads of coal a day will shortly be saved in connection with the electric lighting of Berlin by erecting an overhead high-pressure transmission line between Wittenberg and Berlin, which will now be fed by the Zschornowitz-Piesteritz line, supplied from the Zschornowitz (lignite) power station, the generating station for works for the fixation of nitrogen. The overhead line will be made of aluminum-covered iron, and the work is being carried out by the A. E. G.—*London Electrical Review*, Nov. 22, 1917.

The Swiss Law Concerning the Utilization of Hydraulic Power.—G. TOCHON.—An examination by a French lawyer into the law concerning water power that became effective in Switzerland Jan. 1. Like the new Italian law, it tends to centralize all public utilities occupying water sites and to bring under public control the reserve energy contained in rivers and falls. The predominance of the general interest over private interests is insisted on. Each canton has, however, the right to dispose of its own water powers, subject to the broad policy prescribed by the confederation. Only in two cantons have private rights been predominant in the past. It would perhaps be exaggerated, the author says, to speak of the state as having seized the sources of hydraulic power; it is rather a matter of stricter control within just limits which are such as not to prevent development.—*Revue Générale de l'Électricité*, Nov. 24, 1917.

Traction

Railroad Electrification.—A. BARBAGELATA.—The writer holds: (1) That at present it is absolutely necessary for Italy to push railroad electrification in every manner; (2) that electric traction may be economically extended even to secondary lines, if they are treated like suburban lines, with light and frequent trains; (3) that the three-phase, 16-cycle system adopted in Italy, which has given excellent results on the Giovi lines, is no longer the best, and that direct current at high tension should be substituted.—*L'Elettrotecnica*, Dec. 25, 1917.

Installations, Systems and Appliances

Relay Protective Devices.—C. J. MONK.—This paper describes the various types of relays used on the Rand Mine & Power Supply Company and the Victoria Falls Power Company systems, with details of their operating characteristics and results achieved with these automatic devices. There are something like 400 relays in operation on the systems.—*Transactions of the South African Institute of Electrical Engineers*.

Ironclad Switchboard.—Description of high-tension ironclad distribution boards and truck-type cellular switchboards equipped with oil switches, etc.—*London Electrical Times*, Dec. 27, 1917.

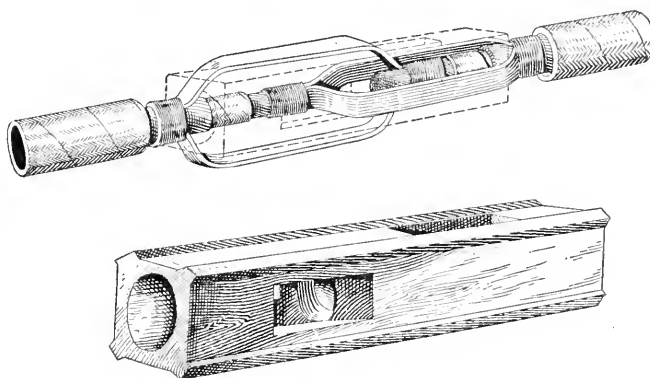
Examples of Electrically Driven Cranes.—H. H.

BROUGHTON.—The author points out in this article the great importance of using machinery in place of unskilled labor. Examples are given of special plants for handling materials, such plants including shipyard cranes, steel works cranes and bridge tramway plants.—*London Electrician*, Dec. 14, 1917.

Belt Shipping Plants.—F. G. MITCHELL.—Attention is drawn to the great advantages of the belt conveyor for conveying coal and ore in bulk. A detailed account is given of an interesting plant at Durban. This plant is not limited by mechanical difficulties, and any disadvantages do not increase, but rather the reverse, as the output is increased.—*London Electrician*, Dec. 14, 1917.

Wires, Wiring and Conduits

Transposition Joint for Split-Conductor Cables.—Description of a method for providing transposition joints in three-core split-conductor cables to balance the impedances of the inner and outer conductors. It involves the use of a hard-wood separator for each conductor. After stepping back the lead and insulation in the usual way, two short lengths of braided copper of a total section equal to one of the conductors are bound and sweated to each inner conductor; the two pieces of copper braid are then threaded through apertures provided in the hard-wood separators, the ends of the inner conductors being separated from one another by a dia-



JOINT FOR THREE-CORE SPLIT-CONDUCTOR CABLE

phragm left solid in the center of the wood block, and are bound and sweated to the outer conductor of the adjacent length. The braid lies loosely along shallow grooves on the outside of the separators, expansion and contraction of the conductors thus being also provided for. The joint on each phase is then surrounded by a paper tube, the three tubes of the completed joint being bound together, centralized by means of spreaders, and the whole inclosed in a lead sleeve and filled up solid with insulating compound in the usual manner. Joints made in this manner by jointers having no special knowledge of the requirements of split-conductor joints have withstood 15,000 volts between split conductors for five minutes and 100,000 volts between phases and between phases and earth for fifteen minutes, at a temperature of 176 deg. Fahr.—*London Electrical Review*, Jan. 4, 1918.

Electrophysics and Magnetism

New Radiator Type of Hot-Cathode Roentgen-Ray Tube.—W. D. COOLIDGE.—The article is descriptive of the new radiator type of hot-cathode Roentgen-ray tube developed for military use. The essential feature of this tube is the target of large heat capacity (provided

with an external radiator) of such composition that the focal spot will not at any temperature emit electrons. The tube therefore is self-rectifying, which makes it feasible to operate the tube directly from the terminals of a high-tension transformer. A description of a simple and effective lead-glass protective shield is included.—*General Electric Review*, January, 1918.

Electric Conductivity of Mica.—EDOUARD BRANLY.—Abstract of a paper read before the French Academy of Sciences embodying the results of experiments on mica with particular reference to its use as an insulating material in wireless telegraphy. A leaf of mica about 0.003 mm. thick was placed between two metallic disks. In a very short time its electric resistance to a continuous current became of negligible value when the applied emf. was less than 0.004 volt and the mechanical pressure was not more than 1 cm. of mercury. A descriptive summary of the apparatus employed is given, together with data on the variations of conductivity in mica as apparently influenced by the diameter of the minute holes discoverable by means of polarized light.—*Revue Générale de l'Electricité*, Nov. 24, 1917.

United States Magnetic Tables and Magnetic Charts for 1915.—D. L. HAZARD.—As its name implies, this report gives terrestrial magnetic data obtained by the United States Coast and Geodetic Survey for 1915.—*Department of Commerce Special Publication No. 44*.

Chromium Steel for Magnets.—Owing to the commandeering of tungsten for military purposes, German electricians found themselves without tungsten for their magnet steels early in the war, and experiments on the use of chromium in the place of tungsten, which had already been projected before the war, were accelerated. From investigations conducted by the Reichsanstalt chromium steels which have undergone suitable heat treatment do not rank below tungsten steels on an average. The very best magnetic chromium steels, however, are not equal to tungsten steels. Technically, chromium steels would thus appear to be quite satisfactory, while for special researches their further improvement is desirable.—*London Engineering*, Jan. 4, 1918.

Miscellaneous

Utilization of Pulverized Coal.—HENRY G. BARNHURST.—After calling attention to the fact that the use of pulverized coal for heating purposes is not new, 30,000,000 tons to 50,000,000 tons having been used to date in cement mills alone, the author mentions some of the characteristics that are desirable in coal in order that it may be burned satisfactorily in this form. Large deposits of lignite, quantities of coke breeze and millions of tons of silt or waste coal are available for burning in the pulverized forms. The author then goes on to explain the degree of fineness to which coal should be crushed before drying, the best methods of drying, extracting pieces of iron, the care which should be exercised in pulverizing and storing the fuel and how it may be conveyed to the place of usage. The power required in a first-class pulverized-coal plant per net ton of coal handled is in the neighborhood of 17 hp.-hr. per ton produced. Generally speaking, the repair expenses run 5 cents to 7 cents per net ton handled. With coal carrying 5 to 10 per cent moisture about 25 lb. to 35 lb. (11.3 kg. to 15.9 kg.) of coal has to be burned to dry a ton.

When handled in large quantities 50 tons to 100 tons and upward can be pulverized and delivered to the furnaces at a cost of 20 cents to 50 cents a ton. Generally speaking, an ideal plant with a capacity of 100 tons of pulverized coal daily will cost, with the present prevailing high prices, in the neighborhood of \$300 to \$400 per ton of coal pulverized. The cost of a plant for 250 tons daily capacity of pulverized coal will be from \$250 to \$300 per ton.—*Journal of Cleveland Engineering Society*, November, 1917.

Report of British Coal Conservation Committee.—The sub-committee of the reconstruction committee in Great Britain recommends that the present inefficient electric service system in that country be superseded by a comprehensive system divided into about sixteen districts, in each of which there shall be one authority dealing with all generation and main distribution. Sites suitable for electric generating purposes should be chosen on important waterways and preferably outside, not inside, towns. Plans should be prepared for the construction immediately after the war on these sites of large super-power plants capable, first, of supplying energy to a comprehensive electric power distribution system and, secondly, of supplying electrical energy at lowest possible price for all processes and manufactures. Such plants should be designed so that, as methods are perfected for extracting by-products from fuel before using it for the purpose of production of electrical energy, the by-product plant can be combined with the power plant. Power available from surplus gas or waste heat should be turned into electrical energy in local plants, which should feed into the main distribution system. Coal which does not warrant transportation away from the mine should be used at the spot for power generation. With a view to carrying out this policy, a board of electricity commissioners should be appointed with the following powers: (a) To stop the extension or multiplication of uneconomical stations for public supply; (b) to arrange for the handing over on equitable terms of the generation, transmission and main distribution systems in each of the areas into which the country is to be divided; (c) to standardize for each area the frequency and voltage of the main transmission and distribution systems; (d) to select for each area authorities to work under adequate control as regards limitation of dividends, etc. Alternative types of electric service organizations are described in an appendix. In reference to these alternative types the sub-committee emphasizes the need of initiative and resource in the management of electric service organizations and the freedom of range and keenness which are distinctive of private enterprises, as such things are highly conducive to the best success.—*London Electrician*, Dec. 28, 1917.

Hardening of Aluminum Bronze.—According to advice from Europe, copper-aluminum alloys, combined with small quantities of iron, silica, etc., can be made to equal in hardness Bessemer steel with 0.35 per cent carbon. In order to obtain these degrees of hardness, temperatures of 800 deg. C. are required, whereby 100 deg. to 260 deg. (Brinell test) is reached. Bearings made of such aluminum bronze have proved satisfactory with shafts turning at 20,000 r.p.m.—*Schweizerische Bauzeitung*, Dec. 22, 1917 (abstracted from *Z. d. V. D. I.*).

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

STUDY OF THE TARIFF BY ASSOCIATED MANUFACTURERS

General Committee Is Co-operating with Section
Committees—Separate Treatment of Electrical
Apparatus and Supplies Desired

Steady progress is being made by the tariff committee of the Associated Manufacturers of Electrical Supplies in its work of studying tariff conditions affecting the electrical manufacturing industry.

At a recent meeting of the committee there were also present a number of members of section sub-committees on tariff.

The chairman, John J. Gibson, Westinghouse Electric & Manufacturing Company, stated that in each section committees were preparing to act along the general lines proposed.

B. E. Salisbury, Pass & Seymour, Inc., felt that one point to be considered was administrative features of the tariff law. Mr. Salisbury stated that so far as he knew the tariff schedules on electrical devices were very incomplete and that it would be necessary to outline some plan especially applicable to the wants of the electrical industry. He also felt that the duties now assessed on an ad valorem basis should be based on the market price. After extended discussion the following resolution, which was presented by Mr. Salisbury, was passed:

Resolved, That it be the sense of this meeting that the value of all electrical commodities now assessed on an ad valorem basis should be determined by the market price of those commodities in this country rather than the market price in the country of origin."

One member brought up the desirability of some tariff legislation to overcome the condition that foreign makers had copied the design of many devices of electrical supplies, which they were bringing into some sections of this country and selling in direct competition with the home markets, although these various devices had not yet been approved by the Underwriters' Laboratories.

F. S. Sells, Diehl Manufacturing Company, emphasized his opinion that at this time it would be impracticable to develop figures representing the amount of tariff protection needed on any particular lines, and his opinion was concurred in by all present. It was thought necessary for the section tariff committee to make the study which had been requested and complete so that the committee could have it approved by the various sections.

In the meantime the general committee should take steps to get into touch with the United States Tariff Commission, with the purpose of recommending the following results:

First—That the electrical industry be recognized so that, if thought advisable, it would secure separate treatment of its apparatus and material instead of

having them mixed in with the apparatus and material of other industries.

Second—In order that the electrical industry might have a voice at the present time in the matter of the revision of the administrative sections of the tariff law.

It was the sense of the meeting that the general tariff committee should secure from the board of governors authority to employ a tariff expert.

Chairman Gibson called attention to the resolution passed by the board of governors broadening the duties of the general tariff committee so that they would include questions in regard to export as well as import. Authority has been given by the governors to change the name from the tariff committee to "international trade committee" if this would be desirable.

I. E. S. TO DISCUSS THE CURTAILMENT OF LIGHTING

Preston S. Millar to Present Paper at Special Meeting
in New York on Feb. 14—General
Discussion Planned

A special meeting of the Illuminating Engineering Society will be held at 8.15 on Thursday evening, Feb. 14, in the Engineering Societies Building auditorium, New York, to discuss lighting curtailment.

A paper will be presented by Preston S. Millar, general manager Electrical Testing Laboratories and chairman of the committee on war service of the Illuminating Engineering Society. The author will present figures dealing with coal consumption, including the coal employed for lighting throughout the country and the amount which may be saved, methods of accomplishing the results expected through the curtailment of lighting, present status of artificial lighting used for various purposes and other pertinent facts.

The following is a list of those who have been invited to speak personally or send a representative to discuss this question: Albert H. Wiggin, Federal Fuel Administrator for New York; Harry T. Peters, member of the conservation and advisory committee of the New York State Fuel Administration; John W. Lieb, chairman National Committee on Gas and Electric Service; R. E. Enright, Commissioner of Police; Nicholas J. Hayes, commissioner of Water Supply, Gas and Electricity, New York; Dr. Colman W. Cutler, chairman illumination committee, National Committee for the Prevention of Blindness; Ernest T. Trigg, chairman committee on coal conservation, United States Chamber of Commerce; Dr. Edward B. Rosa, acting director National Bureau of Standards; L. B. Marks, chairman national lighting committee, United States Committee of Labor; Frank W. Smith, chairman lamp committee, National Electric Light Association. Representatives of the American Institute of Electrical Engineers and American Gas Institute are also expected to participate.

Effect of Garfield Fuel-Saving Order

Statements to the "Electrical World" Supplementing Those Published Last Week

BUFFALO GENERAL ELECTRIC COMPANY

OUR load has been reduced 30 per cent. Total kilowatt-hour output per day has been reduced 17½ per cent; 60 per cent of our output is steam-generated and the balance, 40 per cent, hydro power. Our coal saving amounts to about 225 tons each twenty-four hours.

NEW YORK EDISON COMPANY AND UNITED ELECTRIC LIGHT & POWER COMPANY, NEW YORK

The reduction in output of the two companies together for the five days of the Garfield order—Jan. 18 to 22, inclusive—represented an average of 21¼ per cent. The estimated saving in coal for the full period is approximately 3000 tons.

PUBLIC SERVICE ELECTRIC CO., NEWARK, N. J.

During the five days of the so-called Garfield order the output was curtailed very materially. Our normal load is approximately 125,000 kw., and on the first day of the order this was reduced to about 40,000 kw., which load was somewhat increased later on owing to exemptions granted in specific cases. Roughly speaking, it might be said we were operating on a less than 50 per cent basis during the five days the order was in force.

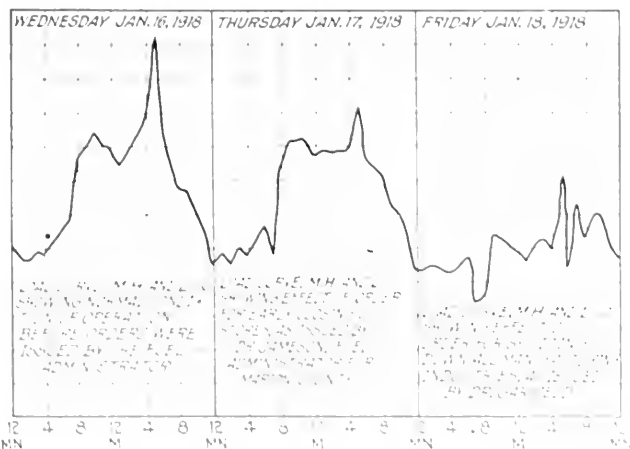
INDIANAPOLIS LIGHT & HEAT COMPANY

Our peak load prior to the Garfield order ran about 17,000 kw., with 230,000 kw.-hr. output for the day and a consumption of 1,050,000 lb. of coal. The effect of the Fuel Administration order was to reduce the peak to 9129 kw., with a total output of 113,000 kw.-hr. and a consumption of 696,000 lb. of coal.

MERCHANTS' HEAT & LIGHT COMPANY, INDIANAPOLIS

We inclose typical load curves which show the comparative effects for three days: Wednesday, Jan. 16, 1918, load curve representing normal condition of operation before any orders were issued by the Fuel Administrator; Thursday, Jan. 17, load curve showing the effect of the local order closing stores at 4.30 p. m. as issued by Dr. Jameson, Marion County Fuel Administrator; and Friday, Jan. 18, load curve showing the effect of order shutting down all of the manufacturing industries as issued by Dr. Garfield.

These curves show graphically the conditions to be expected on our system as a result of the Fuel Administra-



tor's order, and it is evident that it will mean a considerable reduction in our gross receipts due to the decreased electrical output in kilowatt hours. At this time we are not prepared to give definite estimates of the actual saving of fuel that may result. The radical change in the character of our load makes it hard to figure the saving accurately.

COLUMBUS RAILWAY, POWER & LIGHT COMPANY

As compared with the corresponding days of the preceding week our output was reduced as follows: During the five days of reduced operation covered by the Garfield order: Friday, 29.6 per cent; Saturday, 23.9 per cent; Sunday, 18.0 per cent; Monday, 31.3 per cent; Tuesday, 18.0 per cent.

Taking the five-day period as a whole, the decrease in output as compared with the five corresponding days of the

To the Citizens of Columbus:

THIS COMPANY is today in a more critical situation as regards fuel supply than ever before, having in fact only enough coal on hand to produce its normal output for a period of two days.

The large savings in fuel, resulting from the five-day suspension order of the Fuel Administration, have been more than offset by the failure of the railroads during the severe weather to deliver coal to meet even the reduced demands.

A suspension of electric service is probable if not inevitable. You can postpone that suspension by using less current.

The Columbus Railway Power & Light Company

preceding week was 24.6 per cent or 430,000 kw.-hr. During this period our peak hour was decreased as follows on various days: Friday, 8300 kw.; Saturday, 4500 kw.; Sunday, 3100 kw.; Monday, 6700 kw.; Tuesday, 3250 kw.

During the period covered by the Garfield order railway service was reduced considerably and extreme efforts were made to induce the users of electrical energy to close or reduce their requirements to a minimum. All of our lines, however, were energized as usual, we taking the position of the responsibility for obeying the order rested with the consumer and not with us except in cases where we might receive specific instructions to shut power off from specified consumers. Compliance was so general that we received no such orders.

The effect upon our revenue was substantially in proportion to the reduced output. The amount of fuel saved was also approximately in proportion to the decrease in output. At the beginning of the five-day period we had on hand 2800 tons of coal and at its close we had on hand 1600 tons. At the beginning of the five-day period there were in transit on the steam roads, consigned to us, ninety carloads of coal. At the close of the period there were in transit on the steam roads, consigned to us, eighty carloads of coal. From these figures it is apparent that although we consumed very much less fuel the railroads and mines were unable to keep up with our requirements.

READING (PA.) TRANSIT & LIGHT COMPANY

Our 480 industries closed down on midnight of Jan. 22 to resume operation on Jan. 23, with the exception of power plants which were on the exempt list on account of working on strictly governmental work. Our newspapers and

manufacturers have shown the most enthusiastic and patriotic spirit in conforming with this plan.

MASSILLON (OHIO) ELECTRIC & GAS COMPANY

The effect has been to cut our load approximately 75 per cent and necessarily has cut our revenue by a greater percentage, but has affected our operating expenses only a very little.

CHARLESTON (S. C.) CONSOLIDATED RAILWAY & LIGHTING COMPANY

Day load reduced about one-third.

CENTRAL POWER COMPANY, NEWARK, OHIO

Our output is reduced approximately 25 per cent. Practically all of our industrial power consumers have obeyed the order to close, and we expect a reduction of 50 per cent. However, we have large power consumers in the mining districts who of course are making use of power. We anticipate a further reduction on Jan. 19 and 21, and in all probability our output will be reduced 50 per cent on account of the order. The saving is approximately 75 tons of coal per day.

MISSISSIPPI RIVER POWER COMPANY

As would be natural, the increased fuel prices during the last six months, as compared with pre-war conditions, have caused our customers to use as much of our power as they could.

The normal water power available with our present installation at this point is approximately 650,000,000 kw.-hr. per annum. Taking 5 lb. of coal per kilowatt-hour as the average consumption with the Illinois coal available in this section, we figure that this 650,000,000 kw.-hr. represents an annual fuel saving of about 1,625,000 tons of coal.

During the calendar year 1917 we manufactured 481,505,050 kw.-hr., which on the same basis of figuring as I stated above would represent a saving in coal during 1917 of about 1,200,000 tons.

ALABAMA POWER COMPANY

At present no steam energy is being supplied the hydro system of the Alabama Power Company and therefore, so far as the energy served customers by this system is concerned, they have not been affected. It possibly, however, has affected some customers who use fuel for heating or other purposes. The customers who are served by energy made by steam at points not connected with the hydro system, however, are affected by the regulation issued by the Fuel Administration governing coal consumption.

URGE FUEL ECONOMY BY SHUTTING PRIVATE PLANTS

Indiana Public Utility Men Ask Fuel Administration to Consider Cessation of Operation of Inefficient Power Stations

C. N. Wilcoxon, F. J. Haas, S. W. Greenland, Robert Todd and Charles L. Henry, a committee of Indiana public utility operators, have made four recommendations to Evans Woollen, Fuel Administrator, Indianapolis. The first three have to do with heating, lighting and operation of street cars. The fourth is:

One other thing we would suggest that it would be advisable to inquire into, and that is whether in many instances small power plants, which are always operated uneconomically and at a heavy expense, might be discontinued and the necessary energy now produced by them be supplied from larger and more economically operated stations. This, we consider, is a field from which much might be secured in the way of fuel economy, and it would incidentally be a benefit to the consumer of energy, because he can usually purchase energy from a larger plant at a less price than he can produce it himself at the smaller plant.

The recommendation has not yet been acted upon.

WHITE CEDAR ASSOCIATION URGES ACTION ON WAR BOARD

Problems of the Pole Industry Arising Out of the War Are Discussed at the Twenty-second Annual Meeting—J. E. Gerich Elected President

The labor situation, priority regulations, income tax laws and conditions of supply and demand in the pole market were the main topics discussed at the twenty-second annual meeting of the Northern White Cedar Association at the Hotel Radisson, Minneapolis, on Jan. 22.

The labor situation in the camps was described as one of great unrest. This condition was ascribed to the war. The belief was expressed that labor should be conscripted in order to assure a successful and vigorous prosecution of the war. The application of the income tax to individuals and to business firms was explained by several speakers. For the more vigorous prosecution of the war the following resolution was adopted:

It is hereby resolved that it is the unanimous opinion of this convention that for the best interests of the country, and to expedite the prosecution of the war to a successful conclusion at the earliest possible time, a war board should be established at once, composed of a small group of men selected from the best possible talent to be obtained in the United States, with full power to act under the direction of the President for a speedy prosecution of the war with every resource we can command.

A. T. Naugle of Chicago, speaking for the pole committee, commented upon the surprising amount of poles on hand. He ascribed this condition to some extent to the lack of transportation facilities. He stated further that the purchasing power of operating utility companies was restricted by inability to secure funds for improvements. It was the consensus of opinion that sales for the coming year would not exceed 50 per cent of those for 1917.

The report of the secretary, N. E. Boucher, stated that in 1917 traffic in cedar products had reached an extraordinary volume.

The election resulted: J. E. Gerich, MacGillis & Gibbs Company, Milwaukee, president; L. L. Hill, Page & Hill Company, Minneapolis, vice-president; W. B. Thomas, White Marble Lime Company, Manistique, Mich., treasurer; N. E. Boucher, secretary; W. L. Lafean, Nagle Pole & Tie Company, Chicago, and J. C. Kirkpatrick, National Pole Company, Escanaba, Mich., retiring president, were elected directors.

"EDISON PIONEERS"

FORM ORGANIZATION

Early Associates Organize a New Society to Include Those Who Were with the Inventor Up to 1885

Early associates of Thomas A. Edison in laboratory work and his various enterprises met on the evening of Jan. 24 in the council room of the American Institute of Electrical Engineers and organized a new society to be known as the "Edison Pioneers." The following organization was effected: President, Francis R. Upton; vice-presidents, S. Z. Mitchell and T. C. Martin; secretary, R. T. Lozier; treasurer, Fred Scheffler; historian, W. H. Meadowcroft. The membership is limited to those who were with Mr. Edison up to 1885.

COAL OUTLOOK ACUTE IN THE MIDDLE WEST

Curtailment of Electric Service to Non-Essential Industries and in Some Places to Domestic Consumers Seems Inevitable

The coal situation is so serious in Illinois, Iowa, Michigan and Wisconsin that curtailment of electric service to non-essential industries, and in some places of service to domestic consumers, between 9 a. m. and 5 p. m. seems inevitable. This is the opinion of the Illinois Fuel Administration.

Speaking to a representative of the ELECTRICAL WORLD, Deputy Administrator Allen said that at present there is absolutely no reserve supply of coal.

The realization of these conditions and the desire to meet the difficulties have caused the Illinois Fuel Administrator to issue a broad order which will cover the curtailment of public utility service. This was issued purely as a coal-saving measure that is deemed necessary. The Fuel Administrator has expressed a desire to keep every public utility operating.

In some cases, among which are those of the Galesburg Railway & Light Company and the Aurora, Elgin & Chicago Railroad, coal has been confiscated to keep plants in operation.

In commenting upon this situation the Fuel Administration paid high compliments to the Insull group of public utilities. The companies had laid in large quantities of coal. When the shortage came they very liberally gave up their surplus to other public utilities and to various other concerns so that even now their own supply is short.

WAR SERVICE WORK OF THE UTILITIES COMMITTEE

National Committee on Gas and Electric Service Is Active in Many Directions Bearing on Government War Needs

A partial report of recent activities of the National Committee on Gas and Electric Service was published in the last issue of the ELECTRICAL WORLD, page 216. Other recent activities of the committee, of which J. W. Lieb is chairman, are shown in the following extracts from the report. They indicate tendencies in the affairs of the utilities and the trend of problems affecting their service in the war:

The War Department in increasing the facilities for the production of important war material is constructing and considering the construction of many new plants which will require either the installation of a complete new power plant or additions to present existing steam plants. This has brought about the necessity of repositioning large electrical apparatus, including steam turbines, which at present are under order by the various public utilities with electrical manufacturers. In order to disturb central-station conditions as little as possible, this committee has been asked to co-operate with the War Department, and on receiving the requests of that department as to size and type of machinery required, the committee takes up with the various central stations having orders placed for delivery at about the dates these machines are required by the government. Selections are made that will disturb central-station conditions as little as possible.

Some disturbance has been caused recently to electric light and power plants when manufacturers who are being served go ahead with additional construction work and ex-

tensions to their plants without first conferring with the central-station officials as to whether the power which they apparently depended upon getting for their extensions would be available. This has happened in a number of cases, and through no fault of the public utilities they have suddenly been called upon for a supply of electrical energy which their generating capacity is unable to meet. The situation thus becomes complicated when it becomes necessary for certain industries which have enjoyed uninterrupted service to have their service curtailed or even discontinued in order to take care of the additional demands made by the enterprise of greater importance which has made the more recent demands for service.

Several delegations of steel manufacturers and others making necessary war material have visited this committee with requests that we use our influence and assistance to render possible the extensions to certain central stations upon which they expect in the near future to make heavy demands for service. This is a much better method of approach than by going ahead with their own extensions without first finding out whether power is available.

This committee is still endeavoring to obtain all the information possible regarding any excess supply of hydro-electric energy that may be available, which information is very much sought for by the government with a view to establishing munition plants and other plants to manufacture war material in the vicinity where such power would be available.

At the meeting of the war service executive committee of the United States Chamber of Commerce on Jan. 16 the National Committee on Gas and Electric Service was recognized as having been formed in accordance with the resolutions adopted at the conference of war service committee chairmen on Dec. 12 to represent the gas and electric light and power industry.

WAR SERVICE WORK OF WASHING-MACHINE MAKERS

Labor-Saving Character of Product Set Forth by the Industry, Which Is Standardizing to Effect Economies

Through its war service committee the American Washing Machine Manufacturers' Association has presented facts concerning its industry to the War Industries Board.

Every member of the association and a number of other manufacturers have agreed to eliminate 171 styles and models which might be considered as less essential as soon as present stock of material for these styles and models is consumed. They have also agreed to eliminate sixty-three parts on styles and models which they hope to be permitted to continue to manufacture, this elimination to be accomplished by standardization, use of duplicate parts now used and by elimination of parts not essential to successful marketing of the machine. They have also agreed not to purchase any more of the materials claimed as eliminated except what is absolutely necessary to balance up material now in stock.

Fuel used in the industry in 1917 included 19,641 tons of coal and 2,369,418 kw.-hr. of electrical energy. Total capital employed in the industry was \$9,650,000, and the value of the product (factory) in 1917 was \$10,000,000. Employees were 5000. Plants manufacturing washing machines for household use total 106.

The War Service Committee, which emphasizes the labor-saving character of the product, is composed of L. E. Dietz, H. W. Eden, J. D. A. Johnson, W. L. Rodgers and Sam T. White, chairman, and Raymond Marsh, secretary.

DISCUSSION ON WAR EFFECT AT CHICAGO SECTION, A. I. E. E.

Changing Viewpoint on Extensions for Customers
Brought Out at the Western Gathering—Conservation by Commercial Departments

[This account of the discussion at the Chicago Section on the paper by Lynn S. Goodman and William B. Jackson on "Effects of War Conditions on Cost and Quality of Electric Service" follows the report of the discussion at the meetings of the New York and Boston Sections, published in the ELECTRICAL WORLD of Jan. 19, 1918, page 165.]

On account of the severe weather the attendance was small at the meeting of the Chicago Section of the American Institute of Electrical Engineers on Jan. 14. About seventy-five were present.

After Mr. Jackson had presented the paper R. F. Schuchardt, chairman of the meeting, opened the discussion. He characterized the paper as one of importance to engineers and financiers. While recognizing the pessimistic side of the paper, he spoke strongly of its brighter aspects, one of the most important of which is the widespread recognition of the real value of this economic industrial development and of the benefit from centralization which must react to the industry. He closed with an appeal to engineers to be resourceful and to create precedents rather than to follow old lines of thought.

F. A. Coffin, Milwaukee, reviewing the situation from the central-station sales department's angle, pointed out ways in which commercial engineers can effectively aid in conservation movements.

C. W. Pendell also discussed the paper from the commercial viewpoint, emphasizing the necessity that customers shall finance extensions.

D. W. Roper stated that the former value he had placed on service interruptions, nearly twenty times the loss of the revenue to the company, had undergone recently a marked revision downward on account of the changing times. He also pointed out that while formerly a customer would be taken on if his revenue would pay the cost of extensions in two years, it was now thought to be advisable to consider such customers only if the revenues would pay for the extension in two months. After outlining some curtailments of gratuitous service that had been or might be made, he emphasized the importance to central-station companies of urging a movement to diversify the hours of industrial and office employees for going to and returning from work. This would, of course, reduce the peaks of both labor and power requirements. To emphasize the importance of this Mr. Roper stated that one-third of the investment of the Commonwealth Edison Company produces only one-half of 1 per cent of the company's total output during the year.

C. A. Keller, who had made recently a study of increased values of generating stations and substations on account of present high prices, presented a table showing the percentage of increase in value to-day as compared with normal previous times. The pre-war figures were based on varying market prices over a period of ten to fifteen years before the war. The table showed that generating stations, including buildings, boiler equipment, turbines and auxiliaries and electrical equipment, have increased 45 per cent; substations, including buildings, electrical equipment and

storage batteries, 30 per cent; line extensions, including conduits and tunnels, poles, cross-arms and pins, transmission lines, overhead lines, underground lines and services, 50 per cent, and transformers 30 per cent. The weighted average per cent increase over the whole list was 43 per cent.

A. Honegger, in a discussion of the difficulties of getting capital, pointed out that utility securities were being sold to farmers in some Western States.

CLEVELAND HEARING ON OHIO INDUSTRIAL LIGHTING CODE

Unusual Interest by the Manufacturers in Proper
Lighting for Their Establishments Is Shown
at Initial Public Hearing

Unusual interest among manufacturers in the proper lighting of their establishments was shown at the first public hearing on the proposed code of lighting for factories, mills and other workplaces for Ohio. More than 300 representatives of industrial plants and factory inspectors were on hand when the hearing opened at the Hollenden Hotel, Cleveland, on Jan. 16, under the direction of Victor T. Noonan, director of safety, Ohio Industrial Commission.

The proposed rules are based largely upon the code prepared by the Illuminating Engineering Society, but the supplementary matter differs greatly in treatment from that issued by the society. A novel feature of the Ohio code is the classification of industrial operations under the several grades of intensity required in the rules. This is the first attempt made in any state to give such definiteness to the regulations, making it possible for plant managements to know just what standards factory inspectors will require them to maintain.

It is worthy of note that no objection was voiced to the minimum values of intensity required for the several industries and operations; several plant engineers pointed out that their practice was well above these values and in some cases even above the upper values of the suggested range for good practice. Discussion of the code related largely to its construction from the legal standpoint and questions of liability under special conditions.

Educational features were combined with the hearing. The principal factors in lighting—intensity, direction, diffusion, glare, etc.—were shown by simple exhibits. There were motion pictures of industrial hazards, including insufficient and faulty illumination. Great interest was shown by those present in the new foot-candle meter.

The proposed code was prepared by a special committee of the Industrial Commission, consisting of Prof. F. C. Caldwell, Ohio State University, chairman; J. Q. Adams, architect, Industrial Commission; H. H. Craiglow, operating engineer Buckeye Steel Castings Company; S. E. Doane, chief engineer National Lamp Works; Thomas J. Donnelly, secretary Ohio Federation of Labor; John J. Graney, Federation of Labor, Youngstown; H. L. Jenkins, works manager, Holophane Glass Company, and George W. Walker, Cooper-Hewitt Electric Company, secretary.

Further public hearings are planned for Cincinnati and Columbus during February.



—From the Atlanta Constitution.

GENERAL INCREASE OF RATES MADE AT PROVIDENCE, R. I.

Features of the New Schedule Are the Coal Clause
for Lighting Service and the Service Charge—
No More Free Lamps

With approval of the Rhode Island Public Utilities Commission a general increase in rates by the Narragansett Electric Lighting Company, Providence, has been established, effective on all electricity billed on and after Jan. 1, 1918.

This is the first rate increase in the history of the company, covering about thirty years, although many decreases have been made. The war has brought about unforeseen and abnormal conditions, the company pointed out to the commission, resulting in changes in prices for labor and materials, especially coal, which have increased so materially the cost of producing and supplying electricity as to necessitate rate revision. The company has realized for many months that it would be necessary to change rates if public obligations are to be met and standards of service maintained, but it has deferred action as long as it reasonably could. Every effort has been made to economize, and much has been accomplished and will be continued under the new schedule, with the hope of greater savings in the future.

The chief factor in increased cost of production is coal. From Jan. 1 to Oct. 31, 1917, the company burned 75,995 tons of coal at a cost of \$641,944, an average of \$8.44 per ton. During the corresponding period in 1916, 49,178 tons were burned at a cost of \$187,631, an average of \$3.81. Making proper allowance for the increased production of electricity in 1917, the company estimates that cost of coal increased \$227,000 for the ten months. This will be increased somewhat for the year.

To provide for uncertain and fluctuating coal prices,

the rate schedule now adopted is based on a price of \$8 per ton and is governed by a coal clause. Rates will be increased or decreased automatically according to the average price of coal at stated intervals. In this adjustment the company has endeavored to make rates equitable to all classes. In pursuance of this a service charge has been provided in connection with retail lighting. This will insure a fair return from a large number of customers whose payments under the former schedule have been insufficient to cover even the cost of installing and maintaining meter and service.

The company has also discontinued the practice of furnishing a multiplicity of meters to certain classes and the free supply of carbon lamps.

Based on 1917 sales, the new schedule would have increased the gross revenue approximately \$211,000. The new schedule was submitted to representatives of Providence and to R. B. Brunet, city public service engineer, before presentation to the Public Utilities Commission. It received the approval of all these authorities.

Probably the most important revision is the introduction of a service charge of \$6 per year into lighting rate "A," under which electricity is sold to residence customers and other small users. The rate was formerly 9 cents per kilowatt-hour, with no service or minimum charge. Because of this rate the company has accumulated a large number of customers using little or no electricity. In 1916 and 1917 the number of customers paying less than 50 cents per month varied from approximately 1500 to nearly 8000. This large number of unprofitable customers shifted the burden which they should have borne to those who used more electricity.

The company feels that the service charge principle is preferable to the minimum charge, as the customer who uses more electricity under a service charge gets a more favorable price. The new rate consists of a service charge of \$6 per year billed at 50 cents per month and an energy charge of 7.5 cents per kilowatt-hour for all electricity used. It is provided that no electricity shall be billed at less than 9 cents net per kilowatt-hour, including both service and energy charge. Summer customers, or those requiring installation for a few months in the summer season at a location not their permanent residence, are required to pay a minimum of \$10 for the season or any part. Summer customers whose residence is outside the Providence city limits are required to deposit \$10 to guarantee payment.

The furnishing of lamps for first installation and renewals has been discontinued under all rates. The company has also discontinued the practice of furnishing a multiplicity of meters to customers operating office and factory buildings. The former policy was to install a lighting and power meter for each tenant in such buildings and bill the electricity to the owner or landlord. The new practice calls for the installation of one meter for each rate under which the customer purchases electricity. All other meters are furnished at a rental of 50 cents per month per meter.

The former "B" rate (for lighting customers, domestic heating appliances and motors of 1 hp. or under) has been increased $\frac{1}{2}$ cent per kilowatt-hour on every step except the first, which remains at 10 cents per kilowatt-hour from 1 kw.-hr. to 499 kw.-hr. per month. The minimum rate on this schedule is $4\frac{1}{2}$ cents for

100 kw.-hr. and over, and there is a minimum charge of \$2.50 per month on this rate. Time switches are rented at 50 cents per month per switch on both "A" and "B" rates. Formerly there was no minimum charge per month on the "B" rate.

The power rate "D" has also been increased $\frac{1}{2}$ cent per kilowatt-hour. This is now $6\frac{1}{2}$ cents net, and former minimum charges obtain of \$1 per month under 1 hp., 50 cents per horsepower per month from 2 hp. to 10 hp., and \$5 per month for installations exceeding 10 hp.

Power rates "F" and "G" have also been increased both service and energy charge. The range in the "F" rate (for customers signing an annual contract with a demand of 5 hp. or more) is: 5 hp. to 10 hp. demand, monthly service charge, \$1.75 per horsepower; energy charge per kilowatt-hour, 1.6 cents; for 200-hp. to 300-hp. demand, \$1.25 monthly service charge per horsepower and an energy charge of 0.95 cent per kilowatt-hour. On the "G" rate (for customers signing contracts for a demand of 225 kw. or more), the range is as follows: One-year contract: 225 kw. to 300 kw., \$1.54 monthly service charge per kilowatt of demand and an energy charge of 0.95 cent per kilowatt-hour; on 375 kw.-hr. and more the energy charge is 0.85 cent. On a contract for five years or more the monthly service charge for 500 kw. to 750 kw. demand is \$1.44 per kilowatt of demand, and for 1500 kw. demand and more it is \$1.20 per kilowatt of demand. In all cases, including these limits in demand, the energy charge is 0.85 cent per kilowatt-hour. Under the "G" rate, should the net price of energy for any month under five-year contract rates, including demand and energy charge, be lower than 1 cent per kilowatt-hour, the bill for that month is rendered either at the flat rate of 1 cent per kilowatt-hour, including demand and energy charge, or at the one-year contract rate, whichever is lower.

FINANCING SERVICE EXTENSIONS

In consideration of the fact that the expense for lines and equipment necessary to supply customers is considerably in excess of normal cost and in further consideration of the difficulty of financing extensions, when the customer agrees to pay to the company a sum equal to the full cost of necessary lines and equipment. Such portion as shall represent the excess cost over and above normal costs as of July 1, 1914, shall be retained by the company. The balance, "normal cost," is to be refunded to the customer annually at the rate of \$20 for every \$100 paid to the company for electricity used by the customer at this location. The company agrees to pay 6 per cent interest on any unrefunded balance of normal cost. After five years from the beginning of the unrefunded balance of normal cost becomes the property of the company. The company reserves the right to refund at any time all or any part of the unrefunded portion of normal cost.

The coal clause applicable to power rates and to the lighting rate for demands over 5 kw. is based upon a cost of \$8 per long ton of coal of 14,500 B.t.u. in the bunkers of the Narragansett company station. The cost of coal in the bunkers for any month is determined for such month by obtaining the true average cost of all coal in storage on the first day of such month and all coal received during such month, and after making any

necessary adjustments for heating values or handling, storage and carrying charges for each month. Coal cost for any longer period is taken as the true average of monthly costs during such period. For every 10-cent decrease or increase in cost as determined below or above \$8 per long ton there is a decrease or increase of 0.1 mill per kilowatt-hour under this contract. Such decrease or increase is made by periods of three months each, and the cost to be used in determining such decrease or increase for this period is that determined as above for the three months' period next preceding.

In connection with lighting rates "A" and "B," for every decrease or increase of \$5 or fraction greater than one-half in the cost of coal as above determined below or above \$8 per long ton there is a decrease or increase of 5 mills per kilowatt-hour sold. Any decrease or increase is made for periods of six months each, and the cost to be used in determining such change for the period is that determined as above for the six months' period next preceding.

The service charge or minimum charge under all rates other than those requiring a contract for one year or longer ceases upon discontinuance of service, but should the service be replaced within one year for the same customer \$1 is charged. The customer's application forms a part of the schedule, as printed for distribution, as in the practice of the Philadelphia Electric Company.

CIVILIAN INSPECTORS ARE NEEDED FOR SIGNAL CORPS

Men of Mature Years and Judgment with Specialized Training Can Devote Services to Government in Helping Speed Production

The personnel division, inspection and training for the War Department inspection section, equipment division of the Signal Corps, in the Chicago district needs a few men of mature years and judgment to undertake work of inspection of materials, parts, sub-assembly and final assembly. Men preferably under forty years of age and over draft age are in demand.

The work is divided into five departments: Motors, instruments, fabrics, electrical work, lumber and lumber treatment. Men who have training in any of these lines and feel that they have enough education to adapt the knowledge of their profession to the government's needs by means of a short training course for inspectors in Signal Corps work may present applications.

Fred R. Jenkins, formerly manager of the Chicago Central Station Institute, is devoting a large part of his time to selection and training of men for this work. He has been appointed general supervisor of the personnel division named above, with headquarters in the Consumers' Building, Chicago. With few exceptions the Chicago district embraces all of the territory west of Pittsburgh to the Rocky Mountains and from Canada to the Gulf.

The inspectors selected must fulfill a dual function. In addition to conducting inspection work they will be expected to accelerate quantity production. The latter duty is considered of great importance. The men who are appointed as inspectors will retain their civilian status, but will be sworn employees of the government. Senior inspectors are paid not to exceed \$150 per month and junior inspectors not to exceed \$125 per month.

INSISTENT DEMANDS FOR MORE POWER FROM NIAGARA

Needs of War Industries and Curtailment of Supply
to "Non-Essential" Industries in Buffalo District
Stir Consumers to Urge Action

Aroused by the insistent demands of munition and other war industries along the American Niagara frontier for additional electric power, the government is now beginning to realize the urgent necessity of utilizing to the fullest extent the natural resources of Niagara Falls.

Unable to meet the demands for additional power, the government has been forced to requisition all of the energy produced, imported and distributed by the Niagara Falls Power Company, the Hydraulic Power Company and the Cliff Electrical Distributing Company, of Niagara Falls, and plans are now being made by the War Department for a complete redistribution. More than five score factories and mills will be cut off.

Some of these so-called non-essential industries will be supplied with limited amounts of power during off-load hours, and many will be forced to work only at night, but some have given up all hope of operation during the war.

Although the redistribution has relieved the situation considerably, the government is still unable to meet demands of war industries, and efforts will be made at this session of Congress to secure a new international treaty between the United States and Canada.

The present treaty allows diversion on the American side of 20,000 cu. ft. (560 cu. m.), and Canadian power companies have the right to divert 36,000 cu. ft. (1008 cu. m.). American power companies are not diverting all of the water allowed under the treaty because of lack of equipment. Before the war the power companies were diverting 15,600 cu. ft. (436.8 cu. m.), the maximum allowed by Congress, but until next June they have the right to divert the full 20,000 cu. ft. Instead of developing the additional 4400 cu. ft. (157 cu. m.) allowed by Congress as a temporary measure, the two American power companies are diverting only about 3000 cu. ft. (84 cu. m.) of the additional amount.

The additional diversion amounts to only 80,000 hp., which is far from sufficient for the increased demands of industries. Electrical engineers who made a recent survey on the American side say that diversion of 40,000 cu. ft. (1120 cu. m.) per second would not impair the scenic beauty of the cataract.

The Buffalo Chamber of Commerce urges the full diversion of 100,000 cu. ft. (2800 cu. m.).

Under the partial redistribution of power by the Niagara Falls Power Company and the Hydraulic Power Company two large paper mills in Niagara Falls using 5500 hp. were forced into idleness when their power supply was cut off. Plans are being made for releasing for war industries almost 7000 hp. now supplied to the Aluminum Company of America by the Hydraulic Power Company.

Phillip P. Barton, general manager Niagara Falls Power Company, says that 4000 hp. used by non-essential industries has been cut off and all other factories served by his company using 200 hp. will be cut to 100 hp. The International Railway Company will lose about 14,000 hp. now received from Niagara Falls. The International Company will be forced to rely almost

exclusively upon its steam station, and the government has ordered that it pool its interests with the Buffalo General Electric Company and release 5000 hp. from its 50,000-hp. steam capacity for other industries served by the Buffalo General Electric Company. The cost of generating by coal at the International Railway steam plant is almost \$40 per horsepower, and the company has been paying between \$20 and \$25 for Niagara Falls power.

All non-essential industries using electric power will not be allowed to operate between 8 and 10 o'clock in the morning or between 2 and 6 o'clock in the afternoon. By operating non-essential industries wholly at night there will be a saving of approximately 18,000 hp. of the Buffalo General Electric Company.

The addition to the Buffalo General Electric Company steam plant will be ready for operation early in the spring. This will mean an additional 50,000 hp. The government has negotiated with the company for an additional 50,000-hp. installation, to cost approximately \$5,000,000. With the government behind the project the work can probably be completed within one year.

HEARINGS ON THE WATER-POWER BILLS

Although They Will Be Held at an Early Date, They
Will Be Short, as the Country Is Well
Informed on the Subject

Hearings on present water-power bills, it is expected, will take place in one or two weeks, or just as soon as the emergency war measures have been acted on by the House of Representatives.

Thus far the only measure before the committee is the Shields bill, passed by the Senate. The so-called administration measure has not yet come up for action.

It is recognized very generally that water-power legislation is needed and it will be enacted, but not a war measure. Congressman Sims, chairman of the House committee having water-power legislation in charge, has intimated that the hearings on the measure will be short and formal, since the general subject has been pretty well thrashed out in Congress and the country is well informed.

GIFFORD PINCHOT APPROVES ADMINISTRATION BILL

In a letter issued on Nov. 16, 1917, Gifford Pinchot urged support of seven definite principles in water-power legislation. Mr. Pinchot states in a letter to the ELECTRICAL WORLD that every one of these principles is fully safeguarded in the administration's water-power bill. He adds:

What remains, therefore, is for Congress to put the measure through without delay. The administration water-power bill will first come before the House of Representatives, where an effort will certainly be made to amend it in the interest of the power interests. If that fails, the water-power lobbyists will endeavor to have the indefensible provisions of the Shields bill substituted in the Senate or the administration bill. Beaten in that, they will fall back upon the formula of obstruction and delay they have used successfully for the last ten years.

This measure is practical, fair and wise. The friends of conservation should insist that their friends in Congress shall give their prompt and full support to the administration water-power bill, and shall see to it that it is passed without emasculation, substitution or postponement.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 287 of this number.

Maryland Division of the N. E. C. A.—At a recent meeting, attended by about 180 representatives of Baltimore's electrical business, the nucleus of a Maryland division of the National Electrical Contractors and Dealers' Association was organized. The principal speaker was William L. Goodwin.

Urbana (Ill.) Section, A. I. E. E.—At a joint meeting of the American Institute of Electrical Engineers, Urbana section, and the Electrical Engineering Society, held at the University of Illinois on Jan. 18, J. L. Stair, chief engineer of the National X-Ray Reflector Company, Chicago, delivered a lecture "Some Principles of Illumination and Their Application."

Further Development of Water Power.—In an address before the Columbus (Ohio) Rotary Club on Jan. 15, C. A. Under, president of the Niagara Falls Power Company, advocated the further development of the nation's water power. "The war program cannot wait," he said, "action must be prompt. The 3,000,000 or more horsepower available at Niagara Falls, said the speaker, if developed, would save for posterity about 100,000,000 tons of coal per year, or 100 horsepower per minute—a carload every thirty seconds."

Delegate Guests at St. Louis Jovian Luncheon.—Delegates to the first meeting of the year of the executive committee of the National Electrical Contractors and Dealers' Association, which convened in St. Louis Jan. 22 and were guests at the Jovian luncheon at the American Annex Hotel in that city Jan. 22. Col. Robley S. Stearnes, chairman of the organization, was the principal speaker of the occasion. Addresses were also made by James R. Long, E. L. McCreary and Harry C. Brown, secretary of the organization. J. B. Adam of the Frank Adam Electric Company officiated as chairman of the meeting.

Jovian Electric League, Los Angeles.—At the luncheon of the Jovian Electric League held Jan. 9 William F. Rice spoke on "South America." At the meeting held on Jan. 16 George A. Brown of the Bion J. Arnold Company, Chicago, and formerly dean of the Cooper College of Technology, Pasadena, addressed the league on "Making Democracy Worth While." Harry W. Brown of the Commercial Electric League acted as chairman of the day. At the regular Wednesday luncheon of the league on Jan. 23 Jay W. Stevenson, manager of the Fire Prevention Bureau of the Pacific, gave an illustrated address on "Reducing Fire Losses." A. Vedder was chairman of the day.

Los Angeles Section, A. I. E. E.—H. C. Gardett, assistant engineer Los Angeles Bureau of Power and Light, gave an illustrated address at the Jan. 15 meeting of the Los Angeles Section on features of the hydroelectric development of the city of Los Angeles. A round-table talk followed on the Los Angeles aqueduct and its significance to the city in time of drought, and praise was given to the men who made its construction possible. At the February meeting J. F. Wilson, University of Southern California, will speak on "Tendencies in Design of Generators."

"Balancing the Light Beam."—Under the foregoing title, W. A. Durgin lectured before the Chicago Section of the Illuminating Engineering Society on Jan. 17. As the lecturer explained, the title was a bit of popular camouflage covering the old subject of photometry. He explained the similarity between candlepower, illumination and brightness. Some of the fundamental principles of brightness and light flux were illustrated by means of ingenious apparatus. One interesting feature was a guessing contest by the audience on equality of brightness and on the relative brightness values of several surfaces presented. This demonstrated that the eye is a very poor judge of relative brightness values except where these values are nearly equal. Even then the presence of a color difference distorted the judgment. The three most commonly used types of portable photometers were explained, the speaker going in detail into their relative good and weak points. He also made a public exhibition for the first time of a new "brightness comparator" of his design, which is intended to measure the relative brightness of two adjacent surfaces within the field of vision, with a view to determining the contrast glare.

Central Station Versus Isolated Plant Discussed at Providence.—F. B. Kenney, Blackstone Valley Gas & Electric Company, Pawtucket, R. I., presented a paper on "The Central Station Versus the Isolated Plant" before the Providence Engineering Society Jan. 9, which was followed by a general discussion of the subject by the consulting and mill engineers present. In the discussion C. H. Bromley of *Power*, New York, said that most isolated plants fail through mismanagement, the indifference of many operating engineers to economic conditions being amazing. W. B. Lewis outlined the savings from scientific management in the plant of the Crown Hotel, Providence. The lack of interest shown by the manufacturer in his power plant was emphasized by Mr. Kenney. K. A. Skinner, Narragansett Electric Lighting Company, Providence, cited an isolated plant which ran non-condensing for about twenty-five years, changed over to condensing service, and because of some temporary noise in the piping went back to the old method. In closing, Mr. Kenney stated that the average manufacturer prefers to spend money for a tangible substance like coal rather than for an invisible service like that of the central station.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Deposits for Gas and Electric Service.—The California Railroad Commission has authorized the Santa Barbara Gas & Electric Company to modify rules as to deposits for gas or electric service in residences so as to require a rate of \$2 for temporary occupancy and \$1.50 for permanent occupancy for four-room flats or dwellings, \$2.50 for between four and eight rooms, and \$5 for eight or more rooms.

Snow in River Blocks Power House.—One of the common methods of disposing of heavy snowfalls in Chicago is to haul the snow to the river and dump it in. Following this method of procedure after the recent heavy snowfall resulted in crippling the water-power plant of the Sanitary District at Lockport. So much snow was dumped into the river that it hindered the flow and resulted in a greatly reduced output at the plant.

Drive to "Recruit" 250,000 Men for Shipbuilding.—With the aid of the Council of National Defense, the Shipping Board, governors of states, organized labor and business, the Department of Labor began on Jan. 27 the "recruiting" of an army of 250,000 men to fill all present and future needs of the shipbuilding yards of the United States. Every man in the country with some skill in a mechanical trade used in shipbuilding and willing to accept employment in this branch of war industry will be enrolled and registered in the United States Public Service Reserve, a division of the United States Employment Service and the war labor "reservoir" which the Labor Department is creating to meet the coming needs of every war industry.

Booster Station in Plant of Power Customer.—The Illinois-Pacific Glass Company, San Francisco, made application recently to the Great Western Power Company for direct-current industrial load amounting to nearly 500 kw. An examination of the direct-current distributing system developed the fact that, with copper at 40 cents per pound, it would be preferable to install an alternating-current-direct-current machine at the plant rather than to extend the service leads of the direct-current system to accommodate a load of this size at the consumer's location. The power company had on hand a direct-current motor slightly larger than the capacity required, and this machine was installed and tied in with the direct-current system serving the territory in the vicinity of the glass works. With this arrangement the machine becomes a booster of considerable value in maintaining service in that part of the town.

C. E. Fabrney, manager of the Ottumwa Railway & Light Company, Ottumwa, Iowa, was elected director of the Ottumwa Savings Bank at its recent annual meeting.

W. E. Richards, electrical engineer of the Toledo Railways & Light Company, has been appointed a member of the electrical safety committee of the Industrial Commission of Ohio.

Harlow Moore has resigned from the position of district manager for the Pacific Power & Light Company at Seaside, Ore., to become connected with the Board of Fire Underwriters in Portland.

E. Dean Tanzer, assistant professor of electrical engineering, Lafayette College, has been appointed to the position of assistant professor of electrical engineering at the Georgia School of Technology and will assume his new duties on Feb. 1.

W. R. Davis, chief engineer of station A of the Springfield (Ill.) Gas & Electric Company, has had a grant of absence from the company while acting as chief instructor of the Naval Radio Service Training School at Dunwoody Institute, Minneapolis, Minn.

John H. Roemer, of the firm of Cummins, Roemer, Flynn, Milkewitch & McKenna, counsel to H. M. Byllesby & Company, and former chairman of the Wisconsin Railroad Commission, has been appointed one of a board of five appraisers to fix the value of the Bush Terminal properties in Brooklyn which have been taken over by the government for the period of the war. The valuation determined will be used as the basis for establishing the rental to be paid by the government.

Clayton W. Pike, consulting engineer of the Utilities Bureau, Philadelphia, has been commissioned a major in the Ordnance Department of the army. Major Pike was born in 1866 and was graduated from the Massachusetts Institute of Technology in electrical engineering in 1889. The following year he was electrical engineer for the Merrimac Manufacturing Company in charge of electric lighting, power and signals. During 1891 and 1892 he was instructor in electrical engineering in the University of Pennsylvania and during the two following years was electrical engineer for Queen & Company, manufacturers of scientific and electrical instruments. From 1895 to 1900 he was electrical engineer for the Falkenau Engineering Company, engineers and contractors, and from then till 1910 was vice-president and general manager of the Keller-Pike Company, electrical engineers and contractors. In 1912 he became chief of the Electrical Bureau of Philadelphia, resigning in 1916 to become engineer of the Utilities Bureau, which position he now holds. Mr. Pike has had a wide connection with engineering and technical societies and was president of the Electrical Section of Franklin Institute in 1896 and 1897, vice-president of the Society of Municipal Engineers in 1914 and 1915, and president of the Philadelphia Section of the A. I. E. E. in 1895.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Howard Pett, manager of the Albion plant of the Consumers' Power Company, has been appointed superintendent of power distribution of the company to succeed H. W. Courville.

S. R. Inch, operating manager of the Utah Power & Light Company, has been elected vice-president and general manager of this company, succeeding C. R. Groesbeck, who has become connected with the Electric Bond & Share Company. Mr. Inch first became connected with the Salt Lake City property Jan. 1, 1913, having previously been for seven years manager of electric light and street railway properties at Missoula, Mont.

Gerard Swope, vice-president and general sales manager of the Western Electric Company, has been decorated by the Emperor of Japan with the Or-



GERARD SWOPE

der of the Rising Sun. Mr. Swope has but recently returned home after spending seven months in the Far East. Since his graduation from the Massachusetts Institute of Technology in 1895 he has been constantly in the employ of the Western Electric Company and has been general sales manager since 1908.

Edward J. Neary, electrical engineer with the Public Service Commission for the First District of New York, engaged on rate and capitalization cases, has been granted a leave of absence to accept an appointment as an electrical officer on board the U. S. S. Utah with a commission as lieutenant. Mr. Neary was graduated from Pennsylvania State College and has been in the electrical field for the last ten years. Since he was graduated he has been with the American Gas & Electric Company, the University of Pennsylvania, H. L. Doherty & Company and the commission.

Lester S. Ready has been made electrical engineer of the Railroad Commission of California, in charge of the gas and electric department. Mr. Ready who has for several years been assistant engineer in this department, succeeds F. Emerson Hoar, who is now in government service.

Obituary

F. A. Driver, for many years a director of the Driver-Harris Company and identified with the company since its inception, died on Jan. 22, at the age of eighty-two years.

Henry M. Taylor, president of the American Vulcanized Fibre Company and vice-president and treasurer of the Remington Machine Company, died at his home in Wilmington, Del., on Jan. 14, at the age of fifty-nine years.

James Edward Latta, general agent of the Underwriters' Laboratories, died after a short illness at Washington, D. C., Jan. 17. He was a graduate of the University of North Carolina, the State of his birth, and of the graduate school of Harvard University. His engineering training was obtained at the Polytechnic Institute of Brooklyn, N. Y., at the Stevens Institute of Technology, and the shops of the Westinghouse Electric & Manufacturing Company and those of the Hooven, Owens, Rentschler Company. In 1903 he was appointed assistant professor of physics in the University of North Carolina, soon becoming acting head of the department of physics and applied electricity and after a year and a half being made professor of electrical engineering. While engaged in this work until 1909 Mr. Latta frequently was called upon as a consulting and supervising engineer in various parts of the country. In 1909 he became associated with the Edison Lamp Works of the General Electric Company at Harrison, N. J., where for seven months he conducted an employees' educational course in applied electricity and illuminating engineering. Subsequently he was engaged in power plant construction and operation in the Southwest. In the summer of 1911 he became technical editor of *Electrochemical*. When that publication was consolidated with the *Electrical Review and Western Electrician* six months later, Mr. Latta became an associate editor on the staff of this journal, having charge especially of the sections on electrical construction and inspection. In December, 1913, he was appointed special agent of the Underwriters' Laboratories, Inc., and about a year ago was advanced to the position of general agent. While making his headquarters at Chicago, Mr. Latta had traveled very extensively in all parts of the country in the last four years, representing the Laboratories at a great many conventions, meetings and conferences and helping to spread theospel of conservation by elimination of the fire hazard. It was a trip of this kind that brought him to Washington, where on Jan. 12 he was taken down with pneumonia, to which he succumbed five days later.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Competitive Plant Construction Opposed Temporarily.—A decision has been rendered by the Colorado Public Utilities Commission on a petition of the Western Light & Power Company against the city of Loveland for a determination of the question whether the city had begun actual construction of its proposed electric light plant before July 16, 1917, and had since prosecuted such work in good faith, uninterruptedly and with reasonable diligence in proportion to the magnitude of the undertaking under any franchise, permit, ordinance, vote or other authority heretofore granted but not heretofore actually exercised, or whether a certificate of public convenience and necessity is required. The commission holds that the city began construction of its plant prior to the enactment of the amendment to the law requiring a certificate of public convenience and necessity to be obtained from the commission before a utility may enter territory now served by a utility. Therefore such a certificate is not required, but the municipality must now proceed under such rules and regulations as the commission may prescribe. The decision adds: "The testimony before the commission, with the estimates prepared by the municipality's engineer, shows that the cost of completing the proposed electric light plant has greatly increased since the beginning of the war; that the increase is such that approximately two dollars must now be spent where one would suffice under normal conditions. Recognizing the existence of this condition, and realizing also that the city of Loveland and its inhabitants are now well served by an existing public utility, the commission, under its authority to provide rules and regulations for the completion of this plant and in keeping with the intent of the law and the requests of the national government, will hold that the city of Loveland has prosecuted the work of constructing its municipal plant in good faith, uninterruptedly and with reasonable diligence according to the magnitude of the undertaking, and that the municipality may and shall proceed further with the construction of its municipal plant until further application be made to the commission for the municipality to complete its work, or until such time as the commission on its own motion shall authorize the municipality to resume work under more normal conditions. The rights of the national government in connection with its need of materials and labor for the proper prosecution of the war must also be protected, and

must be given consideration over other demands for materials and labor, except where such demands relate to matters absolutely essential to public welfare. It is the purpose of this commission, however, to provide that no public utility, taxpayer or person may again appear before the commission and attempt to show to the satisfaction of the commission that the municipality of Loveland has not proceeded in good faith, uninterruptedly and with reasonable diligence in proportion to the magnitude of the undertaking, until such time as the municipality may proceed under the regulations of the commission to construct its electric light plant in a manner to conserve to the taxpayers of Loveland their funds raised by the issuance of bonds or in the process of general taxation."

Value as Basis for Rate Increase.—A decision of the West Virginia Public Service Commission, on the application of Godfrey L. Cabot to increase natural-gas rates in Elizabeth and other communities, holds that the reasonableness of a proposed increase in rates is not established by a mere showing of increased cost of maintenance and operation, in the absence of evidence as to the value of the plant and equipment, and as to revenues and expenses.

New Securities in California.—From Jan. 1 to Dec. 22, 1917, the California Railroad Commission passed upon applications for authority to issue stock, bonds and notes involving the following amounts: Authorized, \$98,168,183; denied, \$2,873,283; dismissed, \$1,848,706; total, \$102,890,173. Of the amount authorized to be issued gas and electric companies had \$52,361,557, or 53.3 per cent, divided as follows: Stock, \$30,115,533; bonds, \$20,070,835; notes, \$2,175,189.

Cost of Making Record.—Commissioners of the Illinois Public Utility Commission have been placed in contempt of court in a friendly suit before the Circuit Court of Sangamon County, in which Springfield is situated. This will be in force until the Illinois Supreme Court decides whether a litigant taking an appeal from the commission to the Circuit Court shall pay the State for the cost of preparing the record. The question has been up for two years. The commissioners were before Judge E. S. Smith in response to a citation for contempt following their refusal to file the record in a case. The cost of preparing the record had not been paid. The commissioners were fined \$25 and costs, payment being suspended during the appeal to the Supreme Court. The commission bases its demands for payment on Section 7 of the Illinois Public Utility law. In the appeal of the Springfield Gas & Electric Company from a commission order the company contested payment of the fee for preparing a record, amounting to several hundred dollars. The court required the company to deposit the amount of the fee in a bank designated by the court, pending a decision upon the point. Since then contingent payment has been guaranteed in some cases.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Modification of Commission Order.—An order of the Public Service Commission can be modified only by a formal promulgation, especially where the order itself provided that it should be modified "by further order," etc., it was held by the Appellate Division of the Supreme Court of New York (167 N. Y. S. 810).

Liability for Employees' Negligence.—Plaintiff was employed by defendant by the day to assist in or superintend the installation of certain heavy machinery in defendant's plant. Plaintiff owned and furnished and, without the direction or control of any other agent of the defendant, set up the windlass, pulleys and other apparatus, but the windlass was operated by defendant's employees. It was held by the Court of Appeals of Kentucky in *Danville Light, Power & Traction Company versus Baldwin* (198 S. W. 713) that if the employees operating the windlass were under the control and direction of defendant's superintendent, plaintiff was not an independent contractor, and defendant was responsible for their negligent acts causing injury to plaintiff, whether their negligence was gross or ordinary.

Municipal Rate Discrimination.—Municipalities of the State are authorized to establish, maintain and operate lighting, power and heating plants and furnish the municipality and the inhabitants thereof with light, power and heat. The powers thus conferred are proprietary in their character, and in the management and operation of such plants municipal officials are permitted wide discretion. Courts are without authority to interfere therewith upon complaint merely that the capacity of the plant is overtaxed and streets of the municipality are insufficiently lighted by reason of furnishing energy to private consumers, and that the rates charged for energy are inadequate to meet the cost of production and transmission thereof, it was held by the Supreme Court of Ohio (117 N. E. 953). But where the council of any such municipality fails to adopt and use a system or schedule of rates for energy furnished to private consumers as contemplated by the General Code, but leaves the matter of rates to the administrative officers of the municipality, who arbitrarily fix and determine the rates in each case, and in so doing unjustly discriminate between citizens in the matter of rates and service, such action constitutes an abuse of corporate power which may be restrained by the court upon suit instituted by the city solicitor or by a taxpayer if the city solicitor refuses to bring suit.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

TAKING CARE OF THE MORAL-RISK CUSTOMERS

Things That Can Be Done After Credit Is Extended
on Character to Help Insure Payment
of the Account

When the credit man has been prevailed upon to pass a customer's order and that customer has no collateral backing or dependable asset but his character, the time is opportune for the credit man to strengthen the customer commercially. The logical point to start would be with the customer's credit relations with his own trade.

The chances are that the facilities of this customer for securing credit information are very meager. On the other hand, the credit man has many sources of credit information at his command. This may be explained to the customer, and it may be impressed upon him that the credit man is almost a partner in his business on account of the credit extended, and also because disaster may overtake him if proper precaution is not exercised in his credit dealings. The credit man need not hesitate about virtually insisting that this customer call on him for information, especially in transactions where comparatively large amounts are involved. If the credit man will come down to his customer's level and give him proper assurance of his willingness to assist in this capacity, he will no doubt be surprised to find how careful the customer becomes and how often he consults the seller's credit man.

However, when the credit man has established such relations with the customer it will soon become evident that this customer needs suggestions in reference to the importance of properly closing orders and contracts, especially taking into account terms of sale. It is not an uncommon occurrence to find well-financed concerns taking advantage of the small man in business because he lacks backbone when soliciting the business or harbors a fear of losing the business if terms of sale are mentioned. The customer in these instances knows very well that he cannot afford to give long terms, and it is up to the credit man to bolster him up a bit and to teach him the real meaning of quick turnovers. In some cases it may even be expeditious for the credit man to make collections for the customer, so that both may receive payment without waiting for the remittance to come strolling along as the small man usually does.

MORE EVIDENCE OF BETTER TRADE MERCHANDISING

Habirshaw Electric Cable and Western Electric Put
Out "Home Electrical" Manual to Facilitate
Co-operation

A still further evidence of the growing tendency of the electrical industry toward a better and broader plan of merchandising is contained in "The Home Electrical" manual now being distributed by the Habirshaw Electric Cable Company and the Western Electric Company, which distributes the former's products. It is designed to "deliver complete electrical equipment to the ultimate consumer at the lowest possible cost consistent with dependable materials and skilled workmanship." The execution of this merchandising policy involves, its sponsors state, "first, the preparation and distribution of correct plans and specifications for the use of the architect; secondly, a duplicate of the architect's plans and specifications to be placed in the hands of electrical contractors; third, a practical working plan of distribution and a stabilized basis from which

contractors and architects can closely estimate the investment for materials of the plans for each installation."

To this end the manual is being distributed. It contains complete plans and specifications which can be used by architects and contractors, either in whole or part, as an example to their clients of an installation for the home.

In distributing this manual the publishers state that the data contained therein were compiled from the most reliable sources and represent the best market practice. It is intended to answer all of the questions that may arise between the architect, contractor and owner in considering electrical equipment for the house.

FAN SCHEDULES FOR 1918 ANNOUNCED TO THE TRADE Selling Policies—Price Differentials Formulated— Matter of Shortage in Question—New Standards Noticed

Fan manufacturers have announced their schedules, contracts, selling policies and other information incidental to the campaign for 1918. Heretofore a differential of about \$1 each was made in the price of alternating-current and direct-current fans. This year the same practice was expected to prevail, as a difference in the manufacturing cost of the two types is claimed. On this account the schedule, it is reported, were held back longer than usual, some firms just now sending out their formal notifications. It appears that one leading producer has named the same price for both, but a majority of the remaining concerns adhere to the differential of former years.

As was pointed out in the ELECTRICAL WORLD for Oct. 1, the 1918 fan shows many new standards. The standard type will have four blades, although six blades are cataloged, in the 12-in. and 16-in. alternating-current oscillatory types. Likewise a lower figure is named for certain models on the same outlines of the more expensive kind, its reduced price being due to the absence of the speed-control switch, highly polished blades and the omission of other requirements not required for reliability and durability. Eight feet of new code reinforced cord is supplied with each fan, though six feet is specified on some less expensive types.

An increase in price of both oscillating and non-oscillating models is made in the 1918 lists, ranging from \$3 to \$4, \$4.50 and \$5 each, a little more than originally foreshadowed in the ELECTRICAL WORLD. This is owing to the increased cost of raw material and production. One house states in its printed notice to the trade, that it "cannot undertake to guarantee fan-motor prices against advance during the season of 1918 in contracts made with either wholesalers or retailers."

Discounts also vary, according to methods in vogue between the manufacturers and buyers, the greater number adhering to the quantity basis plan. A prominent producer who has followed this rule in his other lines is putting it to work on fans this year for the first time. Discount arrangements are subject to various considerations and differ with each of the manufacturing companies.

The fan-selling season proper is usually during the last quarter of the year. Delivery of requirements are to be made before the expiration of the contract date. The buying so far on the part of jobbers and dealers is understood to exceed that of last year. Much speculation has been indulged in as to a shortage of fans. Authorities agree and disagree on this point, but one of the largest distributing companies has already announced, and in a public manner, that "there is sure to be a shortage of fans next summer."

BUSINESS IN MOTORS

REMARKABLY SOUND

Large Buying Expected to Develop for Small Units
for Industrial Drive to Displace Many Large
Units Now on Group Drive

The well-sustained volume of business in electric motors under all vicissitudes of trade speaks well for the future of this branch of electrical manufacturing and distribution. While *less essential* industries—there are few really "non-essentials"—show declines in purchasing, the acceleration in military and naval preparations throughout the country absorbing practically all the motors which can be built, and deliveries on the largest sizes are fast approaching a year, including both freight and express delays. The first rush of munitions plant requirements led to a heavy volume of large unit buying in the motor trade, group drive being necessarily first installed on account of its lower first cost, the latitude available in reserve capacity in many installations, minor importance of electrical efficiency at the start of war operations, and general overload characteristics. At present the volume of this large-motor business is still very great, but the increasing importance of fuel conservation through the use of more efficient power equipment is leading to a more general consideration of industrial motor-vehicle betterment problems. This means that more and more smaller motor units will be required to handle existing and developing loads, and well-informed opinion is that after the war and perhaps earlier the large-motor market will be overstocked through the release of many units now operated upon an inefficient basis and the substitution of small units for individual or subdivided group driving. The fuel shortage has focused attention upon the value of hydroelectric energy, and the outlook for profitable motor business and economic applications is nothing less than remarkable, taking the long view ahead. Power users recognize the necessity of maintaining motor prices at levels yielding a fair profit to the manufacturer and distributor, and the indications are that no branch of the electrical manufacturing industry faces brighter prospects to-day.

METAL MARKET SITUATION

Stronger Sale of Copper Is Looked For—Wire
Products Easier—No Tin in Sight

Wire prices, while being figured on a 30-cent base, are looked for easier, with a tendency to softness. Large consumers are buying practically at their own price but with reservations. The extension of the official price of copper for four months ahead has had a stabilizing effect, and purchases of the metal may be on a more liberal scale. Transportation, labor and other difficulties are having their effect on industrial consumers of copper, more so than on producers. The consumer is dependent on a doubtful and unsettled domestic demand, which is unsettling. If under current conditions the output shall exceed consumption, it will have an effect on the price that will rule after the present term expires. Other metals remain about the same, excepting tin, which is scarce, with no relief in sight.

NEW YORK METAL MARKET PRICES

	Jan. 21			Jan. 28		
	£	s	d	£	s	d
Copper:						
London, standard spot	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	27.00			27.00		
Gold, trust price	6.75			6.75		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter	19.00			19.00		
Steel, spot	7.82½		7.92½	7.82½		7.92½
Strait	85.00*			85.00*		
Aluminum, 98 to 99 per cent	34.00		36.00	34.00		36.00

OLD METALS

Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.75 to 14.50	13.75 to 14.50
Brass, light	10.00 to 10.50	10.00 to 10.50
Lead, heavy	6.25 to 6.37½	6.20 to 6.25
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50
Nominal.		

THE WEEK
IN TRADE

STORMS and embargoes have held up freights in all parts of the country, excepting in the South, during the week so that deliveries were not greatly improved, if at all. In some instances the delay is reducing electrical stock to a point where jobbers and dealers are disturbed over the outlook. With this temporary check, however, sales and trade in general are reported as increasing. Where business was practically suspended on account of the blizzards, the normal status is resumed. The labor shortage is becoming more acute where large industrial enterprises of a government nature are centered. A shortage of new motors is said to exist in some sections, but used machines are selling better elsewhere owing to shorter deliveries. Fixtures, washers and heavy equipment are recorded in the improved sales class.

Collections range from fair to excellent, January being said to be better than December. Industrial accounts are particularly prompt in settlement. Credits continue to be carefully looked after.

NEW YORK

Concern over the slow delivery of goods is expressed by representative jobbers and distributing houses. It is said that manufacturers who are unable to carry out their time contracts are offering various excuses for the non-delivery of electrical merchandise, the greater number of which are not only valid but are governed by circumstances which they are powerless to remedy. The buying of staples continues along conservative lines. Heating appliances are coming into the market in larger lots, but a scarcity still exists. Wiring material is slightly easier in price. Collections have been impaired by the severe weather, but credits are still treated with a great deal of circumspection.

A jobber, with a wide reputation as a heavy operator in every line of electrical staples, specialties and general merchandise, is revising his entire price list. Notable changes are not exactly the purpose of the revision, but there may be surprises in store. The new list is down for appearance along in February, and in certain instances the figures are to harmonize and tie up with the Goodwin plan of buying and selling, which is interesting the trade.

SMALL MOTORS.—While deliveries for standard sizes are better, prices have also receded slightly, but not so much as to affect conditions a great deal.

LAMPS.—Manufacturers are gradually catching up on past shortages on standard sizes, but some types are still short. With the anticipated demand for large quantities of all kinds of lamps that the government will doubtless requisition in the near future, to meet the requirements of the vast housing preparations of the Shipping Board, now under way, it is possible that the situation may be again seriously affected.

ELECTRIC RADIATORS.—Marked efforts are being made to push through a number of important shipments of electric radiators to meet the extraordinary demands in New York City and neighboring places.

COLLECTIONS AND CREDITS.—As mentioned in a previous review, the holding up of freight—the exasperation connected with the slow arrival of merchandise—has had a shrinking effect on collections, which have heretofore been quite satisfactory. The credit managers are exercising their usual care in disposing of applications for time accommodation in opening accounts.

LIGHTING FIXTURES.—Trade is still rather quiet, owing to the practical elimination of building operations. A well-known firm just issuing its new price list is making a few slight increases on fixtures having heavy brass castings,

but on the regular line a shade lower is noted—an "even break," as the house expressed it. Bowls, shades, etc., are spoken of as being in ample supply, with shipments from the factories coming out of stock. Deliveries are three and four months back.

FLASHLAMPS.—Trade in flashlamps is very active, the recent advance apparently not affecting the sale appreciably. It is a question just now of obtaining stock.

CROSS-ARMS.—With the rapid absorption of the visible stock of cross-arms for cantonment and general government purposes, the supply is growing less. Prices, as stated last week, took a jump, and if a further increase should come along large handlers would not be surprised.

HOUSEHOLD SPECIALTIES.—Excepting heating appliances, the sale of household energy-consuming specialties has been affected to some extent by the conservation of energy by the central stations. Goods of this description are expected to move more rapidly when the fuel-saving situation is not so acute.

CHICAGO

The trade has recovered from the blizzards and is back on a normal basis. During the stormy days when shipments were not made on account of lack of transportation facilities orders piled up to an appreciable extent. These have all been filled and shipped now. Heatless Monday was a boon to some jobbers. The railroads were not receiving freight, but were giving all assistance in getting incoming shipments unloaded. This permitted jobbers to put their entire merchandise handling departments to work on the incoming shipments with the result that goods were received, checked and shelved in one day, whereas, in the ordinary run of things, the handling of the same volume would have taken a week. The lull in business that usually follows the inventory period is reported to be about over and normal movement being slowly resumed.

COPPER.—To some observers the future price of wire to the trade is a puzzle. The government has of course fixed the price of ingots at 23.5 cents. Ordinarily the mills formerly got about 1 cent a pound for working it up. Now they get, on account of labor conditions, from 3 cents to 4 cents, bringing factory prices on wire up to 26.5 cents to 27.5 cents. The Chicago jobbers are at present continuing on a 30-cent base for rubber-covered and a 28-cent base on weatherproof.

MOTORS.—Sizes smaller than 15 hp. can be had on immediate delivery. The large sizes are more scarce.

SECOND-HAND MACHINERY.—Bad weather has interfered with inquiries in the last few weeks. This slowing up is regarded as temporary. Prices show no signs of breaking. In fact, some buyers are paying more for second-hand motors than they would have to pay for new motors out of stock owing to the panicky condition of the market. The outlook for 1918 is considered good, the usual run of factory changes being looked to to produce much of the business. Analyses of 1917 business show that the volume of business in dollars was greater than that of 1916, but that the tonnage was just a trifle under that of 1916.

MERCURY-VAPOR LAMPS.—The large amount of industrial night work that is going on is making a real market for mercury-vapor lamps. One company's 1917 business in the Chicago district increased 43 per cent over that of 1916. Deliveries on direct-current lamps are on about a ten-day basis. Deliveries on alternating-current lamps are on about a three-week basis.

LAMP GUARDS.—Industrial activities and the higher price of lamps are making a lively market for lamp guards. Government orders in the hands of some manufacturers have set back deliveries from out of stock to ten days.

CEDAR POLES.—Lack of transportation facilities and slowing up of utilities' activity have acted to create large stocks of poles in the hands of distributors. The 1918 pole buying is expected to be about 50 per cent of that for 1917.

FUSE SWITCHES.—A few large orders have been received, and these tend to make the market continue to appear active.

BOSTON

Jobbers report a reasonably good volume of business with but a slight falling off due to the enforced holidays and weekly shutdown. Stocks are substantial, although railroad embargoes and congestion are hampering deliveries sufficiently to retard considerably the replacement of shipped materials. No let-up appears in government orders, and important consignments are being billed for foreign use as well as for service in military and naval establishments on this continent. House wiring is very quiet over New England as a whole. Central stations are recovering somewhat from the effects of the "heatless Monday" order, as additional exemptions are provided.

Prices hold firm in most lines, but an advance in washing machines is rumored to be in prospect. Central stations report good results from vacuum cleaner campaigns now under way, the Feb. 1 price advance being a decided stimulus to earlier installment buying. Labor is getting scarce and the more general use of women in industry cannot long be deferred. One prominent jobber reports a 20 per cent larger trade in December than a year ago, with large mil business, running as high as \$30,000 per annum in an individual case. Collections are fair, and from industrial customers excellent.

The Massachusetts Gas and Electric Light Commission also has just made public a statement emphasizing the fundamental soundness of the central-station industry and the expectation that dividends will continue along present line despite the adverse effects of the war.

MOTORS.—A prominent dealer states that 90 per cent of the motor business of New England is associated with the war industry, and that the volume of sales shows no sign of falling off. On motors of 75-hp. rating and over nine months' delivery is being quoted. Prices are firm, and the above dealer is of the opinion that there are not over 50 motors in New England stocks ready for instant shipment. Illustrating the present scarcity, \$200 was lately paid for a dozen frames of motors of 1-hp. to 5-hp. rating, with windings totally ruined by overheating, and in other cases higher prices are being paid for second-hand than for first-hand units, because of better delivery conditions.

WIRE AND CABLE.—Stocks are increasing, at least temporarily. One large manufacturer reports putting the first stock order through the works for many months, covering varied sizes. Weatherproof wire is quoted at 27 cent and rubber-covered at 30 cents.

ELECTRIC PASSENGER CARS.—The scarcity of chauffeurs and good performance of electric vehicles in Boston during the cold weather promise a healthy spring business. Consistent work among suburban "prospects" is yielding results; power requirements are relatively small, and when intelligent sales methods are applied growth of business seems certain to follow.

VACUUM CLEANERS.—The drive to sell these machines in larger numbers prior to the advance of Feb. 1 gave every evidence of success early in the week. Cleaners are becoming almost as much of a staple as electric irons, and few are returned after being placed on trial.

FLASHLAMPS.—Business shows a slight falling off late. If the second draft comes early in the spring, a boom in these devices is expected to follow.

CONDUIT.—Smaller sizes of pipe are accumulating in the stockrooms, but deliveries are in general irregular and much of the local buying in New England is on the hit-or-miss order.

ATLANTA

No visible effects of the embargo on some of the Eastern railroads have been noticed in the Southeast this week. As a matter of fact, this section is too busy with other problems since last week's industrial dislocation by the fuel order. The various hydroelectric power companies rendered invaluable service during the period of shutdown and are rewarded by the fact that a number of essential industries were kept running. A sleet storm visited this section early in the week and caused considerable damage, tying up street-car service and crippling lighting and power systems.

all telephone, telegraph and power lines are reported as repaired, and practically normal conditions prevail. There is a movement to restrict unnecessary building and other enterprises not essential to the war and to save capital investments for war bonds, the idea being to appoint local committees of business men and bankers and intrust them with the task of cutting off at the source proposed expenditures which can be eliminated during the war. It is not expected that this movement will make much headway for some time. Anyway, a large volume of construction has already been projected and the momentum of this business will continue for some time.

Manufacturers and jobbers state that collections are excellent and that January is showing up much better than December. A number of municipalities which are unfortunately not situated near hydroelectric systems are being hard pressed for ready funds, owing to the fuel situation. These seem to be the only cases materially affecting the credit outlook at present.

LIGHTNING ARRESTERS.—Heretofore the demand for this line was more or less sporadic, but expansion of transmission systems in the Southeast has tended to flatten out the demand. Manufacturers report that last week's thunderstorm stimulated sales and brought to the attention of operating engineers the necessity of anticipating summer requirements. The aluminum-cell type has been quite effective, but deliveries are slowing up. Manufacturers report great difficulty in securing steel containers and aluminum. Arresters for 6600 volts and below are promised for two months. Higher potentials cannot be had in less than five months, with the possibility of even longer shipments. There has been no decided change in prices recently.

ELECTRIC HEATERS.—The call for heaters of all types has been good this winter and a large volume of sales has been recorded, but when the recent five-day fuel order made itself felt the demand for heaters was more than local and scattered stocks could stand. From information at hand it appears that all the heater stocks are exhausted, and as there will be eight more heatless Mondays the prospects are very bright for more big business in this line.

SEATTLE

There were no outstanding features in the past week's business. Jobbers say that the volume of sales to shipyards, lumber mills and industrial plants was noticeably less than during the last three weeks. Sales to the government were also negligible, with the exception of orders for lamps and wiring devices for additional cantonment work. Retailers report a noticeable increase in volume due to the incipient building boom in Puget Sound cities. This volume is expected to increase. Several inquiries from a big shipbuilding concern and allied industries for heavy equipment indicate that February's total, provided orders are placed, will be heavy. Few new credits were placed during the past two weeks. Collections are satisfactory.

Seattle apparently is experiencing a building boom as regards the erection of residences. Opinions differ as to whether the present rate of construction will continue. In spite of the fact that January is regarded as a particularly unfavorable month for building activity, 130 new residences were started during the first twenty-eight days.

The establishment of many camps and portable sawmills and construction of new railroad lines in the Grays Harbor country will follow the recent award of the government of the contract for millions of feet of airplane spruce on the "cost plus" basis. The contract for furnishing more than 100,000 worth of machinery, including a large amount of electrical equipment, was awarded last week by a new Grays Harbor shipbuilding concern.

The freight situation in the Northwest remains the same as reported for the past month. There has been no speeding up, and over 5000 carloads of Oriental freight in Seattle yards and hundreds of carloads in warehouses block the efforts of railroads to solve the traffic problem. To relieve this congestion and prevent a railroad embargo, steamship and railroad officials representing all the principal lines have agreed to a steamship pooling arrangement designed to facilitate the quick handling of freight and to be used only in

case of necessity. The embargo on the shipment of freight other than fuel, food or munitions now in effect on Eastern lines has not been emphasized to date, although it is expected to materialize.

Appliances as a whole are moving satisfactorily. Jobbers state that the sale of sewing machines during the month of January has never been equaled in the Northwest. Immediately following the holiday let-down this appliance began to move and this movement is increasing daily. Dealers state that the Christmas sales of machines have proved the best advertisement possible. Stocks of appliances are fluctuating considerably, but at present are in fair shape. Floodlamp sales have been on a decided increase the past two weeks and a slight shortage is noted. Portables are moving satisfactorily and shortages on other lamps are very pronounced. The volume of sales is well sustained. Motor and transformer sales slowed up slightly during the past week. No orders of important consequence were placed.

SAN FRANCISCO

The long-continued drought in California is causing much concern in all lines of business and there is apprehension that the coming year will see hard times because general prosperity in California is so closely related to good crops. For the time being, however, the drought is bringing a rush of motor and transformer business from farmers who desire to install pumping systems to insure water supply. During freight clearance week more than 3500 freight cars were released in California. The saving of 20,000 kw. which was available immediately after the consolidation of the four large power companies has provided power for immediate needs, and this load is rapidly being absorbed chiefly in comparatively small blocks.

Shipyard activity is steadily increasing, and as the first boats are launched new keels are laid so that there is a steady demand for electrical supplies in that line. Renewed activity in building construction is in prospect in San Francisco. The building inspector's office announces considerable more business in the month of January than was done in the preceding three months combined. New contracts are for industrial loft, light manufacturing and automobile uses. No hotel, office or apartment buildings are included.

CREDITS AND COLLECTIONS.—These continue in good shape. The readjustment to business on a war basis seems to have been completed even in the retail shops, and concentrating on lines that can be moved now has improved business conditions. Credits are still scrutinized closely and overstocking on a high-price basis is being carefully avoided.

LAMPS.—The situation remains in a strained condition, and dealers are inclined to complain about the difficulty of securing supplies, but in reality actual needs are adequately handled as heretofore.

WIRE.—Rubber-covered wire stocks have been seriously depleted of late by the slowing down of deliveries without corresponding decrease in demand. Despite this condition a tendency to a lower price is reported. Weatherproof wire stocks are also in worse shape than before, but are not so bad as rubber-covered.

CONDUIT.—Stocks are in worse shape because of poor deliveries. However, demand in this line is below normal, the chief fields now being the government and industrial.

GLASS INSULATORS.—In this line considerable uncertainty has arisen because of the manufacturers' announcement that orders will be accepted only at prices as of date of shipment. The fact that shipments are poor adds to the uncertainty.

POLE-LINE HARDWARE.—Since the first of the year construction has dropped off. Good stocks are in hand.

MOTORS.—The demand for agricultural purposes is increasing. The question of delivery is now entirely a matter of a priority order. The Priority Board is very careful and only unquestionable claims are allowed. Stocks are continually improving. One manufacturer, for example, who recently quoted stock delivery on single-phase motors up to 15 hp., later moved this up to 20 hp. and now quotes up to 30 hp. from stock.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must

increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		Last per 1000 Ft.
B. & S. Size		
No. 14 solid		\$61.00
No. 12 solid		71.00
No. 10 solid		90.00
No. 8 solid		106.00
No. 6 solid		145.00
No. 10 stranded		95.00
No. 8 stranded		115.00
No. 6 stranded		160.00
No. 4 stranded		205.00
No. 2 stranded		266.00
No. 1 stranded		315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	125.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor		No. 14 Solid
Less than coil		List to \$61.00
Coil to 1000 ft.	+10%	59.17
		No. 12 Solid
Less than coil		List to \$71.00
Coil to 1000 ft.	+10%	68.87

Twin-Conductor

		No. 14 Solid
Less than coil		List to \$105.00
Coil to 1000 ft.	+10%	\$70.00 to 10%
		No. 12 Solid
Less than coil		+10% to \$135
Coil to 1000 ft.	+10%	\$130.95

DISCOUNT—CHICAGO

Single-Conductor

		No. 14 Solid
Less than coil	+10%	to +20%
Coil to 1000 ft.	—5%	to —10%
		No. 12 Solid
Less than coil	+10%	to +20%
Coil to 1000 ft.	—5%	to —10%

Twin-Conductor

		No. 14 Solid
Less than coil	+10%	to \$115
Coil to 1000 ft.	—10%	to \$80
		No. 12 Solid
Less than coil	+10%	to +20%
Coil to 1000 ft.	—5%	to —10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	20% to list
Std. pkg.	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List Per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. strp.	List to \$75.00 —15% to \$69.75
3/8-in. d. strp.	List to 75.60 —15% to 72.00
1/2-in. s. strp.	List to 100.00 —15% to 93.00
1/2-in. d. strp.	List to 100.00 List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	\$75.00 \$63.75
3/8-in. double strip	78.25 71.25
1/2-in. single strip	100.00 85.00
1/2-in. double strip	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
1/2	\$0.05 1/2	1 1/4	\$0.25
3/4	.06	1 1/2	.33
1	.09	1 3/4	.40
1 1/4	.12	2	.47
1 1/2	.15	2 1/4	.55
2	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$25.00-\$55.00	\$20.50-\$24.50
1/4-in.	\$28.00-\$60.00	\$22.50-\$27.00
		\$20.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$36.00-\$55.00	\$25.00-\$37.50
1/4-in.	\$40.00-\$60.00	\$27.00-\$30.00
		\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

Couplings, List Elbows, List

Size, In.	Couplings, List	Elbows, List
1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	2500-5000 lb.	1/4 in. to 1/2 in.	3/4 in. to 1 in.	1 in. to 3 in.
4% to 6%	6% to 8%	7% to 9%	9% to 11%	

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.	2500-5000 lb.	1/4 in. to 1/2 in.	3/4 in. to 1 in.	1 in. to 3 in.
1.3% to 4.7%	3.3% to 6.7%	4.2% to 7.7%	6.3% to 9.9%	

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	\$5.00 to \$6.00
Discount	30%

CHICAGO

List	\$5.00 to \$6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.	100	\$0.30
60-watt—B.	100	.35
100-watt—B.	24	.70
75-watt—C.	50	.70
100-watt—C.	24	1.10
200-watt—C.	24	2.20
300-watt—C.	24	3.25

Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55

Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4 3/8 in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$24.90 to \$31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$29.00 to \$35.60
Coil to 1000 ft.	21.50 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.25 to \$25.75
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OUTLET BOXES

No.	List, per 100
01—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
02—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.	30.00
03—C.A., 9, 4R, B 1 1/2	25.00
06—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%-37%	20%-32%
\$10.00 to \$50.00 list.	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N. C.—Solid Nail-it—N.C.				

Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.				

Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket.	500	.30
1/8-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	\$25.00 to \$45.00
1/5 std. pkg.	23.00 to 42.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:		
30-amp. S. P. S. T.	\$0.80	
60-amp. S. P. S. T.	1.20	
100-amp. S. P. S. T.	2.25	
200-amp. S. P. S. T.	3.48	
300-amp. S. P. S. T.	5.34	
30-amp. D. P. S. T.	1.20	
60-amp. D. P. S. T.	1.78	
100-amp. D. P. S. T.	3.38	
200-amp. D. P. S. T.	5.20	
300-amp. D. P. S. T.	8.00	
30-amp. 3 P. S. T.	1.80	
60-amp. 3 P. S. T.	2.68	
100-amp. 3 P. S. T.	5.08	
200-amp. 3 P. S. T.	7.80	
300-amp. 3 P. S. T.	12.00	

Low Grade:		
30-amp. S. P. S. T.	0.42	
60-amp. S. P. S. T.	0.74	
100-amp. S. P. S. T.	1.50	
200-amp. S. P. S. T.	2.70	
30-amp. D. P. S. T.	0.68	
60-amp. D. P. S. T.	1.22	
100-amp. D. P. S. T.	2.50	
200-amp. D. P. S. T.	4.50	
30-amp. 3 P. S. T.	1.02	
60-amp. 3 P. S. T.	1.84	
100-amp. 3 P. S. T.	3.76	
200-amp. 3 P. S. T.	6.76	

DISCOUNT—NEW YORK

Less than \$10 list.	List to + 5%
\$10 to \$25 list.	11%
\$25 to \$50 net.	14% to 15%

\$25 to \$50 net.....	14% to 15%
	Low Grade
Less than \$10 list.....	5% to 10%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.....	+5%
\$10 to \$25 list.....	-10%

\$25 to \$50 list.....	—14%
	Low Grade
Less than \$10 list.....	—5%
\$10 to \$25 list.....	—16%
\$25 to \$50 list.....	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to -15%
Std. pkg.	List to 30%

SWITCH BOXES, SECTIONAL CONDUIT

	List
Union and Similar—	Each
No. 155.	\$0.34
No. 160.	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00	List	Net
\$2.00 to \$10.00	list	
\$10.00 to \$50.00	10% to 20%	5%
list	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00	list	25%
\$2.00 to \$10.00	list	25%
\$10.00 to \$50.00	list	25% to 35%
list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	—

CHICAGO

List price	\$4.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/2
No. 18, full spools.	0.43 1/2

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.65
No. 18, full spools.	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

No.	Price per 1000 Ft. Net			
	Less than	500 to	1000 to	1000 to
	500 Ft.	1000 Ft.	5000 Ft.	5000 Ft.
11.	\$15.00-\$18.00	\$13.00	\$11.25-\$11.50	
12.	23.25- 25.41	21.30- 21.78	15.97- 19.35	
10.	32.40- 35.21	29.70- 30.18	22.13- 27.00	
8.	45.70- 49.12	41.90- 42.12	30.88- 38.00	
6.	72.40- 77.84	66.35- 66.72	48.93- 60.30	

CHICAGO

	Price per 1000 Ft. Net			
	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.	
No.				
14..	\$18.00	\$13.00-\$13.50	\$11.50-\$12.00	
12..	25.33- 26.28	22.02- 25.33	18.35- 20.93	
10..	30.48- 36.54	27.94- 31.26	22.86- 29.23	
8..	42.54- 51.57	38.99- 44.13	31.90- 41.36	
6..	66.46- 88.38	56.15- 75.61	50.53- 70.70	

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	34.25 to 38.25

CHICAGO

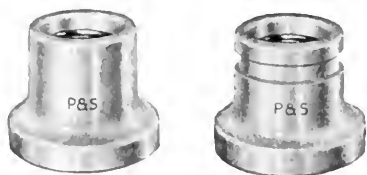
	Per 100 Lb. Net
Less than 25 lb.	\$35.50 to \$40.35
25 to 50 lb.	34.35 to 39.35
50 to 100 lb.	33.50 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Porcelain Concealed Receptacles

Pass & Seymour of Solvay, N. Y., have brought out two porcelain concealed receptacles, to be known as P. & S. 4000 and 4001. The wires are introduced from the back of these receptacles.

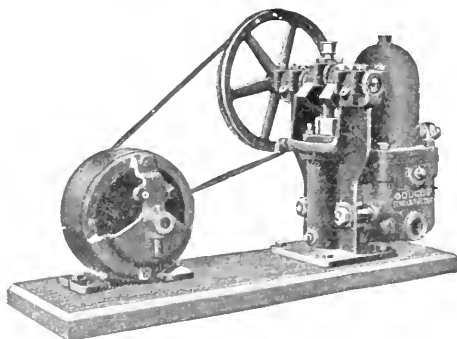


RECEPTACLES WITHOUT AND WITH
SHADE-HOLDER GROOVE

cles. The outer porcelain shell entirely conceals the supporting screws as well as the binding screws and terminals. P. & S. 4000 is shown without the shade-holder groove and P. & S. 4001 with the shade-holder groove. The outside diameter of the base of these receptacles is $2 \frac{5}{16}$ in. (5.87 cm.).

Pumps and Pumping Outfits

The Goulds Manufacturing Company of Seneca Falls, N. Y., is placing on the market a new line of "Hi-Speed" pumps and pumping outfits that are supplied in 3-gal. and 6-gal. (11.4-l. and 22.7-l.) sizes. This line consists of thirteen outfits, twelve of which are motor-driven. It is pointed out that the small capacity is ideal from the central-station standpoint in that it carries the pumping over a longer period of time, thereby doing away with the objection of having pumps of larger capacity operating for only a few minutes during the day. Attention is called to the interchangeability of the



INTERCHANGEABILITY OF COMPONENT
PARTS A FEATURE OF THESE PUMPS

component parts. This interchangeability of component parts, it is said, will enable the dealer, by having one complete outfit in stock and various extra parts, to make up any one of the thirteen different outfits. Four of

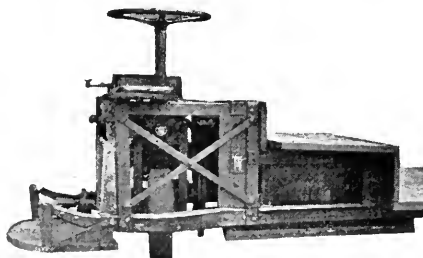
these outfits are supplied with 32-volt motors, making the outfits suitable for operating from farm lighting sets.

It is pointed out that all gears have been eliminated, thereby making the pump absolutely quiet and smooth-running. The pump operates on a speed of 500 r.p.m. This allows it to be belt-driven from either electric motors or gasoline engines with only a slight reduction and consequently with a small pump pulley instead of the extra-large pulley usually required.

Industrial Floor Trucks and Tractors

The special features pointed out for the electric industrial floor truck shown herewith, made by the Enterprise Machine Works of Los Angeles, Cal., is turning in wheel-base length, simple in its make-up, low first cost, low upkeep, speed control system without resistance, 25 per cent reduction in weight. This truck is said to be the first floor truck to be placed on the market that demands from the storage battery a current supply below the normal rate of discharge.

The truck is equipped with a special



NON-RESISTANCE SPEED-CONTROL SYSTEM
USED

high-speed four-pole motor, running on Hess-Bright ball bearings, mounted on the yoke over the traction wheel and geared thereto for propulsion and steering of the truck. The Haschke non-resistance speed-control system is used. The battery is always in series, and the three speeds are obtained by cutting out (harmoniously on each pole piece) field coils. It is equipped with a speed controller, consisting of a single switch blade conveyed into three switch jaws, and is the only continuous torque control system on the market. The control of the motor can also be operated by the foot brake automatically. As standard equipment a fourteen-cell, fifteen-plate battery is used, either Gould, Exide or Philadelphia make.

Steering is accomplished by mounting direct to the steering head a large-size automobile steering wheel. The steering head revolves in a Timken

roller bearing and has two projecting arms terminating with small ball-bearing wheels running on a circular track, to withstand rough roadbed operating.

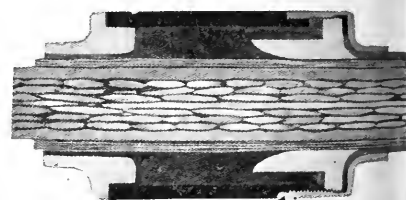
Light Controller

The automatic light controller here described is placed on the dash under the hood of an automobile and requires no adjustment or manipulation by the operator of the car. By means of a moving armature, which is automatically pulled under a magnetized field as the car speeds up and drops out as the speed decreases, the lights are kept practically constant throughout the range of speed of the car. It is manufactured for use on Ford cars in which an alternating-current magneto is used. The controller operates on the impedance or reactance principle. The American Sales Corporation is the sole distributor in the United States, with headquarters at 614 Fulton Building, Pittsburgh.

Cable Potheads

The Philadelphia Electric Company Supply Department of Philadelphia has placed on the market a cable pothead in which the base member consists of two parts so arranged that when they are screwed together they serve to clamp the lead sheath, forming an effective waterproof and so derless joint. The inner members form a static shield of the pothead and are constructed as to provide a gradually diverging concentric continuation of the inner surface of the metal sheath. By means of this form of construction the bellling effect can be reduced to a minimum, resulting in a compact design. When completely assembled the entire surface is surrounded by a compound which eliminates all air from this surface and distributes with absolute uniformity any static strain which arise, it is claimed.

The body of the pothead is con-

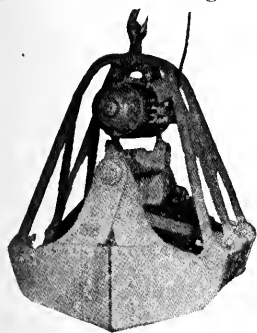


DETAILS OF PRINCIPAL ELEMENTS

structed of fiber, porcelain or metal dependent upon the class of service required. The cover is furnished with either disconnecting or non-disconnecting terminal bushings and is made of composition, porcelain or metal.

Electric Motor Clamshell Bucket

The Hayward Company, 50 Church Street, New York City, is manufacturing the electric motor bucket shown herewith. This bucket, as the name indicates, has as an integral part a

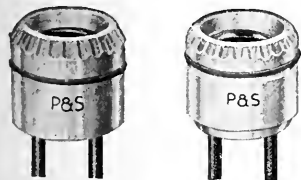


EQUIPPED WITH MOTOR-OPERATED WINDING MECHANISM

motor-operated winding mechanism which opens and closes the jaws of the bucket, making it an electrically operated unit. Attention is called to the fact that an important feature of this bucket is the introduction into the transmission of a multiple-disk clutch, its function being to slip and permit the motor to continue to run in case the edges of the bucket come together or are held apart by some obstruction, while the controller is in the closing position. This eliminates the necessity of limit switches, circuit breakers or similar devices, and makes the bucket practically "foolproof" in the hands of the ordinary crane operator.

Receptacles

P. & S. 4003, which is a companion piece to P. & S. 437, is a short-backed receptacle furnished with 6-in. (15.2-cm.) leading-in wires and has been de-



DIFFER ONLY IN SIZE OF BACK

veloped by Pass & Seymour, Solvay, N. Y. P. & S. 4035 is a screw-ring sign and outlet-box receptacle of the same series as P. & S. 437 and P. & S. 4003 and differs from P. & S. 4003 only in that it has a 1-in. (2.54-cm.) back.

Color-Matching Unit

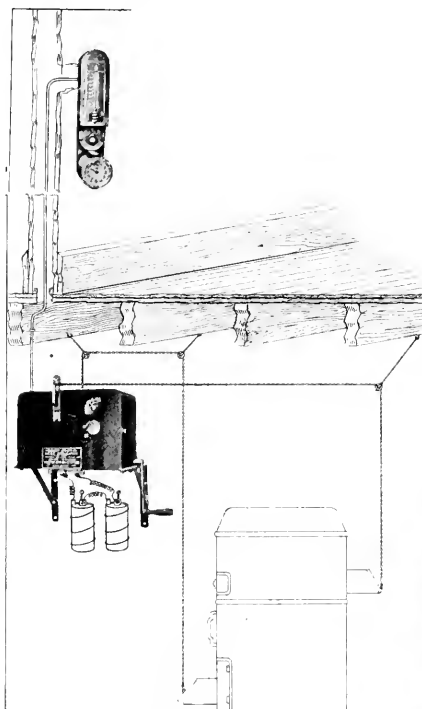
The Nela Specialties Division, Nela Park, Cleveland, Ohio, has developed and is marketing the new "Trutint" units, one a portable color-matching unit, the other a pendent unit. The pendent unit is a substantial fixture of pleasing design, made of spun brass, regularly furnished with a cloister finish. Other finishes may be obtained on special order. This unit is suitable for hanging over a showcase or counter.

The portable unit fills a demand for a color-matching unit suitable for use in high-class shops and stores. It is neat, of pleasing appearance, compact, substantial and adaptable to almost any service that may be desired of a color-matching unit. The reflector is of spun brass, the arm of steel, both heavily nickelled. The base is of iron, finished in black. The unit is recommended for use on counters or show-cases of shops of the highest class.

Heat Regulator

The Western Electric Company of New York is offering to the trade a heat regulator which, it is said, prevents the overheating of the furnace and thus the wasting of fuel. It permits the maintaining of comparatively low temperature at night and at a predetermined hour in the morning will automatically open the drafts.

A thermostat is mounted on the wall on the first floor. Connected to this is a cable running to a motor in the basement. A change of the room tempera-



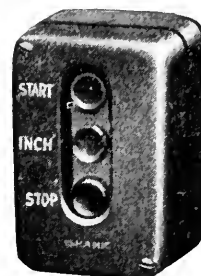
BATTERY-OPERATED HEAT REGULATOR

ture on the first floor of 1 deg. causes an electrical impulse to be sent to the motor box, and the drafts will be opened or closed as required. This device will regulate the underfeed draft and the check damper of either hot-air, steam or hot-water furnaces. It can also be applied so as to govern the main valve on gas, municipal or community steam-heating plants.

Two types are made, one for homes that are not wired for electricity where two cells of dry batteries on a substantial spring motor are furnished. The other type is used in homes wired for electricity. This is equipped with an alternating-current motor and a transformer to furnish low voltage for use on the thermostat circuit.

Master Switch

The master switch shown herewith has an "inching" button as well as a starting and stopping button. When the "inching" button is pressed the motor circuit is closed, but the starting resistance is not short-circuited, conse-



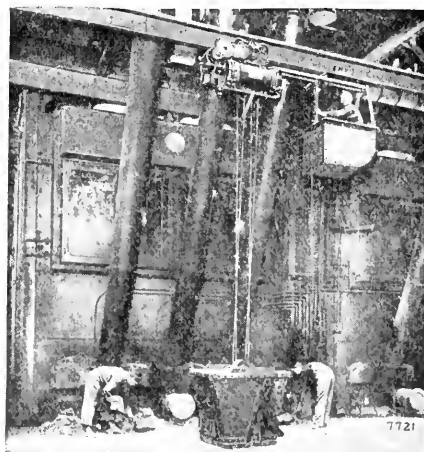
EQUIPPED WITH AN "INCHING" BUTTON

quently the motor starts, but only runs at a low speed and stops immediately pressure of the "inching" button ceases. This switch is a product of the Igranic Electric Company, Ltd., of London, Eng.

Electric Monorail Hoists for Handling Ashes

A monorail electric hoist with a bottom dumping bucket for handling ashes is made by the Link-Belt Company of Chicago. This machine runs on the lower flange of an I-beam track. It is operated by a man traveling in a trailer cage who controls the raising or lowering of the bucket as well as the travel of the hoist. The laborers who clean the fires fill the bucket with ashes; the operator then hoists the bucket and runs it out directly over the car, where it is dumped by the motion of a lever in the cage.

The machine is very compact and requires little headroom—an important consideration in an installation where it is necessary to get a large bucket over the side of a high-side gondola car.



INSTALLED IN BOILER ROOM

In many instances, an overhead bin cannot be installed for lack of space. It may then be practicable to use the same monorail hoist system to handle the coal as well as the ashes. Better even than this, a bucket with a small cnuite and under-cut gate is often used.

Trade Notes

THE ARNOLD COMPANY, constructing engineer, 105 South La Salle Street, Chicago, has discontinued its New York office at 111 Broadway.

THE CRESCENT ELECTRIC MANUFACTURING COMPANY of Pittsburgh, Pa., recently bought the entire stock of the Pittsburgh Armature Works.

R. J. MORGAN, formerly supervisor of sales for the American Steel Export Company of New York City, has been appointed assistant general manager of sales.

THE PETTINGELL-ANDREWS COMPANY of Boston, Mass., will open a branch soon in the Back Bay for distributing storage batteries and automobile supplies.

THE EMIL GROSSMAN MANUFACTURING COMPANY of Brooklyn, N. Y., on Jan. 13 held a winter meeting of the salesmen and department heads. A luncheon was also held. The company's executive staff was present.

THE CHINA PRODUCTS COMPANY of Zanesville, Ohio, has purchased the Virginian Potteries Company, its plant, manufactured products, tools, fixtures and raw materials. Possession was delivered to the new owners Jan. 30.

THE WAGNER ELECTRIC MANUFACTURING COMPANY of St. Louis, Mo., announces the opening of a service station at Seattle, Wash., to take care of this branch of its business in the State of Washington and the Northwest.

H. H. MILLER, formerly employed by the Doubleday-Hill Company, Pittsburgh, Pa., has accepted a position with the Square D Company of Detroit. Mr. Miller will cover the Pittsburgh territory, working in conjunction with D. M. Stone, manager of that district.

THE WESTINGHOUSE LAMP COMPANY of New York City has removed its advertising department from 165 Broadway (City Investing Building) to the Park Row Building, 21 Park Row, opposite the General Post Office. It has taken a suite of offices on the sixteenth floor.

P. C. GUNION has been made advertising manager of the industrial bearings division of the Hyatt Roller Bearing Company, Newark, N. J. Previous to his recent appointment he was manager of the company's office in Pittsburgh, Pa., and for two years was in the sales department.

FRANK J. FOLEY, formerly manager of the mining department of the Westinghouse Electric & Manufacturing Company, on Jan. 1 became connected with the Edison Storage Battery Company, Orange, N. J., as manager of the mining and traction department, with headquarters at the main office.

THE ESTERLINE COMPANY of Indianapolis, Ind., announces the appointment of the F. R. Jennings Company, 616 Ford Building, Detroit, Mich., as its sales representative for graphic instruments for Michigan. Mr. Jennings will handle that entire State for the Esterline Company, with the exception of the northern peninsula, which is taken care of by the Milwaukee office.

THE ERNER-HOPKINS COMPANY, Columbus, Ohio, held its annual sales conference and dinner in the Athletic Club rooms on Jan. 10. Twenty-seven men were present. Addresses were made by M. A. Dixley, vice-president and general manager; J. T. Dunnick, secretary, and V. G. Eastman, sales manager. Reports of the officers showed that the company had enjoyed one of the best years in its history.

C. H. SANDERSON, formerly assistant chief engineer of the Havana Electric Railway, Light & Power Company, Havana, Cuba, is now manager of the auto and truck departments of the Frank G. Robbins Company of New York and Havana. Mr. Sanderson will handle gasoline and electric pleasure cars and trucks, as well as storage batteries, and will also be in charge of the garage, machine shops and charging station in Havana and the sales and service work for the entire island.

THE MERCHANTS' ASSOCIATION of New York City has issued in pamphlet form a report of five conferences between employers and representatives of the British Ministry of Munitions. It is entitled "Readjustment and Operation of Industry in England Since 1914," and, besides the conference details referred to, also gives a summary of five additional conferences between a special commission from the British government and many employers of New York City, northern New Jersey and Connecticut. Copies may be had on application to the Merchants' Association.

THE WESTERN ELECTRIC COMPANY of New York City about the middle of the month will remove its distributing staff—clerical and heads of departments—from 483 West Street to the Broadway-Fifth Avenue Building, 221-225 Broadway and 149-151 Fifth Avenue, at Twenty-first Street. The company will occupy the thirteenth, fourteenth, fifteenth and sixteenth floors, comprising an area of about 45,000 sq. ft. The engineering department of the local company was cramped for room, and in order to provide for its expansion additional quarters were required. The new place is leased for a term of years.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY held its annual pre-holiday meeting on Dec. 21, 1917, at the Aiken Institute, Chicago. The annual meeting day has for several years been a sort of holiday. More than 500 persons attended the meeting this year. The remembrance to each employee was based on a Christmas present of \$5, plus \$1 for each year the employee had been in the service of the company. A few were present who received \$20 in their envelopes, which marks the extreme length of service, for the Benjamin company is a little more than fifteen years old. R. B. Benjamin, president, and W. D. Steele, vice-president and general manager, addressed the employees.

Trade Publications

SALES SERVICE.—The Society for Electrical Development, Inc., New York City, is distributing the February number of its *Monthly Sales Service*.

INDUSTRIAL TRUCKS.—The Enterprise Machine Works of Los Angeles, Cal., have prepared a folder descriptive of their electric industrial floor trucks and tractors.

MOTOR EQUIPMENT.—Motor equipment for textile service is described in leaflet 3910, prepared by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

LIGHT CONTROLLER.—The Barrett automatic light controller for Ford cars is described in a leaflet prepared by the American Sales Corporation, 614 Fulton Building, Pittsburgh, Pa.

MOTOR-GENERATOR SETS.—The Electric Specialty Company, Stamford, Conn., has prepared its bulletin No. 212, descriptive of its motor-generator sets for battery charging and signal work.

VACUUM PUMPS.—Bulletin 52, descriptive of Rees roturbo patent rotary jet vacuum pumps for surface condensers, is being distributed by the Manistee Iron Works Company of Manistee, Mich.

FLOOR-POLISHING MACHINE.—The Dale-Rey Corporation, 25 Church Street, New York City, has prepared a circular descriptive of its electric polishing machine for waxed floors of wood or linoleum.

LAMP PRICE SCHEDULE.—The Westinghouse Lamp Company is distributing its new price schedules effective Jan. 1, 1918. This schedule includes list-price changes on Mazda and metallized-filament lamps.

LOCOMOTIVES.—The Baldwin Locomotive Works of Philadelphia, Pa., are distributing record No. 88, descriptive of their Santa Fe type locomotives. They have also prepared record No. 89, descriptive of the development of the eight-driving-wheel locomotive.

GENERATORS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has prepared leaflet 3555-A, descriptive of its self-contained vertical shaft alternating-current generators. This company has also prepared leaflet 2000, giving information regarding its 10-kw. direct-current turbine-generator.

AUTOMOTIVE EQUIPMENT.—A special publication descriptive of starting motors, lighting generators and ignition units for automobiles, trucks, tractors, airplanes, motor boats and locomotives has just been issued by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This gives a general description of the Westinghouse starting motor for engines of piston displacement from 200 cu. in. to 1000 cu. in., and of Westinghouse generators of capacities from 15 amp. to 25 amp. at 6.5 volts to 13.0 volts. Among the latter are included the new cam-regulated generators which are being used on military and commercial trucks and on farm tractors. Generators thus regulated will give constant voltage over a wide range of speed even though the battery is disconnected from the circuit. The book is profusely illustrated with views of the apparatus and its various parts, and tables giving the necessary data for application are included.

New Incorporations

THE CLINTON (TENN.) POWER COMPANY has been incorporated with a capital stock of \$20,000 by R. A. Moser, J. W. Hill, H. D. Hicks and others.

THE MERIDIAN ELECTRIC COMPANY of Buffalo, N. Y., has been incorporated with a capital stock of \$50,000 by J. A. F. and E. M. Keppel of Ebenezer.

THE CONNOQUESSING LAWRENCE LIGHT & POWER COMPANY of New Castle, Pa., has been incorporated with a capital stock of \$10,000 to operate a local plant. E. C. Dunlap is one of the incorporators.

THE GAS ENGINE & ELECTRIC COMPANY of Charleston, S. C., has been incorporated by H. Stevens White, A. D. Wall and J. Ewing Bonneau. The company is capitalized at \$50,000 and proposes to manufacture gas engines.

THE CUTHBERT COMPANY of Dayton, Ohio, has been organized with a capital stock of \$500,000 by Charles S. Hall of the Hall Electric Company of Dayton and others. The company proposes to manufacture electrical devices.

THE STENMAN ELECTRIC VALVE GRINDING COMPANY of Worcester, Mass., has been incorporated with a capital stock of \$50,000. The officers are: B. F. Stenman, president, and Albert W. Larson, 10 Conway Street, treasurer.

THE HANAK CONVEYOR COMPANY of Houston, Tex., has been incorporated with a capital stock of \$5,000 by Edward Hanak, J. G. Belton and Robert Kornbeck. The company proposes to manufacture conveyors and trolley systems.

THE GUIDE & SIGNAL LIGHT COMPANY of Indianapolis, Ind., has been incorporated by Richard McClellan, L. Greenburg and Robert Eaglesfield. The company is capitalized at \$100,000 and proposes to manufacture electrical devices.

THE INVENTIONS BOARD, INC., of New York, N. Y., has filed articles of incorporation with a capital stock of \$5,000 for the purpose of manufacturing wiring apparatus. The incorporators are: P. D. Strogoff, O. B. and M. Wren, 5 Nassau Street, New York City.

THE UNITED ELECTRIC SUPPLY CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$20,000, to manufacture electrical machinery of all kinds. The incorporators are: F. M. Byrne, J. F. Byrne and H. H. Byrne.

THE UNEEDUS MERCANTILE CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$30,000 by I. E. A. Konigsberg, H. J. Lucke and S. M. Bender, 2 Rector Street, New York City. The company proposes to manufacture telephone and acoustic apparatus.

THE SUN-LIGHT ARC COMPANY of New York, N. Y., has been incorporated by M. M. Eisenberg, E. M. James, 2 Rector Street, New York City, and A. C. Head, 187 Martense Street, Brooklyn, N. Y. The company is capitalized at \$300,000 and proposes to manufacture patented arc lamps.

THE EVANWOOD BATTERY CORPORATION of Buffalo, N. Y., has been chartered with a capital stock of \$500,000 by H. E. Evans, H. J. Wood, 1358 Main Street, Buffalo, N. Y., and R. H. Templeton, 428 Ashland Avenue, Buffalo. The company proposes to manufacture chemical electric batteries.

THE BOSTON INSULATED WIRE & CABLE COMPANY of Hamilton, Ont., has been chartered with a capital stock of \$200,000 to manufacture cables, wire, etc. The incorporators are: Benjamin T. Burley of Worcester, Mass.; Harry B. Burley of Brookline, Mass.; Grant W. Arnold of Hamilton and others.

NATHAN A. KRISCHER of New York, N. Y., has been incorporated by N. A. Krischer, M. Krischer, 30 West 112th Street, New York City, and J. Weinstock, 1459 Minford Place, the Bronx. The company is capitalized at \$50,000 and proposes to manufacture metal and leather goods and novelties and gas and electrical supplies.

THE MONTGOMERY TRANSIT LIGHT COMPANY of Norristown, Pa., has filed articles of incorporation under the laws of the State of Delaware to construct and operate electric railways and light plants. The company is capitalized at \$1,000,000, and it is understood that it will take over the Montgomery Transit Company, which operates a railway from Norristown to Harleysville, a distance of 11 miles.

New England States

LENEX, MASS.—Application has been made to the State Gas and Electric Commission by the Lenox Electric Company for permission to issue \$51,000 in capital stock the proceeds to be used for additions and extensions to its system.

PLYMOUTH, MASS.—The Plymouth Electric Light Company is planning to extend its electric transmission line to Livermore Falls, a distance of 2 miles, to be completed June 15, 1918. A. F. Wentworth is treasurer.

DANBURY, CONN.—The National Electric Utilities Corporation has recently closed a contract with the Navy Department at Washington for 300 electric ovens to be used on Government vessels.

NORWICH, CONN.—At a special election held recently the voters authorized an appropriation of \$200,000 for the installation of a 3000-kw. turbine and two 500-hp. boilers in the municipal electric-light plant; also an appropriation of \$25,000 to install a new water-gas unit in the municipal gas plant.

WATERBURY, CONN.—The Mattatuck Manufacturing Company is contemplating the construction of a boiler house.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

FRANKLIN, N. J.—The installation of a new electric fire alarm system is under consideration by the Borough Council.

NEWARK, N. J.—The Board of Freeholders has awarded the contract for electric and power wiring at the County Hospital at Overbrook to the Beaver Engineering Company, 59 Mechanic Street, at \$14,174. Extensive improvements to the heating system at the institution are under consideration, to cost about \$75,000.

SKILLMAN, N. J.—Contract has been awarded by the Philadelphia & Reading Railroad Company of Philadelphia, Pa., to A. L. Carhart, of Philadelphia, Pa., for the construction of a power house and signal tower in Skillman, to cost about \$40,000.

SUCCASUNNA, N. J.—The New Jersey Power & Light Company of Dover has begun work on the installation of a new street-lighting system from Kenvil to Succasunna.

WHARTON, N. J.—The New Jersey Power & Light Company has submitted a contract (renewal) to the Borough Council for lighting the streets of the borough for a period of five years.

ASHLEY, PA.—Contract has been awarded by the Central Railroad Company, 143 Liberty Street, New York, N. Y., for the construction of an addition, 70 ft. by 70 ft., to its power plant at Ashley.

BENNINGTON, PA.—Contract has been awarded by the Pennsylvania Railroad Company for the erection of a new signal tower, 15 ft. by 25 ft., two stories, to P. W. Finn & Son, of Altoona, Pa.

HARRISBURG, PA.—The City Commission is considering the installation of a new electrically-driven pump and motor at the municipal pumping station. Improvements to the electric fire-alarm system are also under consideration.

KUTZTOWN, PA.—At an election held recently the proposal to appropriate \$15,000 to complete the municipal electric-lighting plant was carried.

NEW BLOOMFIELD, PA.—Plans are being considered by the New Bloomfield Hosiery Mills for equipping its plants for electrical operation, to replace steam power.

PHILADELPHIA, PA.—The Colver Electric Company has filed notice with the Public Service Electric Company of an issue of \$25,000 in capital stock, the proceeds to be used for improvements, etc.

PHILADELPHIA, PA.—The Tioga Steel & Iron Company, Fifty-second Street and Gray's Ferry Avenue, has awarded contract for the erection of an addition to its power house, to cost about \$8,000, to Crowell, Lunderd & Little Company of Philadelphia.

PHILADELPHIA, PA.—Bids will be received by William S. Twining, director department of city transit, City Hall, Philadelphia, Pa., until Feb. 14 for electrical installations in station buildings at Torresdale Avenue and Tioga Street, under contract No. 512. Plans and specifications can be seen at Room 748, Bourse Building, and copies obtained, with blanks for proposals, upon deposit of \$10, which will be refunded upon return of plans.

READING, PA.—Notice has been filed by the Metropolitan Edison Company with the Public Service Commission of an issue of \$97,500 in bonds, the proceeds to be used for improvements, extensions, etc.

FAIRMONT, W. VA.—George W. F. Mulliss of Martinsburg, agent of the Intervoven Mills at Fairmont, would like to receive estimates on electrical equipment for installation at Fairmont.

TIMBERVILLE, VA.—The local electric-light plant, owned by the estate of the late Charles E. Fahrney, has been purchased by Hoover Brothers.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 18, under specification (No. 2760) for mechanical equipment for power plants at Norfolk and Philadelphia navy yards.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 1671—miscellaneous leaded and armored interior communication cable, 145,000 ft. plain single-conductor wire; Schedule 1670—630,000 ft. incandescent lamp cord, 115,000 ft. rubber-insulated, lead-covered wire, miscellaneous duplex, single-conductor, rubber-covered wire, 120,000 ft. rubber-insulated telephone wire, 130,000 ft. twin-conductor wire. Schedule 1669—miscellaneous 12-in. desk and bracket fans. Application for proposal blanks should give the schedule desired by number.

North Central States

GRAND RAPIDS, MICH.—Preparations are being made by the City Council for the construction of a 300,000-gal. concrete reservoir for which bids will be advertised for next month. F. H. Leonard is superintendent of the light and water plant.

LOWELL, MICH.—The town of Lowell expects to take over the water-works system March 1. T. J. McMahon is superintendent of the municipal electric-light plant.

MUNISING, MICH.—The Electric Light & Power Company of Munising contemplates running a submarine cable to Grand Island, a distance of 1 mile, from the end of its service line. James Hosking is vice-president and manager.

MELBOURNE, KY.—Contracts have been awarded by the Sisters of Providence for the electric wiring of the administration building and mother house to Tisber Brothers of Covington. The cost of the building is estimated at \$200,000.

DECATUR, IND.—Contracts have been placed for one 500-kw. General Electric turbo-generator, with barometric jet condenser, to be installed in the municipal electric-light plant in the spring. R. G. Christin is clerk.

INDIANAPOLIS, IND.—The capital stock of the Standard Machine & Electric Company has been increased from \$75,000 to \$100,000.

MARION, IND.—The Delta Electric Company has increased its capital stock from \$90,000 to \$115,000.

MARION, IND.—The Indiana Public Service Commission has authorized the Indiana General Service Company, controlled by interests represented by R. E. Breed, of New York, N. Y., to purchase the properties of the Marion (Ind.) Light & Heating Company and the Muncie (Ind.) Electric Light Company.

BONDVILLE, ILL.—The Bondville Electric Light Company is considering the installation of power service for one or two elevators, which would require 20 hp. in motors each. The company would like to receive information and prices on equipment for same. Jay C. Flowers is secretary.

HOMER, ILL.—The Homer Electric Light & Power Company, recently taken over by J. M. Capel and others of Champagne, has been reorganized under the name of the Homer Electric Light Company. The new company is capitalized at \$30,000.

SOUTH BEND, ILL.—The building occupied by the Indiana & Michigan Electric Company was recently destroyed by fire, causing a loss of about \$120,000.

SWANSEA, ILL.—The municipal electric-light plant was recently destroyed by an explosion causing a loss of about \$15,000. Post office address, Belleville, Ill.

WOODLAWN, ILL.—The Southern Illinois Light & Power Company of Hillsboro has applied to the Public Utilities Commission for a certificate of convenience and necessity to operate an electric light and power plant at Woodlawn.

BLOOMER, WIS.—The City Council is considering the question of establishing a municipal electric-light and power plant.

DE SOTO, WIS.—The village of De Soto is considering the construction of a municipal electric-light plant.

HARTFORD, WIS.—Bids will be received by A. Martin, city engineer, until Feb. 19 for a deep-well pump and a two-phase, 60-cycle alternating-current motor, switchboard and temporary connections with water mains.

LAKE GENEVA, WIS.—Bids will be received until Feb. 4 for the erection of an electric line on Clover and Pleasant Streets west of Conant Street to the city limits.

SHAWANO, WIS.—Plans are being considered by the Shawano Lumber Company for the construction of a new lumber mill, to be equipped throughout for electrical operation, to cost about \$30,000.

STOUGHTON, WIS.—The Porter Electric Line Company, recently incorporated, it is reported, will erect an electric transmission line to connect with the Stebbinsville-Stoughton conduit system. The proposed line will be about 10½ miles long, and will extend from Dunkirk to the Cooksville-Edgerton Road, and from there to Cooksville, and thence to Tolles Corner.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received at the office of W. W. Wotherspoon, superintendent of public works, Capitol, Albany, until Feb. 5 for barge canal work, including construction of additional protection work in by-passes at lock and barge canal terminal, furnishing fourteen 2-ton steam tractor cranes, building freight house and four electrically operated timber derricks.

BROOKLYN, N. Y.—Contracts have been awarded for the construction of a new power plant, 55 ft. by 105 ft., at the Brooklyn Naval Hospital.

BUFFALO, N. Y.—The City Council has approved a bond issue of \$60,000 for the purpose of placing the wires of the police and fire departments underground.

GROTON, N. Y.—The Groton Electric Power Corporation, which has leased the municipal electric-light plant, is installing a 250-hp. Erie boiler. W. E. Yates is engineer of the power station.

NEW YORK, N. Y.—The J. F. & M. B. Construction Company is considering the construction of a new power house at 1562 Odell Street, the Bronx, in the near future.

NEW YORK, N. Y.—Plans have been filed by the New York Edison Company, 130 East Fifteenth Street, for the construction of a new transformer station at Park Avenue, near 139th Street, to cost about \$15,000. Contract has been awarded to the Louis Weber Building Company, 171 Madison Avenue, New York City.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 11, for piping and accessories, turbine-driven centrifugal pump, structural steel foundations and miscellaneous work in connection with the installation of new equipment in the central power plant at the navy yard, New York. Drawings and specifications (No. 2794) may be obtained on application to the above bureau or to the commandant of the navy yard named.

NIAGARA FALLS, N. Y.—Plans have been filed by the Oldbury Electric Chemical Company, Buffalo Avenue, Niagara Falls, for the erection of a new reinforced concrete addition to power house. The building will be about 35 ft. by 65 ft., and will cost about \$15,000. Contract has been awarded to G. W. Moyer & Son, 633 Tenth Street, Niagara Falls.

OXFORD, N. Y.—Bids will be received by Mrs. Georgiana Griffith, president of board of managers, of the New York Woman's Relief Corps Home, Griffith, until Feb. 13 for refrigeration plant. Drawings, specifications and blank form of proposals may be consulted and copies obtained at the Department of Architecture, Albany, the New York City office of the Department of Architecture, Woolworth Building, or at the home, Oxford, N. Y.

CAMDEN, N. J.—Plans have been filed and contract awarded to the Holbrook Cabot Rollins Company of Camden by the New York Shipbuilding Company for the construction of a new power house, 45 ft. by 95 ft., at its works at Broadway and Fairview Street.

DOVER, N. J.—The New Jersey Power & Light Company has entered into a contract with the International High Speed Steel Company for furnishing electricity for motors, lamps and electric furnaces at the plant of the steel company.

WEST ALLIS, WIS.—The Board of Education it is understood, will soon ask for bids for the construction and equipment of a high school and manual training institute. The building will be 176 ft. by 277 ft., three stories and basement, with a separate boiler house, to cost about \$200,000.

BROOKTON, MINN.—The installation of a 2½-hp. oil engine and a 1-kw. generator to take the place of the present storage battery in the municipal electric-light plant is under consideration by the Town Council. F. W. Sonnenberg is superintendent.

GLYDON, MINN.—Arrangements are being made by the Glydon Light Company for the installation of additional street lamps. H. C. Royle is secretary.

HIBBING, MINN.—The city of Hibbing is contemplating the construction of a new municipal electric plant, to cost about \$500,000. G. L. Thaum is secretary of water and light commission.

MILAN, MINN.—The Milan Light & Power Company contemplates the installation of a complete new storage battery in the spring. Messrs. Haughland & Kanten are owners.

PINE RIVER, MINN.—The Pine River Electric Light & Power Company expects to install a steam plant in the near future. Upon completion of the proposed new plant a 23-hour service will be established. T. L. Arvig is secretary and superintendent.

PIPESTONE, MINN.—Laundry, power plant and pumping system at the Pipestone Indian Training School were recently destroyed by fire, causing a loss of about \$25,000.

AMES, IOWA.—A new 600-kw. General Electric 2200-volt, three-phase, 60-cycle turbine is being installed in the municipal electric-light and water plant. A. F. Hill is manager.

INDEPENDENCE, IOWA.—Plans are being considered for an addition to power house at the State Hospital for Insane, for which, it is reported, bids will be asked in the spring. New equipment, including one generator and two boilers, will be installed. H. T. Liebke, State House, Des Moines, is architect.

PERRY, IOWA.—Bids will be received by the city of Perry until Feb. 15 for one 60-kva., two-phase, 60-cycle, 220-volt generator, directly connected to engine, to be installed at the municipal waterworks. Specifications may be obtained at the office of the city clerk. Adrian Cross is city clerk.

WATERLOO, IOWA.—Application has been made to the Board of Railroad Commissioners by the Citizens' Gas & Electric Company of Waterloo for a franchise to erect electric transmission lines to adjoining counties and towns.

BUCKLIN, MO.—The property of the Bucklin Light & Power Company has been purchased by H. A. Spradling, of Marcelline.

KAHOKA, MO.—Plans are being considered to extend the electric transmission lines of the municipal electric-light plant to Luray, Williamstown, Clark City and Medill in the spring. L. R. Sherrill is superintendent.

OREGON, MO.—The city of Oregon is planning to secure electricity from St. Joseph to operate the municipal electric-system and will erect a transmission line at once.

FULLERTON, N. D.—The Ellendale (N. D.) Electric Company has been granted a franchise to erect electric transmission lines from its Ellendale plant to Fullerton and Monango. G. F. Phillips is treasurer and manager of the company.

NOME, N. D.—The City Council is considering the installation of an electric-lighting system.

AINSWORTH, NEB.—The Ainsworth Light & Power Company has secured a contract to supply electricity in Bassett, and will erect an electric transmission line to Long Pine, where it will connect with the line to be built by the Bassett Distributing Company. W. V. Finney is manager.

ARLINGTON, NEB.—The Arlington Light, Heat & Power Company is contemplating the installation of a kerosene engine and changing its system from single phase, 125 cycles, to three phase, 60 cycles, 2200/110-220 volts. M. E. Winset is manager.

BENKELMAN, NEB.—The Council is considering the purchase of a 12-kw. generating unit (for engine service) soon for the municipal electric-light plant. J. R. Hardisty is manager.

BROADWATER, NEB.—The Broadwater Electric Light & Power Company is planning to install a new generating unit, consisting of a 50-hp. oil engine and a 35-kw., 125-volt direct-current generator. T. F. Black is engineer.

ERNST, NEB.—The Meyer Hydro Electric Power Company is considering extending its electric transmission lines to Nelson, Ong, Shickley and Tetyahere. Ernst Meyer is president and manager.

LONG PINE, NEB.—S. H. Kyner, owner of the local electric-light and power plant, is considering the installation of a 100-kw. generator, switchboard and one 20-hp. motor at his power plant; also two pumps and constructing about 4000 ft. of water main from city main to plant.

PIERCE, NEB.—The Pierce Milling Company is rebuilding its power house and installing an additional 50-kva. generator, to be driven by water power and a new 250-hp. Corliss steam engine. Frank E. Drebert is manager.

RED CLOUD, NEB.—The city of Red Cloud has rebuilt part of its pole line system to Riverton and Inavale, and is now erecting a single-phase transmission line to Incz. C. Z. Woodworth is superintendent.

SCHUYLER, NEB.—Plans are being considered by the City Council to rebuild the municipal electric-light plant. It is proposed to replace the present direct-current apparatus with an alternating-current equipment. E. A. Schmid is manager.

SIDNEY, NEB.—Improvements are contemplated to the municipal electric-light plant during 1918, including the installation of a 200-hp. boiler and a 150-kva. generator and engine. J. E. Poquette is manager.

STRATTON, NEB.—Improvements to the municipal electric-lighting system in the near future, including the installation of a 20-hp. semi-Diesel engine and a 10-kw. generator, are under consideration. Elmer Martin is engineer.

ARCADIA, KAN.—An electric transmission line will be erected from Arcadia to Oskaloosa to supply electricity to operate the local system, owned by Phillip K. Tohl.

CHARDON, KAN.—At an election held recently the proposal to issue \$25,000 in bonds for the installation of a new electric-light plant was carried.

COLBY, KAN.—Bonds to the amount of \$30,000 have been voted for improvements to the municipal electric-light plant.

GARFIELD, KAN.—The Kinsley Electric Light & Power Company has secured a contract to supply electricity in Garfield. An item published in the issue of January stated that local business men had entered into a contract for electricity from the municipal electric plant in Larned. A. L. Moe is owner and manager of the Kinsley Electric Light & Power Company.

HUGOTON, KAN.—The Liberal (Kan.) Light & Power Company is contemplating extending its electric transmission line to Hugoton to furnish electrical service here.

Southern States

CARROLLTON, GA.—Plans are being considered to double the output of the yarn mill of the Mandeville Mills. Four frame type motors having total capacity of 450 hp. will be purchased.

SAVANNAH, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 15 for furniture, lighting and repairs to conduit and wiring in the United States post office at Savannah. Drawings and specifications may be obtained at the above office.

MIAMI, FLA.—The Miami Traction Company is considering the construction of an electric railway between Miami and Miami Beach.

CHATTANOOGA, TENN.—The Tennessee Power Company, it is reported, contemplates additional hydroelectric developments and erection of transmission line extensions to prepare for supplying electricity to the explosive manufacturing plant the government will build at Hadley's Bend.

CLINTON, MISS.—Preparations are being made by the Town Council to install an oil-burning outfit in the municipal electric-light plant, but as yet it has been unable to secure an engine. M. Latimer is mayor.

HOMER, LA.—Preparations are being made to drill another well to double the output of the water supply of the municipal water-works system. W. A. McKinzie is superintendent of the municipal water and light plant.

BRISTOW, OKLA.—The City Council has decided to call an election to submit the proposal to issue \$36,000 in bonds for the purchase of the local electric-light and power plant to be owned and operated by the municipality.

CANYON, TEX.—The plant of the Canyon Power Company was recently damaged by fire.

DALLAS, TEX.—The Dallas Light & Power Company is contemplating erecting an electric transmission line from its local plant to Norwood.

HOUSTON, TEX.—The Houston & Texas Railway Company is contemplating the construction of an interlocking signal tower, 24 ft. high, at a cost of about \$16,000. I. A. Collingham is engineer.

Pacific and Mountain States

ELLENSBURG, WASH.—Application has been made to the Board of County Commissioners by Henry C. Mills for a franchise to erect and operate electric transmission lines on highways throughout the county for a period of 50 years.

SEATTLE, WASH.—Plans have been completed for the erection of a boiler shop, 180 ft. by 263 ft., for the Puget Sound machinery depot, to cost about \$75,000.

SEATTLE, WASH.—Bids will be received by the Board of Public Works, Seattle, until March 1 for construction of the proposed hydroelectric power plant to cost \$5,000,000. Bids may be submitted by either owners of sites or contractors in conjunction with owners of sites. It is probable that bids will be submitted on construction of a plant on the site to which the city of Seattle has just secured from the Government full rights on the Skagit River.

SPOKANE, WASH.—The erection of a charging plant for rebuilding electrical machinery and charging storage batteries is under consideration by the Chase Engineering Company.

PENDLETON, ORE.—Improvements are contemplated by the Pendleton Kolier Mills involving an expenditure of about \$10,000, and will include the installation of dump scales, conveyor belts and other improvements.

SAN FRANCISCO, CAL.—Work has begun on the construction of the shipbuilding plant of the Pacific Coast Shipbuilding Company at Bay Point. The buildings will include a plate shed, 80 ft. by 400 ft., two stories; machine shop, 120 ft. by 400 ft., one story, a large warehouse, power house, an office building, planing mill, etc. The launching ways will be 500 ft. long, 53 ft. wide, with 95 ft. clearance between. Aerial trolleys will be used for the transportation of supplies. The cost of the plant is estimated at \$500,000.

KINGMAN, ARIZ.—The Desert Power & Light Company is planning to extend its electric transmission lines to Hackberry and to Cyclopic.

BRIDGER, MONT.—The Bridger Water & Light Company contemplates changing its system from direct to alternating current, provided equipment can be secured. J. S. Emmett is secretary and treasurer.

Canada

BANFF, ALTA.—The Alberta Electro-Chemical Company is contemplating the installation of machinery at its plant at Kananaski Falls, Alberta, for the manufacture of carbide, etc. Dr. Harry Brett of Banff is in charge.

PRINCE RUPERT, B. C.—The Prince Rupert Hydro-Electric Company has submitted a proposal to the City Council offering to sell the Falls River plant, including improvements, to the city of Prince Rupert for \$34,000.

SYDNEY, N. S.—The Cross Fertilizer Company, Prince Street, it is reported, will rebuild its mill and engine room, recently destroyed by fire, at once. The cost is estimated at \$20,000.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 11 for furnishing soft steel, structural steel, plate steel, 100 ft. black pipe, trans-formers, 15,000 ft. cable, copper wire, 300 ft. conduit, 645 fixtures, one electric range, 600 reflectors, 75 resistance units, one fee pump, three hoist blocks, etc.

PANAMA.—Bids will be received at office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 6 for furnishing mill work for ordnance shop, two annunciators, 19 porcelain blocks, brass junction boxes, 50 vibrators, bells, 100 push buttons, 50 buzzers, tinne copper cable, 25 fans, 150 glass tube fuses, miscellaneous electric fixtures, 150 marine globes, electrical supplies, receptacles, sleeves, stuffing tubes, terminal boxes, conduit tubes, desk tubes, etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

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ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, September, 1918.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, M. C. Gilman, Toronto Electric Light Company.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, F. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

CONNECTICUT ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavelly, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

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FLORIDA ENGINEERING SOCIETY. Secretary, R. Benton, Gainesville, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. Morrow, Norman, Okla. Annual meeting, May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga. Annual meeting, June, 1918, Tybee Island, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections

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Printed in the First Issue of Each Month

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INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

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KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti, Louisville, Ky. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

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NATIONAL ARM, PIN AND BRACKETT ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

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NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell. Annual meeting, Silver City, N. M., Feb. 11-13.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekum Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PENNSYLVANIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davison, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, Inc. General Manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual meeting, June 19-20, Atlanta, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Bargebaugh, 703 First National Bank Building, El Paso, Tex. Annual meeting, April, 1918.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, March, 1918.

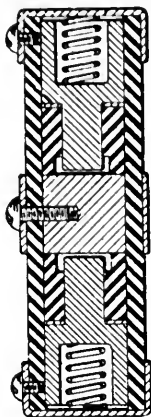
WISCONSIN ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

(Issued Jan. 1, 1918.)

1,251,818. ELECTRICALLY OPERATED SWITCH. Theodore Varney and Howard L. Beach, Pittsburgh, Pa. App. filed June 28, 1911. Necessity for heavy and expensive switch-board panels is avoided.

1,251,856. ELECTRIC SWITCH; Carl Barr, Chicago, Ill. App. filed March 26, 1917. Improved clip for co-operation with the knife of an ordinary knife switch in order to complete or break an electric circuit.

1,251,867. AUTOMATIC CARriage RETURN FOR TYPEWRITERS, LINE SPACERS AND RE-



1,251,572—Electrical Protective Apparatus—

VERSE TABULATORS; Thomas F. Crawley, Newton, Mass. App. filed Oct. 16, 1915. Improvements.

1,251,940. AUTOMOBILE SIGNAL; James J. Ulich, Des Moines, Iowa. App. filed July 13, 1916. Electrically operated.

1,251,967. CALL-ANSWERING METER FOR CORD CIRCUITS; Hiram D. Currier, Chicago, Ill. App. filed Sept. 19, 1914. Improved apparatus for actuating such a meter.

1,251,982. MULTIPLE-PHASE-MOTOR REGULATING RESISTANCE; Fredrik Ljungstrom, Finspong, Sweden. App. filed April 16, 1915. Resistances in which two conoidal or more or less funnel-form conducting parts and intervening fluid are employed to make the resistance.

1,251,983. CONNECTION FOR ELECTRIC CONDUCTORS; James H. Lockwood, Bridgeport, Conn. App. filed Jan. 29, 1917. Improvement.

1,251,985. AUTOMATIC SWITCH; Frank A. Lundquist, Chicago, Ill. App. filed Feb. 12, 1917. Improvements.

1,251,988. AUTOMATIC SELECTIVE SWITCH; James L. McQuarrie, Montclair, N. J. App. filed Nov. 15, 1916. Controlling means.

1,251,991. ELECTRIC-CORD PROTECTOR; Claude R. Dodge, Salt Lake City, Utah. App. filed Nov. 2, 1916. Will also serve as a shock-absorbing means.

1,252,028. TELEPHONE-EXCHANGE SYSTEM; Osvald E. Rasmussen, West Hoboken, N. J. App. filed Nov. 17, 1916. Improvements in automatic numerical switches used in automatic and semi-automatic telephone-exchange systems.

1,252,052. LOCOMOTIVE; Norman W. Storer, Pittsburgh, Pa. App. filed Aug. 10, 1915. Quill drive.

1,252,056. TELEPHONE RECEIVER; Naho Tannaka, Boston, Mass. App. filed Dec. 19, 1916. Improvements.

1,252,057. TELEPHONE TRANSMITTER; Naho Tannaka, Boston, Mass. App. filed Feb. 14, 1917. Improvements.

1,252,060. ELECTRICAL REGULATOR; Allen A. Tirrill, Pittsburgh, Pa. App. filed Oct. 5, 1911. Regulation is effected by adjustment of the field excitation of a dynamo-electric machine.

1,252,067. HOLDER FOR LIGHT-TRANSMITTING BOWLS AND REFLECTORS; Edwin L. White, Brooklyn, N. Y. App. filed June 13, 1917. Semi-indirect lighting effect.

1,252,110. THEFT DETECTOR FOR AUTOMOBILES AND OTHER VEHICLES; John H. Hills and Joseph M. Mason, Philadelphia, Pa. App. filed Jan. 9, 1917. Improvements.

1,252,141. ELECTRIC FUSE; Thomas E. Murray, New York, N. Y. App. filed Dec. 23, 1916. Tubular fuse case formed of struck-up sheet metal.

1,252,142. METHOD OF ELECTRICAL WELDING; Thomas E. Murray, New York, N. Y. App. filed Jan. 10, 1917. Improvements.

1,252,143. ELECTRIC WELDING MACHINE; Thomas E. Murray and Harry R. Wood-

Record of Electrical Patents

Notes on United States Patents

row, New York, N. Y. App. filed Feb. 19, 1917. Welds in succession a plurality of joints between the bodies to be united.

1,252,144. PROCESS OF AND APPARATUS FOR WELDING METAL BODIES AND FOR ANNEALING SAID BODIES AT THE WELDED JOINT; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed April 24, 1917. Improvements.

1,252,145. APPARATUS FOR ELECTRICAL WELDING; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed May 5, 1917. An apparatus for electrical welding, comprising an electrode having an opening constructed to receive and fit upon one of the bodies to be welded and an electrode connected to the other of said bodies, the first-named electrode being of a material having greater electrical conductivity than said received body.

1,252,146. METHOD OF AND APPARATUS FOR ELECTRICALLY WELDING PLATES OR BARS TOGETHER; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed July 13, 1917. Improvements.

1,252,147. METHOD OF ELECTRICALLY MAKING OPENINGS OF DESIRED CONFIGURATION IN METAL PLATES; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Oct. 10, 1917. Improvements.

1,252,148. METHOD OF AND APPARATUS FOR ELECTRICALLY DIVIDING METAL PLATES; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Oct. 10, 1917. Improvements.

1,252,185. DIAGRAM FOR ELECTROLYTICAL AND ELECTRO-OSMOTICAL PURPOSES; Botho Schwerin, Frankfurt-on-the-Main, Germany. App. filed Jan. 4, 1913. Improvements.

1,252,196. COMBINED FIRE AND BURGLAR ALARM; Arthur A. Taylor and Henry J. Schatz, Omaha, Neb. App. filed March 2, 1917. Improvements.

1,252,201. ELECTRIC METER; Elihu Tomson, Swampscott, Mass. App. filed Oct. 10, 1914. Direct current.

1,252,203. RHEOSTAT; William F. Valcke, Jr., Chicago, Ill. App. filed Oct. 30, 1916. For regulating the amount of current which is supplied to a lamp or other apparatus connected to the socket.

1,252,216. TELEPHONE TOLL SET; Clarence A. Anderson, Abilene, Kan. App. filed April 30, 1917. For small stations.

1,252,219. BRIDGING DEVICE FOR FUSE RECEPTACLES; Clarence A. Bates, Bridgeport, Conn. App. filed Jan. 21, 1916. Improved.

1,252,288. SIGNAL; Charles W. Monahan, Pittsburgh, Pa. App. filed Jan. 31, 1917. For trains.

1,252,289. METHOD OF PRODUCING INTEGRAL PROJECTIONS ON METAL PLATES; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Oct. 4, 1917. Improvements.

1,252,290. METHOD OF LOCALIZING AND ELIMINATING IMPERFECTIONS IN ELECTRICALLY WELDED JOINTS; Thomas E. Murray, New York, N. Y. App. filed Nov. 1, 1917. For eliminating imperfections due to make and break of the welding current.

1,252,312. ELECTROMAGNETIC ACTUATOR; Henry E. Warren, Ashland, Mass. App. filed March 7, 1913. For valves, circuit breakers, etc.

1,252,314. METAL CONDUIT FOR ELECTRIC WIRES; Chauncey W. Abbott, Pittsburgh, Pa. App. filed Aug. 18, 1915. For application to a wall, ceiling or other exposed supporting surface.

1,252,317. SEWING-MACHINE MOTOR; Chester H. Beach, Racine, Wis. App. filed June 21, 1915. Improvements.

1,252,330. AUTOMATIC TRAIN STOP; Adiel Y. Dodge, Chicago, Ill. App. filed Jan. 28, 1914. Capable of causing the brakes to be applied gradually, and such that it may be used also in connection with throttle-closing apparatus.

1,252,353. INSULATING SUPPORT; Horace P. Liversidge, Philadelphia, Pa. App. filed March 9, 1917. Novel manner of fastening the base supports and metal tops to insulators.

1,252,372. INCANDESCENT LAMP; William A. Duffah, Mansfield, Ohio. App. filed July 31, 1914. Increases the efficiency of incandescent lamps by reducing the loss of heat by the continuous passage of a relatively hot filament or the radiating element of the lamp.

(Issued Jan. 8, 1918.)

1,252,393. THERMOSTATIC CIRCUIT CONTROLLER; Charles R. Burlew, Yonkers, N. Y. App. filed March 22, 1915. Wheel-like construction is preferably provided.

1,252,399. TELEPHONE EXCHANGE; Henry P. Clausen, Mount Vernon, N. Y. App. filed April 12, 1917. In which a plurality of subscribers' stations are connected to the same line circuit.

1,252,403. ELECTRIC FIXTURE; David Conlan, Jr., New York, N. Y. App. filed Nov. 8, 1915. Does away with the necessity for splicing and soldered joints now employed in making connections at outlet boxes between main and branch conductors.

1,252,413. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; Lewis E. Dickinson, Boonton, N. J. App. filed Nov. 6, 1916. Hea coils.

1,252,417. ELECTRIC SWITCH; Evald C. Engelke, Cleveland, Ohio. App. filed March 21, 1917. Improvements.

1,252,427. TRANSMISSION SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Oct. 8, 1915. For establishing communication between a moving train and a central or dispatcher's station.

1,252,443. PROCESS OF MAKING METALS IN ELECTRIC FURNACES; Ernest Humber Welland, Ontario, Canada. App. filed April 26, 1917. For producing a metal containing a certain percentage of carbon in the electric furnace.

1,252,451. VOLTAGE REGULATOR; Charles F. Kicklighter, Pasadena, Cal. App. filed June 16, 1911. Improved automatic voltage regulator which may be employed in connection with any of the well-known forms of arrangements for controlling alternating-current circuits.

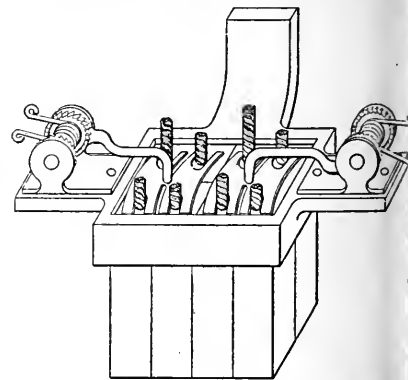
1,252,462. AUTOMATIC SWITCHING MECHANISM; Frank A. Lundquist, New York, N. Y. App. filed Aug. 16, 1916. Patent type.

1,252,492. ENTRANCE SWITCH; Clarence A. Platt, Bridgeport, Conn. App. filed March 3, 1917. Inclosed type of switch.

1,252,493. INCLOSED-SWITCH CONSTRUCTION; Clarence A. Platt, Bridgeport, Conn. App. filed April 6, 1917. Means for permitting locking of the switch in the open-circuit position.

1,252,498. ELECTRIC SWITCH; Sidney Samson, Duluth, Minn. App. filed Jan. 3, 1917. Disconnecting knife-blade switch.

1,252,502. PROTECTIVE CIRCUIT; Hebert I. Shreeve, Millburn, N. J. App. filed Feb. 1, 1915. Provides an auxiliary protection against excess current which shall be ineffective during such period as the maximum-current-limiting device is ineffective.



1,251,827—Brush for Electrical Machinery

1,252,504. X-RAY APPARATUS; Homer Snook and George H. White, Haverford, Pa. App. filed May 26, 1915. Improvements.

1,252,560. ELECTRIC SWITCH; Clarence Evans, Milwaukee, Wis. App. filed Dec. 15, 1914. Snap switch.

1,252,586. ELECTRIC SWITCH; Charles Klein, Milwaukee, Wis. App. filed Jan. 30, 1915. Snap switch.

1,252,587. ELECTRIC CANDLE AND T-LIKE; Charles J. Klein, Milwaukee, Wis. App. filed Nov. 13, 1915. Improvement.

1,252,615. CURRENT RECTIFIER; Charles Quill, San Francisco, Cal. App. filed Sept. 25, 1916. Improvement on mechanical pole changer.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Volume 71

New York, Saturday, February 9, 1918

Number 6

Electricity a Factor in Increasing Coal Production

COAL shortage has not been without its redeeming feature so far as the electrical industry is concerned. In the anthracite region, especially where labor shortage is a handicap, operators have turned to machinery to increase production, and it is of interest to note that no other class of material has been in so great demand as electrical equipment. Had manufacturers been able to make deliveries, 1917 would have been a banner year. Shovels, hoists, drives, haulage systems, pumps, blowers and other machinery are being equipped more than ever with electric motors. The cry is for electric power, and central stations throughout the coal regions are now not hunting for markets but for equipment to keep up with load requirements. Electricity has maintained its reputation; production has been increased despite 5 per cent labor shortage, and, more than that, low costs can now be mined profitably.

Central Stations Should Take Nothing for Granted

HOUSING of the army of workers necessary at shipyards and other places engaged in war work is one of the serious problems confronting the government. In the model communities already erected all the homes have been equipped with electricity, not because of any special urging by the electrical industry but because the designers feel that electricity is the proper thing. Some day, however, the gas companies may show enterprise and these new communities and cities may be won over to the use of gas for illuminating, heating and cooking purposes. It is not wise, therefore, for the central-station industry to take anything for granted. The tortoise has been known to outrun the hare.

Constructive Criticism Needed on Water-Power Bills

WITHIN a very short time hearings will be held on water-power bills now before Congress. It is not expected that any new light will be thrown on the general proposition, for there is no subject before Congress that has been more talked of, at and for during the last decade. The need is recognized by all, and the opportunity for the passage of a constructive measure was never more favorable. But if a deadlock between the Senate and House is to be avoided—consummation devoutly to be wished—factional differences must in large measure be put aside. The so-called "administration" bill admittedly offers a simple

solution of the water-power legislation problem and is an improvement over other measures. It seeks to protect the rights of the public and at the same time to offer private capital adequate security for its investment. In short, it is 90 per cent good and the other 10 per cent is not irremediably bad. If, therefore, constructive criticism be offered on the minor defects of the measure, due allowance being made for honest and irreconcilable differences, a satisfactory compromise on these detail features may be effected and the necessary legislation finally enacted. To defer action longer on our water powers would in itself be criminal, and to damn the "administration" measure because of any slight imperfections, and thereby wreck all hope of a reasonably fair bill, would be more so.

Concrete Poles in Power Distribution

THE use of reinforced concrete for electric line poles is not new, but the example which we describe this week is in several respects somewhat out of the ordinary. The case in which poles were required was for a private distribution line to seven pumping plants in California. The transmission to be accomplished was at 22,000 volts and the aggregate power demanded 2800 hp. In this case the permanency of the installation, with perhaps somewhat greater security against line trouble, was the deciding factor in the choice of reinforced concrete. The poles were designed as square, tapered beams, reinforced symmetrically on two sides. For economy of material two sizes of poles were designed, the heavier ones to be used at each substation and for every fifth pole on the line as well as at crossings. The lighter poles served for the remainder of the work. The spacing adopted varied from 250 ft. to 390 ft. (76.2 m. to 118.9 m.).

A striking feature of the construction is that the cross-arms were molded with the poles and the whole work of molding was done on the ground on account of the great weight of the finished pole, averaging about 4 tons. The forms were laid out horizontally, reinforcement was suspended in place, and the concrete was hand-mixed and molded into them. In the cross-arms the reinforcing is of steel angle irons, which carry the insulator pins directly so that even were the concrete to be broken from the arms the stability of the conducting system would not be disturbed. After completion the poles were erected by a double derrick mounted on a derrick. The derrick was put in position, the pole caught just above its center of gravity by a chain sling, and the pole lifted on end and dropped into its hole. The average cost per pole erected was a little

less than \$70, divided with fair equality between material and labor. The poles were designed with a high factor of safety, in fact so as to withstand a 90-mile (144.8-km.) wind with all the wires on one side broken, a condition thought considerably more severe than is likely to be actually encountered in the operation of the system. It is safe to say that so far as the strength and stability of the poles go that particular line will be immune from trouble due to wind and weather for a long time to come.

A Step Toward Synchronous Operation

OPERATING engineers will be interested in a brief account we publish this week of the line-synchronizing stations of the Central Illinois Public Service Company. Two such stations have recently been erected to facilitate the interconnection of two branches of the great system, each comprising about 250 miles (402 km.) of 33,000-volt network. Previous to this installation the lines did not generally operate in parallel, and when it became necessary to do so synchronizing at one of the distant stations involved some time and annoyance. Just why these two networks have not regularly been tied in in parallel it is a little hard to see, but there are many such cases of neglected opportunity, and it is altogether pleasant to see the obvious step toward unified distribution being so effectively taken, especially at this time when every effort is being made to conserve fuel, labor, capital and equipment and still keep up the standards of service.

It was found in every-day practice that it took twenty minutes or so of juggling load and frequency, via long-distance telephone, to make the interconnection successfully. As the necessity for parallel operation grew, the present improvement was made. Two simple stations with synchronizing apparatus have been put out on the lines at the necessary interconnection points. Their arrangement is of the simplest possible character. Provision is made for interconnection of the apparatus and for cutting out a necessary section for repairs or inspection. For still further simplicity the synchroscopes used are of the electrostatic variety, which are found to operate admirably and give practically a considerable advantage in the absence of costly instrument transformers and their numerous accessories.

For this reason alone the installation of the electrostatic instrument saved more than \$500 in each of these synchronizing stations. As time goes on, the necessity for such stations is likely to increase. Larger and larger networks would be normally operated in parallel, as many of them are to-day. It may be necessary now and then, under these circumstances, to split off certain sections of the network while still keeping them in operation, for the sake of convenience in repairs or dealing with certain emergencies of load. It is then a great convenience to be able to synchronize and reunite these sections at any convenient point in the shortest time possible. Such special synchronizing stations, therefore, as those here described, under the control of the load dispatcher, may serve an exceedingly useful purpose, and the complete simplicity of the layout should encourage its more frequent use.

The Inductance of Long Reactance Coils

IN ELECTRICAL engineering one of the devices most frequently encountered is a coil of insulated wire. There are all kinds of coils. Their name is legion but they all have inductance. Their inductance is often a property of preponderating importance in the behavior and use of the coil. From the standpoint of inductance all coils may be divided into two classes, namely, those having magnetic cores and those having non-magnetic cores. The inductance of coils containing magnetic cores is so complicated, and depends on so many factors, that, in the discussion of their behavior, the conception of inductance is commonly relinquished. On the other hand, the inductance of coils with non-magnetic cores is a very valuable property, from the technical standpoint. It ordinarily remains nearly constant over a wide range of operating frequencies and current strengths.

For many purposes it is important to predetermine the inductance of a coil of given dimensions during the stage of its design and in advance of its construction. The conception of the inductance of an air-cored coil is easy. If we suppose that 10 amp. or 1 absampere of current flows steadily through the coil, we may imagine that all the magnetic flux lines or maxwells become visible to the eye and can be counted. Actually, of course, we can only visualize these flux lines in the mind's eye with the aid of pictures obtained from scattered iron filings. If now we count, in imagination, all the maxwells linking through each turn of the coil, the sum total of all these linkages for all the turns in succession will be the total inductance of the coil, expressed in abhenries.

The numerical realization of the inductances of such coils is, however, mathematically difficult, owing to the complexity in the distribution of the magnetic fluxes linked with them. Only in certain easy cases, such as closed circular solenoids or very long simple helices, is the formula a simple one. Various formulas have been published for different degrees of approximation, some simple and others more complex.

The article by H. B. Dwight this week on the subject is of considerable interest. He divides all non-magnetic cored reactance coils into long coils, short coils and flat coils. The "longs" have their lengths greater than their mean diameters. The "shorts" have their lengths less than their mean diameters but greater than their radial winding thicknesses. The "flats" have their lengths less than their radial winding thicknesses. This seems to be a useful basis for classification. The article supplies engineering formulas for the long coils only, it being the author's intention to discuss short coils later. The formulas are rather long, but they are definite and easily worked out, as is evidenced from the two problems which are cited in the text of the article by Mr. Dwight.

Incidentally it is noticeable that it is advantageous from an engineering standpoint to measure the dimensions of a coil in centimeters rather than in inches, and to express the inductance in abhenries rather than in henries, in order to obtain the simplest formulas. By this means, as the article indicates, certain constant perpetually appearing in the arithmetic can happily be eliminated.

Power at the Mine's Mouth

FOR a good many years past engineers with large vision of the future have dreamed and preached about the electrical transmission of power on a large scale from cheap coal burned at the very mine itself. But of it all little has come until very recent years, but to-day the projects for great networks fed from colossal generating stations and supplying the varied industries of a huge territory loom large on the horizon. They are beginning to come to realization, and it is a pleasure to give in our columns this week some further account of the first great system of the kind to undertake the fulfillment of its mission in the United States. The Windsor plant lies in the load center of the great manufacturing district concentrated in eastern Ohio, western Pennsylvania and the adjacent corner of West Virginia. From a physical standpoint the location is an exceptionally good one, too, inasmuch as an ample supply of good coal is available from a mine adjacent to the station. To-day it has a capacity of 60,000 kw. in two huge units, with four more to be added in the near future, two of them within the current year.

The boiler plant carries out the large proportions of the whole project, for there are but four boiler units for each turbo-generator, carrying 250 lb. pressure and furnished with superheat to 250 deg. Fahr. Each pair of turbines discharges into a single condenser pit, with the Ohio River for source of supply. Condensation involves some serious problems inasmuch as the river varies 50 ft. (15.2 m.) between high and low water. Each condenser pit is therefore carried down 74 ft. (22.5 m.) to take care of this extraordinary variation in level. Inasmuch as the boilers are also fitted with economizers, the auxiliaries are in the main motor-driven and are on a somewhat startling scale, requiring 600 hp. in motors for the two hydraulic air pumps and the two hot-well pumps in each condenser pit. The whole conception and execution of the project is on the basis of great output produced with the utmost economy, and it is estimated that from its situation at the mouth of the mine the plant even now releases to the railroads for other service about 4000 cars, thereby freeing locomotives, tracks and terminals. The significance of this feature, considering the dire lack of transportation facilities, is obvious. When the present plant is completed it will be one of the very largest central stations in the world, either steam or hydraulic, and cannot fail to

produce important industrial results in its territory.

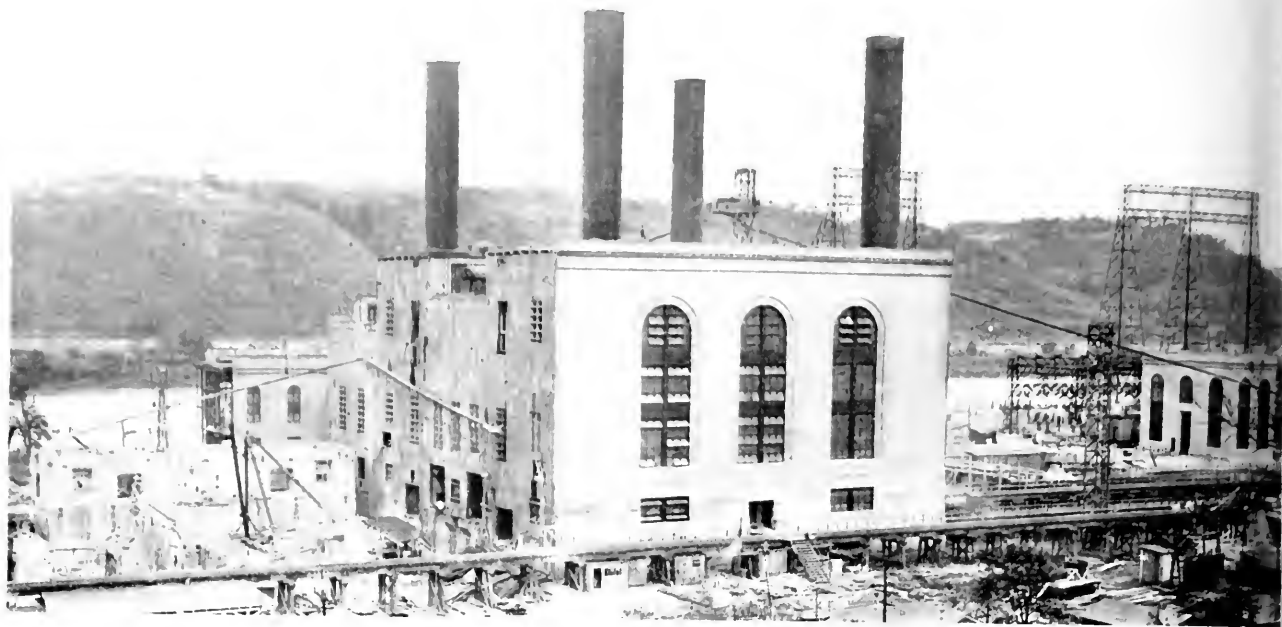
It is interesting, too, inasmuch as it is owned in common by two companies, the Central Power Company and the West Penn Power Company. It is probably the first case of two independent companies thus operating a joint generating plant, and the idea of physical union has been carried even beyond this so as to include some of the transmission and distribution facilities. The two companies had each considered building a plant, but found that the joint enterprise would cost not much more than half the sum required for the two separately, owing in no small measure to the great cost of the condensing system. Working as a single station there is a better diversity factor and a higher load factor, to say nothing of elimination of no small number of lines for distribution. To conserve the interests of the two companies the perhaps unnecessary precaution was taken of building the plant on each side of a center line, so that its halves could be operated separately if at some future time it should seem desirable, and for simplicity the respective shares in the plant have been leased to an operating company which takes up the fixed charges and bills the component companies only their respective shares of the operating expense.

This has been determined in a rather ingenious way. Each item of the operating expense has been divided into a capacity charge and an output charge as fairly as has proved feasible. Then each company is charged on the basis of maximum demand and of annual consumption according to the weights given respectively to each of these factors. In this way each distributing company buys its power in bulk of the operating subsidiary on a fair division of costs. The arrangement is somewhat unusual but seems exceedingly practical. At all events, through this conjoint effort the beginnings have been made of bulk supply on a basis which brings at last a great possibility to realization. The experience of the last few years has very plainly shown that save under exceptional circumstances an economical steam plant can give hydroelectric stations a hard rub in the matter of cheap production of energy. Great sections of the country can be reached from commensurate hydraulic sources only by very long transmission lines, and if these are to be undertaken the ultimate ends of efficiency would be best served by turning the hydroelectric systems to the service of regions destitute of coal and permitting the latter to meet their own needs and reach out to adjacent territory as has been done in this admirable pioneer system.

WITH transportation facilities as congested as they are at present, the placing in operation of a bulk-supply generating station at the mouth of a coal mine is more than welcome, as it releases many coal cars, locomotives, tracks and terminals which would otherwise be required to serve a number of local generating stations. These advantages are particularly noticeable in the case of the Windsor (W. Va.) power plant, described in this issue, as it serves a great industrial district containing many coal mines, clay-products factories and steel mills which would have difficulty in operating isolated plants owing to the scarcity and poor quality of boiler-feed and condensing water available. The electrical features of this plant, including switching, trans-

The Coming Issues

forming and auxiliary drive arrangements, will be discussed in the next issue of the ELECTRICAL WORLD. Another feature of the Feb. 19 issue will be a particularly complete discussion of the fuel and maintenance savings possible from treating boiler-feed water. Results of numerous investigations are reported, relative advantages of different water-treating methods are outlined, and the amount which can be economically spent for treating apparatus will be calculated for a specific case. In addition to other articles which should be of interest to engineers with electric service companies, consulting firms, industrial plants, etc., there will be an article giving the results of an investigation to determine the effect of frequency and wave form on the performance of mercury-vapor rectifiers.



Bulk-Supply Generating Station at Mouth of Min

Features of the Windsor (W. Va.) Power Plant Now Being Operated Jointly by Two Companies—Arrangements Which Have Been Made for Dividing Operating Expense

WHEN considered in retrospect, the construction of the Windsor (W. Va.) plant of the American Gas & Electric Company and the West Penn Power Company will probably be looked upon as marking a new epoch in the central-station industry. Far-seeing engineers and central-station executives now view it as a pioneer station; they see it as one of an interconnected group of great plants strategically located to produce large quantities of energy so cheaply that it may be economically transmitted over wide areas to serve one of the greatest industrial districts in the world. It is true that plants have been built at coal mines before; but they have usually been handicapped by the quantity or quality of water available and have not been so convenient to large markets for energy. Before another year lapses the station will rank among the world's largest steam plants. It is the initial step toward carrying into actual practice in a broad way what has proved to be successful on a smaller scale in the Middle West with steam and in the Far West with hydroelectric power.

As a bulk-supply generating station the Windsor plant has an enviable location. Being on the Ohio River, it has an ample and dependable supply of water for condensing purposes. No other place between the Great Lakes and the Ohio River affords such a good and reliable supply. Plenty of good coal (13,500 B.t.u.) is available and easily securable, as a forty-five-year contract is signed with a coal mine adjacent to the station. Being situated at the mouth of the mine, the Windsor plant releases to the railroads of this country about 4000 cars,* the number that would be required were the energy developed by this plant produced locally. The plant operates at the high economy of 18,-

000 to 19,000 B.t.u. per kilowatt-hour, thereby saving about 3,500,000 tons of coal annually over that which would be required if the energy were produced in small local plants. This plant has the further advantage serving a territory in which the general run of boiler feed water gives enough trouble to isolated plants to make central-station service especially desirable to them.

From an electrical point of view the plant is also excellently situated. It lies in what is practically the center of the eastern Ohio, western Pennsylvania and Wheeling (W. Va.) industrial districts, being within 65 miles of some of the largest industrial centers in this country—Pittsburgh, Youngstown, Wheeling and Canton—with their coal mines, steel mills and clay products factories. In addition, the station is within one day's ride and two days' freight distance of 60 per cent of the population of the United States. Lying between the Eastern and Central time belts, the station benefits from the diversity in demand which comes from serving loads thrown on systems at different times because of the arbitrary shifting of clocks as the meridian is passed.

This station is particularly interesting because it represents the first case where two independent electric service companies have attempted to operate a generating plant jointly. This pooling of facilities has been extended beyond the generating station, however, to include some of the transmission and distribution facilities. The idea has frequently had its advocates, but until this instance no practical solutions have been found for handling the financial problems involved in making separation possible in case it is desirable to end joint ownership and operation.

Joint ownership was undertaken in this case because both the Central Power Company, a subsidiary of the American Gas & Electric Company, and the West Penn

*Based on number of cars in transit, loaded or returning, time required for loading and unloading, etc.

Power Company had separately considered building their own plants and found it would cost almost twice as much as for one jointly owned plant. This conclusion was reached because very expensive condensing water facilities are necessary owing to the large rise and fall (53 ft.) in the Ohio River. Furthermore, more reserve units and two operating forces would have been required if two independent plants had been built. As it is, a better diversity factor and hence a higher load factor are obtained. The same thing holds true with the distribution of energy. In some places the two companies have consumers in the same territories, which condition would have required duplication of lines if separate systems were employed.

To avoid the objections ordinarily raised to joint ownership the plant has been built on each side of a center line, so that at any time when the companies wish to operate they may take over separate and distinct plants. The financial problems have been simplified by the owners leasing their shares of the plant to an operating company, of which the Central Power Company and the West Penn Power Company each own 50 per cent of the stock at present. As the fixed charges are covered in this way, the operating company will bill the separate companies only for their respective shares of the operating expenses.

The prorating of the operating expenses has been simplified by dividing each item (Table I) into a capacity and an output charge, thereby compensating for the power factor and load factor. The ratio of the capacity charge to the output charge was arbitrarily chosen in each case, the proportion being obvious in most cases. For instance, supervision has to be provided regardless of whether the plant is operating or not, whereas the amount of fuel used is almost entirely dependent on output, a small percentage, of course, being required for banking. The capacity charge is based on the fifteen-minute integrated peak as actually measured.

From the analysis of each operating expense item it was found that a weight of 63 should be given to the maximum demand and 37 to the actual energy consumed. Thus if one company's maximum demand is

10,000 kw. and its annual consumption 25,000,000 kw.-hr., it will pay $(10,000 \div \text{plant capacity}) \times 0.63$ total operating expense and $(25,000,000 \div \text{total output}) \times 0.37$ total output expense. Similar arrangements are made for dividing transmission expenses where the lines are jointly used.

The ultimate rating of the station as it is now laid out will be 180,000 kw. in six units. Sixty thousand kilowatts of this rating is now provided in two ma-



FIG. 2—ROTATING SCREENS STRAIN THE CIRCULATING WATER

chines, and two additional units will be completed in 1918. The last two units will probably be installed shortly thereafter. For each turbine there are four boilers with 12,625 sq. ft. (136.0 sq. m.) of surface apiece. Each boiler is equipped with a separate economizer and induced-draft fan set over the boiler. Forced draft is also applied under the underfeed stokers. The boilers are arranged on both sides of a wide firing room. Along the center of this room is a large concrete coal pit into which fuel is delivered directly from the mine. From the pit coal is delivered to individual hoppers in front of each boiler.

In the turbine room the machines are set in a single line with their axes parallel to the firing aisle of the

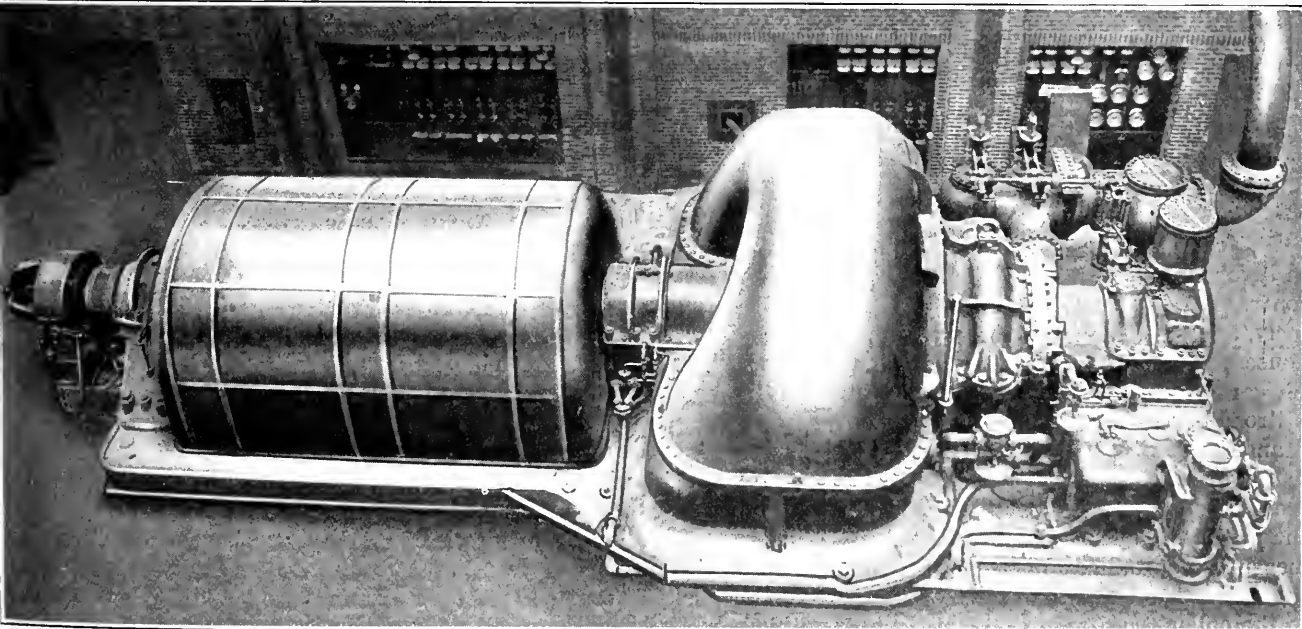


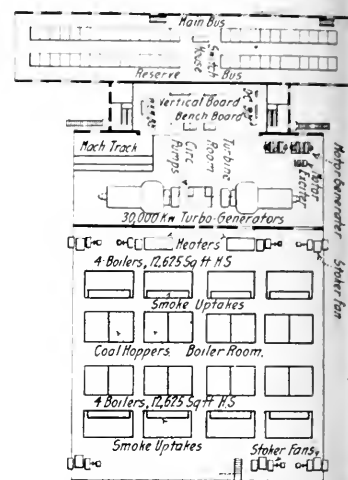
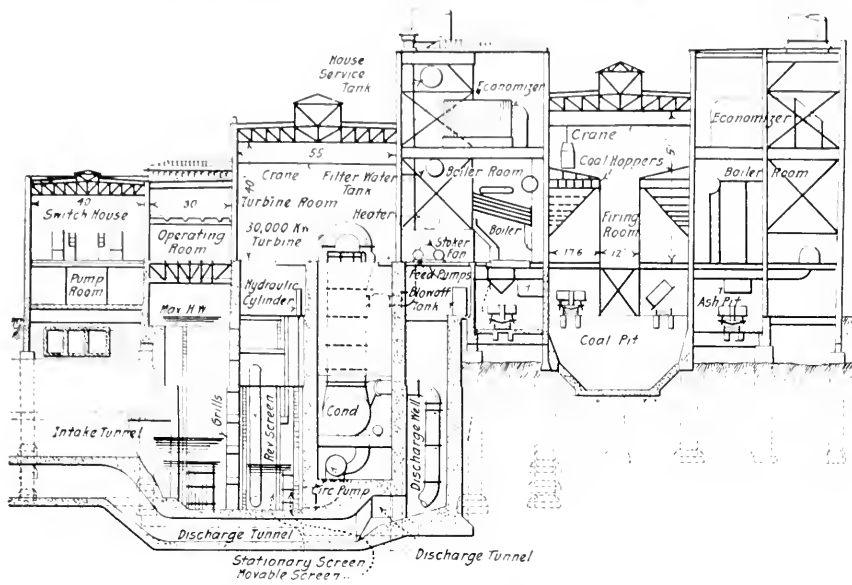
FIG. 1—ONE OF THE 30,000-KVA. TURBO-GENERATORS IN THE WINDSOR PLANT

boiler room. The steam ends of the turbo-generators installed are placed adjacent to each other and directly over a single condenser pit, an arrangement which will be carried out with each pair of units added. This scheme was employed to avoid the expense of two condenser pits, and to facilitate operation of the steam auxiliaries as well as the main units. The walls of the condenser pit serve as a foundation for the main turbines.

A very deep condenser pit was required—74 ft. (22.5 m.) below the main floor level—to permit placing

a 3-cu. yd. (2.29-cu. m.) grab bucket operated from an overhead crane. After being weighed it is dropped into the individual hoppers which serve each boiler. This indirect but effective method of handling coal inside the boiler room permits a rather large quantity of fuel to be carried inside the plant without great expense, since it was possible to construct the coal pit of concrete instead of steel. A large coal-storage yard will be provided near the plant in the future.

From the hopper the coal goes by gravity to West-inghouse underfeed stokers with fourteen retorts per boiler. A 100-hp. motor-driven forced-draft fan is provided for each boiler. Stokers of the underfeed



FIGS. 3 AND 4—CROSS-SECTION AND PLAN OF WINDSOR PLANT, SHOWING DEEP CONDENSER PIT, INSIDE COAL-STORAGE FACILITIES AND RELATIVE POSITIONS OF EQUIPMENT

the circulating pumps below the extreme low-water level of the Ohio River, and also to allow placing the condensers low enough for the cost of pumping circulating water to be a minimum at low river stages. The basement floor is just above high-water level and the main floor 18 ft. (5.4 m.) higher. The maximum variation in river level which has been recorded is 50 ft. (15.2 m.).

As this arrangement brings the basement floor 15 ft. (4.6 m.) above the ground outside the station, all tracks running into the station had to be laid on high trestles. While they were costly at the outset, space beneath them will be used for ash dumps for several years to come, thus providing a very economical means of disposing of ashes.

PROVISIONS FOR HANDLING COAL

The coal-handling facilities at the plant are unique in several respects. Coal is secured under a long-term contract from a mine owned by the Richland Coal Company, approximately 2000 ft. (609.6 m.) from the power house. It is hauled into the station in side-dump transfer cars on a standard-gage railroad track. All of this railroad equipment is owned by the central station. Standard-gage track is considered necessary, because in an emergency it will permit the shipment of fuel from other mines without inconvenience. At the plant the transfer cars are dumped into a concrete pit which measures approximately 35 ft. (10.7 m.) wide and runs the entire length of the station beneath the firing aisle in the boiler room. From this pit, which will hold more than 2500 tons (2267.9 t.) of coal, the fuel is lifted in

type were chosen for this service on account of the fact that they have proved efficient in burning West Virginia coal and have possibilities of high capacities.

The four boilers which serve each turbine are of the B. & W. cross-drum type. Each boiler has 12,625 sq. ft. (136 sq. m.) of heating surface and supplies steam at 250-lb (17.6 kg.) pressure and 250 deg. superheat. All settings are incased in steel to prevent air leakage. The four boilers which form a unit to serve each turbine are arranged in banks of two facing each other on opposite sides of the firing aisle. Each bank of boilers is connected to a manifold, which in turn is connected to the steam pipe running to the corresponding turbine. Leads from the separate boilers are cross-connected. The drums are placed 26.5 ft. (8.07 m.) above the firing aisle floor to provide an extra large furnace. Diamond soot blowers are installed on each unit.

As the gases leave the boiler they pass through economizers set directly over each boiler. The economizers, which are of the Sturtevant high-pressure type, are arranged in two divisions, eight tubes wide by thirty-six tubes long, giving 8625 sq. ft. (92.8 sq. m.) per economizer. This arrangement, the engineers believe, provides the maximum heat transfer. It also allows the space between the two sections to be utilized for a by-pass duct and permits a neat arrangement of the duct to the double-suction induced-draft fan. Moreover, this arrangement makes the economizer narrower and hence more accessible for repairs and cleaning. Dampers are provided in the uptake and are so arranged that in one position they close off the economizer and in the other they close the by-pass duct.

From each economizer the gases pass through a 60-in. fan to a smoke flue which connects three boilers to a 13-ft. by 146-ft. (3.9-m. by 44.5-m.) steel stack. Through the combined action of the induced and forced draft fans a practically balanced draft condition is

TABLE I—DIVISION OF OPERATING EXPENSES INTO CAPACITY CHARGE AND OUTPUT CHARGE

OPERATION	Capacity Charge, per Cent	Output Charge, per Cent
Labor:		
Superintendence	100	..
Boiler labor	62	38
Turbine labor	100	..
Electrical labor	73	27
Miscellaneous labor	80	20
Total operating labor	83	17
Fuel:		
Fuel for steam	22	78
Supplies:		
Water for steam .....	..	..
Lubricants	70	30
Steam supplies and expenses	55	45
Power plant supplies and expenses	92	8
Total operating supplies and expenses, excluding fuel	78	22
Total operation	34	66
MAINTENANCE		
Labor and material:		
Repairs to boiler-plant structures	75	25
Repairs to power-plant structures	75	25
Repairs to boiler-plant equipment	56	44
Repairs to prime movers	55	45
Repair to accessory mechanical equipment	56	44
Repairs to generators	56	44
Repairs to accessory electrical equipment	71	29
Total maintenance, labor and material	59	41
Total steam-power production: Labor, fuel supplies and repairs	37	63

maintained over the fire. The stoker blast equipment is designed to give a pressure equal to 6.5 in. (16.5 cm.) of water. Hand regulation is employed to give proper relation of fuel and air. The ash from the furnaces is dropped into pits, from which it can be dumped into the same transfer cars that are used for bringing coal to the plant.

As was already mentioned, the river fluctuates as much as 50 ft. between high and low water level; therefore it was necessary to set the condensers in a deep pit measuring 25 ft. 6 in. wide by 91 ft. long and 74 ft. deep (7.8 m. by 27.7 m. by 22.6 m.). The condensing

room between the machines has made it possible to handle the condensing machinery into and out of the pit with the 110-ton (99.8-t.) turbine-room crane.

Each condenser is set directly beneath the turbine which it serves and is connected to it by a pipe 13 ft. (3.96 m.) in diameter. An expansion joint with a new type of mercury seal is placed in the exhaust connection just above each condenser. The steel cross members which support the condensers are about 15 ft. (4 m.) above the floor of the condenser well, leaving space in the bottom of the pits for pumps. The vacuum pumps are of the Westinghouse Le Blanc type. On account of the fact that the condenser wells are deep and a large part of the auxiliary machinery is under the condensers electric push-button-operated elevators are employed between the turbine-room floor and the condenser pit for the convenience of the operator.

Water for the entire plant is taken from the Ohio River through a concrete tunnel to an intake crib, which stands beside the condenser well of units No. 1 and No. 2. In the crib the water passes successively through bar-iron grills, traveling screens and stationary

TABLE II—IMPORTANT DATA* AND LIST OF EQUIPMENT

UNIT BOILER ROOM	
Boilers....Babcock & Wilcox cross-drum water-tube, four per turbine unit.	
Heating surface, each, sq. ft.....	12,625
Superheater surface, each, sq. ft.....	8,625
Heating surface, per kilowatt, sq. ft.....	1.65
Working pressure, lb. gage.....	250
Superheat, deg. Fahr.....	250
Stokers, Westinghouse underfeed, retorts per boiler.....	14
Boiler room coal-pit capacity, tons.....	2,500
Feed-water heater, rated capacity per square foot boiler heating surface, hp.....	0.37
Chimneys (steel unlined), height above boiler floor, ft.....	146
Chimneys, diameter, ft.....	13
UNIT TURBINE	
30,000 kw., three-phase, 60-cycle, r.p.m., General Electric Co. Weight per rated kilowatt capacity, lb.....	30.6
Condenser.....Westinghouse Electric & Manufacturing Co. Total tube surface per condenser, sq. ft.....	50,000
Tube area per kilowatt turbine capacity per square foot floor space, outside measurements, kw.....	140
Circulating pumps, centrifugal, motor-driven; capacity each, gal. per minute.....	50,000

*These data show what ratios, proportions, velocities, etc., have been used in the design of this station. The capacities are calculated from specification or guarantee figures. Unless otherwise specified, all ratios, both terms of which relate to boilers and kilowatt capacity, are based upon 30,000-kw. unit capacity.

screens to the rear chamber of the crib. The station arrangement permits the screens to be handled by the turbine-room crane, which is provided with a 15-ton (13.5-t.) auxiliary hoist. The traveling screens are arranged so that they can be raised or lowered as the river rises and falls.

From the screens the water is taken through cast-iron pipes to the circulating pumps, which are set directly under the condenser. Each pump discharges into the bottom of its respective condenser's water box. Similar arrangements will be provided for any other units added. An extra heavy sluiceway operated by a hydraulic cylinder is supplied to control flow of water to each circulating pump.

The discharge from each condenser comes out of the top and goes through a cast-iron pipe to the discharge well. It is returned to the river through a discharge tunnel which lies adjacent to the intake tunnel, but which is brought off at an angle so as to separate the discharge mouth from the intake.

Because the boilers are equipped with economizers and since the large units permit the production of energy at low cost, most of the auxiliaries are motor-

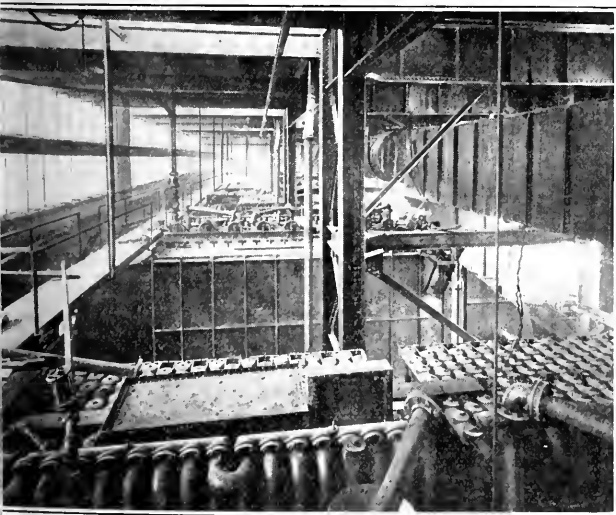


FIG. 5—TWO-SECTION ECONOMIZERS OVER BOILERS

equipment for two 30,000-kw. units is installed in this pit. Each condenser will contain 50,000 sq. ft. (5385 sq. m.) of cooling surface. Making the condenser pits large enough to contain two condensing equipments and providing an opening in the turbine

driven. In connection with each condensing equipment there are two hydraulic air pumps driven by 200-hp. motors and two hot-well pumps driven by 100-hp. motors. The hydraulic air pumps are set on a gallery adjacent to the condenser, making a very short suction connection. The hot-well pumps are installed on the floor of the condenser well under the condenser. All of the pumps which are operated in connection with each condensing equipment, including a 50,000-gal. (18,926.6-l.) circulating pump, are motor-driven.

The condensate is pumped through a primary heater in the upper part of the condenser and then up into a feed-water heater of the open type which is set on a platform immediately over the feed pumps. These pumps and one service pump are the only steam-driven auxiliaries in the plant.

Besides the auxiliaries which are attached to each separate unit there are one motor-driven and one steam-driven turbine service pump in the condenser well. These units are connected to a steel service tank under the boiler-room roof. This supplies all service and all make-up water, the latter being run through a settling tank and quartz filter before going to the feed-water heaters. No other water treating equipment is necessary. From the feed pump water is taken to the boilers through a double-feed system, the main feed being arranged to take water through the economizers and the auxiliary feed being arranged to deliver the water to the boilers direct. The water level is controlled by S. C. regulators.

The electrical features of the Windsor plant will be described in a future issue of the *ELECTRICAL WORLD*.

CONCRETE POLES CARRY 22,000-VOLT POWER LINE

Poles Cast Along the Lines—Cross-Arms Reinforced to Be Independent of Concrete—Erected with Derrick on Truck

In designing an electric pumping system for the 22,000-acre (8903-hectare) irrigation district at Brentwood, Cal., it was decided to take the current required at 22,000 volts. This made it necessary to distribute at this voltage by private line to the seven pumping plants located along a 6-mile (9.7-km.) length of the main canal and requiring in the aggregate approximately 2800 hp. The current was stepped down at each station to an operating voltage of 440.

Reinforced-concrete poles were selected for this transmission line because of their permanency, low maintenance cost and the greater security against line trouble which it was believed they would afford. The poles were designed in accordance with the specifications of the N. E. L. A. report of the committee on overhead-line construction, except that the allowance for ice load was omitted as unnecessary in the territory served.

The poles were considered as concrete beams reinforced symmetrically on four sides. To facilitate the computations and comparisons of costs and strengths for poles of various sizes, curves were drawn based on the A. S. C. E. reinforced-concrete beam formulas for beams reinforced symmetrically on two sides. As a result of the comparative studies it was decided to construct all poles of the same size, but to use two reinforcing systems so that there would be two grades

of poles, one light and one heavy. The poles were therefore made 16 in. (40.6 cm.) square at the ground when set 6 ft. (1.8 m.) deep, 41 ft. (12.5 m.) long and 8 in. (20.3 cm.) square at the top. The reinforcing in the heavy pole begins with twelve 1-in. (2.54-cm.) twisted steel bars at the base and in the light-weight pole with eight 1-in. (2.54-cm.) twisted steel bars. The



FIG. 1—MOLDING CONCRETE POLES ALONG RIGHT-OF-WAY

reinforcing decreases toward the top in both poles, but at least four bars extend to the top of the pole in both cases. The heavier pole is designed to withstand a 90 mile (144.8-km.) gale with the wires on one side broken. The lighter pole would probably not fail under these conditions, but would be subjected to much higher stresses.

When these poles were built the price of cement was \$2.23 per barrel and that of reinforcing bars 2.3 cents per pound (5.1 cents per kg.). At this rate there went into each pole \$7.23 worth of cement and \$21.30 worth of reinforcing bars. The total cost of labor, including casting, digging holes and erecting poles, amounted to \$30 per pole. The rate on common labor was \$2.50 an



FIG. 2—ERECTING CONCRETE POLES WITH SPECIAL DERRICK

for carpenters \$3.50 per nine-hour day. The average cost of the 109 poles erected in place was \$69.60 each exclusive of insulators, but inclusive of pine and telephone brackets, and with no allowance for salvage. The derrick built specially to erect the poles or on other tools used.

The average weight of 4 tons per pole made it i-

practicable to cast them in a yard and deliver the finished poles along the line, so the materials used in the concrete were delivered along the line and mixed by hand. Forms were laid on a platform consisting of two 4-in. by 10-in. (5.1-cm. by 25.4-cm.) planks. The vertical sides were held in place at the bottom by cleats and at the top by ties spanning the box. The reinforcement finished as a complete unit was suspended in these forms from the cross ties and the concrete shoveled in and carefully spaded. The cross-arms and buck-arms were molded integral with the pole.

DETAILS OF CONSTRUCTION AND ERECTION

In the cross-arms the reinforcing consists of 2-in. by 1/2-in. by 3/16-in. (5.1-cm. by 5.1-cm. by 0.5-cm.) steel angles bolted together at the ends and spread apart at the center so the reinforcing bars could be threaded through holes punched in the angles for that purpose. The insulator pins are carried directly by these angles, and thus the conductors are not in danger of falling in

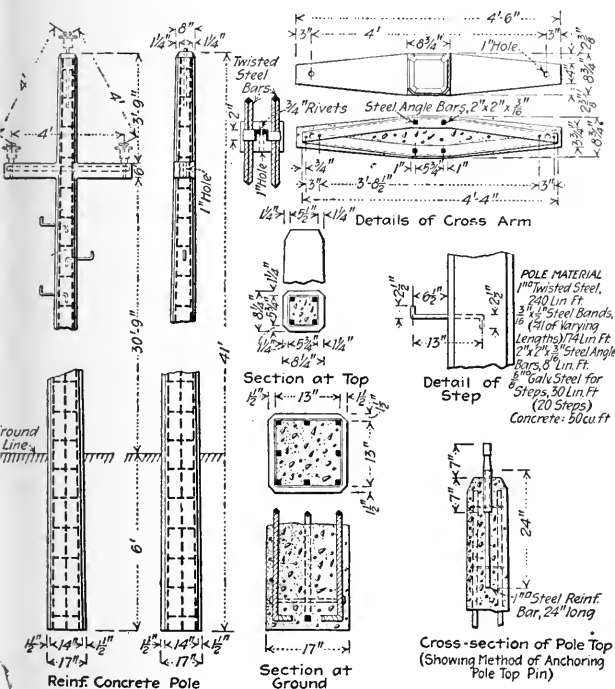


FIG. 3—DETAILS OF CONCRETE POLES

use the concrete is broken from the cross-arms. The spans vary from 250 ft. to 390 ft. (76.2 m. to 118.9 m.). The heavier poles are used at each station and at every fifth pole between, also at road and line crossings where they are set in concrete.

The unusual weight of the concrete poles made it necessary to provide special means of erection. This was accomplished by mounting a double derrick on a dray, equipped with a six-part wire-rope tackle operated by a hand crab on the dray. A 10-in. by 10-in. (25.4-cm. by 25.4-cm.) timber was secured horizontally across the bed of the dray and extended 10 ft. (3.1 m.) beyond the front end of this timber a four-part manila rope tackle was run to the top of the derrick, thus affording leverage by which the outboard half could be lifted from the ground when it was desired to move the derrick.

After being put in position near one of the holes, two men guided the foot of the second leg as the four-part tackle was gradually eased up, thus locating the legs so that the derrick straddled the hole. A chain sling was

placed around the pole just above the center of gravity, the concrete being protected by wooden corner pads. The six-part wire-rope tackle was then hooked on and by means of the hand crab the pole was up-ended and dropped into the hole.

The poles were designed and built and the system was installed for the East Contra Costa Irrigation Company by Augustus Kempkey, consulting engineer, San Francisco, by whom the foregoing information was supplied. The contract for the construction was carried out by Balfour, Guthrie & Company.

WHITE WAY LIGHTING

BEGUN IN NEW ORLEANS

First Installment of 20 Miles of System Under Contract with New Orleans Railway & Light Company Is Started

The first installment of 20 miles (32.18 km.) of white way lighting provided for in the city contract signed recently with the New Orleans Railway & Light Company has been completed on Napoleon Avenue. It consists of ornamental metal standards mounting 200-cp. series tungsten lamps in round white globes, in double



NEW ORLEANS "WHITE WAY" LIGHTING IS BEGUN

rows spaced about six units to the block, providing very even distribution of light.

This system when completed will embrace all the principal streets of the city. In all 1500 single-light standards equipped with 200-cp. series incandescent lamps will be installed. At the same time the present arc lamps in other parts of the city, not to be equipped with the ornamental standards, will be replaced with high-power magnetite lamps which will practically treble the illumination afforded by the present system. The result will be a complete reorganization of the lighting of the entire city with a great improvement of the standard of brilliance and efficiency.

If Your Paper Is Late

If your copy of the ELECTRICAL WORLD is late in reaching you, please wait a day or so before writing us that it has been lost. Unparalleled congestion of the mails has caused delays in delivery of all mail matter.

Better Handling of Coal Problem Needed

Stimulus to Production and Methodical Co-ordination of Mining and Transportation Activities Are Essential to Meet the Enormous Fuel Requirements of the Present Year

IT IS characteristic of the energy and resourcefulness of the men controlling electric utilities that they are studying the subject of fuel supply and cost from every angle. They are going directly to the sources of supply, directly to the avenues of transportation. They are looking critically into methods of distribution, are analyzing details of cost.

Their investigation has been directed so carefully into every nook and corner of the coal situation that they may with modesty claim to be authorities equal to any other consumers, equal to many producers and carriers, equal even to the government officials who are now rigidly supervising fuel production, transportation and distribution. Although offering frequent suggestions, although participating actively in movements looking to the correction of past mistakes, they have very generally accepted and made the best of conditions imposed by the fact of war and strict governmental control.

CONSUMERS BECOME PRODUCERS ALSO

From the position of mere consumers of coal many of these properties have turned to be producers and, in part, the transportation or equipment agencies for their own supply. Collectively, therefore, the electrical industry represents every stage of the coal problem from unmined seams in the ground to grate.

It is from the background thus obtained that the industry, fighting to secure the adequate supply of fuel which alone will keep the steam stations in operation, fighting to secure it at a cost which can be met without financial disaster, presents its claims for better national (whether under government or private control) policies on the vital questions involved. These questions were not met and answered adequately in 1917, nor is the record of 1918 so far any more promising.

Such being the regrettable condition, the electrical industry believes that large statesmanship is necessary, that the co-operation of labor is required, that better co-ordination of production, transportation and distribution facilities is a vital essential in the tremendous-scale improvement which alone will assure adequate supply at fair cost. In the opinion of the industry, a reconsideration of these elements is all that will give comfortable conditions throughout 1918 and in the already dreaded winter of 1918-19.

Reconsideration of the methods adopted in handling these different elements will give an opportunity for new decisions. New decisions can be made in the light of the mistakes in the old decisions, with a longer

outlook into the future than it is felt controlled the policies of last year. Admitting frankly that mistakes have been made, there is still room to build new policies for the future and to eliminate the errors of the past. To admit that no mistakes have been made would subject the nation to the risk of the same policies which tangoed it carelessly along in 1917 to the almost fatal consequences of the last few weeks.

In handling the coal-producing industry the government had to face all of the great problems and all of the little details that were certain to exist in an industry loosely organized, many of whose units were unscientifically directed and were deficient in knowledge of fundamental business and commercial practices. It faced an aggregation of unrelated units, large and small intermingled, with little if any uniformity of action where true cost accounting was not generally in force. It confronted an untrained army of producers where price had run exorbitantly rampant. It found production highly stimulated by abnormally heavy demand from every center of consumption. On top of these conditions, entering them as a bomb might fall into a intensified war-industry factory, there came price fixing, widely advertised differences of opinion between Cabinet officers, advice to consumers not to pay the prevailing market figures but to hold off. And government legislation and ukase followed; prices were fixed only to be advanced when their inadequacy was proved. In short, the conditions which developed rapidly in the production end of the problem were complete demoralization. Producers did not know "where they were at."

THE ALL-IMPORTANT TRANSPORTATION PROBLEM

On the monumental issue of transportation the government had before it a condition made up of different factors but all pointing to the entire breakdown of facilities which was so sharp an outstanding feature of the internal situation in 1917. Railroads were years behind their normal construction programs in cars and locomotives, trackage and terminal capacity. The rates were inadequate. They were not even properly equipped to handle normal business, let alone normal business plus war requirements. They had neither the facilities nor the credit for buying the facilities. In brief, they were helpless to move coal and other traffic with the sure expedition which war demanded.

Both of these factors—production and transportation—together with the collateral one of distribution, the government now has entirely in its hands through the

THE largest and best-managed electric light and power stations that are burning coal are using it with the greatest economy known in engineering practice. Considering the fluctuating demand for energy, it is not to be expected that by any changes of apparatus they can make any further important saving of coal. The smaller sta-

tions and those that are not up to date in the equipment and methods of management can make a great saving of coal by acquainting themselves with what is being done in the best plants and copying them as far as possible.—*United States Fuel Administration in the ELECTRICAL WORLD*, Jan. 5, 1918.

Fuel Administrator and his representatives in all sections and the Director General of Railroads. All power is in the government, but the events of the times show clearly that power alone is not enough to bring cheery brightness out of the gloom of coal supply conditions. Optimism alone will not do it. Clear-sighted wisdom is necessary, not alone in the high seats at Washington, but also throughout the country wherever co-operation can be given. Orders can be issued at Washington, but much more than that is required in a democracy even in time of war. Large planning, foresight, broad vision, plain justice to worker and capital are required in order that the unaccustomed regulations may yield fruit.

MISGIVINGS OVER GOVERNMENT CONTROL OF MINES

Not without many misgivings has the electrical industry seen the sweep of government control over coal mines. There are differences of opinion in the electrical industry concerning the benefits or detriment of such control. In part, they are based on ideas of policy, in part they are based on intimate contact with coal-producing areas and on observation of conditions therein. Generally the electric central stations reached in the ELECTRICAL WORLD canvass merely accept the act of government control without comment and base their remarks on the condition thus imposed on them. In other cases there is sharp criticism of the effect of government control, as the following expressions show:

I have never heard of the government taking any co-operative steps that had any value to the consumer of our type. In fact, if the government would step down and would let the coal people take care of themselves, I am sure that they would be quite capable of handling it, but the government is not. In my judgment the same thing applies to transportation. From my limited experience with the government in this connection, I think it is 90 per cent responsible for this coal entanglement that we are all in, and I now it is directly responsible for reduction in output in some coal fields by many hundred thousands of tons.

In our judgment the government has taken a very unwise step. It has put in new men to handle the coal proposition, crowding out men who have spent their lives in coal operation. I do not think there is any difficulty in producing all the coal, and more coal, than can possibly be handled by the transportation agencies. Many of the railroads are up against it seriously owing to crippled condition of engines and bad condition of crews. Labor at this time is something never before known. Our laborers are not interested in their work; they only think of the mighty dollar and are afraid they are not getting their share. I believe if assistance could be had from Western roads in rolling stock, especially engines, the coal mines would be able to supply all the requirements made upon them. I also believe, as stated, that these matters should be put in the hands of men who have spent their lives in the industry and know quality and conditions of coal.

The series of articles which is now completed was prepared in the hope that it would result in constructive policies to better the coal-supply conditions. It has presented the point of view of many companies, enormous consumers of coal, and has covered generally all

phases of the subject. As bearing particularly on the vital mining and producing features the comment of one company is illuminating. Its constructive suggestions are the result of long-continued observation of coal conditions at short range and of experiences which have been particularly trying during the last winter. Like many other companies, this property has partially met the increased coal cost by a fuel differential added to power rates. This differential was intended to cover the increased cost of fuel and would do so if the fuel were of normal value and quality. It, however, applies at the best to only about one-half of the output, and therefore increased cost of coal has caused a very considerable decrease in the net earnings of the company. The general manager says:

To obtain relief I believe that government conscription of labor will be required. This is especially true of the coal mines. The wages now paid to the miners are the highest in the history of the country. The miner will work until he acquires about a certain weekly wage. In other words, the more you pay him the less time he will work. If he earns sufficient money for his food, his rent, what little clothing he requires and enough beer to last him through the idle time, he quits. As a consequence, the higher the wages the less the production. The coal producer is largely unable to improve conditions without material support and protection from interruptions, annoyances and losses due to labor disturbances.

The transportation agencies can help and could better themselves in various ways, as by the pooling of coal, so that instead of one mine furnishing one particular customer or more, etc., necessitating gathering a few cars from this mine and a few cars from that mine, taking them to classification yards, and there sorting them into trains in accordance with the destination, the coal can be taken directly from the mines to users without entering the classification yards. This would necessitate, of course, a sort of coal-clearing house and would mix qualities up for the time being, but it is also equally certain that classification yards now have standing in them many cars filled with coal awaiting classification and freight movement.

I believe that every classification yard and many sidings in their yards all through the great coal district and between that district and the lakes will, on investigation today, be found filled with coal cars awaiting movement.

Part of the trouble the railroads are to blame for; part the miners are to blame for; part the manufacturers and utilities are to blame for. To illustrate—suppose that a mine and a utility were located at point "A" or reasonably contiguous to point "A" and that a mine or utility were located at point "B" or reasonably contiguous to point "B," with a distance between point "A" and point "B" of one hundred or more miles; does not it look foolish for the coal from point "A" to be used by the manufacturer or utility at point "B" and vice versa? Yet that is practically just what is happening—not in one case but in hundreds.

Standing near the tracks in any one of the large coal-producing districts, you will see heavy freight loads of coal pass from time to time, some going in one direction—some in the other. Why is this cross movement necessary to such an extent? Of course, the answer is that part of the movement has come about by the preference of a certain manufacturer for certain coal; part has come about by judicious railway business handling to obtain traffic; part perhaps from various causes. It is a fact, however, that exists.

ANY one who has had the responsibility of having 140 to 150 carloads of coal for use at the generating stations every morning during the past three or four weeks realizes the coal situation. My conclusion is that in Illinois, at least, our railroads had been strong, if their terminals had been developed as they should have been for

the size of their communities, if they had had the cars and the motive power, we would not have been brought to these five fuelless days.—*J. F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, in an address before the Indiana Engineering Society, Indianapolis, on Jan. 25, touched on railroad unpreparedness.*

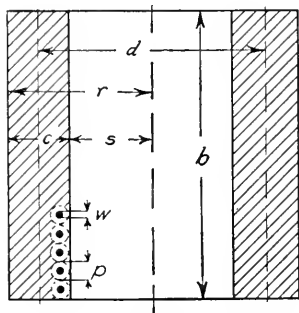
Self-Inductance of Long Reactance Coils

Development of Practical Engineering Formula for Computing This Value, with Two Examples Which Are Worked Out in Order to Illustrate the Application of the Method

BY H. B. DWIGHT

FOR the calculation of the self-inductance of circular coils used in engineering work three formulas are needed to cover the range. These are, first, a formula for long coils, in which the length b (Fig. 1) is greater than the mean diameter d ; second, a formula for short coils, in which b is less than d but greater than the thickness c ; and, third, one for flat coils, in which b is less than c . In this article an engineering formula (4) for long, thick coils is described, and other formulas for long coils are presented which may be useful for special calculations but which are probably not required for engineering work. Engineering formulas for short and flat coils will be given in a future article.

As indicated below, all the dimensions of a coil should be measured to the pitch lines of the conductors. Thus the length of the coil should be taken as the number of conductors per layer multiplied by the pitch of



SECTION OF REACTANCE COIL

the conductors. The exact dimensions over the copper are slightly too small and should never be used.

In order to obtain an expression for the self-inductance of a thick cylindrical coil, it is first necessary to know the mutual inductance of two coaxial and concentric thin solenoids of equal length. For long solenoids this has been given in a useful form by T. H. Havelock.¹

By using the form in elliptic integrals given in equation (4) of Havelock's paper in the *Philosophical Magazine*, and by changing to the dimensions shown in Fig. 1, the expression for mutual inductance becomes:

$$M = \frac{\pi^2 d^2 N^2}{b^3} \left[b - \frac{2D}{3\pi d^2} \left\{ (D^2 + d^2) E - (D^2 - d^2) F \right\} - D \left\{ -\frac{1}{8} \frac{D}{b} + \frac{1}{128} \left(1 + \frac{d^2}{D^2} \right) \frac{D^3}{b^3} - \frac{1}{1024} \left(1 + 3 \frac{d^2}{D^2} + \frac{d^4}{D^4} \right) \frac{D^5}{b^5} + \frac{5}{2^8} \left(1 + 6 \frac{d^2}{D^2} + 6 \frac{d^4}{D^4} + \frac{d^6}{D^6} \right) \frac{D^7}{b^7} - \dots \right\} \right] \quad (1)$$

where d and D are the diameters of the two thin solenoids, where N is the number of turns on each solenoid,

and where F and E are complete elliptic integrals of the first and second kinds, to modulus d/D .

The two elliptic integrals can be expanded in terms of the complementary modulus, K' , as follows:²

$$E = 1 + \frac{1}{2} K'^2 \left(\log h \frac{4}{K'} - \frac{1}{1.2} \right) + \frac{1^2 3}{2^2 4} K'^4 \left(\log h \frac{4}{K'} - \frac{2}{1.2} - \frac{1}{3.4} \right) + \dots \quad (2)$$

$$F = \log h \frac{4}{K'} + \frac{1^2}{2^2} K'^2 \left(\log h \frac{4}{K'} - \frac{2}{1.2} \right) + \frac{1^2 3^2}{2^2 4^2} K'^4 \left(\log h \frac{4}{K'} - \frac{2}{1.2} - \frac{2}{3.4} \right) + \dots \quad (3)$$

$$\text{where } K' = \sqrt{1 - K^2} = \sqrt{1 - \frac{d^2}{D^2}}.$$

The expression for mutual inductance can now be integrated twice over the section of the thick coil indicated in Fig. 1, and the following engineering formula for the self-inductance of a long thick coil is obtained:

$$L, \text{ in henries,} = \frac{\pi^2 d^2 N^2}{0.3937 \times 10^6 b} \left[1 - \frac{2}{3} \frac{c}{d} + \frac{1}{3} \frac{c^2}{d^2} - \frac{4d}{3\pi b} \left\{ 1 - \frac{1}{4} \frac{c^2}{d^2} \log h \frac{4d}{c} + \frac{23}{48} \frac{c^2}{d^2} \right\} + \left(\frac{1}{8} + \frac{1}{12} \frac{c^2}{d^2} \right) \frac{d^2}{b^3} - \left(\frac{1}{64} + \frac{7}{192} \frac{c^2}{d^2} \right) \frac{d^4}{b^5} + \left(\frac{5}{1024} + \frac{17}{768} \frac{c^2}{d^2} \right) \frac{d^6}{b^7} - 0.00214 \frac{d^8}{b^9} + 0.00112 \frac{d^{10}}{b^{11}} - 0.00066 \frac{d^{12}}{b^{13}} + \dots + \frac{2b}{\pi q d N} \left(\log h \frac{p}{w} + 0.14 \right) \right] \quad (4)$$

In this formula N is the number of turns of effective conductor in the coil, q is the number of wires or cables in parallel, and the dimensions are in inches. If the dimensions are in centimeters, the factor 0.3937 should be omitted. (Note that $\log h m =$ the hyperbolic or natural logarithm of $m = 2.3026 \log_{10} m$.)

It is assumed that the coil is wound with round wire or cable. For square wire the constant 0.14 in the last term should be omitted. The general term of the series in d/b , omitting the terms in c , is

$$\frac{(-1)^n (2n)! (2n+2)!}{n! (n+1)! (n+1)! (n+2)! 2^{2n+2}} \left(\frac{d}{b} \right)^{2n+2}$$

By putting $c = 0$ and omitting the last bracket, formula (4) becomes the same as Havelock's expression for the self-inductance of a thin solenoid.

If the more usual expansions of the elliptic integral in powers of the modulus k are used, the following formula for the self-inductance of a long thick coil is obtained:

¹*Philosophical Magazine*, March, 1908, p. 340, equation 25; and *Bulletin of the Bureau of Standards*, Vol. 8, No. 1, 1911, p. 56, equation 38.

²*Bulletin of the Bureau of Standards*, Vol. 8, No. 1, by E. J. Rosa and F. W. Grover, p. 8, equation 3.

$$\begin{aligned}
 L, \text{ in henries} = & \frac{2\pi^2 N^2}{0.3937 \times 10^9 b^2} \left[\frac{1}{3} r^4 - \frac{4}{3} r s^2 + s^4 - \right. \\
 & \frac{1}{b} \left(0.2441272 r^5 - \frac{2}{3} r^2 s^3 + 0.4277559 S^5 + \frac{1}{10} s^4 \log \frac{r}{s} \right) + \\
 & \frac{s^4}{b} \left(0.004464 \frac{s^2}{r^2} + 0.000543 \frac{s^4}{r^4} + 0.000129 \frac{s^6}{r^6} + \dots \right) + \\
 & \frac{1}{9b^2} (r^2 - s^2)^2 - \frac{1}{30b^2} (r^2 - s^2) (r^2 - s^4) + \\
 & \frac{1}{84b^2} (r^2 - s^2) (r^4 - s^4) + \frac{3}{200b^2} (r^4 - s^4)^2 - \\
 & \frac{5}{864b^2} (r^4 - s^4) (r^2 - s^2) - \frac{3}{112b^2} (r^4 - s^4) (r^4 - s^4) + \dots + \\
 & \left. \frac{bc^2 d}{\pi q d N} \left(\log \frac{p}{w} + 0.14 \right) \right] \quad (5)
 \end{aligned}$$

The general term of the power series in s/r in the above formula is

$$\frac{(2n-1)!(2a+1)!}{n! n! (n+1)! (n+2)! (2n+5)2^{2n}} \frac{s^{2n}}{r^{2n}}$$

Formula (5) is especially applicable to very thick coils, even those with the internal diameter equal to zero; but as it is long and not easy to apply to thin coils, it does not seem as generally useful as formula (4), which is probably sufficient for the calculation of long coils in engineering work.

PRECISE CALCULATION FOR MODERATELY THICK COILS

The following extended form of formula (4) gives a precise method of calculation of the self-inductance of long, moderately thick coils:

$$L, \text{ in henries} = L_s + \Delta L,$$

where L_s is the self-inductance of an infinitely thin coil, or cylindrical current-sheet, of diameter d , and where ΔL is the correction due to the thickness of the coil and the spacing of the conductors. L_s may be calculated by formula (4), omitting the terms in c and the last bracket, or it may be accurately found from Table XXI, *Bulletin of the Bureau of Standards*, Vol. 8, No. 1.

$$\begin{aligned}
 \text{Then } \Delta L = & \frac{\pi^2 d^2 N^2}{0.3937 \times 10^9 b} \left[-\frac{2}{3} \frac{c}{d} + \frac{1}{3} \frac{c^2}{d^2} + \frac{4d}{3\pi b} \right. \\
 & \left\{ \left(\frac{1}{4} \frac{c^2}{d^2} - \frac{1}{80} \frac{c^4}{d^4} \right) \log \frac{4d}{c} - \frac{23}{48} \frac{c^2}{d^2} + \frac{1}{1600} \frac{c^4}{d^4} + \dots \right\} \\
 & + \frac{1}{8} \frac{d^2}{b^2} \left(\frac{2}{3} \frac{c^2}{d^2} + \frac{1}{9} \frac{c^4}{d^4} \right) - \frac{1}{32} \frac{d^4}{b^4} \left(\frac{7}{6} \frac{c^2}{d^2} + \frac{13}{30} \frac{c^4}{d^4} + \dots \right) \\
 & + \frac{1}{32} \frac{d^2}{b^2} \left(\frac{17}{24} \frac{c^2}{d^2} + \frac{169}{240} \frac{c^4}{d^4} + \dots \right) - \\
 & \frac{1}{32} \frac{d^4}{b^4} \left(\frac{775}{1536} \frac{c^2}{d^2} + \frac{2167}{2304} \frac{c^4}{d^4} + \dots \right) + \dots + \\
 & \left. \frac{2b}{\pi q d N} \left(\log \frac{p}{w} + 0.14 \right) \right] \quad (6)
 \end{aligned}$$

If the coil is so thick that the terms in c^4/d^4 in formula (6) are not extremely small, thus indicating that further terms of the series ought not be neglected, then formula (5) should be used instead of (6).

For precise work the constant 0.14 in the last term, which is an average value, should be changed in accordance with Dr. E. B. Rosa's results for various shapes of coils, given in the *Bulletin of the Bureau of Standards*, Vol. 3, 1907, page 37, and Vol. 8, No. 1, 1911, page 141.

The results of formulas (4) and (6) are the same,

except for one coefficient, as those of a method published by S. Butterworth,² giving three corrections to be added to the current-sheet formula, to obtain the self-inductance of a thick coil. The coefficient in that method which is not in agreement with formula (6) is $-1/9 \times 2167/80$ (equation 23), which, when changed to the notation of this article, becomes $-1/32 \times 2167/11,520$. The corresponding term of formula (6) is

$$-\frac{1}{32} \times \frac{2167}{2304} \times \frac{c^4}{d^4} \times \frac{d^2}{b^2}$$

In both methods of calculation this term is derived from the same quantity, namely,

$$-\frac{5}{864b^2} (r^2 - s^2) (r^4 - s^4) - \frac{3}{112b^2} (r^4 - s^4) (r^4 - s^4)$$

By putting $r = \frac{1}{2}(d+c)$ and $s = \frac{1}{2}(d-c)$ it is seen that the correct coefficient is $-1/32 \times 2167/2304$ as in formula (6).

Problem I.—To find the self-inductance of a coil with 1000 turns of round wire in ten layers of 100 turns each. The diameter of the insulated wire is $p = 0.1$ cm. and the diameter of the bare wire is $w = 0.08$ cm. The mean diameter of the coil is $d = 10$ cm., the length is $b = 10$ cm., and the thickness is $c = 1$ cm. (Example 1, *Bulletin of the Bureau of Standards*, Vol. 4, No. 3, page 374.)

Formula (4), omitting the terms in c and the last bracket, gives the value of L_s , the inductance of a thin coil of diameter $d = 10$ cm. Thus

$$\begin{aligned}
 L_s = & \frac{\pi^2 \times 10 \times N^2}{10^9} [1 - 0.4244 + 0.1250 - 0.0156 \\
 & + 0.0049 - 0.0021 + 0.0011 - 0.0007] = \frac{\pi^2 N^2}{10^9} \times 0.6882.
 \end{aligned}$$

The remaining terms of formula (4) are

$$\begin{aligned}
 \frac{\pi^2 N^2}{10^9} [-0.0666 + 0.0033 + 0.0039 - 0.0020 + 0.0008 \\
 - 0.0003 + 0.0002 + 0.0002] = -\frac{\pi^2 N^2}{10^9} \times 0.0605.
 \end{aligned}$$

$$\text{Thus } L = \frac{\pi^2}{100} \times 0.6277 = 0.06194 \text{ henry.}$$

This is less than one-fifth of 1 per cent different from the value given in the bulletin referred to above, which is 0.061865 henry. The self-inductance of the same coil, as calculated by formula (5), is $L = 0.06188$ henry. It is not necessary to separate the terms for L_s , as above, but it is often convenient.

Problem II.—To find the self-inductance of a coil of mean diameter $d = 50$ in. (127 cm.), wound with ten layers of cable, seventy-five turns per layer, two cables in parallel. The diameter of the cable is $w = 0.5$ in. (1.27 cm.), and the distance from center to center of cable is $p = 1$ in. (2.54 cm.). Therefore $b = 75$ in. (190.5 cm.), $c = 10$ in. (25.4 cm.), $q = 2$ and $N = 375$. As in Problem I,

$$\begin{aligned}
 L_s = & \frac{\pi^2 \times 50^2 \times 375^2}{0.3937 \times 10^9 \times 75} [1 - 0.2829 + 0.0555 - 0.0031 \\
 & + 0.0004 - 0.0001] = \frac{\pi^2 \times 50^2 \times 375^2}{0.3937 \times 10^9 \times 75} \times 0.7699.
 \end{aligned}$$

The other terms of formula (4) are

²Proceedings Physical Society of London, Vol. 27, 1915, p. 371.

$$\begin{aligned} \pi^2 \times 50^4 \times 375^2 &= 0.1333 + 0.0133 + 0.0085 \\ 0.3937 \times 10^4 \times 75 &= 0.0054 + 0.0015 + 0.0003 + 0.0001 + 0.0011 \\ \text{Therefore, } L &= \frac{\pi^2 \times 50^4 \times 375^2}{0.3937 \times 10^4 \times 75} [0.7699 - 0.1146] \\ &= 0.07700 \text{ henry.} \end{aligned}$$

The self-inductance of this coil, as calculated by formula (5) is $L = 0.07699$ henry.

INTERPOLE MILL MOTORS VERSUS NON-INTERPOLE

Severe Tests Show that Interpole Machines Will Stand Abuse Much Better than Motors of Older Type and Are Desirable with "Plugging"

BY W. R. RUNNER

Westinghouse Electric & Manufacturing Company

BY FAR the larger proportion of direct-current motors in steel mills require rapid braking, either by "plugging"—that is, reversing at full speed—or by dynamic braking. The former operation is the more severe of the two, as it will be seen that if a series or heavily compounded motor is reversed when running at high speed the armature emf. adds to the line emf. The effect of this is cumulative, the increasing current causing an increasing armature voltage, the maximum value of the latter depending on the speed and the saturation of the magnetic circuits of the motor. While the peaks are of very short duration, the armature emf. sometimes goes to nearly double normal value and the current to three or more times the full-load value. As these peaks tend to produce flashing at the brushes, tests have been made to determine the effectiveness of the interpole in eliminating the flashing. That the interpole motor is better adapted to this service than the older type of motor was very clearly shown by the results obtained.

The motors tested were all of the totally inclosed mill type, series-wound, and represent standard designs of interpole and non-interpole machines. That the motors of a given rating were very similar in speed, voltage and weight is shown in the following table. Likewise, their performance curves are very similar so that the comparison is made on an equitable basis:

	One-Hour Rating, Hp.	Speed, R.p.m.	Voltage	Weight, Lb.
Interpole	80	480	230	4,550
Non-interpole	75	500	220	4,360
Interpole	40	525	230	2,900
Non-interpole	37½	535	220	3,070

The two motors of a size were coupled together, and the one not being tested was used as a generator for load. This had the additional advantage of operating both motors with the same inertia load, an important point in tests of this type. The scheme of connections is shown in Fig. 1, except that the arrangements by which either motor could be used for test are not shown. The usual type of magnetic control was used, so that the interval the current was off between "run" and "reverse" was essentially the same as in actual practice.

The method of test was as follows: The motor *M* was started by means of the usual starting resistance (not shown) and run at normal voltage. The generator *G* was loaded with resistance *R*, its field being

separately excited. When the correct speed had been obtained by varying the load on *G*, the motor *M* was reversed by opening switches 1-3 and closing 2-4, the magnitude of the peak being determined by resistance *R*. By reducing *R*, the plugging peak was increased until a slight spit was produced at the brushes. This point of maximum allowable peak was determined at

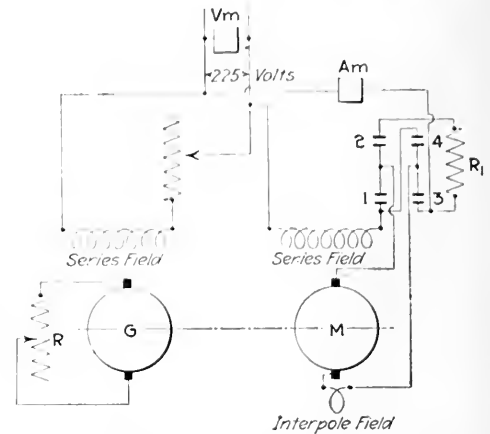


FIG. 1—SIMPLIFIED DIAGRAM OF CONNECTIONS

a number of speeds on all motors, and the results were plotted as shown in Fig. 2.

The curves in Fig. 2 were plotted from the ammeter "kick" readings taken as described in the preceding paragraph. The ammeter used was the usual permanent magnet and moving-coil type, heavily damped. It was known that this meter would not record the actual maximum peak, so to determine the error an oscillograph was used to check the meter at several points on the curve. It was found that at the higher speeds the ammeter and oscillograph readings were rea-

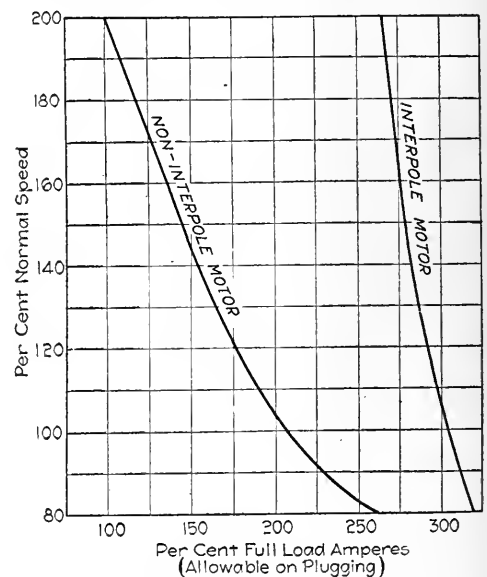


FIG. 2—RELATIVE EFFECTS OF INTERPOLE AND NON-INTERPOLE MOTORS

sonably close, but at the lower speeds the ammeter readings were approximately half of the values obtained by the oscillograph. The discrepancy at the lower speeds was probably due to the extremely short time interval required to bring the motor to rest, owing to the large current used and the low speed. At the high speeds the current on "plug" was lower

and the rotative energy high, varying as the square of the speed. This meant a comparatively long time required to reverse, giving the ammeter time to swing to nearly full value. This fact made the test somewhat in favor of the non-interpole machines, as owing to lower plugging currents a longer time to stop was required. As a result the ammeter readings were nearer the actual value of the current commutated than were the readings on the interpole motor.

Referring to Fig. 2, it will be seen that the interpole motor commutated a peak load of 320 per cent normal load at 80 per cent of the full-load speed, and that increasing the speed to 200 per cent of normal decreased the maximum peak only to 270 per cent full-load current. On the other hand, while the non-interpole motor commutated 270 per cent full-load current at 80 per cent speed, it commutated only full-load current at 200 per cent speed.

In addition to the foregoing tests a cycle test was run to determine the effect of plugging on the two types of motors. The same general scheme of connections was used as shown in Fig. 1, except that all operations were controlled by a motor-operated master drum. The cycle of operation was start, run under load, and plug, this being carried out on each motor alternately. This cycle was repeated approximately

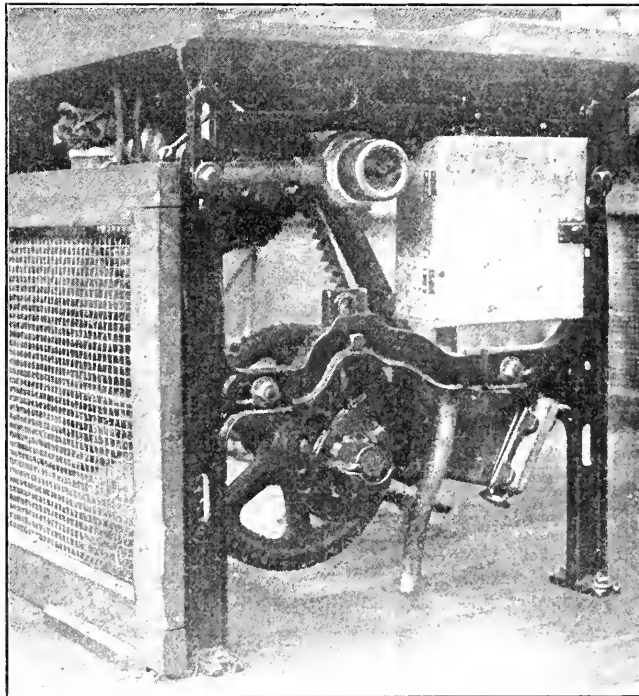
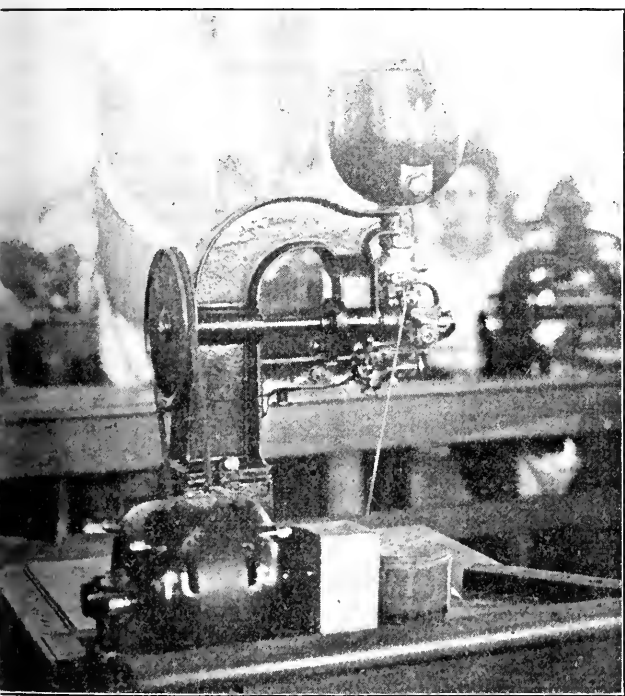
sults being very much the same in each case, showing that the interpole is extremely desirable in motors which are to withstand severe plugging service.

IMPROVING MOTOR DRIVE IN MAINE SHOE FACTORY

Individual and Group Drives Favored in Different Cases—Arrangements Employed in Repair Shop to Insure Economical Operation

ONE of the best equipped shoe factories in New England from the point of view of the motive-power engineer is the plant of Lunn & Sweet at Auburn, Me. Within two years various features of the motor service have been much improved. Energy is furnished by the Androscoggin Electric Company of Lewiston and Auburn, and the plant is operated by about 175 motors ranging in size from 0.1 hp. to 25 hp. Most of the motors are rated at 3 hp. to 10 hp., the majority being 5-hp. units or under.

An improved motor application in the stitching room is illustrated in Fig. 1. In this section eight "Peerless" fold cementers were formerly belted to a 3-hp. motor which also ran twelve sewing machines. At present four cementers are mounted on a single bench, consti-



FIGS. 1 AND 2—CEMENTER DRIVEN BY INDIVIDUAL MOTOR; CHAIN DRIVE, SNAP SWITCH AND FUSE BOX FOR ONE GROUP OF SEWING MACHINES

7500 times on each test, each cycle requiring about thirty seconds. At the end of this time it was found that the commutator of the interpole motor had acquired a good polish and showed no bad effects from being plugged at 150 per cent speed with a peak of approximately 275 per cent full load. The non-commutating-pole motor, however, did not show up so well as indicated by the curve in Fig. 2, as the commutator began to show signs of pitting, due to plugging peaks of slightly more than full load, the speed and number of cycles being the same as for the other motor. This test was conducted on several different sizes, the re-

sulting a productive unit, each machine being directly belted to a 0.1-hp., 110-volt General Electric (Fort Wayne) induction-type motor. The eight cementers require but 0.8 hp. when all are in service, and these motors are more efficiently loaded than under the previous arrangement. A separate snap switch at each operator's position controls the motor, thereby affording maximum ease of control and saving energy.

The bench units mentioned are illuminated by four 25-watt lamps per bench, as indicated in the illustration. Each lamp is mounted in a Holophane metal reflector, the latter being hung by a lamp cable which passes

through the end of a forked wooden arm hinged at the lower end to the counter. Screw eyes in the rod provide a snug attachment for the lead wire and afford sufficient flexibility to enable the arm to be turned through a considerable angle for the convenience of the machine operator. The arms are 30 in. (76.2 cm.) long and were made up at the factory at nominal cost. The



FIG. 3—OLD ARRANGEMENT OF GROUP MACHINE DRIVE

four lamp units on each bench are controlled by a single snap switch from which the units are fed by leads carried in molding, the feed from the floor to the switch being in $\frac{3}{4}$ -in. (19-mm.) iron conduit.

In the stitching room a number of sewing machines were formerly driven in large groups by motors ranging in size from 1.5 hp. to 5 hp. This service has now been subdivided so that in a typical case five sewing machines are grouped on a 1-hp., two-phase, three-wire, 440-volt induction motor. In the older arrangement, which included more machines and larger driving units, control was effected by a four-pole fused switch mounted on a slate base in a 20-in. by 24-in. by 5-in. (50-cm. by 60-cm. by 12.5-cm.) steel box which is carried on walls or posts.

Subdivision has enabled a more compact switch to be utilized, as shown in Fig. 2. The fuses are carried in the fireproof box under the table, but the motor switch is a three-pole snap-type unit of General Electric make, used largely in the latest individual textile-drive installations. Entire satisfaction has resulted from the use of these snap switches on 440-volt power circuits at this factory. The former motor arrangement was less convenient, the motors being mounted in perforated metal boxes on top of the benches, as shown in Fig. 3. Here three 2-hp., 440-volt, two-phase motors operated twenty-six Singer sewing machines, the starting switches and fuses being placed on the back of the bench in each case.

Probably a 5-hp.-motor is the most convenient size used in an ordinary shoe factory, on account of the convenience with which this size may be utilized either singly or in combination drives. Thus, a pair of such motors are belted to a line shaft from which are operated nine rotary shoe pounders. Special care in determining the proper pulley sizes enables this service to

be handled between two units, each taking half the load. The two motors in this case are two-phase, four-wire machines and are protected by one fuse in one wire of each phase, or two fuses per motor. A home-made mechanical belt guard arranged with rungs protects the operators in the plant in case a broken belt falls toward the floor, the rungs keeping the belt off the heads of the employees.

REPAIR SHOP FEATURES

In connection with the maintenance of motors at this plant, a compact repair shop is in service adjoining the stitching-room floor. The cabinet is about 10 ft. high, 7 ft. wide and 1 ft. deep (3 m. by 2.1 m. by 0.3 m.). One of the most interesting features is a fuse rack built of three pairs of slotted upright wooden bars of 1.5-in. by $\frac{3}{8}$ -in. (3.8-cm. by 0.96-cm.) stock. Each pair corresponds to a certain numbered section of the factory and carries the fuse sizes normally used on the motor circuits of that section. In case of a report of interruption the maintainer, who is informed of the factory section involved, seizes the fuses corresponding to that section without any loss of time, and upon arriving at the scene of trouble effects a replacement in minimum time. Even fifteen seconds saved in the restoration of service in a factory where intensive production is the practice counts in these days. Rapid cooling of a burned-out motor, with consequent increased speed of replacement, is accomplished by the use of a Pyrene fire extinguisher, one of which is always kept at the front of the cabinet.

To facilitate layout and maintenance work, a series of roller plans has been prepared showing the location of every machine, shaft line, column, hanger and motor in the plant. Fig. 4 shows one of these plans, drawn to a scale of $\frac{1}{8}$ in. to 1 ft. (10.4 mm.-1 m.) and kept in the office of the superintendent of buildings and maintenance, who has charge of all electrical service. Experience shows that a scale of $\frac{1}{4}$ in. per ft. (20.8 mm. 1 m.) is preferable for future work of this kind. The

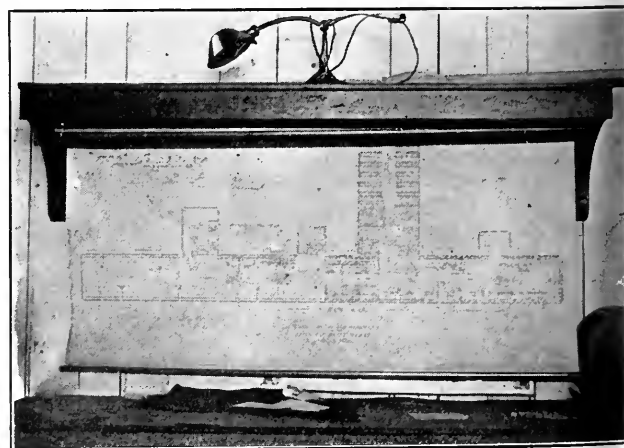


FIG. 4—SCALE DRAWING OF MOTOR LAYOUT

plan shown is about 5 ft. (1.5 m.) long and saves many measurements in the field. The larger scale, however, is more convenient for all-around service.

Ernest Bragdon is the superintendent of building and maintenance in the plant described, and under his direction the motor applications have for the most part been made.

Synchronizing Stations to Reduce Interruptions

Flexibility of Operation of a 33,000-Volt System Greatly Increased by Installation of Two Synchronizing Stations That Are Some Distance Apart—Use of Electrostatic Synchroscope Reduced Investment Considerably

ENDEAVORING to reduce service interruptions to a minimum and to permit paralleling its stations and shifting loads in the shortest time possible, the Central Illinois Public Service Company of Mattoon, Ill., has installed two three-phase, 33,000-volt outlying synchronizing stations, one at Pana and another at Roodhouse. The design and construction of these installations is of particular interest because they are built primarily in the interest of better and more efficient electric service and because the use of the glow type of synchroscope permitted the engineers to effect a substantial reduction in the necessary investment. The two stations are alike in design and purpose, except that the station at Pana is a two-circuit layout, while the other at Roodhouse is a three-circuit design.

The function of the Pana station is to connect and disconnect the lines between the power house at Mattoon, 42.4 miles (68.2 km.) distant, and Kincaid, 36 miles (57.93 km.) distant. The function of the three-circuit station at Roodhouse is to permit operators to connect together in any combination the lines from the power house at Kincaid, those from the substation at Hull and those to Jerseyville. The system toward Kincaid consists of 250 miles (402.33 km.) of 33,000-volt network fed normally by two power houses. Hull is 50.6 miles (81.5 km.) from Roodhouse, but the system in that direction comprises 252 miles (405.5 km.) of 33,000-volt network, receiving energy from the Keokuk hydroelectric plant normally and from two other generating plants under abnormal conditions. The Kincaid generating plant is about 60.4 miles (90.1 km.) distant. There are four substations but no generating plants on the shorter line to Jerseyville. The relative localities of these points are shown in Fig. 1.

and then synchronize its machines with the completed line at the power house. On account of the fact that the operators and the load dispatcher had to use the long-distance telephone of the Bell system for communication in such cases, it usually required upward of twenty minutes to put the two plants in parallel. Similar difficulty was encountered if one station wanted to shift a part or all of its load to the other. Even if the company had owned its own telephone dispatching lines

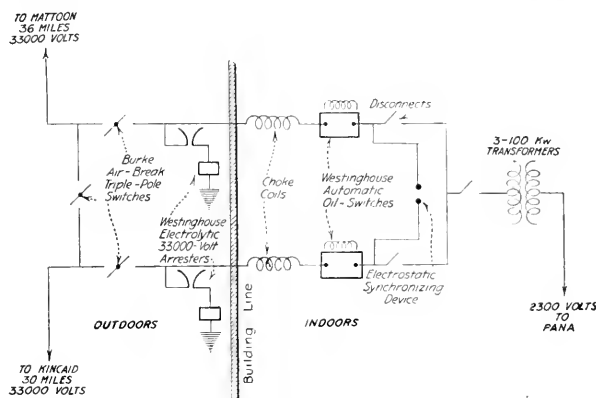


FIG. 2—ONE-LINE DIAGRAM OF CIRCUITS AT THE PANA STATION

synchronizing would still have required an interruption. With these new synchronizing stations in operation, however, loads can be shifted and the plants paralleled with great flexibility.

Both of the stations are of the indoor type, not because the equipment itself demands housing, but because of other conditions that entered. At Pana it was necessary to house some mercury-arc rectifiers, so the synchronizing station was placed in the same build-

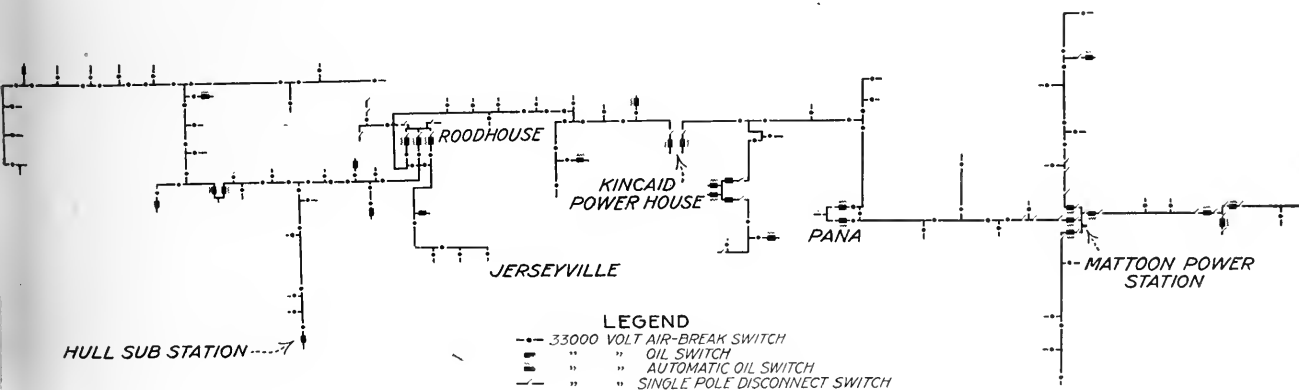


FIG. 1—TRANSMISSION SYSTEM, WITH THE LOCATIONS AT WHICH SYNCHRONIZING STATIONS ARE INSTALLED

Before these synchronizing stations were placed in service it was not customary for the Mattoon and Kincaid plants to operate in parallel. The line was usually open at Pana; consequently when the operators desired to synchronize the two lines it was necessary for one station to drop the part of its load between the two towns, permit the other station to pick up the load,

ing. At Roodhouse the equipment was placed indoors because it could occupy a building which had to be put up for an attendant.

The general layout of the Roodhouse station is shown in Fig. 3. All three lines enter through air-break tie switches. Two similar air-break tie switches were also added ahead of these switches for added

flexibility of operation. The lightning arresters are of the latest sphere-gap electrolytic 33,000-volt type. The breakers are equipped with low-voltage trips to localize trouble and to permit a generating plant to come back on the line quickly after a disturbance. Four sets of

scope as it would appear properly connected for synchronizing two circuits is shown in detail in Fig. 4. The synchronizing indicator is known as the glow type. It consists of three electrostatic glowers with special receptacles mounted in a case resembling those

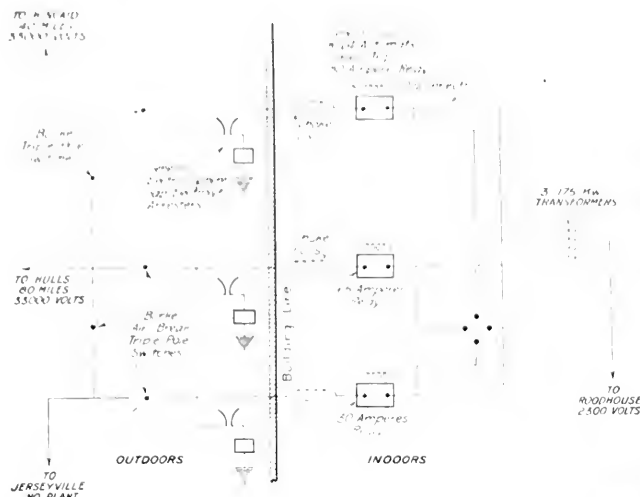


FIG. 3—ONE-LINE DIAGRAM OF CIRCUITS AT THE ROODHOUSE STATION

three single-pole disconnecting switches are installed between the oil switches and the high-tension bus for Roodhouse to permit de-energizing any part of the equipment for repairs. In fact, with the layout as it is, many combinations can be worked out to give continuous service to the three 175-kw. transformers serving Roodhouse and to all other parts of the system and yet leave a section of the station free for repairs or inspection.

It should be observed that three 175-kw., 19,100/2300-volt transformers connected Y-delta, with the neutral of the Y grounded, have been installed. The primary object of this arrangement is to better the service, but it also eliminates to some degree excessive surges and localizes trouble out on the lines more quickly. These transformers are much larger than are required to carry the 200-kw. load at Roodhouse, but the additional rating was thought advisable to take care of breakdowns out on the line which would throw a short circuit through the transformers in one leg of the Y. Therefore, in addition to carrying the load, these units will act as grounding transformers. Since the station will not be heated in the winter, the oil switches are filled with General Electric No. 19 oil. Except for the air-break switches supplied by the Railway Industrial & Engineering Company, all equipment at Roodhouse was supplied by the General Electric Company.

The leads to the electrostatic synchroscope are taken from the 33,000-volt line between the oil switches and the "disconnects." The wiring diagram for the synchro-

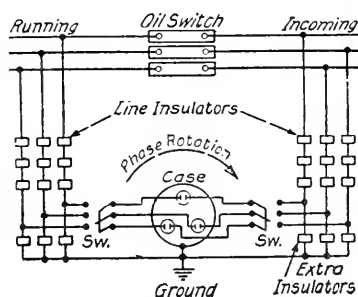


FIG. 4—CONNECTIONS FOR ELECTROSTATIC SYNCHRONISM INDICATOR

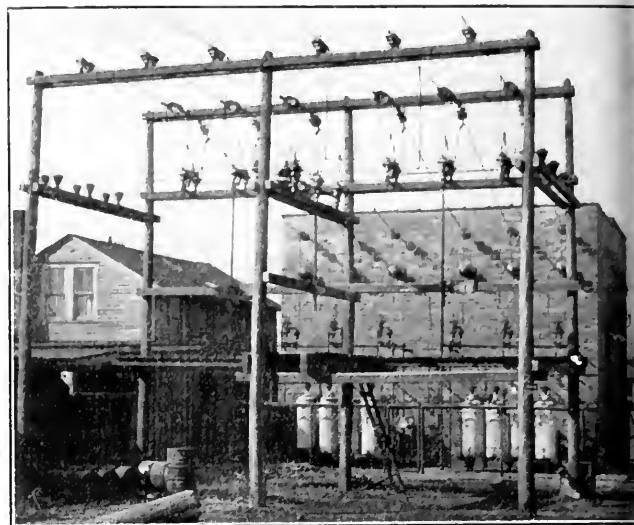


FIG. 5—GENERAL VIEW OF EXTERIOR OF PANA SUBSTATION

used for round-pattern switchboard instruments, two special triple-pole disconnecting switches mounted on a specially treated marble panel with 90-in. (228.6-cm.) pipe supports and braces, a standard disconnecting hook and insulators for breaking the circuit between the incoming lines and the terminals of the glowers. The device is designed for use on lines having either suspension or strain-type insulators. On lines equipped with petticoat insulators suspension-type insulators would have to be substituted at the point of connection for the synchronism indicator. In all cases one extra insulator would have to be provided for each line wire as shown in the connection on the wiring diagram. The

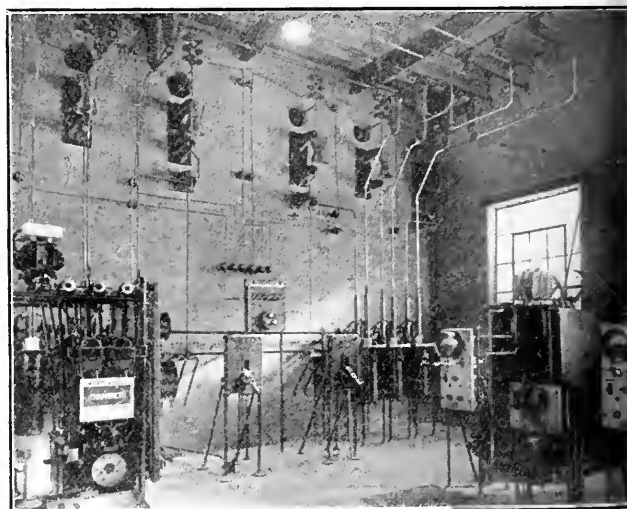


FIG. 6—INTERIOR OF PANA SYNCHRONIZING STATION AND SUBSTATION WITH SYNCHRONISM INDICATOR ON SMALL PANEL BETWEEN OIL-SWITCH PANELS

terminals of one of the glowers are connected to the leads of the same phase of running and incoming lines. These glowers are each connected across dissimilar phases of the remaining leads of the running and incoming lines. When the lines are not in synchronism

glowers indicate the relative frequency of the lines in the same manner as the usual synchronizing lamps. When the lines are in synchronism the rotating effect disappears, the glower connected to the corresponding line becomes dark, and the other two show about half brilliancy.

By the use of the electrostatic synchronizing device at this station and the one at Pana it was possible to eliminate investment in instrument transformers and their attendant accessories. These instrument transformers themselves cost about \$250 each. Conservatively estimated, therefore, the reduction in investment through the use of the synchroscope was more than \$500 for each station. Owing to the fact that certain materials necessary to the manufacture of these synchroscopes are not obtainable, they are at this writing temporarily withdrawn from the market.

The station at Pana is similar in its general design to that at Roodhouse, with the exception, as before mentioned, that it is a two-circuit layout instead of three-circuit. Furthermore, at Pana the use of grounding transformers is not required. The oil switches and lightning arresters in the Pana station were supplied by the Westinghouse Electric & Manufacturing Company.

PLANNING INDUSTRIAL CENTER TO TURN OUT WAR MATERIAL

Electrical Equipment to Be on a Huge Scale—Account of Housing Plans—Fifty-Million-Dollar Appropriation

Housing preparations on a gigantic scale are now being made by the United States government, which not long ago acquired a tract of land near Charleston, Va., where industrial works are to be erected covering every possible branch of manufacturing activity for the production of war material. An available appropriation of about \$50,000,000 has been made by Congress for this purpose, one of several projects of its kind, and a force of draftsmen, architects, engineers, etc., numbering at least 250 is now engaged designing mills, factories, foundries, machine shops, administrative buildings, power plants, dwellings and such other structures as may be useful in the construction, equipment and installation of a city with a population of 100,000.

The property is on the Great Kanawha River, with a water frontage of three miles (4.8 km.) and running back from about three-quarters of a mile to a mile (1.2 to 1.6 km.). in depth. The preliminary work of planning and designing the buildings, which will be of all sizes and shapes, is in charge of Graham, Anderson, Probst & White, architects and engineers, 14 Madison Avenue, New York City, who have been commissioned by Secretary McAdoo to put into execution the aims of the Shipping Board. When the ELECTRICAL WORLD called upon the firm for information respecting the electrical equipment and installation of the enterprise, it was found that stage of the work had not yet been entirely finished, although a corps of specialists had been steadily employed for a month past in making plans and estimates. Besides, numerous consultations were held with persons and firms, either professionally or for the supply of material, which may contribute to the speeding up and early com-

pletion of the vast war-time industrial undertaking.

For the central station, which will be situated about the middle of the reservation, 2300 three-phase, 60-cycle motors have been decided upon for the distribution of power. The actual motor voltage will be 440. Special electrical equipment will be manufactured for the powder mill, but the size or design has not been as yet determined; and this plan will be followed with other buildings erected for specialized products. Nevertheless, standard types of apparatus and supplies will have the preference when suitable. Construction work is under way, and the specifications for the electrical installation will be taken up and disposed of within a month, probably sooner. A great quantity of motors, with the question of horsepower still in abeyance, will be required. The lighting-plant requirements will call for thousands of tons of cables and wire, great quantities of line material, wiring devices, thousands of insulators and incandescent lamps, projecting floodlamps, conduit, fuses, switchboards, sockets, globes, bowls, shades, not to mention transformers, converters and other apparatus.

So far as could be gathered from the informant of the ELECTRICAL WORLD it is not the intention to advertise for bids but to go into the open market and place contracts for electrical material of all kinds to the best advantage and with firms that can make the best and quickest deliveries. Evidently there will be a minimum of official convention in making purchases whenever the buying starts, and all parts of the country will be called upon to supply the machinery, apparatus and accessories. Doubtless the greater portion of the large equipment will be bought direct from the best known manufacturers, with plants that can handle orders expeditiously; but in the minor supplies manufacturers, jobbers and general distributors having stocks of sufficient size to draw upon will get their share. Being given priority orders in every instance, the requisitions will receive immediate attention and prompt shipment will be given to them.

The McKenney & Waterbury Company, Boston, has been awarded a fixture contract for 100 houses at Braintree, Mass., for the War Department, and has recently received similar contracts for thirteen other public or semi-public buildings, most of which are in Massachusetts.

Electric Plants from the French Insurance Companies' Viewpoint

The insurance premiums against fire in electric plants are generally less than those imposed on other plants because of the preventive measures against fire ordinarily taken in building the former. The French insurance companies, now thinking these premiums insufficient, are endeavoring not only to raise the rates but also to limit the risks covered by the policies. A writer in the *Revue Générale de l'Electricité* holds that such limitation would multiply the contests, already too frequent, caused by provisions of this nature, inasmuch as the companies would have an interest in maintaining that fires were caused by electrical accidents not covered by the terms of the contract. He insists that the new tariff shall cover all risks without discrimination, thus simplifying the question of extra premiums and preventing litigation.

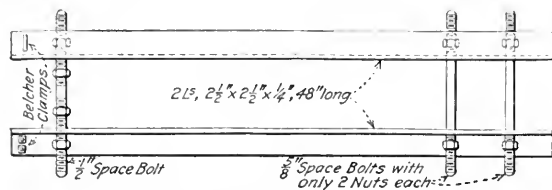
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

STURDY TYPE OF BAYONET CONSTRUCTION FOR CORNERS

Method Adopted in Iowa to Eliminate Trouble Occurring from Tendency of Sky Wire to Pull Out of Line at Turns

On its 33,000-volt transmission lines the Iowa Railway & Light Company of Cedar Rapids, Iowa, has adopted the type of bayonet construction shown herewith for use at all corners. With the single-bayonet construction formerly used occasional trouble developed, and this sturdier construction was designed to remedy that condition.



GROUND WIRE IS RUN THROUGH U-BOLT CLAMPS SHOWN AT LEFT END

The outfit consists of two standard 48-in. (121.92-cm.) bayonets, three space bolts, two of which are $\frac{5}{8}$ -in. (1.58-cm.) bolts and one of which is a $\frac{1}{2}$ -in. (1.27-cm.) bolt, and two Belcher clamps. The two larger bolts are used to attach the bayonets securely to opposite sides of the pole, while the space bolt above is used to connect the two angle irons together for greater rigidity. The sky wire is run through the U's of the clamps and need not be cut to make the turn. These devices, according to John M. Drabelle, electrical engineer for the company, have proved satisfactory in service.

THE LOCATION OF SWITCHES ON DISTRIBUTION LINES

Accessibility Most Important Point to Consider in Installing Switches and Cut-Outs on High-Voltage Lines

Many companies operating high-voltage distribution lines (6600 volts to 33,000 volts) in agricultural territory make it a practice to install switches at points where branches leave the main line in order to avoid main-line shutdowns in case repairs are required on a branch. These switches may be either fused or non-fused. In addition, fuses are installed at all transformer stations. Where branches run to single transformer stations an economy will result in placing the transformer cut-outs at the point where the branch leaves the main line, thus omitting a duplication of cut-outs at the transformer.

Not only is a saving effected in the installation cost, but maintenance is made easier, since main lines ordinarily run along rural roads while transformer stations are located in adjacent fields. Fuses at branch points

are therefore more readily accessible than at transformer stations.

The accessibility of switches is one of the most important points to consider in their installation. A switch not readily available in all weathers is highly undesirable since it may prove inoperative when most needed. On a Western 11,000-volt distribution network a tie line *T* was run to connect to a main line *M* which was in itself a tie between two substations.

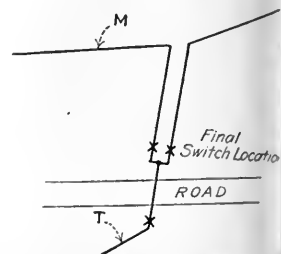
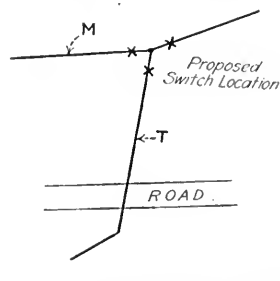


FIG. 1—DIFFICULTY OF SECTIONALIZING LINE AT LEFT AVOIDED BY CHANGING TO ARRANGEMENT AT RIGHT

(Fig. 1). Naturally three air-break line switches were installed to give maximum flexibility.

Investigation of the point of intersection of the two lines demonstrated the fact that a marsh under water in winter intervened between the switch location and the nearest road, one-half mile (8 km.) away. It was therefore decided to loop the main line in the manner shown, placing two of the switches on the adjacent pole on one side of the road and the third on the nearest pole on the other. It is believed that this

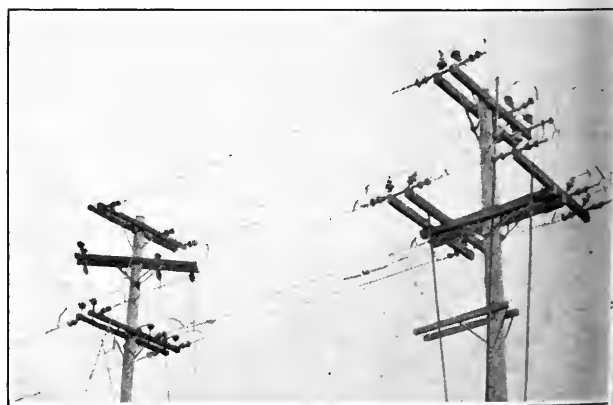


FIG. 2—SPECIAL SWITCH POLES PLACED ON EACH SIDE OF ROAD SHOWN IN FIG. 1

extra half mile of line to make the switches available at all times is a well-justified investment.

In another case location of the three switches at an intersection point at the first pole beyond the intersection in each direction would have placed two of the switches in orchards beyond fences. A special switch pole was installed, and all three switches were mounted on this pole with the operating handles accessible.

Operating handles which may be reached from the ground are great time savers in emergencies and are to be recommended, provided that the handle may be padlocked in either the open or closed position. One Western company which has on its lines several hundred of this type of switch both at transformer stations and branch-line points reports no case in which unauthorized individuals attempted to tamper with a switch. Switch handles should be uniformly installed to be closed when in the up position. A variation in this arrangement which is possible in some types of switches so that the handle is in the up position with the switch open might lead to accidents when switches are operated at night.

Accessibility of switches on distribution lines which are ordinarily not paralleled by company telephone circuits also implies proper location with reference to telephones, particularly those which may be reached at all hours. Often a careful choice of switch locations will save many valuable minutes in the average time taken by a patrolman to reach a switch, open it and report back to headquarters.

PREVENTING EXPLOSIONS IN BOILER FURNACES

Necessity of Special Consideration When Using Low-Grade Fuel—Apparent Causes and Methods of Prevention

BY GILBERT RUTHERFORD

On page 100 in the Jan. 12 issue of the *ELECTRICAL WORLD* the causes and prevention of explosions in boiler furnaces were discussed, attention being directed to the necessity of increased caution because of the present-day use of low-grade fuels. Additional information is given here on this subject:

The banked fire may constitute a danger in several ways, a danger that can be largely removed by remembering that it is possible and taking the simple precautions which follow. The cause is evidently that virtually all air supply to a banked fire is shut off so that the distilled gases do not have an opportunity to burn. As a result, if the proper quantity of air is accidentally admitted a violent explosion is liable to occur. To prevent the dangers of an explosion from this cause it is important to shut the furnace and ash-pit dampers sufficiently to prevent air passing through the fuel bed any faster than is required to keep the fire alive; close the flue damper as much as possible without impeding the escape of the gases distilled by the banked fire and allow air to enter the furnace above the fuel bed. By maintaining air circulation above the fuel bed and through the flue damper stagnant explosive mixtures if formed are able to escape. To prevent explosions occurring when opening the bank preparatory to bringing the fire back to active operation the flue damper should be opened some time before closing the air inlet over the fire. Then, after the combustible gases have had accelerated circulation, it is safe to open the fire dampers, and later the firedoor, to start up the fire again.

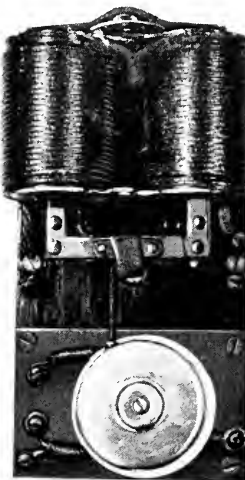
The crux of the matter of furnace explosions is the control of the air. The air required for complete combustion, which means highest combustion efficiencies, is different from that required for explosion. Maintenance of approximately equal pressures outside and in-

side of the furnace, which is accomplished easily where the balanced-draft system of automatic control is employed, tends to accomplish this automatically. However, care should always be exercised to safeguard the furnace and the firemen, and the need for this is greater where coal dust and coals of small particles are used.

INEXPENSIVE REMOTE-CONTROL SWITCH FOR STREET LIGHTING

Details of Construction, Operation and Installation
Given—Switch Is Used on Multiple Electrolier
Lighting and Signs

An inexpensive remote-control switch, series-operated by a pilot circuit, which will be found useful, particularly in controlling multiple electrolier lighting and signs in small communities, may be constructed of a wall-type pull switch in conjunction with a series coil from an old inclosed carbon arc. At present such coils may be purchased for a nominal sum, as many arcs are being superseded by higher efficiency units. The coils and switch are mounted on a wooden base, $4\frac{1}{2}$ in. by 8 in. (11.4 cm. by 20.3 cm.), with the coils uppermost. Leads are brought out to suitable binding posts. The solenoid is attached to the operating cord of the switch by means of a piece of tape which also serves as a buffer between switch case and solenoid.



SWITCH FOR LIGHT-
ING CIRCUITS

It will be found that a momentary direct current of 7 amp. to 10 amp. will be sufficient to operate the switch with a quick, positive motion.

The exact direct-current voltage required to be impressed on the circuit to produce this operating impulse will, of course, depend on the number of solenoids in series, their resistances and the characteristics of the connecting series circuit. Ordinarily, a dozen or more switches can be operated from a 125-volt direct-current exciter circuit, and if a 500-volt railway circuit is available a large group can be operated. A field discharge switch is to be preferred for throwing in the circuit.

By the use of two-circuit and three-circuit electrolier switches various combinations of midnight and all-night lights may be switched from the same circuit. In case such switches are used a pilot switch with lamps should be mounted at the operating switch to indicate the position of the switches in the field.

Since the operating current is only momentary, losses in the series circuit may be neglected and a choice of conductor may be made entirely on a basis of mechanical strength, except that the resistance of the series circuit will, of course, limit the total number of switches which may be operated from the available direct-current source.

POWER REQUIREMENTS OF MACHINES IN LARGE SHOPS

Besides Giving Power Requirements, Table Gives Information on the Grouping of Machines and Horsepower of Motors Used

In the accompanying table are given the power requirements and best grouping of machines in a large machine shop that was recently laid out. The shop is

DATA ON MACHINE GROUPING AND POWER REQUIREMENTS IN A LARGE SHOP

Group No.	Motor		Machines			Remarks
	Hp.	No.	Kind	Size	Hp.	
1	15	31	Shaper	24 in. x 14 in.	2	
		30	Shaper	24 in. x 11 in.	2	
		32	Drill press	1 1/2 in.-3 in.	1	
		42	Planer	12 ft. x 4 ft.	15	
		65	Planer	12 ft. x 3 ft. 10 in.	15	
2	5	7	Borer	8 in.	1	Cylinders
		43	Drill press	1/4 in.-3 in.	1	
		28	Planer	6 ft. x 1 ft.	3	
		40	Shaper	15 in. x 10 ft.	2	
		33	Drill press	1 1/2 in.-3 in.	2	
3	5	18	Lathe	12 in. x 7 ft.	1 1/2	Shaft Turret
		8	Lathe	10 in. x 1 ft.	1	
		37	Emery wheel	8 in.	1	
		71	Surface grinder	1 1/2 in.-2 1/4 in.	1	
		38	Drill press		1	
4	3	63	Sand tone		1	Prentiss tool Shaft Garvin
		13	Lathe	9 in. x 4 ft.	1/2	
		10	Lathe	12 in. x 4 ft.	1	
		69	Grinder (cutter)		1	
		70	Grinder (cutter)		1	
5	10	46	Drill press	1 1/4 in.-1 in.	1/2	Jones & Lamson
		45	Drill press	1/4 in.-1 in.	1/2	
		39	Drill press	in.-1 in.	1/2	
		57	Auto screw cutter		5	
		58	Auto screw cutter		5	
6	5	72	Saw	14 in.	1	Bars and shafts Bars and shafts Threads Threads
		73	Saw	14 in.	1	
		74	Saw	14 in.	1	
		47	Pipe cutter	3 in.	3	
		48	Pipe cutter	4 1/2 in.	3 1/2	
7	5	66	Punch press		1	
		7	Gear cutter		5	
		8	Lathe	33 in. x 9 ft. 3 in.	7 1/2	
		12	Lathe	18 in. x 1 ft.	5	
		1	Lathe	36 in. x 14 ft.	10	
8	10	2	Lathe	24 in. x 9 ft.	5	Drum boring Upright turret Large
		35	Drill press	1/4 in.-1 1/4 in.	1/2	
		25	Lathe	8 in. x 1 ft.	1/2	
		24	Lathe	10 in. x 2 ft.	1	
		14	Lathe	12 in. x 2 ft.	1	
9	7 1/2	44	Emery wheel	24 in. x 11 ft.	1	Drum turning Screw Turret Turret
		3	Lathe	18 in. x 6 ft.	5	
		6	Lathe	22 in. x 1 ft. 8 in.	2	
		5	Lathe		3	
		57	Wet emery wheel		1	
10	10	29	Slotter	10 in.	5	Cranksaft Winch turning Gear turret
		56	Drill press	1 1/2 in.-2 in.	1 1/2	
		55	Miller	4 ft. x 1 ft.	10	
		9	Lathe	11 in. x 13 ft.	1	
		15	Lathe	10 in. x 5 ft.	1 1/2	
11	15	16	Lathe	8 in. x 4 in.	1 1/2	Shaft Shaft Shaft Shaft Shaft
		20	Lathe	12 in. x 18 in.	1 1/2	
		17	Lathe	13 in. x 7 ft. 6 in.	1	
		19	Lathe	11 in. x 8 ft.	1 1/2	
		11	Lathe	10 in. x 8 in.	1 1/2	
12	15	36	Miller	4 ft. x 1 ft.	10	Shaft
		41	Crank Press	8 in. 100 tons	1	
		49	Miller	4 ft. x 1 ft.	10	
		50	Miller	4 ft. x 1 ft.	10	
		51	Drill press	1 1/2 in.-1 1/4 in.	1 1/2	
13	10	52	Grinder	5 in.	1	Emery
		53	Slotter	10 in.	5	
		54	Grinder	5 in.	5	
		21	Lathe	9 in. x 5 ft.	1	
		22	Lathe	9 in. x 3 ft. 6 in.	1	
14	7 1/2	23	Lathe	8 in. x 4 ft. 6 in.	1	Shaft Shaft Shaft Shaft
		26	Lathe	8 in. x 3 ft.	1	
		27	Lathe	8 in. x 4 ft. 6 in.	1	
		59	Saw	24 in.	5	
		75	Drill press	1 1/2 in. to 1 1/2 in.	1 1/2	
15	7 1/2	50	Saw	24 in.	5	Circular blocks Circular blocks Circular blocks
		61	Lathe	42 in.	2	
		62	Saw	12 in.	1	
		63	Planer	15 ft. x 1 ft. 6 in.	3	
		64	Saw	3 ft.	3	

divided into fifteen groups, the table giving a description of the driven machines as well as the horsepower of the motor required to drive the apparatus. This table should prove of value to engineers grouping machines for motor drive. The machines have been so arranged that for most jobs raw materials will enter the rear of the shop and pass from group to group, leaving the last group as a finished product.

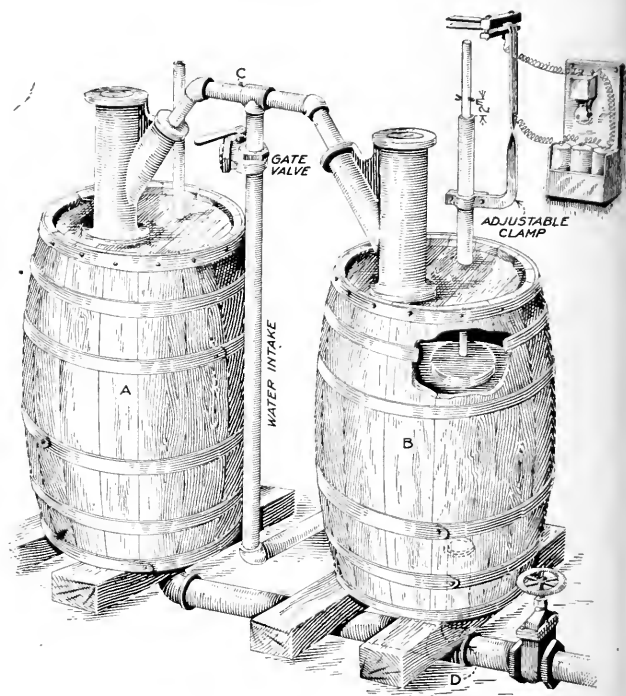
METHOD OF WEIGHING

BOILER-FEED WATER

Water Is Weighed in Barrels so Arranged as Automatically to Fill, Ring a Bell When Full and Then Empty

BY T. W. REYNOLDS

Such refinements as duplex-piston meters or Venturi meters, which are generally used in large power plants, are not absolutely necessary for accurately measuring boiler feed. An accurate method is to weigh the water in barrels by the method given here. The apparatus shown is devoid of complications, automatically indicating the filling of each barrel by means of an electrical alarm. A float in a barrel with a piston rising closes a circuit and rings the bell. The piston rises



EQUIPMENT ARRANGED FOR TESTING WATER FOR LARGE BOILERS

through a 2-in. (5.08-cm.) pipe, the latter serving as a vent to relieve excess pressure tending to burst the barrels.

The weight of water for a filled barrel is predetermined, and the number of fillings are noted as indicated by the bell. When the barrel is filled the intake valve is closed and the outlet valve opened. When empty the process is repeated as often as may be necessary. Two sets of barrels are necessary for testing large boilers. For small boilers only barrel B is required, the tees being plugged at C and D. With both barrels in use, the incoming water is divided equally to each through Y fittings, and entrance must be made on the side opposite the outlet so as not to disturb the float.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

COME OF 50 PER CENT

ON LINE EXTENSION

**Pacific Coast Company's Reasons for Requiring a
Revenue of This Size Before Starting Con-
struction Operations**

The Pacific Power & Light Company, Portland, Ore., in building a line extension, requires an estimated annual revenue from the installation of 50 per cent of the cost of the line. The company arrived at this figure by referring to a report of the Public Service Commission of Washington on the valuation, earnings, etc., of a company made in 1914 and 1915.

The report referred to shows that of every dollar the company has invested 48.7 per cent is in power plants, 8 in transmission lines, 5.8 in substations and 28.2 in distribution lines. Besides, the report shows that for every dollar invested gross earnings amounted to 14 cents and net earnings to 6.5 cents. In other words, the net earnings were 6.5 per cent on the investment. With these figures then in mind, the company reasons as follows: Assuming 6.5 per cent as a reasonable rate of return, gross earnings of 14 cents must be had on every dollar of total investment, of which 28.2 cents are in transmission lines. Conversely, then, with every 28.2 cents in transmission lines, gross earnings amount to 14 cents. Therefore, for every dollar in transmission lines gross earnings must amount to 49.6 cents. Therefore, an income of 50 cents on every dollar invested in distribution lines must be demanded. It has been further pointed out by the company that these figures make allowance for depreciation.

THE SALES DEPARTMENT'S

RELATIONS WITH CUSTOMER

**How the Activities of Commercial Men Connected
with Central Stations May Be Made More
Helpful in War Time**

Speaking before the American Institute of Electrical Engineers, Chicago Section, Jan. 14, F. A. Coffin, superintendent of power sales for the Milwaukee Electric Railway & Light Company, delivered some particularly pertinent remarks concerning those aspects of economy conservation which affect the sales departments of central stations. Mr. Coffin said:

An important condition facing all of us is the growing difficulty in financing extensions to meet new customers. We are rapidly approaching a condition where only such capital expenditures are justified as are directly necessary to the prosecution of the war. It is probable that, in addition to the deterring influence of the high cost of obtaining new money, we shall have regulatory action by federal authorities. All of this vitally affects expenditures for line service extensions which have hitherto been an inseparable part of the progress of attacking new business. There has been the same radical revision of the rule with respect to extensions, and it is the case that during these times customers will be required to finance at least the dif-

ference between normal cost and present abnormal costs in supplying them service.

The second aspect of importance is economy in the conduct of the sales department. I do not share in the pessimistic viewpoint that the war leads to a curtailment of the use of electric service. Early this year our company dispensed with all but the nucleus of its sales organization, and it is of interest to note that the increased business which we hope to receive by the end of the year through the usual sales methods has all come to us unsolicited. The high cost of fuel has no doubt made many industrial enterprises more ready to inquire for electric power supply, and a part of the business gained has been secured through the momentum of the past sales efforts; but, even discounting the effect of the fuel shortage, there is still a normal increase in the demand for service.

The third aspect to which I desire to direct attention is the question of character of service. The user of electric energy in America receives more in auxiliary service rendered by the engineering department, the trouble department, the lamp-renewal department, etc., for the rates he pays than the customer in any other country. We have naturally taken great pride in the completeness of the service we furnish, but there is no gainsaying that it imposes a very substantial expense, which is probably not justified in these times. The food administrators are now recommending an extra charge for delivery of parcels from other mercantile institutions, and there is no reason why similar modifications should not be made in our rules with respect to delivery of lamps, appliances, etc., or why the amount of gratuitous assistance given by engineering departments should not be gaged by the necessities of the situation, rather than by a mere endeavor to accommodate the customer.

Finally, and by no means the least important, the duty of the sales department lies in co-operation with the fuel conservation program of the government. Lightless nights perform an admirable function in impressing upon all customers the necessity of conservation, and no doubt the sum total of little economies effected will help the nation save coal; but we should be deceiving ourselves as well as the public if we lost sight of the fact that the actual amount of fuel in the power house saved by this method is indeed very small, being a mere fraction of 1 per cent of the total coal consumed by the central station and an infinitesimal part of the coal used by the entire community. There is much to be done besides enforcing and thoroughly co-operating with the rule with respect to lightless nights. Perhaps the most important economy which can be achieved would be the organization by the Fuel Administrator of a voluntary inspection service for industrial plants charged with making definite practical recommendations on the proper installation of steam-pipe coverings, satisfactory maintenance of boiler settings to avoid air leaks, scale elimination in boilers, care in banking and firing boilers, avoidance of general illumination of unoccupied factory space, possible savings effected by shutting down machinery when not required, etc., and the general elimination wherever possible of the non-condensing plant. In such a work the commercial engineering department would do effective work. It is not necessary for me to point out that such a system by the central station is a labor in the interest of patriotism.

We are naturally not interested in laboring to make the isolated plant more efficient. Our interest in normal times is to shut it down and to sell it service, but the necessities for fuel conservation are so great and pressing and the possibilities in this field are so substantial that no effort should be spared to co-operate to the greatest extent possible.

EXAMPLE OF CO-OPERATIVE READJUSTMENT OF LOADS

Power Customers Come to Central Station's Assistance, Thereby Reducing System Peak and Insuring Full Energy Supply to All

An instance of patriotic co-operation between a central station and its power customers recently came to light in connection with a service investigation bearing upon the coal shortage. The central station in this case purchased the bulk of its energy from a hydroelectric power company, and was asked by the management of the latter to cut out 20,000 kw.-hr. a week of its input from the water-power system. Further to conserve the energy supply it was requested that each Tuesday a "powerless day" be observed, during which no energy would be taken from the water-power company's lines. The central-station manager in this case was exceedingly loath to shut off energy from any of its customers. His system, though a small one, extended through a dozen municipalities, and it was seen that to cut off the supply would be a great hardship locally. Conferences were held with various power users, and one of these agreed to start up a 250-kw. steam plant and run it twenty-four hours a day, feeding energy into the central-station system as required, in addition to the demand of the machine owner. Eight other power customers voluntarily agreed to cut off their service at 4 p. m. Tuesdays, resuming work at 7 p. m. the same day and running as far into the evening as necessary to make up the deficiency in output. By this arrangement the hydroelectric company was relieved of the 20,000 kw.-hr. above mentioned each week and the peak load on the system was reduced, to the great advantage of the general water-supply situation in the territory, all customers continuing to receive full total weekly service.

LIMITATIONS PLACED UPON FREE SERVICES

Gratuitous Repairs and Deliveries Now Being Curtailed as a War-Time Practice by Commonwealth Edison Company

In speaking of the war-time practice of the Commonwealth Edison Company in regard to gratuitous service before a recent meeting of the A. I. E. E., D. W. Roper, superintendent of the street department of the company, said:

In the most prosperous times if there was any trouble with a customer's lamps or motors the company would, on request, send its troubleman to the customer's premises. If the interruption to the lamps was caused by some minor defect in the wiring or in the appliances, or the sockets of plugs or switches, the repair man would, if he could do it in half an hour or so, make the repairs sometimes temporarily, but he would make the repairs so as to enable the customer to get service. He would then advise the customer what to do in the way of making permanent repairs. Nowadays the company makes a minimum charge of 35 cents for sending a repair man to the customer's premises. If the trouble is found on the customer's premises and does not have to do with the company's part of the system, the charge is considered valid. In addition, a further charge is made for any time over the first fifteen minutes which the man spends on the customer's premises. This practice applies also to heating-device calls in apartment buildings.

There formerly was a sort of a perpetual guarantee on cords for electric flatirons. The practice now is to charge

the customer for the cost of the repair. The charge, 75 cents for replacing an electric-iron cord. This applies also to other heating devices.

Incandescent lamps for a number of years have been delivered free. The company's rates, of course, require that the lamps shall be furnished free, but they do not require that they shall be delivered. It is probable that within the next few weeks the company will make a charge for the delivery of lamps similar to the charge now made in answering a trouble call. It will, of course, be possible, even under the new arrangement, for the customer to get the lamps free by applying for them at one of the numerous delivery stations in the various parts of the city.

A BONUS AND PENALTY SYSTEM FOR SALESMEN

Profits from Fixture Campaign Contribute Material to Support of Sales Department, Besides Stimulating Lighting Business

On March 1, 1917, the new-business departments of the subsidiaries of the Cities Service Company inaugurated a campaign for additional commercial and factory lighting, as stated in the ELECTRICAL WORLD of Feb. 2. The number of fixtures sold as a result of the campaign in the communities served by nine subsidiaries was 5600, with a merchandising value of \$89,600.

This business has been taken entirely from existing customers, so that no new services were required and the installation expense was held to the minimum.

The salesmen worked on a commission basis with a system of penalties and bonuses under which they received a profit on the sale of fixtures and on the increased consumption from the customer and were penalized for any business taken without increasing wattage. These commissions were figured as follows: 10 cents per fixture for 75-watt fixtures, 40 cents per fixture for 100-watt fixtures, 50 cents per fixture for 200-watt and 300-watt fixtures, 65 cents per fixture for 500-watt fixtures or larger. In addition to this a bonus was paid of 50 cents per 100-watt increase in load added without any installation. In any case, however, where the salesman sold new units without increasing consumption he was penalized by not receiving any commission whatever on the sale of the fixture.

The profits secured from this campaign have contributed materially to the support of the sales departments in these properties.

FLATIRONS LOANED TO CONSERVE COAL SUPPLY

Pittsfield (Mass.) Central-Station Company Makes Non-Obligatory Proposition to Customers to Extend Over Six-Month Period

The Pittsfield (Mass.) Electric Company, in an effort to help conserve the coal supply, has made a proposition to its customers to loan them until July 15, without charge, electric flatirons which they may use as they see fit, without any obligation. The flatiron offered is one of the latest General Electric models, retailing at \$5. The offer states that if at the expiration of the time of the loan the customer wishes to keep the iron the company will sell it to him for \$4, payable either in cash or on monthly payments of 50 cents each month until it is paid for. To each customer a return postcard has been sent with the announcement.

HAT IS LEFT FOR THE CENTRAL-STATION SALESMAN? **portunity Which Present Conditions Offer for Actively Developing Appliance Load Can Be Made of Great Importance**

BY H. V. COFFY

H. M. Byllesby & Company, Chicago, Ill.

The central-station industry, among others, is finding existence difficult and somewhat uncertain. Of course, earnings show up well, but the operating costs are little net profit. An increase in rates is one thing the industry must have if it is to continue good service to its customers and meet legitimate obligations to employed capital.

Some companies have been successful in securing the right to make a war surcharge, and many more will secure some similar form of rate relief for the period of the war. Rates are only one of the central station's problems. The difficulty of securing capital on reasonable terms is another.

There has been some talk of the government giving electricity-producing concerns certain priority rights in demand for new capital. Unless something of this sort is done the central station is going to be overwhelmed with proffered new power business and absolutely powerless to serve it. Even if the government does provide a means for these vital industries to secure the necessary capital to build extensions and furnish equipment for the growing demands of war necessities, the cost of material, supplies and labor and the difficulty of obtaining them make it problematical whether the condition can be successfully encountered before the end of the war.

While there are many other problems, the two mentioned are enough for the central-station salesman. It means he can no longer seek new light and power business as he has been accustomed to—it means he must wait after business from an entirely new angle or get into some other department of the business.

He may not be permitted to seek new power business actively which is to be served from an extension, because the extension requires capital, and capital is not to be had. Or, if he is fortunate enough to be employed by a company which is still able to make reasonable extensions, he may have to use the utmost care and discrimination in selecting his "prospects," with the certain knowledge that it is only a matter of time until he must abandon even these efforts. Many companies do not permit the salesman to take on new power business from present customers if it comes on or near peak, because the capacity of the station is overloaded.

While the central-station salesman faces a serious problem, he also faces a big opportunity—domestic electrical appliances.

For years there has been talk of the domestic appliance load filling up the valleys. It has been thought at some time in the future the electric appliance load might represent one of the central station's greatest assets. Manufacturers have preached it and advertised it. Central-station companies and central-station salesmen have believed it, but they have conducted their advertising and their campaigns for the most part in a hasty and spasmodic way and have fallen far short of the real possibilities.

Undoubtedly the past year has seen the greatest progress in the development of the uses of electrical appliances of all the years in the history of the industry. This year will see even greater progress, particularly if the central stations get busy and do just a reasonable amount of promotion and sales work.

It is believed that every city in the United States has felt this growth during 1917. There is one city, for example, with a population of 75,000, the electrical dealers of which sold more than 3700 electrical appliances during the first ten months of the year—nearly 100 a week. No special efforts have been made to build up the electrical appliance business in this territory; it is simply natural growth as the result of the housewives recognizing their needs and satisfying them. What would have been the total if really serious efforts had been made to build up this class of business? This particular community has always been a good appliance territory, but it is safe to say that never before in a like period have anywhere near so many appliances been sold. It is doubtful even now if there are more than half a dozen houses in the city which have anything like a full equipment of electric household time and labor savers, and there are probably thousands of homes in this community which do not possess more than one electrical appliance.

Every house on the lines of a central station is a prospect for this kind of business. If the family have an electric flatiron, the company should try to sell them a vacuum cleaner. If they have both of these, sell them a washing machine. If they have this, get out the sewing-machine motor. If in each instance the real time and labor savers are sold, the other electrical conveniences will come naturally, without much sales effort. Every electrical appliance sold at a home makes it just that much easier to sell another one—assuming, of course, that the purchaser gets real service after the purchase is made.

Many central stations in the past have offered time payments on all electrical appliances. All of them ought to do this. Now particularly, when anything which costs more than \$5 can be purchased on time, special easy terms on electrical appliances are imperative and should be given to the public continuously.

ECONOMIES IN METER READING AND DELIVERY OF ACCOUNTS

Middle Western Company Materially Reduces Regular Force by Means of Employment of High School Students

The employment of high-school students in addition to the necessary regular force to read meters and distribute bills to customers has been practiced for several months past by the Sandusky (Ohio) Gas & Electric Company. This system, the company states, is not only materially reducing the expense of reading meters and distributing bills, but in addition makes it possible to reduce the regular operating force to a minimum, as it has been found that where all meters are read between the twentieth of one month and the first of the next it is not always possible to keep the entire force busy during the period from the first to the twentieth of the month, when no outside construction work is under way during the winter months.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Insurance of Electrical Machinery.—C. STUART BUYERS.—Attention is called to the dependence of industrial output on the reliable operation of the motors used. It is suggested that more plants, not having the services of expert electricians or engineers, insure their motors and take advantage of insurance-company inspectors' advice to determine when motors need attention.—*London Electrical Review*, Dec. 28, 1917.

Alternating-Current Automatic Starters for Squirrel-Cage Induction Motors.—W. H. PATTERSON.—An explanation of the operation of an automatic alternating-current starter for squirrel-cage-type induction motors. Some of its applications and limitations are pointed out.—*Power*, Feb. 5, 1918.

Lamps and Lighting

Portable Magneto Lamps in the Teutonic Armies.—A description of several types of such lamps found in ground recovered from the enemy. They are operated by springs actuated by the hand and have obvious advantages over the non-enduring storage-battery pocket lamp. The drawback of weight, however, makes it little likely that they will supersede the other type. The most powerful of the magneto lamps, which has a reserve of energy affording ten minutes' lighting with no movement of the hand, weighs about 1580 grammes, or 3.3 lb.—*L'Industrie Electrique*, Nov. 25, 1917.

Arc Lamps with Two Pairs of Carbons for Networks with Polyphase Currents of Low Frequency.—ANDRÉ BLONDEL.—Description of a very simple arrangement for suppressing the difficulties that result from the employment of many polyphase arcs.—*Revue Générale de l'Electricité*, Dec. 22, 1917.

Electric Lamps in Non-Gaseous Mines.—GEORGE H. DEIKE.—According to the author, fussing with oil and carbide lamps consumes thirty to fifty-five minutes per shift and reduces the loader's output 35 per cent. Insurance earnings on electric lamps will pay about 18 per cent on the money invested in them. Electric lamps cost roughly a half less to maintain than oil or carbide lamps.—*Coal Age*, Feb. 2, 1918.

Generation, Transmission and Distribution

Some Developments in the Electrical Industry During 1917.—JOHN LISTON.—A review of the activities of the electrical industry during the past year. There are, however, many important developments associated with war work that cannot be mentioned for obvious reasons.—*General Electric Review*, January, 1918.

Mechanical Features of Transmission Lines.—A. GRONDA.—The author discusses latticed posts critically, showing they are not always the most economical, and that tubular construction is sometimes preferable; he considers the reactions between conductors and posts, and gives a chart for the calculation of the ten-

sion of aerial lines, showing how to employ it to determine the strain put upon the posts when they are unsymmetrically loaded.—*L'Elettrotecnica*, Dec. 15, 1917.

A South American Power House.—Description of the new central station at Tocopilla, Chile, built for the Chile Exploration Company, one of the largest copper mining concerns in the world. This power house is 3000 m. (approximately 2 miles) above sea level and serves a 110,000-volt transmission line, the highest tension in operation in South America. Its capacity is 60,000 hp., with room for future growth, four Zoel steam turbines rated at 15,000 hp. each having been installed. Each turbine is directly coupled to a Siemens-Schuckert 10,000-kva., 5000-volt, 50-cycle, 150 r.p.m. turbo-alternator.—*Boletín de la Asociación Electro-Técnicos* (Buenos Aires), October and November, 1917.

Central Stations and Fuel Economy.—E. LEHOUX.—The author maintains that, without affecting their output, many central stations can reduce their consumption of coal by from 10 to 15 per cent by the application of scientific principles to the construction and operation of mechanical and electrical equipment. These principles are based on the transformation of calorific energy into electrical energy at the lowest cost, whether the transformation is wrought by means of gas engines or by steam engines or turbines. Gas engines are economical only in central stations having a high and constant load factor or where surplus production can be utilized for storage batteries. Steam-operated power houses fall into two classes, those supplementing hydroelectric installations and those operating alone or in connection with other steam stations. The first class, operating intermittently and with a variable load, consumes coal at a much greater proportionate rate than the second class, and it is in them that the best opportunities for economy occur. In plants built from 1900 to 1908, with modern equipment and generating units rated at from 1000 kw. to 1500 kw., a kilowatt-hour was produced for every 15,000 calories, or for 2 kg. (4.4 lb.) of coal having a calorific power of 7500 calories per kilogram. Since then in very high-powered plants, with turbine units rated at from 10,000 kw. to 20,000 kw., the record has been reduced to 8000 calories for a kilowatt-hour; that is to 1.07 kg. (2.35 lb.). The author inquires how much nearer the theoretical value 1 kw.-hr. = 3 calories, or 0.115 kg. (0.253 lb.) of coal, it is possible to come. His estimate of 10 or 15 per cent improvement is based on a detailed study of the entire cycle of transformation. To bring it about he would install a complete outfit of meters and registers for every step in the process of creating heat and converting it into electric energy, electrifying these instruments and bringing those for each boiler together upon a board in a convenient position where they would be under the constant supervision of an experienced operator. In addition, equalization of central-station load and

improvement of the load factor of the network of distribution are of great importance. Finally, constructors should bend their energies to the perfection of the gasogen, as a means of ameliorating furnace output, and to the study of the still experimental gas turbine. —*Revue Générale de l'Electricité*, Dec. 15, 1917.

Peat and the Electric Industry.—PIERRE GUIEU.—Continuation of an article dealing with the various ways in which peat may be employed as a main or auxiliary fuel in central stations.—*Revue Générale de l'Electricité*, Dec. 22, 1917.

Installations, Systems and Appliances

Conveyors and Elevators.—W. H. ATHERTON.—Sufficient coal storage is a vital matter for the power station, and introduces problems that are conveniently solved by conveyors. The various types of conveyors and elevators for coal handling and ash handling are considered in some detail, and reference is also made to the suction method of removing ashes.—*London Electrician*, Dec. 21, 1917.

First Electric Steel-Melting Furnace in South Africa.—The shortage of many materials is affecting the mining companies in various ways and in some instances leading to new applications of electric power. For example, a recent issue of the *Journal of Transactions* of the South African Institute of Electrical Engineers contains a paper by W. Buchanan and G. H. Stanley describing what is stated to be the first electric steel-melting furnace in South Africa. This furnace was rendered necessary by the great demands of the mining industry for stamp battery shoes and dies, which can be met with difficulty owing to import restrictions. A regular supply of material amounting to about 7500 tons per annum is required, and arrangements are now being made to utilize by means of a new electric furnace existing accumulations of scrap shoes and dies. The furnace was started on Sept. 3, 1917, the output estimated at being about 60 tons of cast shoes and dies per month.—*London Electrician*, Jan. 11, 1918.

Largest High-Head Francis Turbine.—ARNOLD FAU.—This article describes the hydroelectric equipment installed in the White River plant of the Puget Sound Traction, Light & Power Company, near Sumner, Wash. This plant contains two 18,000-hp. Francis turbines operating under a net head of 440 ft. (134.1 m.) which have developed over 44,000 hp. without any detriment to their efficiency. On account of the hydraulic conditions special engineering problems were involved, which have been solved by special features in design. A new 25,000-hp. unit is being installed, this being the largest hydraulic turbine of its type in the world.—*Power*, Feb. 5, 1918.

Electrophysics and Magnetism

Portable Roentgen-Ray Generating Outfit.—W. D. POLIDGE AND C. N. MOORE.—This article is descriptive of the development of a complete portable Roentgen-ray generating outfit for military service in the field. The essential features of the unit are its simplicity, compactness, portability and unusually high efficiency. Twenty per cent of the generated energy is utilized in the generation of Roentgen rays. The tube has been specially developed for use in this outfit and is fully explained.—*General Electric Review*, January, 1918.

Fluorometric Apparatus for Regulating X-Rays.—H. GUILLEMINOT.—Apparatus for measuring the intensity of the incidental radiation is described.—*Revue Générale de l'Electricité*, Dec. 22, 1917 (abstracted from *Comptes Rendus des Séances de l'Académie des Sciences*, Nov. 19, 1917).

Electrolytic Precipitation of Gold, Silver and Copper.—Because of the uncertain supply of metals, particularly zinc, which is now used exclusively for precipitation in the cyanide process, it is interesting to examine electrolytic precipitation, which affords the most convenient substitute. Results obtained by this method in the laboratory have been satisfactory, but industrially success has not been great in the past. This article deals with experiments made at South African and Mexican mines with improved apparatus. In a treatment with limestone extending over two months, where 4 tons of solution was used for each ton of limestone, the cyanide apparently regenerated was 0.45 kg. (0.99 lb.) per ton of limestone, while 80 per cent of gold and 89.6 per cent of silver were precipitated. The regeneration of cyanide was greater by this method because of the large quantity of copper contained in the limestone.—*L'Industrie Electrique*, Dec. 10, 1917.

Units, Measurements and Instruments

Relations Between the Electrical Units and the Laws Underlying the Units.—This digest develops in a consecutive manner the relations between the units of an "ampere, ohm, ampere-turn, weber" system of units from which all decimal conversion factors and irrational 4π factors have been eliminated. The electrostatically defined unit charge—the coulomb—is taken as the starting point. It is advocated that beginning students be taught to carry on their calculations in a single system of units and not in a mixture of three systems, and that the system taught be the pure practical system, or ampere-ohm-volt system. Furthermore, it is contended that students should not be burdened with the relations between the electrostatic, electromagnetic, the Heaviside and the hybrid practical systems until after they have learned to think in terms of a simple factor-free system. The advantages of such a course and the manner in which the relations between the units may be rationalized and freed of the troublesome conversion factors are set forth in the preface and in the following sections of the bulletin.—*Bulletin No. 880 of the University of Wisconsin*.

Measurement of Air and Gases by the Pitot Tube.—A. H. ANDERSON.—In this article is given an explanation of the use of the Pitot tube and tables to simplify calculations.—*Power Plant Engineering*, Feb. 1, 1918.

Miscellaneous

Mica.—JAMES SCOTT.—An article descriptive of its microscopical structure and behavior.—*London Electrical Times*, Dec. 27, 1917.

Deterioration of Muntz Metal (60:40 Brass) by Selective Corrosion.—The paper reports the study of selective corrosion of Muntz metal, a material having a variety of industrial uses. The selective corrosion is illustrated by four types, including tubings, sheets and forgings. The metal becomes red in color, very weak and brittle by this type of corrosion. The condition favorable to such corrosion is the accelerating effect of

the closely adhering deposits of chloride resulting from the attack of the metal. Other conditions accelerate the corrosion, as contact with the more electronegative constituents, increase of temperature and service stresses.—*Bureau of Standards, Technologic Paper No. 103.*

Condensers with 70-Ft. Water-Level Variation.—F. R. BROSIUS.—A description of the substructure adopted to assure a satisfactory supply of condensing water under unfavorable conditions and to support the great weight of the power plant and equipment on unstable ground at the West End power station of the Union Gas & Electric Company of Cincinnati, Ohio. The condenser wells are five in number. The intake well is 86 ft. (26.2 m.) deep and 60 ft. (18.3 m.) in diameter. Two condenser wells will contain all recondensing equipment; each is 84 ft. (25.6 m.) deep and 86 ft. (26.2 m.) in diameter. The two discharge wells are 17 ft. (5.2 m.) in diameter. These wells are necessarily deep owing to the fluctuating water in the Ohio River, which is about 70 ft. (21.3 m.) between the extreme low-water and extreme high-water levels. The method used for sinking the larger wells is given in detail.—*Power*, Jan. 29, 1918.

Electroculture.—A description of the electrical apparatus employed to stimulate agricultural production. Experiments have shown an increased growth under this treatment as follows: Young strawberry plants, 80 per cent; old strawberry plants, 25 to 36 per cent; potatoes, 20 to 50 per cent (in the size, not the number of the potatoes); carrots, beets and tomatoes, 20 to 50 per cent. Not the least advantage noticed is the destruction of worms and insects that prey upon the plants.—*L'Industrie Electrique*, Dec. 25, 1917.

A Talk to Firemen on Saving Coal.—CHARLES H. BROMLEY.—This is a simple, straight-from-the-shoulder talk to firemen, giving the most important things to do to get the most out of coal, with the hope that firemen and their employers will become interested enough to study fuel economy further as the problem confronts them. The author deals in the main with the following sub-topics: "Employers Need Education," "Hints on the Care of Fires," "Cleaning the Fires," "A Few Hints on the Stokers" and "Some General Hints."—*Power*, Jan. 29, 1918.

Coal and Its Selection.—WALTER N. POLAKOV.—This article includes a description of coal formation and qualities, proper selection and economical use.—*Power Plant Engineering*, Feb. 1, 1918.

Determination of Atomic Weights by Means of X-Rays.—C. W. KANOLT.—From the spectra obtained by exposing crystals of two different substances to X-rays of the same wave-length, the ratio of the distances between adjacent layers of atoms in the two substances can be easily determined, as is well known. If the relative distances are determined in the direction of each crystal axis, these results, together with the inclination of the axes to each other in each crystal, enable one to calculate the ratio of the volumes of the elementary parallelopipeds of each crystal. From this ratio and the ratio of the densities the ratio of the molecular weights can be easily calculated. From the ratios of molecular weights atomic weights can be calculated in the usual manner. After suitable apparatus has once been set up this method should permit the determina-

tion of the atomic weights of a considerable number of elements with less consumption of time and in most cases with greater accuracy than the chemical methods that have been used hitherto.—*Science*, Feb. 1, 1918.

Book Reviews

EVERYMAN'S CHEMISTRY. By Ellwood Hendrick. New York: Harper & Brothers. 374 pages.

Intensified interest in the chemical field caused by the war makes this book timely and useful. It is a real "chemistry book," giving in popular language a view of modern progress in that field, and is designed for those who know nothing about chemistry. The book tells how chemists think and how their work enters into life and industry on every hand. Valuable technical information has been presented in an interesting, readable form, which was the author's aim. This is the second book of a modern science series planned by Harper & Brothers, intended to present the latest and most authoritative pictures of modern science in scientific and sociological fields.

PRACTICAL ELECTRIC ILLUMINATION. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 226 pages, 166 illustrations. Price, \$2.

This is a condensed compilation of some of the best information on illuminating engineering practice and available apparatus. The author is well known to have the art of presenting his facts in a clear and usable form, and this book comes up to that standard. Special care has been given to the diagrams and illustrations in order to present them in a clear manner, and certain mechanical analogies have been worked out by the author to explain the phenomena of light which assist in easy conception of the principles involved. Like many compilations from various authorities intelligently made, this book is probably of greater practical value than some more pretentious works in which there is not such correlation of the different parts. Extensive use has been made of publications in current practical literature and manufacturers' engineering data. The book first takes up fundamental ideas of light and radiation and then follows with principles and units, reflectors, incandescent lamps, arc lamps, mercury vapor and tube lamps, principles of illumination design, interior illumination and exterior illumination. The index is very full and complete. The book is evidently intended to be used hand in hand with the "American Electrician's Handbook" by the same author, as frequent references are made to tables found in that book. In many cases these tables are of equal importance in illumination work with those to which room is given in this book. The matter on glare and permissible brightness contrasts is not quite up to date. A strange error which has crept into paragraph 89 is the statement that it is desirable to express intrinsic brightness in candle-power per square inch because the numbers would be awkwardly large if they were expressed in lamberts. The lambert, which is the present recommended standard of technical societies, is equal to about 0.5 candle per square inch. As a whole, however, the book is probably one of the best of its size and kind now on the market.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

45,000-KW. TURBINE ADDED TO NEW ENGLAND RESOURCES

Narragansett Electric Lighting Company Places
Large New Generating Unit in Operation at
Providence—Power Needed

Within the last few days a 45,000-kw. turbine-generator set has been placed in operation at the South Street steam plant of the Narragansett Electric Lighting Company, Providence, R. I., increasing the generating capacity of the station to about 80,000 kw. and making the most notable single-unit addition in New England central-station history.

The new machine, believed to be the largest size to be placed in operation in the world to date, more than doubles the station rating and institutes a most welcome source of energy under present conditions in the New England power field.

HELP TO HYDROELECTRIC SYSTEM

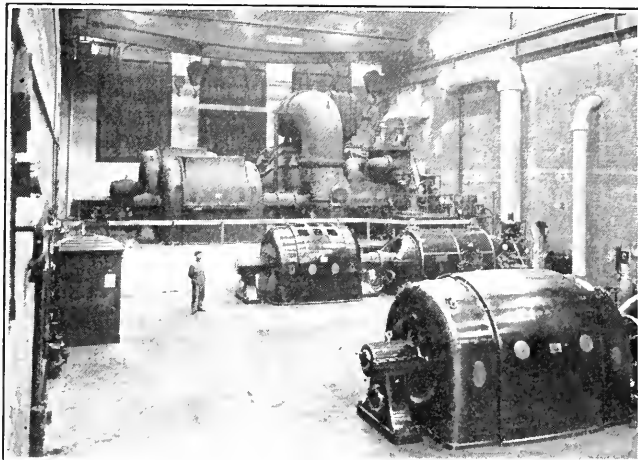
The Narragansett company is the largest central station from which the New England Power Company purchases energy. The former is at present selling the latter company over 2,000,000 kw.-hr. per week, and installation of the new unit, with its guaranteed high efficiency in operation, will benefit the New England company's hydroelectric system to a notable extent in view of the present coal shortage, besides being of great value in handling the load at Providence and elsewhere on the Narragansett company lines.

The new unit was built by the Westinghouse company and has been installed under the direction of Francis Hodgkinson, chief engineer of the manufacturing organization, and Webster Talmadge of the Westinghouse New England staff. It is of the cross-compound type, consisting of a high-pressure turbine exhausting into a low-pressure turbine, the former running at 1800 r.p.m. and the latter at 1200 r.p.m. Each drives a direct-connected generator of 22,500 kw. rating, delivering 11,000-volt, three-phase, 60-cycle energy and designed to divide the load equally between the two. The unit is supported on a structural steel foundation, weighing about 515,000 lb. (233,600 kg.), the foundation being carried on a pile and concrete foundation formerly supporting a brick chimney. Steam is supplied at 200 lb. pressure (14.1 kg. per sq. cm.) and 100 deg. superheat, and the guaranteed water rates at various loads are as follows:

Power Factor 95 per Cent— Per Cent Load		Lb. Steam per Kw.-Hr.— 28.5-In. Vacuum 29-In. Vacuum	
	Kw.		
100	45,000	11.85	11.55
89	40,000	11.75	11.35
78	35,000	11.55	11.20
67	30,000	11.45	11.05
56	25,000	11.60	11.15
45	20,000	11.85	11.35
34	15,000	12.30	11.50

On account of the characteristics of the feed water and also because of space limitations, the condensing

equipment is of the jet type. There are two No. 24 Westinghouse LeBlanc low-level condensers capable of handling 18,000,000 lb. (8,572,897 kg.) of injection water and of condensing 500,000 lb. (226,796 kg.) of steam per hour to 28-in. vacuum, with cooling water at 70 deg. Each condenser is turbine-driven through gears and can be operated separately if desired. The condensers are mounted below the turbine, and salt water from the Providence River is used for injection purposes. Two free-exhaust pipes, 42 in. (106.68 cm.) in diameter, lead from the high-pressure side of the unit to outboard discharges, and two 42-in. back-pressure valves weighing 7000 lb. (3175 kg.) each are installed. The steam supply for the turbine is taken by a 24-in. (60.96-cm.) steel pipe from a horizontal



GIANT TURBINE-GENERATOR SET WILL HELP TO OVERCOME
EFFECT OF COAL SHORTAGE

boiler-room main, the turbine line being carried about 50 ft. (15.2 m.) away from the main to a U-head and thence back to the turbine-room wall and to the throttle, more than 100 ft. (30.4 m.) of pipe being installed to provide for expansion. This piping can be swayed slightly by hand, so that the turbine casing is freed from danger of injury due to pipe expansion. There are now twenty Babcock & Wilcox boilers in the plant, sixteen being rated at 600 hp. and four at 440 hp. All the boilers are equipped with seven-retort Taylor stokers. There are six steel stacks, each 217 ft. (66.14 m.) high above mean high water and 11 ft. (3.35 m.) in inside diameter.

The new unit occupies a space but 50 ft. (15.2 m.) long, 37 ft. (11.27 m.) wide and 18 ft. (5.48 m.) high. About 4,500,000 cu. ft. (127,000 cu. m.) of air per hour are required for generator ventilation, and it is estimated that if the entire output of the unit were utilized in the weaving of cotton cloth it would keep 125,960 looms busy and manufacture into fabric 574,692,000 lb. (260,000,000 kg.) of cotton per year.

The total weight of this great turbine unit is 1,380,000 lb. (625,957 kg.).

MEETING OF GOVERNORS OF ASSOCIATED MANUFACTURERS

John R. Rathom, Skillful Exposer of German Plots,
Is to Address Members of the Association at
Annual Banquet on March 21

A regular meeting of the board of governors of the Associated Manufacturers of Electrical Supplies will be held at 2:30 p. m. on Feb. 15 at the headquarters, New York. Final arrangements in connection with the annual meeting, as well as other important matters, will be discussed.

John R. Rathom, editor of the *Providence Journal*, which has exposed numerous German plots in the last three years, has consented to address the members of the association at the banquet following the annual meeting in New York on March 21.

MANUFACTURERS WORK TO CONSERVE INDUSTRY RESOURCES

"Manufacturer Can Manifest No Greater Patriotism
than by Consulting with Group Committee
Before Making Plant Extensions"

The General War Service Committee of the Electrical Manufacturing Industry has issued the following bulletin, entitled "Conservation of Industrial Resources," to every electrical manufacturer:

Your committee understands that it is the purpose of the federal government to conserve the industrial resources of the country to war needs and that when measures to that end are undertaken they will be in harmony with the following:

1. The full power of all industry, in all departments—labor, equipment and capital—must be utilized primarily for the successful prosecution of the war, to the end that all essential war products may be obtained in the quantities and at the time required.

2. Existing equipment, organizations and agencies will be utilized as far as possible with the least industrial disturbance and avoidance of too great concentration of war work in large industrial centers. It may be necessary to change the character of the work done, but every effort should be made to maintain a normal flow of trade through existing channels and conserve all industry for peace.

3. Plant extensions should not be made, or new plants created, when there is available unutilized national capacity that can be adapted to the needs of the hour.

4. Readjustment of so-called less essential business will be required only to the extent that such business interferes with the essential war program. When such readjustment is necessary the first appeal will be for voluntary action by the industrial group affected.

A function of the industrial representative of the War Industries Board will be to co-ordinate the industrial resources of the country, so as to utilize them with the least industrial disturbance. In sympathy with above course your committee urges electrical manufacturers, by means of their committee organization, to co-operate actively with the government.

During the period of the war a manufacturer can manifest no greater patriotism than by consulting with the appropriate group committee before undertaking any plant extensions.

It is not intended to deter any manufacturer from exercising individual initiative, or to check the normal growth of any business. On the contrary, it is most desirable that every manufacturer maintain his present organization at highest efficiency, making only such readjustments as will harmonize with government requirements.

It is in the interest of the electrical manufacturing industry that excess demand in the proper prosecution of the war shall be met:

1. By unutilized capacity within the group of manufacturers affected.

2. Within the electrical industry as a whole.

3. By unutilized capacity in another industry, presumably by the advice of the industrial representative of the War Industries Board.

To promote such a program, each group committee is requested to keep informed as to excess demand and surplus capacity in its respective lines, and whenever necessary to confer with the general committee.

The committee has also issued a bulletin showing its organization and stating its functions.

COMPTROLLER OF CURRENCY SEES NEEDS OF UTILITIES

Warning that They Must Be Kept Efficient and Solvent as War Measure—Protect Owners
Against Unjust Loss

In his annual report, just sent to Congress, Comptroller of the Currency Williams says that national and state banks and many thousands of small and large investors have suffered seriously from the decline of the earning capacity of public utility corporations and the consequent shrinkage in the value of their securities, representing investments of many hundred millions of dollars. These losses, he adds, naturally diminish the power and disposition of the public to respond to the calls of the government for money for war.

While Mr. Williams recognizes the shortcomings of some of these corporations, he says that generally they were able to serve the needs of their communities with reasonable efficiency and to earn fair returns on the money invested in them. He continues:

Now they are threatened with ruin. If they are allowed to sink into inefficiency, much of the important war work of the government will be crippled or paralyzed.

The continued and increasing efficiency of these corporations is important for the successful conduct of the war. This efficiency is not possible with present conditions. Corporations proved by their own figures to be approaching bankruptcy cannot obtain money for improvements or maintenance. On the other hand, banks and citizens suffering severe losses from investments in the securities of these entirely legitimate and once promising enterprises will be discouraged from lending money to the government or deprived of the means to lend.

The first and most direct relief to the public utilities corporations can be given by the state public utilities commissions and municipal and local authorities, with the broad-minded co-operation of the people generally, notwithstanding the necessities of war and realizing that the more promptly its burdens are accepted the sooner they will be lifted. It is essential that forbearance and consideration be exercised by the state commissions and municipal authorities, and that the corporations also be permitted to make such additions to their charges for services as will keep in them the breath of solvency, protect their owners against unjust loss, and give them a basis of credit on which they may obtain the funds with which to meet the strain put on them by the government's needs. The breaking down of these corporations would be a national calamity.

I am impressed with the importance of early consideration by the Congress of some measure to provide, directly or indirectly, for advance of funds on some conservative basis to such of these corporations as need help most urgently so that they may give adequate service to the government. The remedy would be unusual, but the times are unusual.

Comptroller Williams also urges that banks should not take advantage of war conditions to exact heavy interest. He gives statistics of increased material cost supplied by utility associations.

INCREASE IN RATES

AT SHEBOYGAN, WIS.

Authority Granted Eastern Wisconsin Electric Company by Railroad Commission to Increase Power and Lighting Other Than Residential Rates

The Wisconsin Railroad Commission on Jan. 29 rendered a decision in connection with the application of the Eastern Wisconsin Electric Company to increase power and lighting rates, with the exception of residence lighting rates, at Sheboygan.

The company requested permission to increase the rates mentioned 0.75 cent per kilowatt-hour and to discontinue the sale of tickets at six for 25 cents.

The commission granted authority to increase power rates and all lighting rates other than residence lighting rates 0.25 cent per kilowatt-hour beginning on Feb. 1 and continuing to Aug. 1 of this year, when the former rates become effective, unless upon application the commission approves of a continuance of the rates granted under this emergency order. The minimum lighting rate was reduced from \$1 to 75 cents, and permission was granted to discontinue the sale of six tickets on the electric railway for 25 cents for the period mentioned.

The company has also made application to the commission for authority to increase lighting and power rates at Fond du Lac 1½ cents per kilowatt-hour and to eliminate the sale of the six tickets for 25 cents at that point, and an application has been filed and hearings held in connection with the elimination of eight tickets for 25 cents on the Oshkosh property of the company. No decisions have been rendered on the last two applications.

FUEL ADMINISTRATION

TAKES CONTROL OF OIL

Public Utilities, with Domestic Consumers, Rank Fifth in the Classes of Users Designated for Priority

By proclamation of the President, manufacturers and distributors of fuel oil, including gas oil, with an output of more than 100,000 barrels a year, are placed under the licensing system of the Fuel Administration, effective on Feb. 11.

Under the proclamation the licensee engaged in the distribution of fuel oil in that part of the United States east of the Rocky Mountains shall not without the consent of the United States Fuel Administrator make any deliveries of fuel oil to any customer of any one of the classes mentioned below until he shall have delivered to customers of every class designated by a power number with whom he may have a contract all fuel oil for which deliveries shall be then due upon such contract. Differentials as between members of the same class may be made only with the consent and under the direction of the United States Fuel Administrator:

1. Railroads and bunker fuel.
2. Export deliveries or shipments for the United States Army or Navy.
3. Export shipments for the navies and other war purposes of the allies.
4. Hospitals where oil is now being used as fuel.
5. Public utilities and domestic consumers now using fuel (including gas oil).
6. Shipyards engaged in government work.
7. Navy yards.
8. Arsenals.
9. Plants engaged in manufacture, production and storage of food prod-

ucts. 10. Army and navy cantonments where oil is now being used as fuel. 11. Industrial consumers engaged in the manufacture of munitions and other articles under government orders. 12. All other classes.

SAVING OF COAL MADE

BY THE PUBLIC UTILITIES

Electric and Gas Companies in Twenty-nine Large Cities Report Saving of 21.2 Per Cent During Five-Day Period

Dr. Garfield announced on Feb. 6 that, if possible, the Monday closing order would be rescinded after Feb. 11, but that will be determined by weather and general conditions. Railroad embargoes will be continued indefinitely. Dr. Garfield stated in referring to the conference of Fuel and Railroad Administration officials on Feb. 5 that without exception the Fuel Administrators present bore witness to the uniform and patriotic observance of the closing order on the part of all classes of the community.

The official statement says in part:

The effect of the closing order is not easily measured statistically, the more so because of extraordinary weather conditions, but the State Fuel Administrators report that substantial savings have been effected. The most exact estimates were submitted by the secretary of the National Committee on Gas and Electric Service. These figures were furnished by electric light, power and gas companies of twenty-nine of the largest cities of the country. The weighted average of the saving in five days from Jan. 17 to 22, inclusive, was 21.2 per cent, while the saving for Monday, Jan. 28, was 25.5 per cent of the amounts usually consumed.

Mr. Garfield is informed that the public utilities concerned did not consume on other days appreciably more than the normal amount of coal as a result of the shutdown.

It is estimated that the public utilities reporting furnish a fair index of the general saving in the communities involved.

CANADA NOW GETS A

WORKLESS DAY ORDER

D. H. McDougall Telegraphs "Electrical World" that as Principal Central Stations Have Hydroelectric Power Business Effect Is Slight

An order in council passed by the Dominion of Canada Cabinet on Feb. 4 on recommendation of Fuel Comptroller Magrath suspends operation of all manufacturing plants, including munitions, on Feb. 9, 10 and 11. It does not apply to Western Canada or the Maritime Provinces.

Exemptions similar to those in the United States regulation are granted. Heatless Mondays are ordered from Feb. 18 to March 25 for theaters and other amusement places. Golf, yacht, canoe, hunt and country clubs must close during March except on Wednesdays and Saturdays.

Mr. Magrath is in Washington co-operating with authorities there.

In answer to an inquiry, D. H. McDougall, president Canadian Electrical Association, Toronto, telegraphs the ELECTRICAL WORLD:

Inasmuch as all principal Canadian central stations are supplied from hydraulic power plants Fuel Commissioner's order will have little effect on the business, large part of load, used by furnaces and other munition plants, requiring no fuel. Principal loss will be from store and office revenue.

SIDELIGHTS ON THE EVENTS AT WASHINGTON

The \$10,000,000,000 Which Must Be Raised, Needs of Industry, the War Finance Corporation and a Little Politics

(By Our Washington Correspondent)

A few days ago the United States Treasury disbursed \$86,000,000 in one day. And now it is getting to be pretty well understood that it is necessary to raise before the end of the fiscal year for war needs of the United States and the Allies \$10,000,000,000.

There must be money raised, too, with which to run business, so that business may produce in taxes the money with which to run the war. In this situation, now being driven home with force in Washington, it is proposed that Congress shall create a "War Finance Corporation," with a cash capital of \$500,000,000 and authority to issue and sell \$4,000,000,000 in short-term notes, for financing private war industrial operations. These phrases are other terms for the creation again of priorities—this time, priorities in money and for private industry, not for the government. It is a trifle early to say what Congress will do. The best judgment obtainable in Washington, where so many leaders in the industrial world are now living for the period of the war, is that some form of "War Finance Corporation" to keep private industry going has become a vital necessity.

Many other very interesting things are coming to the surface. A good portion of the money that was tied up in Russian contracts is, of course, diverted; and recently the French government, pointing out that nothing is gained by paying for machinery and materials in this country unless ships can be furnished to carry the machinery and materials to France, had its representatives here discuss with American contractors a basis for the liquidation of contracts, and millions of dollars of machinery contracts were so liquidated. As to Russia, in particular, business men now in Washington insist that there is no cause for alarm concerning the future.

There is much gossip in regard to the growing power and responsibilities of Secretary McAdoo of the Treasury Department. If there is one thing in the way of the easy passage by Congress of the "War Finance Corporation" bill, it is the fact that Secretary McAdoo has had thrust upon his shoulders almost too much work, almost too much responsibility. None the less Secretary McAdoo seems to bear up under the strain, and his friends are sincerely rejoicing that if politics does grow out of his enormous powers and responsibilities he stands a very good chance of being the logical nominee to succeed his distinguished father-in-law in the Presidential chair.

Why, the question is asked, has Edward R. Stettinius, formerly of J. P. Morgan & Company, who for more than three years had absolute control of purchases of the Allies in the United States, been brought to Washington as a "surveyor general" for army purchases, only to report to the highest authorities through

a series of steps beginning with an army colonel? The idea of Mr. Stettinius "reporting" through boards and councils and subordinates, in view of the fact that he is one of the best qualified men to direct all war purchasing, is really laughable. If the war council of the Secretary of War decides that it is policy to purchase a large quantity of this or that, General Goethals, the new acting quartermaster-general, is informed; and then General Goethals asks Colonel Palmer M. Pierce, the new director of purchases, to go ahead, and the Colonel Pierce refers the request to Mr. Stettinius. The latter's recommendation then goes to Colonel Pierce and from him to General Goethals, and the latter is to let the contract. In case of disagreement, Secretary Baker is referee. It seems a roundabout method, and there is talk of reassigning Mr. Stettinius. Perhaps it is not roundabout in practice. The best thing to do in Washington is to have confidence.

LABOR ADVISORY COUNCIL IS OF LARGE IMPORTANCE

National Body Will Formulate Program and Recommend Administrative Machinery on Every Phase of Employment Problem

The first official recognition of the need for a broad consideration of the labor problem was the appointment of an advisory council to the Secretary of Labor.

The council will consider the establishment in the Department of Labor of agencies to perform the following functions:

1. A means of furnishing an adequate and stable supply of labor to war industries. This would embrace:
 - (a) A satisfactory system of labor exchanges.
 - (b) A satisfactory method and administration of training of workers.
 - (c) An agency for determining priorities of labor demand.
 - (d) Agencies for dilution of skilled labor as and where needed.
2. Machinery for immediate and equitable adjustment of disputes in accordance with principles to be agreed upon between labor and capital and without stoppage of work, dealing with demands concerning wages, hours, shop conditions, etc.
3. Machinery for safeguarding conditions of labor in production of war essentials, including industrial hygiene, safety, women and child labor, etc.
4. Machinery for safeguarding conditions of living, including housing, transportation, etc.
5. A body to assemble and present data collected through existing governmental agencies or by independent research to furnish information necessary for effective executive action.
6. A publicity and educational division, developing sound public sentiment, securing exchange of information between departments of labor administration, and promoting in industrial plants the local machinery helpful in carrying out a national labor program.

The council is headed by John Lind, former Governor of Minnesota and envoy to Mexico, representing the public. Waddill Catchings, president Sloss-Sheffield Steel & Iron Company and Platt Iron Works, and A. Landon, general manager American Radiator Company, represent employers. Labor members are John Lennon, treasurer American Federation of Labor, and John J. Casey, former member of Congress. Dr. L. Marshall, University of Chicago, is the economist member, and Agnes Nestor, Chicago, represents women.

MEMPHIS MEETING OF THE ELECTRICAL INSPECTORS

Annual Meeting of Western Association Discusses
Conservation of Foodstuffs, Munitions and
Property by Means of Inspection

Conservation of foodstuffs, munitions of war and property by means of inspection was the keynote sounded throughout the thirteenth annual meeting of the Western Association of Electrical Inspectors at Memphis on Jan. 29, 30 and 31.

Important topics discussed were: "Distinguishing Electrical Signal Systems," "Hazards in Elevator Wiring," "Methods of Grounding Secondaries," "The Demand Factor of Lighting, Elevator and Power Circuits," "Electricity on the Farm" and "War Service of the Underwriters' Laboratories." Some of the points brought out and conclusions arrived at by the convention follow:

SUMMARY OF POINTS DISCUSSED

The electrical inspector must not only make electrical recommendations, but he should compel the property owners to employ sufficient capable and instructed watchmen and install adequate signal protective devices. In making recommendations the inspector should not merely say, "Overhaul the job," but should give specific recommendations that can be complied with immediately by the non-electrical man who is the property owner.

Electric signal systems approved by the Underwriters' Laboratories should be allowed, notwithstanding the fact that they do not comply with the National Electrical Safety Code requirements on high-voltage bell wiring.

The opinion prevailed that wires in elevator shafts should be inclosed in rigid conduit instead of armored cable as allowed by the National Electrical Safety Code, because the latter, if shaken loose from holdings by vibration or other means, would have a tendency to swing against the moving elevator and produce a fire and life hazard.

General discussion showed that many methods are used in grounding the secondaries, but it was agreed that the matter must be considered under local existing conditions in the municipalities. The Memphis Gas & Electric Company assumes the ground-wire responsibility and does not allow contractors to make grounds on the street side of the water mains as recommended in the code. Central stations can be shown that they should co-operate in this problem, but should not be forced by an ordinance to shoulder the entire responsibility.

By testing, the demand factor of power, elevator and lighting circuits can be determined, and if used in calculating the size of wire instead of the hard and fast rule of 100 per cent a conservation of from 25 to 30 per cent of copper can be made.

Farm-lighting systems help in obtaining efficient methods for needful farm production and make farmers contented to stay on the farm, where they can enjoy all the conveniences of city life.

The Underwriters' Laboratories have standardized specifications in fire hose and fabricated roofing materials for war purposes, thus making it possible for the government to obtain materials with several times the

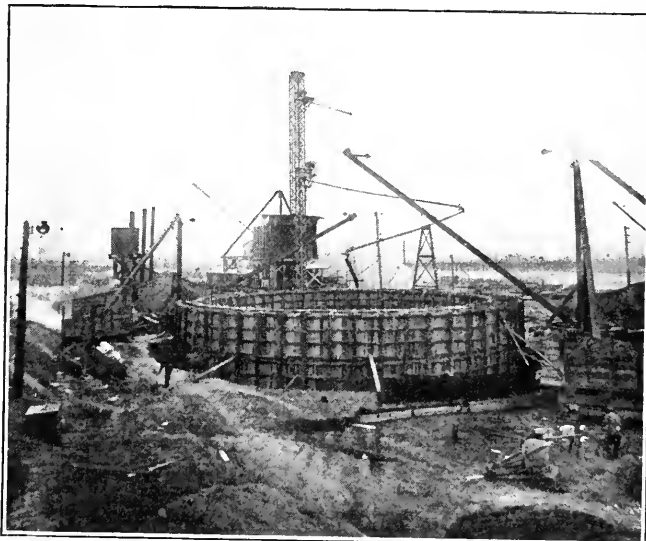
speed that could have been secured under ordinary conditions. Efficient inspectors were valuable because of the fact that the government would have been compelled to secure and train men with a great loss of time.

The nominating committee named the following for officers: President, Frank L. Lucas; first vice-president, C. K. Cregier; second vice-president, K. W. Adkins; secretary and treasurer, W. S. Boyd; executive committee, Oscar W. Tryham, chairman; R. E. Moran, H. M. Beal, H. J. Clark, C. R. George, C. M. Tart and the officers.

PROGRESS IN THE NEW PLANT AT KANSAS CITY

Co-operation from Federal Authorities in Granting
Necessary Priority Orders Is Helping Con-
struction of the Large Station

Construction of the new power plant of the Kansas City Light & Power Company at Kansas City, Mo., is progressing at a satisfactory rate. Gratifying co-operation has been received at every step from the federal



PRIORITY ORDERS HELP THIS NECESSARY CONSTRUCTION

agencies. An original blanket priority order for all materials and equipment had been granted; while this was canceled later, priority orders are being granted in detail on various items as their need arises.

The experience of power users and domestic consumers in Kansas City this winter has demonstrated the real need for the new station. The peak load on the central stations in Kansas City this winter for street railway, light and power has been 57,000 kw., and 13,000 kw. of business has been cut off or denied. The light company has not solicited any new business for two years. It is estimated that Kansas City will use at least 90,000 kw. next winter if the energy is available.

The building plants provide for 300,000 kw. in the unit as laid out, of which 40,000 kw., in two 20,000-kw. machines, is in the first installation, expected to be in service by Nov. 1, 1918.

The plant is being erected on twenty-five acres (10.11 hectares) of river-bottom land, adjoining the Missouri River.

PROGRAM FOR A. I. E. E. MIDWINTER CONVENTION

At New York Convention on Feb. 15 and 16 Circuit-Breaker Ratings and Meters and Measurements Will Be Discussed

The sixth annual midwinter convention of the American Institute of Electrical Engineers will be held Feb. 15 and 16 in the Engineering Societies Building, New York.

On account of war conditions the meetings and papers committee, with approval of the directors, has decided to make the convention purely a business meeting. Therefore no entertainment features or excursions have been included.

The convention will include four technical sessions on the morning, afternoon and evening of Friday and on Saturday morning. A strictly informal dinner will be held between the afternoon and evening sessions on Friday.

The regular monthly meeting of the board of directors will be held on the preceding Thursday at 8 p. m. at Institute headquarters.

The program follows:

FRIDAY, FEB. 15

10:30 a. m.—Opening remarks by President E. W. Rice, Jr.; session on circuit-breaker rating: "Rating and Selection of Oil Circuit Breakers," E. M. Hewlett, J. M. Mahoney and G. A. Burnham.

2:30 p. m.—Session on meters and measurements: "A New Standard for Current and Potential," C. T. Allcutt; "The Thermoelectric Standard Cell," C. A. Hoxie; "The Character of the Thermal Storage Demand Meter," P. M. Lincoln; "Measurement of Power Losses in Dielectrics of Three-Conductor High-Tension Cables," F. M. Farmer.

6:30 p. m.—Informal dinner at Café Boulevard, Forty-first Street and Broadway; subscription, \$2 per cover. President Rice will speak on a timely topic at the dinner.

8:30 p. m.—Lecture, "Some Applications of Electromagnetic Theory to Matter," Dr. A. C. Crehore; to be followed by discussion.

SATURDAY, FEB. 16

10:30 a. m.—Session on alternating-current commutator motors: "Commutation in Alternating-Current Machinery," Marius A. C. Latour; "The Secom—A Kinematic Device Which Imitates the Performance of a Series-Wound Commutating Motor," V. Karapetoff; "The Polyphase Shunt Motor," W. C. K. Altes.

CANDIDATES PROPOSED FOR NOMINATION IN A. I. E. E.

Comfort A. Adams and J. Franklin Stevens Named for President, but Latter Requests Withdrawal of His Name

The following candidates have been proposed for nomination by petition in the American Institute of Electrical Engineers:

For president—Comfort A. Adams, Cambridge, Mass.; J. Franklin Stevens,* Philadelphia.

For vice-presidents—Allen H. Babcock, San Francisco; William B. Jackson, Chicago; F. B. Jewett, New York; Raymond S. Kelsch, Montreal; Harold Pender, Philadelphia; John B. Taylor, Schenectady.

For managers—Charles I. Burkholder, Charlotte, N. C.; G. E. Faccioli, Pittsfield, Mass.; Morton G. Lloyd, Washington; Frank D. Newbury, Pittsburgh; Walter I. Slichter, New York.

*This candidate has requested that his name be withdrawn.

ELECTRIFY ROADS AND SAVE WATER POWER, SAYS MR. RICE

Addressing Lynn Section, the A. I. E. E. President Draws Needed Lessons from the Penalty of Our Wasteful National Policies

Before 600 members and guests of the Lynn (Mass.) Section of the American Institute of Electrical Engineers on February 2 E. W. Rice, Jr., president of the national body and of the General Electric Company, urged general electrification of railroads and comprehensive development of water powers in the United States as a means of conserving fuel and increasing transportation efficiency under the war conditions that now exist.

The annual dinner of the Lynn Section was held in the new Thomson Research Laboratory at the River Works of the General Electric Company, and the speakers also included W. C. Fish, general manager of the Lynn works, toastmaster; Lieutenant Governor Coolidge of Massachusetts, Mayor Creamer of Lynn, Capt. F. P. Dawe of the Second Canadian Artillery, and Prof. Elihu Thomson, consulting engineer of the company. The Lynn Section, with 1650 members, is the largest in the country. Chairman J. M. Davis presided. The meeting dedicated the new laboratory to the service of the company, and in responding to the call of the toastmaster Professor Thomson contrasted the early facilities at his disposal with the present plant and gave many interesting reminiscences of electrical development. Concluding, he summarized the vital importance of research under war conditions as well as in peace.

MR. RICE ON WAR PROBLEMS

In prefacing his address, Mr. Rice paid high tribute to the achievements of the country in war preparations since the declaration of hostilities. He shared widespread regret that these preparations were not begun two years earlier, but pointed out that it is a waste of time to dwell upon this aspect of the war problem. The single object to-day is the winning of the war, and the utmost efforts and highest co-operation are needed to accomplish this.

The country is indeed fortunate, the speaker said, that its President is the true spokesman of its ideals, and because of his genius he has become the spokesman for all on the Allied side. It is fortunate for the world's future that the utterances of President Wilson exhibit no ground for looking toward an inconclusive peace. The vital necessity is to throw our full strength into our military, naval and industrial power. It is a happiness to think that no President has ever received such support as the country has given Mr. Wilson since war was declared. All interests want to give advice to the administration, but apparently the Democrats want no advice from the Republicans.

"Recent events have mystified, but I hope have not discouraged, the average citizen," said Mr. Rice.

The speaker pointed out how the entire country had been stunned by the recent closing order and has become nervous and critical as a result. He emphasized the point that the country has not made a failure of its war preparations, but that all is moving as well as could be expected under the circumstances of unpreparedness under which the United States took up its huge task.

"Notwithstanding a distinguished authority," said

Mr. Rice, "a million men cannot spring to arms overnight, nor can all the great mechanism of war be produced in a year. A certain minimum time is necessary to get ready, and all we can do is to see that that minimum is not unduly prolonged.

"This is a people's war—a war for democracy. It should not be handled as a war to be conducted merely by the party in power; all the people must be represented. The questioning attitude of the country arises from the fear that the ability and experience and wisdom of the whole country is not being called upon. Governmental methods suited to peace times do not fit war conditions."

Mr. Rice said that something like the coalition government formed in England appears desirable here. There is no lack of confidence in the good intentions of our leaders, but we need the wisdom and experience of all the country and not of one-half of it; we need men who take to team play as a duck takes to water. Now that the government has taken over the railroads, ability in the representatives of the people is more needed than ever. In future there will be a more general interest in public affairs, and the speaker urged all engineers to take such an interest, maintaining that all classes of professional and business men should be represented in the government.

LESSONS OF THE COAL FAMINE

Discussing the economic value of water-power development and railroad electrification, Mr. Rice said in part:

We are now in the midst of an extraordinary coal famine due to causes which it is unnecessary and perhaps undesirable for us to attempt to outline. However, I would like to point out in the first place how much worse the situation might have been were it not for the contributions of the electrical engineer and manufacturer, and second, how much better our condition might have been if our contributions had been more extensively utilized.

Suppose we assume that the present serious situation is due to a lack of production of coal. It is comforting to consider to what extent conditions surrounding such production have been improved and how the amount of coal mined has been already increased by the use of electrical devices in connection with coal mining—such for example as the electric light, electric coal cutters, electric drills and electric mining and hauling locomotives. I have no figures before me, but I think it is a fairly safe assumption that the amount of coal mined has been increased at least 25 per cent on the average by the employment of such electrical devices. If this estimate were cut down to 10 per cent, it would still leave an increase in the tonnage of coal produced of something like 50,000,000 tons during the past year.

If, on the other hand, the difficulty is not due to a shortage in the production of coal, but rather to the failure of the distributive agencies of the country, it is interesting to see how this difficulty would have been largely removed if the railroads of the country were operated by electricity instead of steam.

Where electricity has been substituted for steam in the operation of railroads, 10 to 50 per cent increase in actual capacity of existing tracks and other facilities has been demonstrated. This increased capacity has been due to a variety of causes, but largely to the increased reliability and capacity, under all conditions of service, of electrical locomotives. This has enabled a speeding up of the train schedules by some 25 per cent, under average conditions. Of course, under the conditions which prevail in extreme cold weather, when the steam locomotives practically go out of business, the electric locomotives make an even better showing.

It is therefore not too much to say that if the roads of the country were now electrified no breakdown of our coal supply, due at least to failure of distribution, would exist.

But this is not all. It is estimated that something like 125,000,000 tons of coal were consumed by the railroads in the year 1915. Now, we know from the results already obtained from such electrical operation as we have had in this country that it would be possible to save at least two-thirds of this coal if electrified locomotives were substituted for the present steam locomotives. On this basis there would be a saving of over 80,000,000 tons of coal. Even if only half of this saving were realized in practice, I think we can justly claim that there would have been no coal shortage at present if the roads had been electrified.

It is estimated that there is not less than 25,000,000 hp. of water power available in the United States, and if this were developed and could be used in driving our railroads, each horsepower so used would save at least 6 lb. (2.7 kg.) of coal per horsepower-hour now burned under the boilers of our steam locomotives. Unfortunately this water power is not uniformly distributed in the districts where the railroad requirements are greatest, but the possibilities indicated by the figures are so impressive as to justify careful examination as to the extent to which water power could be so employed and the amount of coal saving which could be realized.

The terrors of these "heatless days" will not have been without benefit if they direct the attention of the people and of our lawmakers to the frightful waste of two of our country's most valuable assets—our potential water power and our coal reserves. The first, potential water power, is lost because it is allowed to run to waste, undeveloped, unused. The second asset, coal, is wasted for exactly the opposite reason. It is being used, but in a frightfully ineffective and inefficient manner.

The waterfalls constitute potential wealth which can only be truly conserved by development and use—millions of horsepower are running to waste every day, which once harnessed for the benefit of mankind become a perpetual source of wealth and prosperity.

It is really terrifying to realize that 25 per cent of the enormous amount of coal which we are digging from the earth each year is burned to operate our railroads under such inefficient conditions that the average of 6 lb. of coal is required per horsepower-hour. The same amount of coal burned in a modern central power station would produce equivalent to three times that amount of power in the motors of an electric locomotive, even including all the losses of generation and transmission from the source of power to the locomotive.

Where water power may be utilized, as in our mountainous districts in the West, all of the coal used for steam locomotives can be saved. In the middle Atlantic States, however, water powers are not sufficient, and it will be necessary in a scheme of electrification that the locomotives be operated from steam-turbine stations.

We should not be justified in being so confident of the benefits of electrification of railroads if every element in the problem had not been solved in a thoroughly practical manner. The electric generating power stations, operated either by water or by steam turbine, have reached the highest degree of perfection, efficiency and reliability, while the transmission of electricity over long distances with reliability has become a commonplace.

It may be said that the present is not a propitious time in which to deflect any of the country's capital into railroad electrification. I think that in spite of the enormous advantages of which I have spoken, we should be inclined to agree with such a point of view if it were not for the recent unpleasant demonstration of the apparent failure of our railroad transportation systems to meet the demands which have been placed upon them by the industries, aggravated it is true by the war conditions and also by the unkindness of the weather.

What assurance have we that the present conditions are temporary, and even if they improve as they surely shall with the coming of warm weather, what are we going to do next winter? Of course, even if we should start electrification at once, we could not have all our railroads electrified by next winter, but we could have a good start, and as was said about the resumption of specie payments, "The way to resume is to resume," so "The way to electrify is to electrify."

LESSONS OF THE WAR FOR ELECTRIC UTILITIES

The Problems of Capital, Rates, Extensions, Operating Cost, Fuel Supply, Transportation and Public Policy

BY JOHN F. GILCHRIST

[The following paragraphs are extracts from a timely address made by Mr. Gilchrist, vice-president Commonwealth Edison Company of Chicago, before the Indiana Engineering Society, Indianapolis, on Jan. 25.]

It seems to me that these coal holidays have demonstrated most conclusively one thing, that if there was anything in which this country was not prepared it was its lack of preparation in its transportation facilities, in its transportation system. I believe that, owing to shortsighted policies of the management of transportation systems which in turn developed a hostility among our people until the transportation systems were not accorded the support they should have had, the factor which they were in the prosperity of the country was misunderstood, or not understood, to such an extent that it has resulted in the most deplorable unpreparedness of transportation facilities.

NECESSITY OF RESOURCEFULNESS

The utilities, and the railroads too, have without doubt brought much of the attitude, if not all of the attitude, of the people upon themselves, and the best thing that has happened to the utilities of the country, in my judgment, is the general establishment of commissions in the various states for the regulation of the utilities. I venture the assertion that if those commissions (a very large percentage of which are working honestly and intelligently to grasp the utility business and to work out the problems with which they are confronted) had had another five years before the breaking out of this war, our utilities would have been found to have been in very much better position to resist the demands which are being made upon them than they are to-day.

I believe it is only by the education of the people, by a period of overcoming the prejudice and the rightful aversion which many of our people feel toward the public utilities, and by educating them to the fact that the prosperity of the utility and the prosperity of the community are so closely linked up together that one cannot be prosperous without the other, that matters will be improved.

The growing difficulty in placing their capital stock impressed itself very forcibly upon the utilities. This was very largely a question of lack of capital in the country, because when the government began to go into the market for money, selling its securities, not only did it clean the money up so that the investor in other shares and bonds could not be found, but the government was in the market sixty days of last year, and indications are that it may be in the market anywhere from ninety days to six months this year, and during the time when the government is in the market it is not patriotic, ethical or practical for any one else to try to sell securities. It cannot be done.

INCREASED COSTS AND STATIONARY RATES

In many companies the increased costs, while the rates remained the same, left the margin of net nar-

rower and narrower, and it was impossible to show earnings which were an inducement to the investor.

The great increase in expense was increase of cost for fuel. Some of the companies had provided themselves with mines and were in a position where the increase in the cost of fuel did not affect them so much as it affected the average concern that purchased its fuel under contract or on the market, because if the utilities had favorable contracts with coal companies they were rarely made—hardly ever made, you might say—for more than two years, and frequently for only one year, and that time was soon gone.

So we come to a situation where there are only one or two things to do for the utilities. Utilities must either stop spending money or they must find some way of raising money, and in order to raise money they must be able to make a very good showing, because in these times the industries are making such wonderful returns on the capital invested in their business that they naturally attract what capital there is and the attention of investors, so that the tendency is to get away from the securities of the public utilities.

GROWTH AND STRENGTH MUST BE MAINTAINED

The utilities must be kept growing and kept strong, and the utilities must go to the commissions in their various states and must ask for relief and for prompt relief, and ask it as a war emergency. I do not think it is fair to ask the commissions to pass quickly on the situation for anything other than as a war emergency; because if it were done on any other basis it might be quite possible that utilities would get by, as the saying is, without a proper investigation as to their invested capital and what they were fairly entitled to in the matter of rates and in the matter of return on that capital. On the other hand, it is not fair to the country and it is not fair to the utilities which have this responsibility thrust upon them to attempt to get at an adjustment of rates by the appraisal method, because there are not engineers enough in the country, especially in view of the demand the war is making upon them, to appraise these properties and get at the results in that way, in order to be of any service in the war.

Another thing which the utilities must do, and which they, of course, must have the approval of the regulating bodies to do, is to shut down absolutely on the spending of money for extensions for anything which is not essential to the winning of the war. I know a case within the Middle West territory where, in a mining situation, \$250,000 was asked and put up promptly to build the necessary lines to and in the necessary plant in order to equip those mines, so that they could turn out promptly the product which is so badly wanted by our nation, and it is perfectly fitting that that should be done.

I can cite a case in Ohio where a manufacturing institution was taking at the outbreak of the war a very large amount of power from the electric utility and as a result of war orders it more than doubled its demand. In the meantime the costs had gone up so that the price under a five-year contract was so low that the utility was losing on that one customer \$50,000 a month, and it stood the gaff for ten months or thereabouts, until it finally got its courage up and went to the Ohio commission and got, very cheerfully, relief on a showing of the situation.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Los Angeles Synchronous Club.—At the Jan. 17 meeting of the Synchronous Club, lecture No. 7 of the synchronous electrical course on "Motor Applications" was given by R. H. Cates, power engineer Southern California Edison Company.

Springfield Engineers' Club.—H. B. Lewis, plant superintendent of the Central Union Telephone Company, has been elected president and J. R. Hughes, assistant engineer State Public Utilities Commission, has been elected secretary of the Springfield Engineers' Club of Springfield, Ill.

Schenectady Section, A. I. E. E.—Bassett Jones, consulting electrical engineer, associated with Henry C. Meyer, Jr., of New York City, presented a paper on "Standardized Flexible Distributing Systems in Industrial Plants" at a meeting of the Schenectady Section of the A. I. E. E. held Feb. 1.

Annual Meeting of the Barstow Club.—The Barstow Club, an organization of the employees of the Sandusky Gas & Electric Company of Sandusky, Ohio, held its annual meeting at the office of the company recently and elected Albert Bitzer of the electric department president and Frank Kelly of the gas department secretary.

Jovian Electric League of Kansas City.—The January meeting of the Jovian Electric League of Kansas City, held Jan. 25 at the Muehlebach Hotel, was distinguished by the presence of many out-of-town visitors, including some Jovians now in army service. H. P. Wright, president of the H. P. Wright Investment Company, delivered an address on "The Outlook—Business Present and Future."

Northwest Electric Light and Power Association Committees Appointed.—President Talbot of the Northwest Electric Light and Power Association recently appointed the following committees for the association year 1917-1918: Public policy committee—F. T. Griffith, chairman; H. L. Bleeker, Elmer Dover, F. A. Harmon, J. A. Laing and A. W. Leonard. Hydroelectric and technical committee—George E. Quinn, chairman; R. M. Boykin, J. B. Fiske, L. T. Merwin, F. D. Nims and H. H. Schoolfield. Labor study committee—S. R. Inch, chairman; C. S. MacCalla and W. H. McGrath. Electric-range committee—W. R. Putnam, chairman; M. C. Osburn and A. C. McMicken. Program committee—Lewis A. McArthur, chairman; R. W. Clark, C. P. Osborne and G. C. Sawyer. Entertainment committee—C. R. Young, chairman; G. G. Bowen, W. H. Lines, A. S. Moody and Carl L. Wernicke.

Jovian Electric League, Los Angeles.—At the regular Wednesday luncheon of the league, Jan. 30, Senator L. H. Roseberry spoke on "Some Modern Phases of Socialism." L. D. Wishard of Pasadena, who has done special Y. M. C. A. work in Europe, gave a talk on this work. James M. Colkitt, manager Los Angeles branch John A. Roebling's Sons Company of California, was chairman of the day.

San Francisco Electrical Development and Jovian League.—The Jan. 23 meeting of the association was designated "Architects' Day," local members of the American Institute of Architects being invited. The subject discussed was "The Architect's Relation to the Electrical Industry." Spokesmen for the architects were Louis C. Mullgardt, B. R. Maybeck and Sylvain Schnaittacher, and for the electrical interests H. C. Reid and H. P. Pitts.

Pacific Coast Electrical Supply Jobbers' Association.—The annual meeting of the Pacific Coast Electrical Supply Jobbers' Association was held at Del Monte, Cal., Jan. 24-26. At the open meeting a paper on the conservation of labor was read by E. J. Wallis, Pacific Coast manager Western Electric Company. The annual election of officers resulted as follows: President, W. S. Berry; secretary, Albert H. Elliot; new member executive committee, Tracy E. Bibbins.

Association of Iron and Steel Electrical Engineers.—For the ensuing year the following members will act as chairmen of the respective committees of this association: W. T. Snyder, chairman standardization committee, National Tube Company, McKeesport, Pa.; W. O. Oschman, chairman power committee, Oliver Iron & Steel Company, Pittsburgh, Pa.; A. H. Swartz, chairman publicity and promotion committee, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; K. H. Cederland, chairman electric furnace committee, Duquesne Steel Works, Carnegie Steel Company, Duquesne, Pa.; J. F. Kelly, chairman membership committee, National Tube Company, McKeesport, Pa.; Walter Greenwood, chairman safety committee, Carnegie Steel Company, Youngstown, Ohio; B. W. Gilson, chairman educational committee, Carnegie Steel Company, Youngstown, Ohio; E. Friedlander, chairman editing committee, Carnegie Steel Company, Edgar Thomson Works, Braddock, Pa.; A. H. Swartz, chairman convention committee, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; W. C. Kennedy, chairman electrical development committee, Standard Seamless Tube Company, Ambridge, Pa.; F. D. Egan, chairman finance committee, Pittsburgh Iron & Steel Foundries Company, Midland, Pa. The next annual convention will be held either in New York or Baltimore Sept. 9-13, 1918. A paper on "Alternating-Current and Direct-Current Skip Hoists" will be presented by Mr. Lindquist of the Otis Elevator Company at the Pittsburgh Section meeting at the Hotel Chatham, Feb. 16.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increase in Rates in Illinois.—The Southern Illinois Light & Power Company has filed a petition with the Illinois Public Utilities Commission seeking to increase rates in Litchfield and Hillsboro.

Depreciation Order Upheld.—The Appellate Division of the New York Supreme Court, First Department, has handed down a decision dismissing a writ of certiorari obtained by the New York Railways Company and affirming an order made by the New York Public Service Commission, First District, requiring the railway company to set aside 20 per cent of gross operating revenues, month by month, to provide for maintenance and depreciation of its properties. The commission order was made as a result of reorganization proceedings relative to the old Metropolitan street railway system. The New York Railways Company has been setting aside the 20 per cent required, although contesting the power of the commission to determine what amount should be so set aside for the purpose and for what it should be expended. The company contended that its directors rather than the commission should determine the amount of the company's depreciation reserve.

Municipal Plant Abandons Plan to Decrease Rates.—The Indiana Public Service Commission has dismissed a petition filed by the city of Crawfordsville for authority to decrease electric rates. On Nov. 30, 1917, the city of Crawfordsville filed with the commission its petition praying for authority to decrease electric light and power rates. F. H. Miller, superintendent of the municipal electric light and power plant, in asking that this petition be dismissed, filed with the commission a resolution by the Mayor and Common Council directing that this action be taken. In its decision the Public Service Commission says: "It appearing that the municipality of Crawfordsville, as now organized, desires this petition dismissed; it being known to this commission that the rates charged for electric energy by petitioner are, compared with rates generally charged in Indiana cities of like size, generally low and not extortionate or unreasonable; it being further known to this commission that the costs of future operation during the war period are uncertain but with an upward tendency, and also there being no protest received against the action of said Common Council and Mayor, the prayer to dismiss will be granted, with the modification that said dismissal will be without prejudice to the interest of any party."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Hartford (Conn.) Electric Light Company Dividend Reduced.—An official statement says: "The directors have voted to decrease the dividend payable Feb. 1, 1918, from the 10 per cent to the 8 per cent basis, because it has been found that the increase in the price of energy made last July is insufficient to compensate both for the increase in the cost and for the reduction in revenue arising from the curtailment in the use of electric energy by the public."

American Light & Traction Results.—The increase in total gross business of the companies controlled by the American Light & Traction Company for the year ended Dec. 31, 1917, was \$2,307,138. The normal increase in net which would be expected to follow this large increase in gross has been offset by large increases in operating costs as follows: Increased cost, coal and oil, \$984,700; increased cost, operating labor, \$320,300; increased cost, labor and materials, \$1,305,000; increased taxes—federal, \$618,000; increased taxes—other taxes, \$87,000; total, \$2,010,000.

Insure the Men at the Front.—To safeguard American soldiers and sailors and their families, it is imperative that the fighting forces avail themselves of the full privileges conferred by the military and naval insurance act. For his own benefit and for his family every enlisted man and officer in the army and navy should take the full \$10,000 insurance. Insurance of almost \$4,000,000,000 has already been applied for, but this great total is only a beginning. The army and navy should be 100 per cent insured. Persons in service before Oct. 15, 1917, must apply on or before Feb. 12, 1918. Those who joined after Oct. 15, 1917, have 120 days from the date of enlistment in which to apply.

Louisville Company Releases Coal for the Public.—About 5000 homes were warm during the week of Jan. 28 because the Louisville Gas & Electric Company, through Donald McDonald, vice-president and general manager, threw on the open market at cost a reserve supply of 3500 tons of high-grade West Virginia bituminous coal. This coal, bought last summer, had been held until it was assured that the company's own new mines in western Kentucky could meet all possible requirements. At the earliest moment the coal was sold to the public at cost to relieve a very serious shortage. Householders sent their own conveyances while dealers also got in line. The cost at the company storage shed was \$5.25, below the market price.

Illinois Properties Seek Rate Increase.—A general increase in electric and gas rates, as well as street-railway fares, is asked in a petition filed by thirteen subsidiary companies of the Illinois Traction System before the Illinois Public Utilities Commission on Jan. 31. The increase asked in electric rates is from 6 to 20 per cent. The petition recites that, owing to the abnormal conditions caused by war and causing great increase in cost of producing electric and gas service, the companies are in need of immediate relief. Coal increases alone are said to be \$350,000. The commission has set Feb. 19 for a hearing.

Damage to Tacoma Power Plant.—Llewellyn Evans, superintendent Electric Works, Tacoma, Wash., states in regard to the damage done to the power plant by a recent flood: "The Tacoma municipal power plant was injured by flood during the last two weeks of December and was compelled to cut off two waste-power customers and to purchase some power. The repairs necessary to put the plant in normal shape again include the clearing of the intake and pondage behind the dam and the replacing of liner rings in the turbines. This plant has 20,000 kw. capacity in four units and is situated on the Nisqually River, which is a glacial stream. The operating head is 425 ft. The high water was 30 per cent higher than at any other time in the history of the plant. It was caused by hot winds melting the mountain snow, and by an incessant rainfall. Water came up 7 ft. in the basement of the power house, the surface of the water reaching within 2 in. of the exciter bus. The operating force prepared a temporary cable bus while the water was rising. Continuance of the flood brought down sand and logs and uprooted trees in such quantities that the intake was piled full, and even with a donkey engine and the liberal use of dynamite it was difficult to keep enough water running through the grate bars to run the plant. The two 8-ft. by 10-ft. wash-out gates were wide open but became choked so as to be of no use. The plant is provided with a 1000-ft. settling channel which was washed out daily, removing a layer of sand and silt 7 ft. deep. The regulating reservoir at the plant also accumulated 8 ft. of sand in the bottom, but still the water was dirty enough to cut the wearing parts of the waterwheels, resulting in the most serious damage. To make repairs to these, liner rings around the runners will have to be renewed, the sand-filled water having put the finishing touches to five years of wear. The damage at the intake can be brought back to normal readily with a derrick and orange-peel bucket now being installed. The waste-power customers were the American Nitrogen Products Company, which uses about 3000 kw., making sodium nitrate by the arc process, and the Bilrowe Alloys Company, which uses 1500 kw. in smelting ferro-manganese. The city purchased about \$600 worth of power from the Puget Sound Traction, Light & Power Company, with which it has a 12,000-kw. tie line."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Admission of Evidence.—The admission of the evidence of an experienced telephone lineman that electrical wires will break in a certain manner was not a prejudicial error, the Supreme Court of Kansas held in *Lewis vs. Harvey* (168 P. 856).

Care Required of Electric Wires in Mines.—The employer must exercise the utmost care and skill not only in management and maintenance of electric wires in a mine but in their construction, proper construction of such wires being as necessary to the employee's safety as maintenance thereof after construction, the Court of Appeals of Kentucky held (198 S. W. 724).

Rates Requiring Summer Consumer to Pay Full Annual Rate.—Water rates at a summer resort are held in the Maine case of *Briggs versus Peaks Island Corporation* (P. U. R. 1917 E. 750) not unjustly discriminatory because they require the summer taker to pay the full yearly rate where the plant was built for and is measured by the summer demand and the year-round takers are the incidental consumers.

Foreman Not a Contractor.—An award of the Industrial Accident Commission must be sustained if there is any evidence to support its finding that the injured person was an employee of the party from whom compensation is sought, the District Court of Appeals of California held in *Yolo Water & Power Company versus Industrial Accident Commission of California* (168 P. 1146). An employer's foreman had full authority to hire whatever help he needed, and did hire men admitted to be employees of his employer, and also hired men and teams for a lump sum, and on at least one occasion hired a team separately. He also furnished his own team on some occasions, and the injured person at the time of his injury was driving the foreman's team. The foreman directed the drivers to exactly the same extent as other employees, and intended to engage the injured person as an employee of his employer, and the injured person, who had worked for the employer on numerous occasions, intended to work as usual as its employee. The foreman made no profit on the injured person's services as driver, the injured person being paid the usual wages for driving and the foreman retaining the amount usually paid for a team. It was held that the injured person was an employee of the general employer, and not an employee of the foreman, the contention that when the foreman obtained a team and a man together he stood in the position of a contractor being without merit.

A. L. Strickland has been appointed district manager of the Pacific Power & Light Company at Seaside, Ore., succeeding Harlow Moore, resigned.

Frank Carder has been appointed manager of the Oklahoma Gas & Electric Company, Norman (Okla.) division, succeeding W. P. Jones, resigned.

J. P. Pulliam, formerly with the Eastern Wisconsin Railway & Light Company, has been appointed general manager of the Wisconsin properties of the Wisconsin Securities Company.

W. D. Hodson, formerly superintendent of the Northern Ohio Traction & Light Company, has resigned to take an interest in the Imperial Electric Company of Akron, motor manufacturer.

C. C. Curtis, lighting superintendent of the El Paso (Tex.) Electric Company, has been appointed manager of the Cape Breton Electric Company, Ltd., succeeding E. L. Milliken, who was transferred.

G. A. De Haseth, formerly with the Tacoma Railway & Power Company, has been appointed manager of the Ponce (P. R.) Electric Company, succeeding P. M. Hatch, now in the Ordnance Department of the army.

C. R. Dillman, formerly with the Grand Rapids-Muskegon Power Company at Muskegon, Mich., has been placed in charge of the Akron (Ohio) Appliances salesroom of the Northern Ohio Traction & Light Company.

T. R. Steingoetager has been named business manager of the St. Clair County Gas & Electric Company, with headquarters at Belleville, Ill. He has been with the company since a boy and has served in late years as a traveling auditor and more recently as general auditor of the company at East St. Louis, Ill.

B. J. Caldwell, vice-president of the Caldwell Electric Corporation, Champaign, Ill., has been commissioned by the navy board to do electrical engineering work for the navy. Mr. Caldwell is a graduate of the college of engineering of the University of Illinois in the class of 1911 and has been electrical engineer for the Caldwell Electric Corporation since.

A. G. De Clercq has been appointed construction superintendent of the Commonwealth Edison Company to succeed J. H. Goehst, who before his death was the oldest employe in point of service with the Edison company. Mr. De Clercq's first work with the Commonwealth Edison Company began on May 6, 1899, soon after his return from Cuba with the Illinois Volunteers. It consisted of handling lamp renewals and doing work between times in the testing laboratory. In 1902 he took a leave of absence to enter the Michigan Agricultural College at Lansing. In 1903 he again entered the employ of the Commonwealth Edison Company and since that time has held many positions, including those of job foreman, division foreman, supervisor of station installation, division and assistant construction superintendent. He is at present the president of the Commonwealth Edison Section, N. E. L. A.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

C. R. Phenecie, vice-president of the Wisconsin Service Company, has been appointed general manager of the Wisconsin Security Company and will take up his headquarters at Green Bay as soon as he has completed work on an auxiliary plant at Manitowoc.

H. W. Courville has been promoted from superintendent of power distribution of the Consumers' Power Company, Jackson, Mich., to general superintendent of distribution in the Flint District. Mr. Courville was appointed local manager of the Commonwealth Power Company at Jackson in 1912, having before that been connected with the Denver Gas & Electric Company and more recently with the Butte Electric & Power Company.



L. A. PETTIT, JR.

L. A. Pettit, Jr., who has been associated with the Albert Emanuel Company for the last nine years as general manager of this property and also as treasurer and secretary of its several companies, has severed active connection with the company to engage in the business of controlling and managing public utility properties. Mr. Pettit will remain a director in the following companies operated by the Albert Emanuel Company: Consolidated Utilities Company, Kansas Electric Utilities Company, Emporia, Kan.; Morris County Light & Power Company, Council Grove, Kan.; Southwestern Utilities Company, Alva, Okla.; Williamson (West Va.) Light & Power Company; Union City (Ind.) Electric Company; Sidney (Ohio) Electric Company; Coal District Power Company, Fort Smith, Ark., and Utilities Lighting Company, Albion, Pa. Mr. Pettit also intends to engage in consulting engineering work on utility rates, developments, reports, etc.

H. O. Clarke, Jr., commercial manager of the Houston Lighting & Power Company, has received an appointment from the government to assist the local aviation construction and field officers in an advisory capacity in problems concerning their electrical installations at the local army cantonment.

George H. Losey, assistant general superintendent and electrical engineer for the Indiana Railway & Light Company, Kokomo, Ind., has resigned to become connected with the Great American Refining Company at Tulsa, Okla. Mr. Losey has been with the Kokomo company for the last ten years in various engineering capacities, starting in in the meter department and advancing through a line of promotions. He is a graduate of the electrical engineering course of Purdue University.

C. E. Bennett will be assistant to Charles G. Adsit, consulting engineer of the Georgia Railway & Power Company, Atlanta, Ga., after Feb. 15. Mr. Bennett, who a number of years ago was connected with the Georgia company, has been associated with Curtis A. Mees, consulting engineer of Charlotte, N. C., since last summer. In the summer of 1915 Mr. Bennett resigned the position of electrical engineer with the Northern Contracting Company and the Georgia Railway & Power Company to become associated with Hugh L. Thompson, consulting engineer of Waterbury, Conn. Prior to that time he was electrical engineer with L. B. Stillwell, New York City, and later with Charles O. Lenz of New York City, having been his principal assistant on the Tallulah Falls development of Georgia. He was also connected with the J. G. White Company of New York City. In the summer of 1917 he resigned as mechanical and electrical engineer for Mr. Thompson to become associated with Mr. Mees, as stated above.

Obituary

William Temple Emmet, a member of the Public Service Commission for the Second District of New York since March, 1914, died on Feb. 4 at the age of forty-nine years.

Judge R. S. Taylor of Fort Wayne, Ind., who some years ago was one of the leading patent attorneys of the country, particularly in the electrical field, died at his home on Jan. 28 at the age of seventy-nine. One of his earlier achievements in the patent field was in connection with a suit brought by the old Bush company of Cleveland for infringements on arc-lamp patents. Judge Taylor's victory in this case established the right of all companies to continue the manufacture of arc lamps. Later, as chief counsel for the independent telephone interests established after the old Bell patents had expired in 1893 against the Bell system, he succeeded in obtaining a decision granting the right to the independent companies to continue the use of the transmitter.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

OCTOBER EXPORTS OF ELECTRICAL PRODUCTS

Total Foreign Trade of That Month Officially Valued
at \$4,151,635. as Against a Total Value of
\$4,048,080 in October, 1916

Exports of electrical goods, apparatus, etc., for the month of October, 1917, were about on a level with those of the same month in 1916, namely, \$4,151,635 as against \$4,048,080. Battery exports in October last were nearly double those for October, 1916; dynamos and generators, however, indicate a marked falling off, as do insulated wire and cables, while, on the other hand, exports of metal-filament lamps were more than double.

For the ten months ended October, 1917, there was an increase in value of more than \$11,000,000 over the corresponding period a year previous. Every item in the list, which was compiled by the Bureau of Foreign and Domestic Commerce of the Department of Commerce, represents a larger volume than the same period in the previous year. Insulated wire and cables showed an increase of \$2,000,000; interior wiring supplies, including fixtures, nearly \$900,000; metal-filament lamps more than \$1,000,000, motors \$2,000,000, and transformers \$300,000. The official figures follow:

Articles	October		Ten Months Ended October	
	1916	1917	1916	1917
Batteries	\$173,734	\$275,721	\$1,504,788	\$2,843,768
Carbons		127,271		*463,451
Dynamos or generators	249,281	196,146	1,379,153	1,914,151
Fans	13,949	29,276	269,180	516,606
Heating and cooking apparatus		63,840		*149,236
Insulated wire and cables	575,024	306,713	3,587,342	5,797,767
Interior wiring supplies including fixtures	\$9,214	100,345	735,838	1,030,109
Arc lamps	644	737	13,590	14,152
Carbon-filament lamps	22,417	18,023	93,987	156,340
Metal-filament lamps	103,655	240,686	1,170,292	2,254,661
Magnetos, spark plugs, etc.		283,272		*995,617
Meters and measuring instruments ..	80,895	80,689	705,137	888,870
Motors	528,666	546,255	3,995,668	5,132,542
Rheostats and controllers		23,343		*61,188
Switches and accessories		82,782		*549,679
Telegraph apparatus, including wireless.	18,366	16,609	139,127	486,960
Telephones	105,146	210,276	1,322,939	1,705,521
Transformers	90,367	224,975	892,302	1,263,625
All other	1,996,722	1,324,676	15,266,360	18,153,343
Total	\$4,048,080	\$4,151,635	\$31,075,703	\$44,377,586

*Figures cover period beginning July 1.

SPECIFICATIONS FOR PACKING FOR EXPORT

Suggested Guides for Machinery Supplies and Equipment on Orders Issued by the General Engineer Depot

Recognizing the necessity for informing American manufacturers of the best practice for export packing, the General Engineer Depot, Washington, D. C., suggests the following specifications as guides for packing machinery, supplies and equipment for export or orders issued by its department:

"1. All merchandise must be protected by substantial

boxing and must be securely packed therein. Export shipping conditions involve much rougher handling than is usually understood.

"2. All packing should be as light in weight as possible and cubic contents kept to a minimum in order to economize shipping space, but the paramount consideration must always be safe handling. Brittle pine crates of ½-in. board are worthless.

"3. Packages over 1000 lb. or less than 200 lb. are to be avoided when practicable.

"4. Each case or crate should be firmly bound with strap or band iron. Straps should be not less than 1 in. wide and No. 18 gage. Ends should overlap at least 6 in.

"5. All lumber used in boxing and packing to be strictly sound and of such dimensions as to insure full protection under rough handling. Under no circumstances should outside boxing be less than 13/16 in. thick.

"6. Packages over 300 lb. should be packed in not less than 2-in. stock, additional straps and binding to be used at every 2½ in. for boxes exceeding 3 ft. in length.

"7. Boxes 600 lb. in weight, or over, shall have 4-in. by 4-in. skids, top and bottom of box, securely bolted together with ½-in. diameter bolts, and these bolts, wherever possible, should extend entirely through box. To prevent shifting, ends of box must be securely braced inside.

"8. Use yellow pine, gum, white pine, spruce and hemlock lumber surfaced on one or more sides. This gives a desirable uniformity of thickness and makes easy stenciling on more than one face of the package.

"9. Use cement-coated or barbed-wire nails—eight-penny and ten-penny. This is important to make the nails hold. Not less than two in end of any board and not over 4 in. apart in wide boards (6-in. boards, three nails).

"10. Use corner posts in all packages.

"11. Machinery itself should be covered with waterproofing paper or oilcloth to prevent damage from moisture. Machinery should be thoroughly slushed with suitable protective compound. All loose or detached parts should be firmly and securely fixed to prevent dislodgment during transit. All finished surfaces to be amply protected against injury from salt air and water.

"12. Packages containing machinery or parts should be securely blocked in the case or crate to prevent movement.

"13. Electrical and mechanical apparatus to be solidly packed, in excelsior, straw, salt hay or other filler, in a solid box with paneled ends, securely nailed, and then reinforced with ¾-in. by 3-in. battens around the sides at the ends, with 1-in. by No. 18-in. gage strap iron all the way around the battens, ends lapping at least 6 in.

"14. Hardware, nails, bolts, etc., because of their weight, should be packed in small cases or kegs.

"15. Materials such as glassware, tools, lamps, instruments, powder and acids shall be shipped in boxes, the thickness of stock to be determined by the weight or cubical capacity.

"16. Tools, instruments or any articles subject to damage by moisture shall be well wrapped in waterproof paper and boxes thoroughly lined with waterproof paper before being packed.

"17. Cylindrical articles, such as tanks, boilers, etc., shall be shipped in cradles made of heavy timbers, the articles to be securely bolted to cradles or skids.

"18. Oils, paints and liquids shall be shipped in 50-gal. barrels or steel drums of not less than No. 16 gage or in heavy tin containers which should be hermetically sealed and securely packed in boxes.

"19. On heavy boxes sling marks are to be plainly indicated on outside at the proper place, reinforcement being provided to insure against damage to case.

"20. All wide side pieces of flat packages should be prevented from splitting by cross-pieces nailed thereto—one in the middle for 6 ft. and two for sides over 6 ft.; band iron or corner clips to top and bottom should connect at these cross-pieces.

"21. If new packing is tried, test boxes and crates by forcibly pushing each over the end twice. The package is then dropped from a platform 3 ft. or 4 ft. high. The package must not be broken to any extent by this test.

"22. Projecting portions of heavy castings having narrow necks must be taken off, as they will break off by jarring.

"23. Gray-iron extended parts must be kept $\frac{1}{2}$ in. to 1 in. away from covering, as the spring of boards will cause breakage.

"24. Two heavy cast pieces must not rest together, but must be cushioned or separated by wood brace or block.

"25. In packing machines which are knocked down it is desirable to indicate, "Open on this side."

"26. Heavy items must be firmly bolted to skids or flooring; nothing shall be hung from sides of box. Unoccupied space in packing boxes must be thoroughly braced.

"27. Packages must sometimes be proportioned to facilities for handling at port.

"28. In marking packages use black waterproof marking or stencil paint.

"29. Put the following marks, in rectangle, on each separate box, crate, bundle or piece, unless otherwise instructed.

D. Req.....	F. Req.....
Order No.....	Pkg. No.....

"In addition to all marks hereinbefore specified, there is to appear on each package a synopsis of the contents of same, cubic contents, gross weight and by whom shipped.

"30. Packing lists must be made out correctly and in detail with all information called for. Merchandise must be described in specific terms. Such designations as 'Provisions,' 'Groceries,' 'Canned Goods,' 'Hardware,' 'Machinery,' or any other general terms, must not be used."

METAL MARKET SITUATION

Speculation Rife on the Future of Copper—Prices Reported Cut on Less than Car Lots

Discussion goes on whether the government price of 23.50 cents is equitable to both producers and industrial consumers of copper. Speculation runs along lines as to whether there is sufficient of the metal produced to satisfy governmental and commercial purposes. It is evident that the mining interests are disappointed in not obtaining a better price from the War Industries Board and are therefore still "bearing" the market when possible. On the other hand, there seems to be plenty of copper available. Possibly the official price is being observed in transactions covering car-load lots, but an authority states that there is a constant cutting of the government figure of 24.67½ cents for less than car lots.

The other metals are featureless, the same prices prevailing as last week, with tin scarce and none worth mentioning arriving either from China or the Straits.

NEW YORK METAL MARKET PRICES

	Jan. 28			Feb. 4		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	27.00			27.00		
Lead, trust price	6.75			6.75		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter.....	19.00			19.00		
Spelter, spot	7.82½		to 7.92½	7.92½		
Tin, Straits	85.00*			85.00*		
Aluminum, 98 to 99 per cent...	34.00 to 36.00			34.00 to 36.00		

OLD METALS

Heavy copper and wire.....	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.75 to 14.50	13.75 to 15.00
Brass, light	10.00 to 10.50	10.00 to 10.50
Lead, heavy	6.20 to 6.25	6.00 to 6.25
Zinc, old scrap.....	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

WITH government priority orders practically dominating every industry, the electrical goods line also feels their far-reaching effects. Manufacturers, distributors and jobbers are reported as having their customary methods of doing business greatly disturbed, in production and distribution, by the transportation tie-ups, embargoes, fuelless Mondays and other restrictions of a minor nature. Yet, in the face of these drawbacks, a steady demand for electrical goods of every description is in evidence. Trading, both wholesale and retail, is quite satisfactory, and in some sections heavier than ever. As yet no special difficulty is being encountered in obtaining goods beyond being subject to the embarrassing delivery delays.

A wider and more active market is commented upon for motors, circuit breakers, standard wiring devices, insulating and pole-line material, conduit, heating and general household appliances, vacuum cleaners, etc. Sellers, however, are rather reluctant to engage themselves very far ahead, even at the prevailing high prices. Advances on a few lines were lately made, and a higher level seems almost assured for electrical glassware of every description. Curtailment of iron and steel production in the last few weeks may also cause a more or less acute situation with the manufacturers of finished electrical merchandise wholly or in part of these metals.

Collections are variously stated as excellent, less prompt and fair, due to differing conditions. Credits, however, are held along firm lines.

NEW YORK

With large government contracts in the market for electrical goods, jobbers of the heaviest caliber are not inclined to jeopardize stock by bidding. It is figured that on some articles specified the quantities are so enormous that only manufacturers can safely handle them. Under these circumstances the plants would be completely tied up for months ahead. The first quantity of what is spoken of as the largest requirement on record, the details of which appeared on page 173 of the ELECTRICAL WORLD of Jan. 19, was urgently needed on or before Feb. 1.

Complaints regarding scarcity of labor for sufficient factory forces are heard, as well as of the restrictions placed on deliveries by the inadequate transportation facilities. Prices are generally mentioned as being at peak, but there are rumors afloat of still further advances in some lines.

Collections are from fair to good, and extensions of credits are being closely visé.

PORCELAIN.—The supply of porcelain goods is reported by jobbers only fair. The market has been strained, it is said, by government requisitions for 3,200,000 unglazed cleats, 24,000 knobs, 480,000 rosettes and 769,600 tubes.

FUSES.—Manufacturers are distributing literature descriptive of their goods and also furnishing the details of their sales policy for the year. No price changes have as yet been announced. One manufacturer, who expected to be in the market with a refillable fuse by now, states that on account of the difficulty and delay in making up tools for its production it will be fully six months before the line will be announced. Sales are said to be in good volume, one concern reporting that fuses are selling heavier than ever before. Some dealers complain that discounts on renewable fuses are too low.

SMALL MOTORS.—Deliveries are improving and can be made in four or five weeks if transportation is available.

FANS.—A representative fan manufacturer remarked this week that the distributors on his list had about all signed up for their 1918 requirements. The contracts so

far filed represented about 75 per cent of last year's commitments, he said, but as 1917 was an exceptional fan year, 1918's orders were, therefore, about normal. Another producer of equal prominence declared fans were selling in greater quantities for 1918 and that his company's contracts demonstrated this to be a fact.

CONDUIT.—Up to inch conduit the supply in this market is quoted as fair, and one jobber who has two cars in stock is referred to as being in a fortunate position. Conduit about one inch in diameter is difficult to obtain.

CIRCUIT BREAKERS.—The demand for large-capacity circuit breakers is reported as unusually heavy. Deliveries are from eight to ten weeks in arrears, solely dependent upon the release of cars. No advance in price has been made, a manufacturer of a diversified line says, since Dec. 1 last, when the list was only equalized on certain sizes.

LIGHTNING ARRESTERS.—A sharp call for lightning arresters was noted in the last few weeks. The government recently placed an order for 6000. Prices are stable, with shipments from stock.

HEATING APPLIANCES.—One local distributor did a business in January over twice that done in January, 1916. To a considerable extent this was due to sales of heaters and warming pads. The government is in the market for around \$100,000 of electric heaters and foot warmers. A large part of this order will be for stock.

CHICAGO

Since the first of the year the trade is getting more squarely on its feet. It sees the changed market conditions more clearly. Efforts that were formerly occupied in the building trades field are already shifted to the more profitable industrial plant and resale merchandise business. While the general wiring business is off, the retail trade was never better.

The leading group of electric shops in the city reports that its sales were better month by month in 1917 than in 1916, with the exception of July. The reason July fell below the previous year's record was not that July, 1917, was bad, but that July, 1916, was an exceptionally good fan month. Sales for January, 1918, were better than those of January, 1917, in spite of the fact that January, 1917, was a surprisingly good month.

CONDUIT.—In spite of the very low showing of electrical permits for the last few weeks the demand for conduit very greatly exceeds the supply. This is due probably to the fact that many of the industrial buyers of pipe are outside the city limits. It is said that while this week has been a breathing spell in the conduit field certain large industrial plants are known to be buying conduit in advance of requirements and putting it in stock for future use.

LAMPS.—The price increase has not affected the volume of lamp business. In making the increase of 10 per cent some unusual retail prices, such as 27.93 cents, were arrived at, but these details have been straightened out.

VACUUM CLEANERS.—The manufacturers are finding it easy to market all the machines they can make from the material they can secure. One cleaner has advanced \$10 in retail price and other increases are expected.

BOSTON

A perceptible falling off in trade is noted among jobbers and retailers, as was the case last week, but no permanent curtailment of business appears at all likely. From various quarters it is reported that the Monday shutdowns, which it is hoped will be eliminated throughout the East after this week, have had a bad effect on buying.

Contractors and dealers are on the whole overstocked with supplies at present. Collections continue rather slow, excepting from the larger central stations and from the mills. It is doubtful whether credits will show much improvement for the next month or so unless the smaller contractors get a chance to work off more of their stocks and to carry

through construction work of a more diversified character than is now on their books. Deliveries are very unsatisfactory, owing to railroad congestion and embargoes, but some manufacturers are beginning to improve their shipment dates through stock accumulation, notably in representative types of small alternating-current motors.

A 10 per cent advance in single-phase motors was put into effect in January by the Wagner Company, one of the last manufacturers to establish a recent increase. Appliance sales reflect a fairly healthy market condition. The opinion is advanced in some quarters that further price increases in electrical apparatus and supplies are quite within the bounds of probability during the next few months, though it is not expected that radical advances will take place at any one time. On the whole, the labor situation is reasonably quiet.

There is some hope of better electric railway conditions in Massachusetts at the present legislative session, ultimately leading to more general buying of supplies and equipment than has been practised for a long time.

MOTORS.—Local stocks are rather depleted, and their restoration depends to a very large extent upon the improvement possible in the railroad situation. Prices are firm, barring an advance noted above during the last month. Factory stocks of smaller motors are showing some improvement, but large units are still very scarce.

RADIATORS.—Sustained cold weather, high fuel cost and scarcity of coal are producing an unprecedented volume of business.

CONDUIT.—Prices show little change and stocks are about the same as last week. Until transportation conditions improve deliveries will continue very uncertain. Contractors are reported heavily stocked with the smaller fittings.

POLE-LINE HARDWARE.—Jobbers report this material to be very scarce. Deliveries are anything but satisfactory, on account of the railroad situation. One jobber looks for further price increases this spring.

LAMPS.—There is a prospect that orders of larger volume will be accepted after April 1 for bulk deliveries.

TELEGRAPH AND TELEPHONE MATERIAL.—Substantial sales of this equipment are being made for foreign service. Radio apparatus is in active demand for government use. There is a shortage of 2000 ordinary telegraph keys for New England service. Interior wire for telegraph work is easily obtained and is the first material to arrive on many plant construction jobs.

STORAGE BATTERIES.—An enormous volume of government business is being handled. Inquiries are very active for industrial truck batteries, and a recent price advance in battery equipment increased the corresponding truck price only 2 or 3 per cent. Much interest in trucks is shown by navy yards and arsenals.

ATLANTA

Dr. Garfield's latest interpretation of his fuel order as applied to industries served from hydroelectric sources has tended to clarify a very confusing situation in the Southeast. Almost all industrials using this form of energy operated through the five-day period, but a later announcement to the effect that all plants operating by hydroelectric power "are requested to shut down on Mondays" created a perplexing situation, and local fuel administrators for each state issued orders on the basis of their own construction, the outcome being that a number of plants continued to run while others shut down. From now on the various plants fortunate enough to have hydroelectric connections, and which can operate with sufficient fuel to keep pipes from freezing, can do so without feeling that their patriotism is questioned.

The rainfall has been abundant during this week and most of the streams have become swollen, which will materially help the hydroelectric companies, especially when they close down all auxiliary steam plants on Mondays. Generally speaking, the industries of this section are loaded with orders, principally for government account, and while the stoppage of work in some instances brought about by the fuel decree, in addition to effects of bad weather, curtailed

production and restricted trading in certain areas, a marked improvement is noted in the fuel situation and a more cheerful feeling in outlying districts.

The Brunswick (Ga.) Chamber of Commerce has been notified by a representative of the Emergency Fleet Corporation that at least 1000 houses will have to be erected at Brunswick within the next sixty days. It is also reported that these houses will be wired for electric lights. In this event a market will be opened for standard wiring devices. There is a noticeable falling off in the demand for heavy apparatus of late. This holds true as well with heavier cables, which have shown little activity except in scattered and isolated cases.

POLE AND LINE MATERIAL.—The demand for this line has been strengthened by telephone and telegraph requirements. A slight decrease in the call is noted from central stations. Hardware remains very active in the face of a 10 per cent increase in price in the last two weeks. Shipment promises are better and deliveries show marked improvement.

CROSS-ARMS.—An advance of 10 per cent was made Jan. 1, 1918. The heavy draft on this class of wood by the government for aeroplane work has, for the time, side-tracked and delayed shipments for normal industrial work, and the deliveries to this section have been slowed up materially.

INSULATING MATERIALS.—There has been a notable increase in the call for varnished cambric and mica insulators in the Southeast lately. Various repair shops report a large volume of work on hand. On the whole, deliveries are very good on insulation material, with the exception of a few special requirements.

SECOND-HAND EQUIPMENT.—Although a large quantity of this class of apparatus is being traded in, repaired and put in good shape, the pressure has lessened to some extent, and there is a tendency in certain sections to wait on shipments of new apparatus when other work cannot be completed in an equivalent time.

SEATTLE

Jobbers and dealers as a whole report that the volume of business in January exceeded by far that for any previous January in the history of the Northwest. Sales of household appliances, particularly of sewing and washing machines, equaled sales of December last year, which were large on account of the Christmas demand. Jobbers state that the sale of sewing machines is increasing daily and the Christmas record for washing machines is being sustained. Other household appliances are selling well, and the sale of flatirons is expected to increase materially within the next two months.

January did not experience the usual slow-up, which was a source of surprise and satisfaction. The present activity is expected to continue and increase throughout the year. The week's industrial business is featured by the awarding of several large ship contracts to the Northwest yards. Contracts have been awarded in Seattle for twenty-two cargo steamships, fourteen 8800-ton steel ships, costing \$20,000,000, and eight 4000-ton wooden vessels, costing \$7,000,000. These contracts bring the total number of ships building in Seattle to 135, the majority of which are direct federal contracts, and about three-fifths will be constructed and delivered during 1918. Authorities state that the shipbuilding industry in the Northwest is placed beyond the realm of uncertainty for the next two years by the substantial business already signed by various yards.

Owing to the recent freight embargo in the East box cars cannot be obtained for shipping conduit pipe, etc., to Pacific Coast jobbers who supply shipbuilding corporations. If the situation is not relieved or improved materially within two or three weeks, it may prove very serious. However, local jobbers believe that the matter will be adjusted before the situation becomes acute.

A new record for January building in Seattle was set last month, activity being confined almost exclusively to residences, factories and workshops. Permits for residences alone were issued to the value of over \$300,000. From pres-

ent indications the residence building records will be shattered in Seattle during the next two months. Residence building in Tacoma is progressing at a greater rate than at any time in the last five years. January broke all records. The high prices of materials and labor and the scarcity of both continue to restrict building in Portland, although a residence building boom is expected shortly. The proposed construction of numerous grain elevators in eastern Washington and Oregon will mean much to jobbers in sales of motors and other electrical equipment. During the past month the announcement of construction of at least fifteen, ranging in cost from \$25,000 to \$35,000, has been made.

Collections during January were fair. Government collections, particularly from the navy are slow. Very few new credits were placed, and applications are being scrutinized closely.

LINE MATERIAL.—Telephone equipment, including pole-line material, wire, cross-arms, insulators, etc., experienced a very satisfactory movement in the last two weeks. Several lucrative orders were placed for repairs and needed improvements. Wire stocks are ample, but there is a shortage of cross-arms and poles.

DYNAMOS AND TRANSFORMERS.—Motors, generators and transformers show a very satisfactory volume of sales. A Portland jobber landed an order of considerable size last week, and one or more large orders are in prospect.

SAN FRANCISCO

The foremost topic in discussing California business conditions and prospects just now is the drought. There has been some relief, but the situation is still very serious. In the central valleys, where the seasonal precipitation at this time averages 14 in., only 2½ in. has fallen this year, and even if the average rainfall of 9 in. occurs from now on, much of the unirrigated land will not produce. The land under irrigation systems will also suffer in that the supply of stored water will be very low. In the mountains, where the snowfall is usually more than 20 ft. by this time, only 2 ft. of snow has fallen, and the water stored for hydroelectric power will this year be very much below normal.

These conditions have affected the electrical trade already in that dealers are not placing the usual orders. However, that this is not the only angle from which to view California conditions is shown by the statement from one of San Francisco's large electrical jobbing firms that the last month has been the best in volume of trade for several years. Moreover, a further analysis of that trade indicates that it consisted of purchases whose average value was less than normal. This refutes the claim that the only heavy business comes from large government or industrial orders.

CREDITS AND COLLECTIONS.—Collections are exceptionally good for this time of year and apparently are not suffering under war conditions. Credits are being extended about as usual.

WIRE.—Stocks are in poor shape and deliveries slow. Little improvement can be hoped for.

SAFETY SWITCHES.—Stocks are greatly improved in this line, partly because of the change in recent months from building to industrial construction.

STORAGE BATTERIES.—The sales in January in this line, one manufacturer reports, were about 25 per cent more than in the corresponding month a year ago. The industrial and gasoline-engine manufacturing fields have been very active, supplementing the steady demand for automobiles.

MOTORS.—The irrigation demand continues unusually heavy, and manufacturers are handling the situation very well, being materially aided in this by the Priority Board. It is noted that the demand for transformers from agricultural districts has not been so heavy as would be indicated by the motor business, but this is largely because service is supplied by power companies at voltage suitable for customers' motors.

WIRELESS SUPPLIES.—An even greater demand than before the war is noted in some lines of wireless specialties. Buzzer sets for government schools and equipment for instruction generally have gained large volume.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must

increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil.....	List to \$61.00
Coil to 1000 ft.....	10% to 59.17
	No. 12 Solid
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	10% to 68.87

Twin-Conductor

	No. 14 Solid
Less than coil.....	List to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
	No. 12 Solid
Less than coil.....	List to \$135
Coil to 1000 ft.....	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil.....	+10%
Coil to 1000 ft.....	—10%
	No. 12 Solid
Less than coil.....	+10%
Coil to 1000 ft.....	—10%

Twin-Conductor

	No. 14 Solid
Less than coil.....	+10%
Coil to 1000 ft.....	—10%
	No. 12 Solid
Less than coil.....	+10%
Coil to 1000 ft.....	—10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	20% to list
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

	No. 6 Regular	No. 6 Ignitor
Each Net		
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

	No. 6 Regular	No. 6 Ignitor
Each Net		
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175	.3275
Barrel lots.....	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp....	\$75.00	—15% to \$69.75
3/8-in. d. stp....	+10% to 75.00	List to 72.00
1/2-in. s. stp....	List to 100.00	—15% to 93.00
1/2-in. d. stp....	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip....	\$75.00	\$63.75
3/8-in. double strip....	78.75	71.25
1/2-in. single strip....	100.00	85.00
1/2-in. double strip....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$25.00-\$55.00	\$20.50-\$24.50	\$20.00-\$21.50
1/4-in.....	\$28.00-\$60.00	\$22.50-\$27.00	\$20.00-\$23.50

NET PER 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$36.00-\$55.00	\$25.00-\$37.50	\$22.50-\$24.75
1/4-in.....	\$40.00-\$60.00	\$27.00-\$30.00	\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.27
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb....	4% to 6%	7% to 9%
2500 to 5000 lb....	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb....	1.3% to 4.7%	4.3% to 7.7%
2500-5000 lb....	3.3% to 6.7%	6.3% to 9.9%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	30%

CHICAGO

List.....	\$5.00
Discount.....	25% to 30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50
	600-Volt		
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.	100	\$0.30
60-watt—B.	100	.35
100-watt—B.	24	.70
75-watt—C.	50	.70
100-watt—C.	24	1.10
200-watt—C.	24	2.20
300-watt—C.	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3 3/8 in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4 1/8 in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$24.90 to \$31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$30.00 to \$35.60
Coil to 1000 ft.	22.30 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100.	\$20.00 to \$29.00
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CHICAGO

Net per 100.	\$19.25 to \$25.75
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OUTLET BOXES

	List, per 100
Nos.	
01—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
02—B.A., 6200 S.E., 300, AX, 1 1/2, 4 S.	30.00
03—C.A., 9, 4 R, B 1 1/2.	25.00
06—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%-37%	20%-32%
10.00 to \$50.00 list.	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 26.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N. C.—Solid Nail-it—N.C.				
Less than 1/5 std. pkg.	\$27.50 to \$29.00			\$30.75
1/5 to std. pkg.	15.60 to 20.75			24.20

CHICAGO

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.				
Less than 1/5 std. pkg.	\$11.85			\$30.75
1/5 to std. pkg.	11.10			24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets	500	\$0.33
1/4-in. cap keyless socket.	500	.30
1/8-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	\$25.00 to \$45.00
1/5 std. pkg.	23.00 to 42.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

	High Grade:	Low Grade:
30-amp. S. P. S. T.	\$0.80	0.42
60-amp. S. P. S. T.	1.20	0.74
100-amp. S. P. S. T.	2.25	1.50
200-amp. S. P. S. T.	3.48	2.70
300-amp. S. P. S. T.	5.34	3.76
30-amp. D. P. S. T.	1.20	0.68
60-amp. D. P. S. T.	1.78	1.22
100-amp. D. P. S. T.	3.38	2.50
200-amp. D. P. S. T.	5.20	4.50
300-amp. D. P. S. T.	8.00	7.00
30-amp. 3 P. S. T.	1.80	1.02
60-amp. 3 P. S. T.	2.68	1.84
100-amp. 3 P. S. T.	5.08	3.76
200-amp. 3 P. S. T.	7.80	6.76
300-amp. 3 P. S. T.	12.00	

DISCOUNT—NEW YORK

	High Grade	Low Grade
Less than \$10 list.	List to + 5%	5% to 10%
\$10 to \$25 list.	11%	16%
\$25 to \$50 net.	14% to 15%	24% to 25%

DISCOUNT—CHICAGO

	High Grade	Low Grade
Less than \$10 list.	+ 5%	5%
\$10 to \$25 list.	10%	16%
\$25 to \$50 list.	14%	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to list
1/5 to std. pkg.	List to - 15%
Std. pkg.	List to 30%

SWITCH BOXES, SECTIONAL CONDUIT

	List Each
Union and Similar—	
No. 155.	\$0.34
No. 160.	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.	List	Net
\$2.00 to \$10.00 list.	10% to 20%	5%
\$10.00 to \$50.00 list.	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25%	20%
\$2.00 to \$10.00 list.	25%	20%
\$10.00 to \$50.00 list.	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$5.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/2
No. 18, full spools.	0.43 1/2

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.64
No. 18, full spools.	0.50 1/2 to 0.54

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
	Less than	500 to	1000 to	
No.	500 Ft.	1000 Ft.	5000 Ft.	
11.	\$15.00-\$18.00	\$13.00	\$11.25-\$11.50	
12.	23.25- 25.41	21.30- 21.78	15.97- 19.35	
10.	32.40- 35.21	29.70- 30.18	22.13- 27.00	
8.	45.70- 49.12	41.90- 42.12	30.88- 38.00	
6.	72.40- 77.84	66.35- 66.72	48.93- 60.30	

CHICAGO

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.	
14.	\$18.00	\$13.00-\$13.50	\$11.50-\$12.00	
12.	25.33-\$26.28	22.48- 25.33	20.40- 20.93	
10.	30.04- 36.54	30.03- 31.26	22.23- 29.23	
8.	48.97- 51.51	41.36- 41.98	39.42- 41.36	
6.	66.46- 88.38	62.43- 70.70	56.39- 70.70	

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

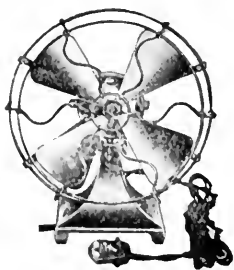
	Per 100 Lb. Net
Less than 25 lb.	\$40.35
25 to 50 lb.	39.35
50 to 100 lb.	38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements
in Manufacturers' Products Used in
the Electrical Field

The New Features of 1918 Fan Designs

CHANGES in the line of fans offered to the trade for 1918 consist almost entirely of the elimination of those types that have been in less demand and which have been discontinued with a view to concentrating manufacturing effort and available supplies of materials on the types of fans most needed. Few new fans will be placed on



HAMILTON-BEACH FAN EQUIPPED WITH
AIR-COOLED MOTOR

the market this year. Virtually all six-blade fans have been replaced by the four-blade type except in the larger alternating-current oscillatory fans. The absence of speed controllers, highly polished parts and other refinements not necessary for reliability is noteworthy. The more important changes in design follow:

Carleton Company, Boston, Mass.—This company will continue to specialize in battery fans of any voltage. This year, except on oscillating fans, a universal ball-and-socket joint will be used instead of the regular hinged joint.

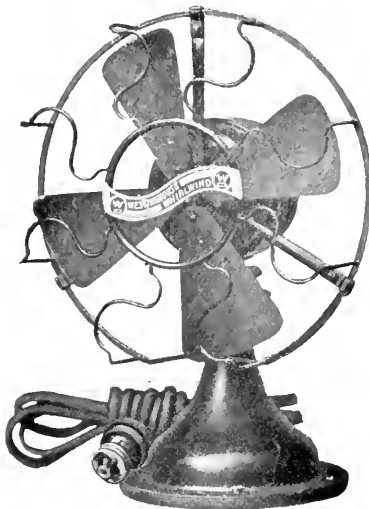
Century Electric Company, St. Louis, Mo.—Minor improvements have been made in several of this company's models, but these changes are not sufficient to change the general appearance. This company's 9-in. (22.9-cm.) fans, which were described in the Jan. 27, 1917, issue of the *ELECTRICAL WORLD*, were not produced in a large quantity and will be featured this season.

Emerson Electric Manufacturing Company, St. Louis, Mo.—This company has discontinued the non-oscillating six-blade residence-type fan for alternating current and direct current, the six-blade direct-current oscillators, the 32-in. (81.3-cm.) sweep ornamental-type oxidized-copper-finish ceiling fan, and all of the ornamental-type ceiling fans previously offered with chain suspension. Six-blade residence-type fans will be made for 1918 in 12-in. and 16-in. (30.5-cm. and 40.6-cm.) alternating-current oscillating types only. A line of new model duplex rotary ceiling and column fans is listed for 1918, designed with careful consideration of the ex-

perience gained in the manufacture of these fans last season, it is said. This company's four-blade, 52-in. (132.1-cm.) sweep oxidized-copper-finish ornamental-type ceiling fan has been replaced by a new type, No. 42,641, equipped with 56-in. (142.2-cm.) sweep blades.

General Electric Company, Schenectady, N. Y.—One novel departure of this company's fans is in the finish, as all metal parts are now enameled a dark green and the blades are lacquered brass. All of these fans are readily adjustable for either desk or bracket use. They are furnished with standard cords and plugs.

The complete line of General Electric Company's fans for this season will include 9-in., 12-in. and 16-in. (22.9-cm., 30.5-cm., and 40.6-cm.) oscillating and non-oscillating four-blade fans in both direct and alternating current. Six-



WESTINGHOUSE FAN FROM WHICH USUAL
REFINEMENTS HAVE BEEN OMITTED

blade oscillating fans in 12-in. and 16-in. sizes are made for alternating current only.

Ventilating fans for 1918 will be handled in 12-in. and 16-in. sizes, six blades, in both alternating current and direct current. These fans, finished in green enamel, with lacquered brass blades and trimmings can also be furnished with special bearings to operate in a vertical position.

In standardizing to three sizes of desk and ceiling fans the company's engineers feel that they have provided a fan suitable for every use.

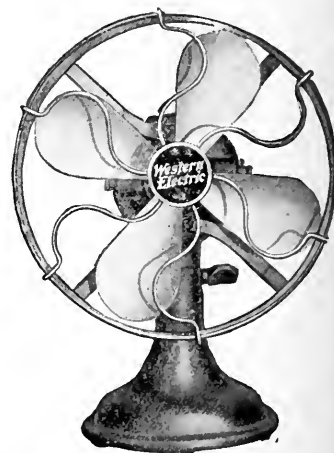
A. C. Gilbert Company, New Haven, Conn.—Several mechanical changes have been made in the Polar Cub fan made by this company. The speed-con-

trol handle, which was found to be too long, has been shortened, the motor is nickel-plated and the guard and blades are finished in black japan. This company has added a 9-in. (22.9-cm.) oscillating, four-blade fan, equipped with a universal motor, to its line.

Hamilton-Beach Manufacturing Company, Racine, Wis.—This company announces its Cyclone universal fan, equipped with the H-B universal air-cooled motor, wound to operate on both direct and alternating current at a voltage of from 105 to 120, 60 cycles. This fan is equipped with a rheostat speed control giving five different speeds and shut-off. It has an extra-heavy base which effectually prevents its creeping, and its design readily permits of its use either as a desk or wall-bracket type.

Knapp Electric & Novelty Company, New York City.—This company has added a new fuse to its line, an 8-in. (20.3-cm.) 110-volt fan equipped with a universal motor. The fan is finished in brass and black japan and equipped with 6 ft. (1.8 m.) of cord and plug. Only minor changes have been made in the fans that were marketed last year.

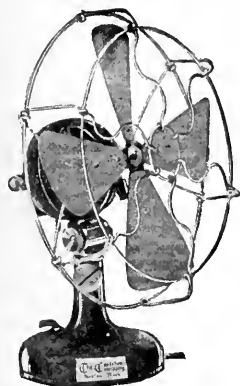
Menominee Electric Manufacturing Company, Menominee, Mich.—This company makes the announcement that its 1918 fan-motor line will not include any radical changes or any entirely new models. It has discontinued temporarily a few of the special patented types, such as the horizon-



WESTERN ELECTRIC 6-IN. FAN

tal table fan and socket fan, which were principally for the foreign market. It is announced that this company's type 150 8-in. (20.3-cm.) universal straight-type low-priced fan can be had this year with or without a three-speed

rheostat in the base. When without, the fan retains the usual type number of 150, but with the three-speed rheostat in the base the type number is 164. The 8-in. (20.2-cm.) oscillator has been redesigned, substituting die casting for



CARLETON FAN EQUIPPED WITH UNIVERSAL BALL-AND-SOCKET JOINT

cast iron. On the 12-in. and 16-in. (30.5-cm. and 40.6-cm.) types the brass guard holders are being omitted. Both guards and guard holders will be black enameled steel, and, as usual, the blades will be of polished brass.

Pittsburgh Electric Specialties Company, New York City.—This company has brought out an improved 8-in. and 10-in. (20.3-cm. and 25.4-cm.) fan of the oscillating type that is finished in black japan with brass blades, adjustable for desk or wall use. These fans have three speed regulations and may be used either as straight or oscillating fans. They are equipped with cord and plug and universal motor.

Sprague Electric Works of General Electric Company, New York City.—Aside from improvements in minor details of construction, the only change made in this company's fan-motor line is the substitution of a blade finished in brass lacquer on its 12-in. and 16-in. (30.5-cm. and 40.6-cm.) fans for the blade finished in black enamel which was used last season. The guard, as well as the motor body and base, will continue to be finished in black enamel.

Western Electric Company, New York City.—The specifications for this company's line for the coming season conform in most particulars to those of the 1917 line, the most noteworthy change being the finish of its 6-in. (15.2-cm.) fan, which will be dark green. As standard for 1918, a 6-in. fan to be operated only on alternating-current circuits and another to operate only on direct-current circuits will be marketed.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.—Concentration on those models whose serviceability and popularity have been amply tested has been the aim of the 1918 changes in the line of fans made by the Westinghouse Electric & Manufacturing Company. Where both four-blade and six-blade fans have been offered the six-blade fans have been eliminated and some of the less popular ceiling fans have been withdrawn.

All portable fans are provided with

a hinge joint to adapt them to mounting on either desk or wall. The oscillating mechanism can be adjusted for a "swing" of from 45 deg. to 90 deg. at the rate of eight per minute, or can be locked out of service entirely. A tilt of 20 deg. from horizontal can also be had.

The Westinghouse Whirlwind, an 8-in. (20.3-cm.) fan at a popular price, has the drawn-steel construction characteristic of Westinghouse fans. From it have been omitted, however, such refinements as speed control, highly polished blades and others not necessary for durability. Current can be cut off by separating the attachment plug.

The remainder of the portable line includes both oscillating and non-oscillating fans of 10, 12 and 16-in. (25.4, 30.4 and 40.6-cm.) diameters. Ten-inch fans have zinc-plated, polished and lacquered blades; 12-in. and 16-in. models have polished and lacquered brass blades. The finish of all other parts is dull black. All models are packed in substantial boxes and include attachment plug and 8 ft. (2.4 m.) of cord.



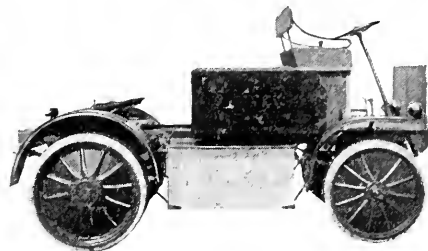
MENOMINEE FAN WITHOUT RHEOSTAT IN BASE

Reports from the Other Manufacturers.—The following manufacturers report only slight changes in fans for the coming season: Dilg Manufacturing & Trading Company, New York City; H. Boker & Company, Inc., New York City; Fidelity Electric Company, Lancaster, Pa.; Manhattan Electrical Supply Company, Inc., New York City; Crocker-Wheeler Company, Ampere, N. J.; Eck Dynamo & Motor Company, Belleville, N. J.; Star Electric Motor Company, Newark, N. J.; Racine Universal Motor Company, Chicago, Ill.; Robbins & Myers Company, Springfield, Ohio; Adams-Bagnall Electric Company, Cleveland, Ohio; Lindstrom-Smith Company, Chicago, Ill., and Hunter Fan & Motor Company, New York City. The Shedd Electric Company, Inc., of Roselle Park, N. J., announce that it does not expect to manufacture any fans this season.

The Peerless Electric Company, Warren, Ohio; Crucet Manufacturing Company, New York City; Dayton Fan & Motor Company, Dayton, Ohio; American Electric Fan Company, Logansport, Ind.; Kokomo Oscillating Fan Company, Kokomo, Ind., and Russell Electric Company, Chicago, Ill., have made developments in fans which are not available at this time, but will be described in later issues of the ELECTRICAL WORLD.

Electric Tractor

Electric tractors that are especially valuable for haulage between buildings of large manufacturing plants and similar places are made by the Walker Vehicle Company of Chicago. Tractors are made with hauling capacities up to 15 tons gross trailing load, the one shown here having a hauling capac-



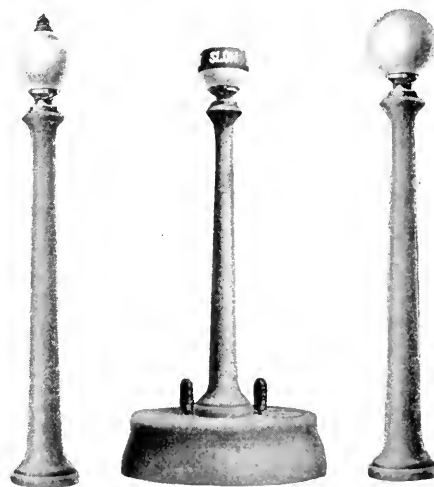
VALUABLE FOR HAULAGE IN MANUFACTURING PLANTS

ity of 10 tons. It is pointed out that the large-diameter wheels of these tractors make them especially valuable on rough pavements. The Walker balance drive used in these tractors is extremely simple, durable and efficient, it is said. A sixty-cell Edison type A-12 battery is used.

Concrete Lighting Posts

The accompanying illustrations represent a part of the line of concrete posts for lighting boulevards, streets and parks made by the Chicago Concrete Post Company of Chicago. All of these are ornamental in appearance, pleasing in design and made to withstand severe and varying climatic conditions. It is said that these posts are not affected by either the heat of summer or the cold and ice of winter. The post heights are from 8 ft. to 13 ft. (2.4 m. to 4 m.), exclusive of globe holder.

The posts are one solid shaft, made in water-tight cast-iron molds, and are



THREE TYPES OF CONCRETE POSTS

each reinforced with four twisted "rail carbon" steel rods. The reinforcing rods extend about 18 in. (45.7 cm.) below the base of the post, and by inserting rods in the foundation the use of anchor bolts is eliminated.

Trade Notes

M. A. B. STEIN has resigned as New England representative of Harvey Hubbell, Inc., to take up work in the contentment division of the Quartermaster's Department of the army at Washington.

THE CROCKER-WHEELER COMPANY of Amherst, N. J., announces that Ben D. Christian and D. B. Graze will hereafter represent it on the selling staff at Cleveland, Ohio, succeeding Howard Dingle and W. W. Clark.

THE STANDARD ELECTRIC & ELECTRIC COMPANY, Inc., of Baltimore, Md., has been reorganized and is offering \$100,000 of 7 per cent cumulative preference stock for public subscription. The money realized through this stock issue is to be applied to the development of the company's physical facilities necessary to present demands.

THE WAR TRADE BOARD, Washington, D. C., in an official announcement, states that henceforth a new export application form will be used in place of all forms hitherto in existence. It will be the only application form in use. Copies of the blanks, with information pertaining to their use and other pertinent directions, may be had on application to the board.

THE DAYTON ENGINEERING LABORATORIES COMPANY of Dayton, Ohio, is now occupying its new buildings, greatly facilitating the output of Delco-light products. In all there are 135,000 sq. ft. of floor space. The three buildings are single-story structures of the monitor type, thus insuring uniform lighting and ventilation. The general offices of the company remain at the old address.

THE GENERAL ELECTRIC COMPANY, Harrison, N. J., has commenced the erection of a large new plant on Cross Street for the manufacture of glass bulbs, and the work is progressing favorably. The company is also planning for the erection of an addition and alterations at its plant at 268 North Nineteenth Street, East Orange, and has taken out a building permit for this purpose.

THE NATIONAL ASSOCIATION OF MANUFACTURERS of New York City, through its foreign department, has published an interesting pamphlet entitled "An Export Order," with a description of an effective agency for promoting the foreign trade of American manufacturers. Various approved forms of correspondence, invoices, packages, etc., are embodied. Copies may be obtained by writing.

H. W. STORTZ, for many years with the Edison Storage Battery Company, Orange, N. J., during which he served as sales manager of the mine lamp department, sales manager of the industrial truck and tractor department and sales manager of the house-lighting department, has resigned to become vice-president and general sales manager of the Swartz Electric Company of Indianapolis, Ind., manufacturer of automatic lighting plants.

THE MECHANICS AND METALS NATIONAL BANK of New York City has prepared a booklet, which is being sent to banks and business organizations throughout the country, outlining a plan for converting non-essential industries of the nation to a war basis on a gradual instead of a drastic scale. It is entitled "Steps to Victory" and described as a "brief discussion of the things to do and the things to do without during the progress of the war."

THE MAXWELL ENGINEERING & MANUFACTURING COMPANY of New York City succeeds to the business of Hickey & Schneider, dissolved, manufacturers of electrical specialties, transmission line equipment, transmission line hardware and outdoor and indoor substations. The new company is established at 61 Broadway. Mr. Maxwell, president and general manager of the company, was for the past five years sales agent for the H. & S. line.

THE IRVING NATIONAL BANK of New York City has published several pamphlets written by Lewis E. Pierson, chairman of the board of directors, entitled respectively "The Trade Acceptance Nationally Launched," "Government Price Fixing and Profit Taxation" and "War Time Finance." A fourth pamphlet, "The Influence of the War on Trade, Domestic and Foreign," is by G. A. O'Reilly, the bank's foreign trade representative. Copies may be had by application.

THE ELECTRICAL ENGINEERS' EQUIPMENT COMPANY of Chicago announces the removal of its general offices and a portion of the manufacturing departments to 710-714 West Madison Street.

This new location is directly opposite the company's present quarters, at 711-715 West Madison Street. The major portion of the factory proper, together with the shipping and stock departments, will remain at the latter address, which is connected to the Madison Street building by means of a runway.

THE PATTON-MACGUYER COMPANY, Providence, R. I., is the new corporation name of what was formerly the Bliss-Chester Company, manufacturer of brass stampings, of that city. The location and nature of the business will be substantially the same as before. The executive officers are: Ralph C. Patton, president; Charles L. Patton, vice-president, and Herman F. MacGuyer, secretary and treasurer. R. C. Patton was formerly chief engineer of the D & W Fuse Company, Providence, R. I., and Mr. MacGuyer special sales representative.

THE DRIVER-HARRIS COMPANY, Harrison, N. J., had a fire in its factory last week, which destroyed two of the buildings used for storage of raw materials and finished stock, machinery, chemical laboratory, testing room, one of the shipping rooms and one of the wire-spooling departments and the electrical cord and wiring insulating department. Suspension in shipment of materials affected by this fire, the company states, will only be temporary. More than half of the machinery required for electrical cord production and other required new equipment has been purchased and is now on the way to the factory. Temporary quarters have been provided.

New Incorporations

THE BUNYAN SIGNAL LIGHT COMPANY of Cleveland, Ohio, has been chartered with a capital stock of \$20,000 by W. J. Bunyan and Andrew Heppel.

THE STANDARD WIRE COMPANY of Harrison, N. J., has been incorporated with a capital stock of \$50,000 to manufacture wire for electrical and other service.

THE ELECTRICAL ENGINEERING COMPANY of Pittsburgh, Pa., has been incorporated with a capital stock of \$30,000 by Thomas G. Hodgson and others.

THE JERSEY CITY (N. J.) AUTO ELECTRIC COMPANY has been organized to operate an electrical repair plant at 279½ Fairmount Avenue. R. Kaiser is one of the incorporators.

THE FRANCO BATTERY COMPANY of St. Mary's, Pa., has been incorporated with a capital stock of \$250,000 by Lyle G. Hall and others. The company proposes to manufacture electric batteries.

THE AUTOMATIC RAILWAY COMPANY of New York, N. Y., has been chartered with a capital stock of \$14,500 by L. H. Washburn, C. K. Allen and J. S. Wooster, 115 Broadway, New York City.

THE ELECTRICAL ENGINEERING COMPANY of Pittsburgh, Pa., has been chartered with a capital stock of \$30,000 by Thomas G. Hodgson. The company proposes to do a general engineering business.

THE ELECTRIC APPLIANCE COMPANY of Pittsburgh, Pa., has been incorporated with a capital stock of \$25,000 to manufacture electrical appliances. The incorporators are A. A. Meagher and others.

THE HARRIS POPP ELECTRIC COMPANY of Charleston, W. Va., has been chartered by A. Norroff, T. H. and Thomas Popp. The company is capitalized at \$10,000 and proposes to manufacture electric fixtures.

MARCUS & COMPANY of Boston, Mass., has been incorporated by Israel H. Marcus, Edward A. Thomas of Winthrop and Daniel F. Cunningham of Brighton. The company is capitalized at \$50,000 and proposes to deal in electrical supplies.

THE RURAL LIGHT & POWER COMPANY of Louisville, Ky., has been incorporated with a capital stock of \$15,000 by W. R. Katterjohn, A. H. and R. M. Thompson. The company proposes to install and operate electric-lighting and power plants.

THE ASHLAND (ME.) ELECTRIC COMPANY has been incorporated by G. H. Mooers, L. C. Mooers and W. L. Waldron of Ashland. The company is capitalized at \$50,000 and proposes to generate and distribute electricity for lamps and motors.

THE DOMESTIC ELECTRIC EXPORT COMPANY of New York, N. Y., has been incorporated with a capital stock of \$200,000 to do a general import and export business and deal in manufactured articles. The incorporators are A. H. Gleason, J. J. Hayden and D. Barnett, 258 Broadway.

Trade Publications

PIPE PUSHER.—The Easy Manufacturing Company of David City, Neb., is distributing a bulletin descriptive of its "Easy" pipe pusher.

FLUSH RECEPTACLE.—Harvey Hubbell, Inc., of Bridgeport, Conn., is distributing bulletin 16-3, descriptive of its Hubbell flush receptacle with adjustable aligning plate.

FANS.—The Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York City, has prepared a leaflet descriptive of its fans for 110-volt and battery service.

INSTRUMENT TRANSFORMERS.—Bulletin 46,013, descriptive of switchboard-type instrument transformers, is being distributed by the General Electric Company of Schenectady, N. Y.

AUTOMATIC RAILWAY SUBSTATIONS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared leaflet 3998, descriptive of its automatic railway substations.

INDUSTRIAL TRUCKS AND TRACTORS.—Electric storage battery industrial trucks and tractors are illustrated and described in catalog No. 117 prepared by the Elwell-Parker Electric Company of Cleveland, Ohio.

CONVEYOR.—The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has just issued an eight-page booklet (known as booklet W) illustrating and describing the C-H dispatch conveyor, which is particularly adapted for newspaper and magazine publishing plants. It is designed for taking papers from the press (regardless of the press speed) and delivering the folded papers in the mailing room. The booklet also gives a list of representative papers using the conveyor. The flexibility of this dispatch conveyor permits turning at any angle, vertical or horizontal, to avoid obstructions. It may be run overhead, down through the floor or straight away.

RESISTANCE MATERIAL.—The Electrical Alloy Company, 135 Broadway, New York City, has just issued its new edition bulletin catalog No. 9, which contains much useful information on its complete line of electrical resistance materials, nickel alloys, pure nickel and electrical alloy grade "A" monel metal. The book will be of extreme interest to all engineers, and particularly to those in the electrical and automobile industries. It is pointed out by the Electrical Alloy Company in its catalog that each electrical alloy product has been standardized only after repeated and exhaustive tests by its staff of electrical and metallurgical engineers, and also that its complete line embodies a resistance material for each resistance requirement.

BAKELITE MICARTA GEARS.—Technical information regarding Bakelite Micarta-D gears is contained in a pamphlet recently published by the Westinghouse Electric & Manufacturing Company of East Pittsburgh. The distinctive features of this material for noiseless gears and pinions are listed, together with its physical properties. Methods of turning and drilling and gear cutting are described and illustrated with many halftones and drawings. Methods of attaching to the driving shaft which have proved suitable for gear of all sizes are shown and tables of pitch, teeth and other gear data are also given. There are formulas for the horsepower rating, the amount of power which can be transmitted through press fit and for calculating other variables in gear practices.

METERS.—Users of gas in large quantities, such as steel mills, gas companies and others, will be interested in knowing that the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has just issued an eight-page booklet (known as booklet T) illustrating and describing the Thomas meter for the accurate commercial measurement of gases and air in large quantities. The booklet gives the principle of operation, illustrates essential parts and shows typical installations. The Thomas meter is different from all other forms of gas meters capable of measuring large quantities of gas in that it gives the quantities in standard units by which gas is bought and sold and does not require any corrections for temperature or pressure. Further, it shows a totalized result on an integrating meter and a graphic record of the rate of flow on a curve-drawing meter. The Thomas meter uses electricity as a means for measuring the quantity of gas and is a desirable load for the electric light company because under usual operating conditions it will have a high load factor and practically unity power factor.

New England States

BATH, ME.—The trustees of the Bath water district are considering the advisability of equipping the pumping station in Woolwich with electrically-operated machinery to replace the present steam power plant.

ASHLAND, N. H.—Improvements are being made to the municipal electric-light plant, including the installation of a 200-kw., three-phase, 60-cycle, 2300-volt Westinghouse turbo-generator set, and thirty-five 400-cp. luxolite lamps. L. G. Field is manager of power station.

BOSTON, MASS.—Bids will be received by the schoolhouse commissioners of the city of Boston, 1007 City Hall Annex, Boston, until Feb. 12 for construction of an elementary school, complete, in Roger Wolcott District, Harvard Street, Dorchester. A complete set of plans and specifications may be obtained upon a deposit of \$25. A deposit of \$15 will be required for a set of heating and ventilating or electrical plans with specifications.

GLOUCESTER, MASS.—The Council has granted the Gloucester Electric Company permission to erect pole lines on Winchester, Court, Warner and Burnham Streets in order to supply additional energy to the munitions plant, and also to provide more power to contemplated industries in the Maplewood section.

PALMER, MASS.—The Central Massachusetts Electric Company has petitioned the State Gas and Electric Light Commission for approval of an issue of additional capital stock of \$200,000, the proceeds to be used to pay the cost of additions to its plant.

PROVIDENCE, R. I.—The Queen Dyeing Company, Valley Street, has awarded contract for the construction of a two-story addition to its power house, to cost about \$7,000.

MERIDEN, CONN.—The Meriden Electric Light Company will install a 3000-kva. Westinghouse steam turbine in April for which necessary construction has been completed. Herman Minkwitz is superintendent.

Middle Atlantic States

BROOKLYN, N. Y.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Marble Architecture Company, Broadway and 216th Street, New York City, for the construction of the proposed new power house at the local navy yard, to cost \$225,000.

BUFFALO, N. Y.—The Public Service Commission has given its approval to the application of the Niagara, Lockport & Ontario Power Company to take over and operate the Salmon River Company.

BUFFALO, N. Y.—Plans have been prepared by the Sizer Forge Company, 238 Larkin Street, Buffalo, for several new buildings, including a machine shop, covered yard and machine and forge-shop in one group, to cost \$112,000; brick forge-shop, \$45,000; heat-treating plant, \$87,000, and a three-story office building, to cost about \$80,000. Plans for additional buildings to represent a total investment of \$1,000,000, including the above, are under consideration by the company.

GLOVERSVILLE, N. Y.—Plans are being prepared by McKenzie, Voorhees & Gmelin, 1123 Broadway, New York City, for the construction of a new telephone exchange building, 30 ft. by 40 ft., for the Glenn Telephone Company.

ILION, N. Y.—The entire municipal electric-lighting system is being rebuilt. The work is now about half done. The work, it is expected, will be finished in about two years. C. S. Daily is manager.

MEDINA, N. Y.—The Western New York Utilities Company is contemplating the construction of a storage dam. G. W. Ide is superintendent.

NEW YORK, N. Y.—The United Electric Light & Power Company is constructing a condensing water intake tunnel connecting Harlem River with its generating station now under construction. During 1918 one 22,000-kw. turbo-generator unit, three-phase, 62½ cycles, 8000 volts, will be installed. L. A. Coleman is assistant secretary.

TULLY, N. Y.—Work is nearly completed on the installation of the new street-lighting system. Series 6.6-amp. lamps are being substituted for arc lamps. Louis C. Clay is chief engineer.

RAYONNE, N. J.—The New York Telephone Company is contemplating the construction of a one-story cable house on First Street, near Lord Avenue, for which permit has been granted.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

KEARNY, N. J.—Extensions and improvements to the electric fire-alarm system are under consideration by the Town Council.

NEWARK, N. J.—The Board of Freeholders has rescinded its contract for electric and power wiring in the laundry at the Essex County Hospital at Overbrook, recently awarded to the Beaver Engineering Company of Newark, at \$14,174.

PLAINFIELD, N. J.—Steps will soon be taken by the board of governors of Muhlenberg Hospital for the installation of an electric plant in the hospital, to cost about \$8,500.

TRENTON, N. J.—The State House Commission has announced that the construction of the proposed new electric plant at the New Jersey State Hospital has been temporarily postponed, due to the high cost of material, etc. The cost of the plant is estimated at \$50,000.

WEST ORANGE, N. J.—The Town Council has approved an appropriation of \$26,000 (in the annual budget) for electric street-lighting purposes.

DU BOIS, PA.—The Du Bois Electric & Traction Company has filed a notice with the Public Service Commission of an increase in capital stock of \$49,000, the proceeds to be used for improvements, etc.

EMAUS, PA.—A number of important public improvements were recommended by Burgess Knauss in his annual message to the Council, including an ornamental lighting system, an improved fire-alarm system, street improvements, etc.

ERIE, PA.—Contract has been awarded by the Erie Forge Company, Fifteenth and Cascade Streets, for the construction of a new substation, about 50 ft. by 70 ft., to the Stader-Conrath Company of Erie.

LEWISTOWN, PA.—The Lewistown & Reedsville Electric Railway Company has filed notice with the Public Service Commission of an issue of \$68,000 in bonds, to provide for extensions, improvements, etc.

PHILADELPHIA, PA.—Plans are being considered by the City Water Bureau for the erection of a new hydroelectric power plant at Fairmount. It is proposed to build a large dam in connection with the new power station.

SCRANTON, PA.—The Scranton Electric Company has purchased the plant and holdings of the Jenkins Township Light, Heat & Power Company.

BALTIMORE, MD.—A permit has been granted to the Consolidated Gas, Electric Light & Power Company to erect a power house, 60 ft. by 90 ft., at 25 Custom House Avenue, to cost about \$65,000.

BALTIMORE, MD.—Plans have been filed and contract awarded by the Crown Electric Company, 149 North Gay Street, to L. Schoenlein, Jr., Guenther Building, Baltimore, for the erection of a two-story addition, 25 ft. by 80 ft., to its plant.

HAGERSTOWN, MD.—The Federal Milling & Refrigerating Company, recently incorporated with a capital stock of \$300,000, is planning to install an ice plant. Electricity will be used as motive power. Orders, it is understood, have been placed for equipment.

SECURITY, MD.—The Hagerstown & Frederick Railway Company is now installing a 6250-kva. turbine at its Security station. M. A. Pooler is general manager.

BRISTOL, VA.—Plans are under consideration by the trustees of King College for the construction of a new power house, to cost about \$30,000. C. B. Kearfoot of Bristol is architect.

NORFOLK, VA.—Plans have been prepared by the Packers' Architectural & Engineering Company of Chicago, Ill., and Wilson & Sompayrac, associated architects and engineers, Columbia, S. C., for constructing and equipping a cold storage plant on the water front for the Seaboard Ice & Cold Storage Company, consisting of main building, 400 ft. by 250 ft., 15 stories high; electric traveling cranes, eight elevators, dry storage building, 300 ft. by 72 ft., and power house, 96 ft. by 66 ft. The plant will be equipped for general cold storage and fish freezing. The cost of the plant is estimated at \$1,899,000. Louis Feuerstein is president.

ROANOKE, VA.—John B. Guernsey & Company of Roanoke, it is reported, contemplate the construction of an electric

plant for a mining camp at Rellim Sid-ing, Va.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, has awarded contract for the installation of an electric-lighting system in the gun shop at the local navy yard to the White City Electric Company, 721 Ninth Street, N. W., Washington, at \$12,900.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, has awarded to the Penn Seaboard Steel Corporation, Franklin Building, Pa., a contract for the installation of a 3000-kw. turbo-generator set at the navy yard, to cost about \$56,385.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for furnishing traveling cranes for the Washington Navy Yard, under specifications 2775. The cost is estimated at \$600,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 18 for furnishing and installing ten electrically-driven capstans at the navy yards at Norfolk, Va., and Philadelphia, Pa. Drawings and specifications (No. 2786) may be obtained upon application to the above bureau or to the commandants of the navy yards named.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 18 for fuel-oil heater, feed-water heaters, flow meters, tanks, reversing well equipment, coal gates, coal weighers, induced-draft fans, carbon-dioxide recorders and miscellaneous equipment at the navy yards, Norfolk, Va., and Philadelphia, Pa. Drawings and specifications (No. 2760) may be obtained on application to the above bureau or to the commandants of the navy yards named.

North Central States

CHARLEVOIX, MICH.—The city of Charlevoix has leased the plant of the Hydraulic Power & Light Company at Bellaire and contemplates installing a 200-hp. water wheel, one 350-hp. Skinner engine, one 500-hp. Corliss engine, one 200-hp. and one 300-hp. Stirling boiler; for auxiliary one 350-kv. Bullock, three-phase, 60-cycle, 2200-volt generator, and the erection of 28 miles of 23,000-volt transmission line. An auxiliary unit, consisting of a 120-hp. oil engine and a Westinghouse 90-kw., 2200-volt generator, is being installed at the Charlevoix plant. A. J. Hamilton is superintendent.

FLINT, MICH.—The local plant of the Commonwealth Power Company was recently damaged by fire, causing a loss of about \$20,000.

CHARDON, OHIO.—At an election held Dec. 2 bonds to the amount of \$25,000 were voted to rebuild and improve the municipal electric-light plant. It is proposed to change the system from 133 to 60 cycles and establish a day service and also to install a new electric-generating unit. Provision will be made to pump the city water as soon as installed, for which a \$58,000 bond issue has been authorized.

LORAIN, OHIO.—Part of the plant of the H. Koppers Company of Lorain, including the machine shop, electrical department, tool room, etc., was recently destroyed by fire.

TOLEDO, OHIO.—The Acme Power Company, which is erecting a large power plant on the East Side, has increased its capital stock from \$500,000 to \$3,200,000. The plant, it is expected, will be placed in operation in the near future. The initial unit will have a generating capacity of 60,000 hp.

WELLINGTON, OHIO.—The Board of Trustees of Public Affairs is in the market for a flywheel of the following dimensions: 40 in. to 48 in. by 10 in. to 14 in., by 6-in. or 6½-in. bore, to weigh approximately 1000 lb. C. E. Gadfield is superintendent.

JACKSON, KY.—Preparations, it is reported, are being made by the Jackson Light & Ice Company to rebuild its electric plant, recently destroyed by fire.

LOUISVILLE, KY.—The Roy C. Whayne Supply Company of Louisville, it is reported, is in the market for single and double drum electrically-operated hoists, either for three-phase, 60-cycles, alternating current or for 220 to 250 volts direct current, and also for two and three-drum hoists, 7 in. by 10 in. or larger.

MAYFIELD, KY.—Bonds to the amount of \$272,000 have been authorized for the purpose of taking over the water and lighting plants of the Mayfield Water & Light Company.

NEWPORT, KY.—Bids will be received by the Artisan Oil & Gas Company, Wool-sack Building, Newport, until March 1 for pumping machinery to operate 3½ miles of 3 in. oil pipe lines.

OWENSBORO, KY.—A new 1875-kva. Westinghouse two-phase, 60-cycle, 2400-volt steam turbine is being installed in the municipal electric-light plant. William Watson is superintendent and chief engineer of the municipal electric plant.

INDIANAPOLIS, IND.—The Board of County Commissioners has signed a contract with the Merchants' Light & Heat Company of Indianapolis for supplying light and heat for the various county buildings for the year 1918.

MONTREY, IND.—Plans are being prepared by Carl Nielsen, 154 West Randolph Street, Chicago, Ill., for the construction of a new power house, 50 ft. by 125 ft., one-story and basement, for the Monterey Electric Light & Power Company.

SCOTT, IND.—The town of Scottsburg is now installing a new system to supply electricity for commercial purposes.

WILLIAMSPORT, IND.—Improvements are contemplated to the municipal electric-light plant, including the installation of a three-phase generating unit (directly connected) to replace the single-phase unit now in use. A new switchboard is now being installed. R. B. Rodman is superintendent.

AURORA, ILL.—The Illinois Public Utilities Commission has granted the Western United Gas & Electric Company permission to issue \$180,000 in bonds.

CANTON, ILL.—Application has been made to the State Utilities Commission by the Canton Gas & Electric Company for authority to erect high-tension transmission lines. William H. Parlin is president.

HARTFORD, WIS.—The purchase of a 500-hp. water tube boiler to supplement the three boilers (total capacity 450 hp.) in the municipal electric-light and power plant is under consideration. The present boiler house will also be enlarged. Definite plans have not yet been decided upon.

LOWELL, WIS.—The Lowell Light & Power Company is planning the erection of 8 miles of electric transmission lines, work on which will begin in the spring. Webster F. Pease is manager.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company contemplates extending its lines a distance of about 5 miles.

DULUTH, MINN.—The Duluth Edison Electric Company is completing the installation of two-phase and three-phase feeder-panel addition to switchboard and the installation of five additional single-phase feeder regulators, making 14 in service. C. W. Higgins is assistant manager and chief engineer.

PINE CITY, MINN.—The Eastern Minnesota Power Company contemplates the installation of a 500-kw. steam turbine, also developing a water power of approximately 1000 hp., which will include 10 miles of electric transmission line to connect with its present plant. R. P. Allen is manager.

ALBIA, IOWA.—The Albia Light & Railway Company is rebuilding its plant, work on which is nearly completed.

DES MOINES, IOWA.—Plans for extensions and improvements to the system of the Des Moines City Railway Company, providing for an expenditure of about \$300,000 this year, will be submitted to the City Council.

MADRID, IOWA.—Plans have been prepared by the People's Telephone Company for improvements to its system, to include a new or remodeled exchange building, new switchboard of the common-battery type and improvements to the telephone lines.

MAQUOKETA, IOWA.—The Iowa Electric Company is extending its 33,000-volt transmission lines to Anamosa. A 300-kw. General Electric generator directly connected to a Buckeye cross-compound engine has been recently installed in the local power plant. John Drabelle is electrical engineer.

MARSHALLTOWN, IOWA.—Improvements are contemplated to the municipal electric-light plant, including the installation of a new 150-kw. generating unit and extensions to the overhead transmission system.

BOWLING GREEN, MO.—Extensions and improvements have been made to the system of the Pike County Electric Light & Power Company, including the erection of 11 miles of electric transmission lines. Mrs. D'Arline Holcomb is president.

ELDORADO SPRINGS, MO.—The Missouri Valley Light & Power Company has purchased another generating unit, consisting of a three-phase, 60-cycle, 2300-volt generator directly connected to a Russell

compound engine, to be installed in April. C. C. Arthaus is superintendent.

LEWISTOWN, MO.—H. H. Bronson, owner of the local electric-light plant, is contemplating the installation of direct-current generator and meters.

MARSHFIELD, MO.—The plant of the Marshfield Electric Company is being overhauled and among the improvements contemplated is the installation of an additional generating unit and the establishment of a day service. Karl Keesy is general manager.

ST. LOUIS, MO.—Plans have been prepared by Charles H. Wray, architect, Riado Building, for the construction of a hospital at Grand and Shaw Avenues, for the Missouri Pacific Railway Company, to cost about \$2,000,000. The plans provide for the installation of a refrigerating plant, boilers, engine, generator, pumps, etc. Bids, it is understood, will be asked for after Feb. 10.

SPRINGFIELD, MO.—Improvements involving an expenditure of from \$15,000 to \$20,000 are contemplated by the Springfield Ice & Refrigerating Company, which will include the installation of new machinery and the purchase of new equipment for the plant.

CAVALIER, N. D.—James Lang, owner of the local electric-light plant, expects to install an additional 35-hp. oil engine.

RAY, N. D.—The plant of the Ray Electric Company is being remodeled and enlarged. Oil storage tanks will be installed as soon as prices get back to normal. A. H. Meyer and R. W. Habein are owners.

BANCROFT, NEB.—The City Council is considering the installation of an electric-lighting system in Bancroft.

CLARKSON, NEB.—Extensions and improvements are contemplated to the municipal electric-light plant this summer to provide for an 18-hour service. L. J. Roubineck is superintendent.

LUSHTON, NEB.—Henry Garb, who owns a large farm near Lushton, is planning to construct an electric power plant on the Blue River to supply electricity in the town of Lushton and the farmers residing along the route of the transmission line.

OMAHA, NEB.—Bids, it is reported, are now being received by George B. Prince, Omaha National Bank Building, Omaha, for electric wiring, heating and plumbing of the new telephone building of the Nebraska Telephone Company, to be erected at Nineteenth and Douglas Streets, at a cost of about \$750,000.

O'NEILL, NEB.—The McGinnis Creamery & Produce Company is contemplating the installation of a new 250-hp. boiler.

PENDER, NEB.—New machinery is being installed in the municipal electric-light plant. J. W. McCready is manager.

RED CLOUD, NEB.—The City Council is considering the erection of a smokestack at the municipal electric plant to cost about \$1300.

ST. EDWARD, NEB.—The Nebraska Gas & Electric Company, Karbalk Building, Omaha, is now installing a new 75-hp. gasoline engine at its local plant. Mrs. P. B. Sargent is local manager. W. C. Ross of Omaha is general manager.

WAYNE, NEB.—New equipment is being installed in the municipal electric and water plant, including one Vilter Corliss engine, 14 in. by 30 in. and 75-kw., and one 37½-kw. three-phase, 60-cycle, 2300-volt generator. E. Merrill is manager.

WILSONVILLE, NEB.—Two new 7½-kw. transformers are being installed on the transmission lines of the municipal electric-light plant. A. L. Frederickson is superintendent.

ABILENE, KAN.—The Riverside Light, Power & Gas Company has nearly completed the installation of a 1250-kva. General Electric turbine at its plant. H. B. Gemmill is manager.

BALDWIN, KAN.—The transmission lines of the municipal electric light plant are being changed from direct to alternating current. A. W. Kirby is manager.

COLLYER, KAN.—The installation of an electric-light plant in Collyer is under consideration. For further information address Dr. LaCerte, editor of the *Collyer Advance*.

LEON, KAN.—Plans are being prepared by W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., for a municipal electric-light plant in Leon, to cost about \$15,000.

WELLSVILLE, KAN.—The Wellsville Electric Light, Power & Ice Company is contemplating the purchase of some 5 or 10-kva. transformers very soon. C. A. Smith is owner.

Southern States

NEWBERN, N. C.—Contracts have been placed by the city of Newbern with the General Electric Company for a 750-kw. Curtis turbine and with the C. H. Wheeler Company for a surface condenser for October delivery. When improvements are completed the plant will have a capacity of 1150 kw. The old 360-kw. outfit will be sold. F. G. Godfrey is superintendent.

ROCKY MOUNT, N. C.—Preparations are being made by the city of Rocky Mount for improvements to the municipal electric-light plant including the installation of a 300-hp. Heine type boiler, plans for which are now being prepared by J. N. Eley, Empire Building, Atlanta, Ga. The city also contemplates the purchase of a new generating unit at the gas plant, prices for which are now being asked for and contracts will be let within 60 or 90 days. The city would like to receive prices and other information on the proposed improvements. A. S. Lyon is superintendent of the municipal light plant.

WARRENTON, N. C.—The Warrenton Electric Light Company is planning to erect a three-phase, 2200-volt transmission line, using No. 4 wire, in the spring. The company will also connect 65 additional horsepower in motors for corn and flour mills, making a total of 261 hp. in motors connected. J. M. King is manager.

JOHNSTON, S. C.—The electric-light plant and ice factory of the Carolina Public Service Company has been purchased by F. M. Boyd, manager. The new owner proposes to install machinery for a flour and feed mill, to be operated in connection with the light and ice plant.

ALBANY, GA.—The Albany Power & Manufacturing Company is contemplating the installation of a 600-hp. water tube boiler, working pressure 185 lb., hand fired. E. S. Killebrew is superintendent.

BRUNSWICK, GA.—The Emergency Fleet Corporation has notified the Chamber of Commerce that at least 1000 houses will have to be erected at Brunswick within the next 60 days. All these houses, it is understood, will be wired for electric lighting.

DALLAS, GA.—Application has been made for a charter for the Dallas Utility Company to construct and operate electric-light and power plants to supply electricity for lighting towns and cities and to operate railroads and street car lines, etc. The company will be capitalized at \$45,000 with the privilege of increasing it to not more than \$100,000. R. D. Leonard, J. W. Hay and J. F. Welch are interested in the company.

SAVANNAH, GA.—Plans for the installation of an entire street-lighting system have been submitted to the City Council by L. A. S. Wood, illuminating engineer of the George S. Cutter Company of South Bend, Ind. Under the first plan the city is to install the necessary substation equipment, distributing system and lighting units, to be operated by the city, energy to be purchased in bulk; second, to replace the present arc-lamp lighting system with gas-filled or Mazda type "C" lamps; third, the abolition of the present ornamental cluster lamps on Broughton Street and the substitution of one-lamp posts. The cost of the first proposition is estimated at \$65,427. The Savannah Electric Company has the contract for lighting the city, which does not expire for some time.

STATESBORO, GA.—A new 200-kw. General Electric turbo-generator is being installed in the municipal electric-light plant. The system will be changed from two to three phase. Daniel L. Gould is superintendent.

BONIFAY, FLA.—The City Council has engaged the J. B. McCrary Company of Atlanta, Ga., as engineer and contractor for the proposed electric-light plant and water-works system. The cost of the work is estimated at about \$21,000.

ST. PETERSBURG, FLA.—The St. Petersburg Lighting Company contemplates improvements to its plant, involving an expenditure of about \$40,000.

HAMPTON, TENN.—J. H. Edens, it is reported, will rebuild the local electric-light plant, recently destroyed by fire.

HARRIMAN, TENN.—The Harriman Foundry & Machine Works has purchased the property of the Harriman Cotton Mills Company, which it will rebuild and equip to manufacture mining cars and contractors' equipment. The power plant in the mill will be dismantled and the plant equipped for electrical operation (individual motor drive). W. S. Baker is manager.

TUPELO, MISS.—New equipment, including a 100-hp. synchronous Westinghouse motor directly connected to a No. 5, two-stage Cameron steam turbine centrifugal pump is being installed in the mu-

municipal electric-light and water plant. E. R. Hisholm is superintendent.

PINE BLUFF, ARK.—The Pine Bluff company is now installing a 2500-kw., General Electric, three-phase, 60-cycle, 2300-volt generator. H. C. Couch is president.

CHANDLER, OKLA.—The Washita Electric Power Company, it is reported, will build a new power house, 50 ft. by 75 ft., in Chandler. The present equipment will be installed and new machinery, including a 40-hp. high-pressure boiler, a 150-hp. Corliss engine, directly connected to a three-phase, 60-cycle, 2300-volt generator will be added. The distribution will probably be rehauled and extensions made. For further information address R. K. Johnston of Auls Valley.

CHECOTAH, OKLA.—The Checotah Water, Light & Ice Company is installing an additional electric generating unit, consisting of a 250-kw. Allis-Chalmers generator, a 350-hp. Monarch Corliss engine and three Atlas boilers, and other necessary equipment, to cost about \$20,000. L. B. Riffing is secretary and manager.

AMARILLO, TEX.—The City Commissioners are considering calling an election to submit the proposal to issue \$200,000 in bonds for the construction of a municipal electric-light plant.

BRYAN, TEX.—The City Commission has granted the Bryan Power Company a permit to erect an electric transmission line from the terminus of the city line to the plant of the Gulf Refining Company, which is outside of the city limits.

GALVESTON, TEX.—Bonds to the amount of \$300,000 have been authorized. The proceeds to be used for lighting and other street improvements.

HEREFORD, TEX.—The Hereford Electric Light & Power Company is replacing a 40-hp. Corliss engine with a 160-hp. Skinner "Unaflo" engine, which will be installed within the next 60 days. The company is also installing a few 15-hp. motors for irrigation purposes. F. H. Oberthier is manager.

JEFFERSON, TEX.—The installation of electrical pumping equipment at the city pumping station is under consideration by the City Council.

LAMPASAS, TEX.—The Lampasas Light & Power Company is installing a pump connected to a 40-hp. three-phase motor to pump the city water, which will be completed in about 60 days.

SAN ANGELO, TEX.—The San Angelo Electric & Power Company contemplates improvements to its plant, involving an expenditure of about \$10,000.

Pacific and Mountain States

ARLINGTON, WASH.—The plant of the Washington Coast Utilities Company, located near Arlington, has been put out of commission by recent floods. A new site, it is reported, must be selected.

CLE ELUM, WASH.—The Town Council is granted the town of South Cle Elum franchise to construct and operate overhead and underground wires on certain streets in Cle Elum for the transmission of electricity for lamps, heaters and motors.

PE ELL, WASH.—The North Coast Power Company of Chehalis, it is reported, is contemplating extending its electric transmission lines from Pe Ell to Meskill.

PORT ORCHARD, WASH.—The Puget Sound Pulp & Power Company has petitioned the Commissioners of Kitsap County for a franchise to erect and operate electric transmission lines over the highways of the county for a period of 25 years.

SEATTLE, WASH.—Plans have been completed by the Puget Sound Traction, Light & Power Company for the superstructure of its proposed coal-pulverizing plant, adjoining the power station on Western Avenue and Seneca Street, to cost about \$5,000.

SEATTLE, WASH.—The construction of third unit at the Union Lake power plant, an estimated cost of \$600,000, in the immediate future, has been recommended by J. D. Ross, superintendent of lighting. The second unit, for which \$390,000 was authorized, is nearing completion.

SEATTLE, WASH.—The City Light Department has made arrangements with the Inman Mills Company to supply the department with 1500 kw. to assist in providing for the extra demand for power. An additional 600 kw. will be obtained from the small hydroelectric plant, which was built to utilize the excess water from the Plunier Park reservoir, but which was never put to use.

TACOMA, WASH.—The city of Tacoma has entered into a contract with the Amer-

ican Nitrogen Products Company of La Grande to furnish electricity to operate the nitrogen plant of the company for a period of five years.

TACOMA, WASH.—The City Council has practically decided on the site near Mineral on which to erect the proposed new unit of the municipal power plant, to cost between \$750,000 and \$1,000,000. N. L. Taylor, engineer of the light department, has charge of boring test holes to locate bedrock at the site.

WINLOCK, WASH.—The Independent Electric Company has recently transferred its franchise to supply electricity for lamps and motors in Toledo, Winlock, Vader and Napavine to the Idaho-Washington Water, Light & Power Company. The new company will secure energy to operate its system from the power plant of the Winlock Lumber Company, about 1 mile south of Winlock.

EUGENE, ORE.—A report of the proposed improvements of the power plant at Waterville has been submitted by N. C. Nelson, engineer of the water and light board, which recommends the construction of a wing dam on the McKenzie River to develop 3000 hp. The plant now has a generating capacity of 2400 hp., and it is recommended that a gate be placed in the forebay to accommodate a second penstock later to supply a third unit. The plant is now built in two units.

GOLD HILL, ORE.—The Utah Mining Properties, located about 12 miles from Gold Hill, have been acquired by O. C. Runnalls of Seattle, Wash., and associates. The new owners contemplate the erection of an electric transmission line, about 5 miles long, to connect with the lines of the California-Oregon Power Company. It is proposed to equip the mines with electrically-operated machinery.

PORTLAND, ORE.—S. C. Jagger of the Morrison Electric Company, and J. H. Stroufe, formerly representative of the Ne-Page, McKenny Company of Seattle, it is reported, have secured a contract for electrical installation in 20 ships under construction for the Republic of France by the Foundation Company of Portland.

CALISTOGA, CAL.—The State Railroad Commission has authorized the Calistoga Electric Company to sell its electric distributing system in and about Calistoga to the California Telephone Company of Santa Rosa at \$28,900.

DEL MAR, CAL.—Application has been filed with the State Railroad Commission by the San Diego Consolidated Gas & Electric Company asking for permission to purchase the distributing system of the Del Mar Water, Light & Power Company, at \$11,037.

HANFORD, CAL.—The People's Ditch Company of Hanford, it is reported, is considering the construction of a new electric-light and power plant for local service.

LODI, CAL.—Among the improvements contemplated to the municipal electric-lighting system are the installation of voltage regulators and additional one-lamp electroliters. John A. Henning is superintendent.

LOS ANGELES, CAL.—The Southern California Edison Company has applied to the Board of Supervisors for a franchise to erect and operate electric transmission lines throughout the entire country for a period of 40 years.

LOS ANGELES, CAL.—Two applications involving proposed expenditures of over \$1,000,000 have been filed with the State Railroad Commission by the Southern California Edison Company. One involves the impounding of the waters of Pitman Creek in Fresno County and the other the waters of Salmon and Horse Creeks in Tulare County. It is proposed to store the waters of Pitman Creek and divert a portion of same to Big Basin reservoir, on Big Creek, and the remainder directly into conduits leading to power plants below. The cost of dam and conduit line to Big Basin Reservoir is estimated at \$842,900. The Salmon and Horse Creeks project provides for the construction of a reservoir with a capacity of 14,049 acre-ft. This diversion is supplementary to a previous one and is intended to augment the supply delivered to Kern River power plant No. 3 during the period from August to December of each year.

PALO ALTO, CAL.—Work has begun on the new electric plant to be erected in what are known as the "corporation yards" on the Stanford Campus near the new University Press Building. It will change the center of electrical distribution from the station underneath the law building on the inner quadrangle.

PITTSBURG, CAL.—The State Corporation Commissioner has granted the Great Western Electro Chemical Company per-

mission to sell 7000 shares of capital stock, the proceeds to be used for extensions to its plant in Pittsburgh.

REDDING, CAL.—The electric power plant, planing mill and boiler house of the Shasta Land & Timber Company of Redding, it is reported, was recently destroyed by fire, causing a loss of about \$50,000.

RIVERSIDE, CAL.—The transmission lines of the municipal electric-light plant will soon be extended to the municipal rock crusher at the end of Central Avenue.

SAN FRANCISCO, CAL.—The Asher Electrical Company, 607 Howard Street, San Francisco, has been awarded the contract for the installation of a street-lighting system and the interior wiring of the barracks buildings at the camp at Angel Island.

KINGMAN, ARIZ.—J. B. Girard has resigned his position as city engineer, it is reported, to devote his entire time to the project of building a large dam in the Grand Canyon at Diamond Canyon. Preliminary work has been completed and work on construction of dam will begin as soon as spring floods subside. Electricity generated at the proposed plant, it is stated, will be used in connection with equipping the Santa Fé Railroad between Needles and Winslow for electrical operation.

ABSAROKEE, MONT.—The hydroelectric power plant of the Absarokee Power Company will be completed and placed in operation in about a month. Edward R. Reber is manager.

HAMILTON, MONT.—The Missoula (Mont.) Light & Water Company has offered to sell its water-works system in Hamilton to the city for \$75,000.

WOLF POINT, MONT.—The local electric-light plant has been purchased by J. E. Galehouse of Carrington and C. B. Aasness of Bismarck, N. D.

DENVER, COL.—The Nevada-California Power Company, it is reported, is contemplating erecting a high-tension transmission line from its power plant on Bishop Creek, Cal., to Reno, Nev., to supply electricity to the large mining camps of Nevada, the Owens Valley, Imperial Valley and Arizona districts.

BATTLE MOUNTAIN, NEV.—The Nevada Valleys Power Company of Lovelocks has taken over the local plant. Work will begin at once for the installation of a 130-hp. engine. When improvements are completed a day motor service will be established. W. W. Mason will have charge of the system in Battle Mountain.

LAS CRUCES, N. M.—The construction of a hydroelectric plant as part of the Elephant Butte reclamation project is advocated by the Rio Grande Water Users' Association. Dr. Nathan Boyd of Las Cruces is at the head of a committee which is promoting the project.

Canada

CHILLIWACK, B. C.—The city of Chilliwack was recently cut off from all power, light, telephone and telegraph service and water supply by storms. About six weeks, it is estimated, will be required to put the electric-light and power system in operation.

CHESLEY, ONT.—The Chesley Chair Company is reported to be in the market for a number of electric motors of from 5 to 30 hp.

COPPER CLIFF, ONT.—The Canada Copper Company, it is reported, is in the market for an electrically-driven pump, 150 gal. per minute capacity, mine pump head of 1100 ft., discharge 6 in., and a 100-hp. alternating-current, 550-volt, direct-driven motor.

TORONTO, ONT.—The general contract for the construction of a boiler house to be erected at the plant of the Swift Canadian Company has been awarded to the John V. Gray Construction Company.

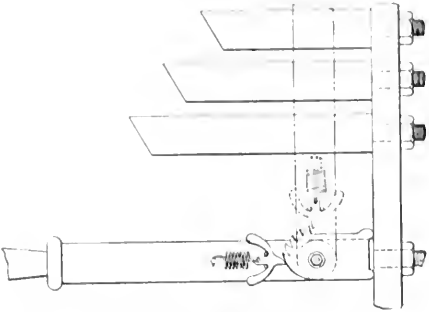
MONTREAL, QUE.—The Southern Canada Power Company, Christine Building, Montreal, is contemplating the erection of about 100 miles of high-tension transmission line and has asked for tenders on poles, cross-arm braces, wire and other material for same. C. A. Haskell is purchasing agent.

Miscellaneous

JUNEAU, ALASKA.—The Union Power Company, recently incorporated, has acquired property for the construction of a hydroelectric power plant in Willow Creek district. An electric transmission line, about 12 miles long, will be erected to reach the neighboring mining properties.

(Issued Jan. 8, 1918.)

- 1,252,633. **ELECTRIC FURNACE**; Carl H. Von Rohr, Douglaston, N. Y. App. filed Aug. 6, 1917. Imperforate bottom and provided with electrodes connected with a two phase, three wire system of electric current distribution.
- 1,252,635. **ELECTRIC ORE FURNACE**; John A. Ward, Spokane, Wash. App. filed April 12, 1917. Means for closely and continuously regulating the heat of electric coils used in such furnaces.



1,253,286—Restraining Device for Electric Switches

- 1,252,661. **ELECTRIC WATER HEATER**; Howard K. Clover, Los Angeles, Cal. App. filed May 23, 1917. Stream or jet of water may be heated as it passes through and issues from the heater.
- 1,252,739. **REVERSING SWITCH FOR ELEVATOR MOTORS**; John E. Thompson and Clarence W. Jameson, Chicago, Ill. App. filed Nov. 1, 1915. Improvement.
- 1,252,809. **APPARATUS FOR ELECTRIC WELDING**; Charles H. Kicklighter, Atlanta, Ga. App. filed Jan. 26, 1914. Apparatus for electrically welding seams of various kinds in plate and sheet-metal work.
- 1,252,813. **BAKING OVEN**; Frederick S. Kochendorfer, Chicago, Ill. App. filed Nov. 11, 1916. For baking incandescent-lamp filaments.
- 1,252,826. **VIBRATORY ACTUATOR**; Edwin H. Messier, Brooklyn, N. Y. App. filed Aug. 15, 1914. Provides an electro-responsive oscillatory actuator that shall be adapted to effect a step-by-step rotative movement of a driven member.
- 1,252,838. **ELECTRIC SWITCH**; William T. Pringle, Wyncote, Pa. App. filed Jan. 20, 1915. Knife switches.
- 1,252,897. **RECIPROCATING MECHANISM AND SYSTEM OF MOTOR CONTROL THEREFOR**; Walter Foster, Plainfield, N. J. App. filed Feb. 11, 1913. Relates to mechanisms having reciprocating tables and reversing motors connected with the tables to drive them.
- 1,252,902. **CONTROL SYSTEM**; Clark T. Henderson, Milwaukee, Wis. App. filed July 3, 1916. Applies particularly to braking systems for printing presses and other machines having a high inertia.
- 1,253,046. **CONDUIT FOR ELECTRICAL CONDUCTORS**; Joseph A. Kennedy, Pawtucket, R. I. App. filed Feb. 24, 1917. Flexible.
- 1,253,063. **MOTOR-CONTROLLING APPARATUS**; David L. Lindquist and David C. Larson, Yonkers, N. Y. App. filed July 7, 1914. Adapted to hand-rope-control alternating-current elevators.
- 1,253,157. **REVERSIBLE BRUSH HOLDER FOR USE WITH DYNAMOS**; John L. Creveling, New York, N. Y. App. filed Aug. 7, 1911. Means for satisfactorily compensating for reversals in rotation of the armature.
- 1,253,194. **SELECTOR RELAY**; Allen B. Kendall, Elizabeth, N. J. App. filed May 20, 1916. Improvements.
- 1,253,198. **WELDING CONTROLLER**; Theodore D. Montgomery and Leroy C. Schantz, East Orange, N. J. App. filed July 21, 1916. In which the power supply to the electrodes is limited when the resistance of the arc is small.

(Issued Jan. 15, 1918.)

- 1,253,201. **TEMPERATURE-REGULATING DEVICE**; Carl N. Auel, Wilkensburg, Pa. App. filed March 30, 1914. Applied particularly to devices for controlling the admission of a fluid to a burner for the purpose of maintaining a uniform temperature.
- 1,253,204. **ELECTRICAL MEASURING INSTRUMENT**; William M. Bradshaw, Wilkensburg, Pa. App. filed April 15, 1914. Induction type.
- 1,253,207. **ELECTRICAL PROTECTIVE DEVICE**; Harold W. Brown, Ithaca, N. Y. App. filed Dec. 19, 1913. Relays.

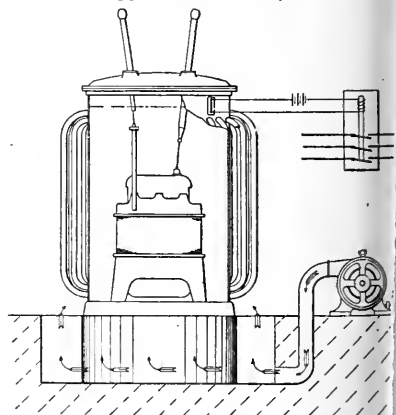
Record of Electrical Patents

Notes on United States Patents

- 1,253,208. **RAILWAY SIGNALING SYSTEM**; Carl H. Buhl, Cleveland, Ohio. App. filed July 22, 1912. Improvements.
- 1,253,210. **CONTACT MAKING AND BREAKING DEVICE**; Lewis W. Chubb, Edgewood Park, Pa. App. filed May 3, 1915. Relatively movable contact terminals of an interrupting device may be relieved of injurious burning or arcing and of the resultant depositing and pitting.
- 1,253,211. **ELECTRICAL TESTING DEVICE**; Lewis W. Chubb, Edgewood Park, Pa. App. filed Feb. 4, 1916. For testing high-voltage insulators.
- 1,253,212. **ELECTRICAL MEASURING INSTRUMENT**; Lewis W. Chubb, Pittsburgh, Pa. App. filed Feb. 7, 1916. For indicating the crest or maximum values of voltage waves having any frequency.
- 1,253,213. **CONTROL APPARATUS**; John A. Clarke, Jr., Wilkensburg, Pa. App. filed Dec. 18, 1914. For use in electric railway vehicles and the like.
- 1,253,223. **CATHODE STRUCTURE FOR VAPOR CONVERTERS**; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed May 3, 1916. Improvements.
- 1,253,235. **CONTROL APPARATUS**; Arthur J. Hall, Wilkensburg, Pa. App. filed June 8, 1916. Liquid rheostats.
- 1,253,242. **FUEL-COIL SUPPORT**; Fielder I. Hiss, Wilkensburg, Pa. App. filed Sept. 28, 1912. For machines of the compound-wound type.
- 1,253,253. **ELECTRIC HEATING ELEMENT**; Sherman L. Kelly, Toledo, Ohio. App. filed Oct. 23, 1916. Open-air heating type for use in ovens of electric stoves.
- 1,253,265. **BRUSH FOR ELECTRICAL APPARATUS**; Samuel C. McKeown, Newark, N. J. App. filed Oct. 18, 1916. Applies particularly to the type of brush used in high-tension distributors.
- 1,253,267. **RECTIFYING SYSTEM**; Friedrich W. Meyer, Pittsburgh, Pa. App. filed June 20, 1914. Provides means whereby energy from a plurality of alternating-current circuits of different voltages and of different frequencies may be rectified and supplied to a like number of direct-current circuits having corresponding voltages.
- 1,253,275. **POLYPHASE REACTANCE COIL**; John F. Peters, Edgewood Park, Pa. App. filed April 5, 1917. The coils are superposed upon one another and connected in circuit in such manner that they are mutually inductively related.
- 1,253,282. **COMBINED LAMP AND BATTERY TESTER**; Gustav Ruckardt, New Hampton, Iowa. App. filed Jan. 27, 1917. Improvements.
- 1,253,286. **RESTRAINING DEVICE FOR ELECTRIC SWITCHES**; Albert E. Sierad, Pittsburgh, Pa. App. filed Aug. 7, 1914. Means for preventing the opening of electrical switches until a predetermined closed position has been reached.
- 1,253,296. **PULL SOCKET FOR ELECTRIC LAMPS**; Samuel Starus, New York, N. Y. App. filed June 3, 1916. Improvements.
- 1,253,297. **ELECTRICAL MEASURING INSTRUMENT**; Harold B. Taylor, Wilkensburg, Pa. App. filed Sept. 25, 1914. Power-factor meters.
- 1,253,305. **MEASURING INSTRUMENT**; Rees E. Tulloss, Cambridge, Mass. App. filed June 25, 1917. Provides a measuring device specially adapted for use in connection with typewriting machines to measure and make records of the exact times of depression of the typewriter keys.
- 1,253,385. **SIGNAL SYSTEM FOR ELECTRIC CARS**; Elmer M. Jones, Atlanta, Ga. App. filed Aug. 21, 1913. Provides an effective system of automatic signals and car control for electric railroads employing a trolley or third-rail.
- 1,253,409. **ELECTROMAGNET**; David W. Martin and Robert F. Thompson, Schenectady, N. Y. App. filed Jan. 23, 1917. Provision of means whereby the chattering of the movable member of the magnet

due to alternations in the circuit is prevented in a simple and efficient manner.

- 1,253,533. **SOUND-TRANSMITTING APPARATUS**; Harrison W. Rogers, New York, N. Y. App. filed April 19, 1916. Means for controlling a pneumatic sound box.
- 1,253,572. **ELECTRODE FOR ELECTRIC-ARC LAMPS**; Frank Buchanan, Syracuse, N. Y. App. filed Oct. 20, 1909. Designed to be used in places where there is vibration tending to jar the electrodes loose.
- 1,253,657. **TELEPHONE-EXCHANGE SYSTEM**; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed June 10, 1916. Improved circuit arrangement for associating the operator's telephone set with and disconnecting the same from the connecting circuits.
- 1,253,659. **SWITCHING APPARATUS**; Christian Aalberg, Wilkensburg, Pa. App. filed Dec. 26, 1913. Provides a group switch which shall embody a plurality of complete, self-contained and independent unit switches assembled in side-by-side relation.
- 1,253,660. **SWITCHING APPARATUS**; Christian Aalberg, Wilkensburg, Pa. App. filed Dec. 26, 1913. Employed in connection with control systems for railway motor cars.
- 1,253,671. **TELEPHONE-EXCHANGE SYSTEM**; Henry P. Clausen, Mount Vernon, N. Y. App. filed April 12, 1917. Provides a system by means of which the time completing connections between telephone lines is reduced to a minimum and which more satisfactory service is rendered to the subscribers.
- 1,253,684. **TELEPHONE-EXCHANGE SYSTEM**; Charles L. Goodrum, New York, N. Y. App. filed Dec. 30, 1916. To enable calling party in a large system to make his connection without the necessity of remembering a large number of digits while operating his finger wheel.
- 1,253,688. **TELEPHONE EXCHANGE**; Myr F. Hill, Boston, Mass. App. filed May 24, 1908. The reduction of the wiring and apparatus and the resulting simplification of the exchange.
- 1,253,698. **AUTOMATIC SWITCHING MECHANISM**; Frank A. Lundquist, New York, N. Y. App. filed Dec. 2, 1916. Provides a switch in which one only of several trunks that may be found simultaneously by a plurality of brushes will be used, the remaining idle trunks found being left free to be selected by other switches.
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- 1,253,732. **ELECTRIC FURNACE-CONTROL APPARATUS**; John A. Seede, Schenectady, N. Y. App. filed June 21, 1917. Arc



1,254,002—Transformer Heat-Regulating System

- 1,253,761. **CIRCUIT BREAKER**; Richard Wolfstberger and Sidney C. Smith, Los Angeles, Cal. App. filed April 4, 1917. To insure the safety from electric shock of the person operating the circuit breaker.
- 1,253,765. **LAMP**; Alfred C. Abramson, Rockford, Ill. App. filed March 6, 1917. Pedestal.
- 1,254,002. **TRANSFORMER HEAT-REGULATING SYSTEM**; Charles S. Cook, Pittsburgh, Pa., and Harold H. Rudd, Edgewood, Pa. App. filed Jan. 23, 1914. For electric power transformers of large capacity.

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Electric Features of the Windsor Plant

IN THIS issue is an article which deals with some of the electrical features of the great Windsor (West a.) station, the mechanical features of which were discussed last week. The not unusual arrangement of double bus system is employed into which the great generators feed. To prevent some of the most serious risks of operating several large generators in parallel the bus is sectionalized by reactors. The switches controlling these protective devices are automatically interlocked in a rather novel manner with the generator switches, thus preventing the generators ever being cut on the bus without the reactors in service, unless intentionally in some special case of emergency. Still further to protect against the danger of surges, really very serious in stations of large output, an oil-insulated condenser is connected with the bus to relieve sudden and abnormal electrical strains. Each of the great turbo-generators carries a direct-connected exciter big enough to supply two generators in a pinch. In addition to this a 250-volt exciter bus, arranged for the connection of all the exciters and all the machine fields, has been installed, running the full length of the station. A motor-generator set can feed into this general bus. The auxiliaries for each turbo-generator are motor-driven at 550 volts, and each set therefore has its own three-phase transformer to feed these auxiliaries, stepping down the main supply from 11,000 volts. Beyond the main switch house the high-tension energy is delivered at two separate high-tension yards belonging to the two companies associated in the ownership of the station. Four high-tension feeder equipments are supplied from the high-tension transformers at 11,000, 25,000, 66,000 and 130,000 volts respectively. The transformers for the two latter voltages are wound so as to be interchangeable. All feeders are equipped with inverse-time-limit relays, while the transformers have definite time-limit relays, the settings for these being adjusted to the feeder necessities.

In the control room of the station one feature has been introduced which is both unusual and important. From this point can be read the temperatures of the transformers in the high-tension yards and also local temperatures at important points in the turbo-generators themselves. Besides this, an alarm system is installed to give warning of any interruption in the flow of the cooling water to the high-tension transformers. The system has clearly been worked out with a keen eye to the future, when the output of the station will rise to enormous figures and will be delivered over widely ramifying networks to great distances.

Saving Fuel and Boilers

IN THE present fuel situation even small economies in coal are worth considering, and when, together with material saving in actual fuel, come a lowered upkeep of the boilers and better steaming capacity it is clear that the matter rises to considerable importance. S. B. Applebaum's paper in the present issue is a thorough study of methods and results with respect to the treatment of feed water to obviate scale. Hard water, particularly of certain types, tends to form scale at a somewhat surprising rate. The effect of this is threefold. It lessens the efficiency of the fuel consumption, decreases the ultimate steaming power of the boiler, and tends to the rapid destruction of tubes. A coating of scale even up to a quarter of an inch (6.3 mm.), thick and nearly as hard as stone, may form in a few months' use of bad water, and such coatings have not been unknown in boilers of electric light plants. Such a non-conducting coating produces results that are unpleasantly obvious, and even when existing in such smaller quantity, scale produces serious loss from every standpoint. The actual loss in fuel depends, of course, upon the amount of scale, which is itself a function of the quality of the water and of care in treating it or cleaning the boilers.

The prevention of scale, either by chemical or mechanical means, the former being much the easier, has been found, as a matter of experience, to save anywhere from 5 to 20 per cent or more of the total fuel bill, to say nothing of the gain in lessened cost of repairs to the boilers—a very serious matter, particularly in the cases where boilers have to be hard pushed to carry over the peak of the load. Mr. Applebaum gives some very instructive data, especially with respect to locomotive boilers, in which it has been repeatedly found that the saving in boiler repairs is a large item, amounting in some cases to at least 5 per cent. The general remedy for scale is found in artificial softening of the water by chemical means, of which there are several available. Mr. Applebaum discusses at some length the actual methods employed, in their bearings on boiler economy, and shows what might have been anticipated—that the net saving is sufficient to pay richly for the installation of the water-softening plant wherever conditions which point to the free formation of scale exist. The actual net gain in coal, repairs and lessened cost of boiler cleaning amounts in the example given by Mr. Applebaum to some \$2.50 per horsepower per year. Of course, the actual figures will vary considerably with the conditions and with the hardness of the water.

Efficiency of Electric Cooking

WITH the great awakening of interest in electric cooking comes a demand for better apparatus. In principle the use of electricity for heating purposes is at almost theoretically perfect efficiency. The difficulty is not in the conversion of electrical into thermal energy but in the utilization of the latter, and there is just as much opportunity for waste at this point as in any other form of heat utilization. In fact, electric heating has suffered in the past and is still occasionally suffering from a certain thick-headedness of the designer which results in an attempt to carry an outward resemblance to old-time inefficient gas and coal ranges into electric range design, often with somewhat disastrous results in the way of efficiency. Prof. R. G. Kloeffler's study of electric range efficiency is of very direct value in showing both the strong and the weak points of such apparatus as is now produced. From an experimental standpoint his task was a simple one. It consisted of measuring the input of energy at the heating unit and the output in heat obtainable therefrom. In practice the output was reckoned by heating water to approximately the boiling point, using in succession various types of utensils adapted to the purpose. The surface heating units on eight different electric ranges were thus tested, three units being of the inclosed-conductor type, four of the open-conductor type and one unclassified. The utensils used were of graniteware and aluminum, these being the materials which are in common use.

Now the notable thing in summing up these experiments is the generally low efficiency obtained. Very few figures for any utensil on any range ran over 50 per cent when starting with the heating unit and water at ordinary room temperature, showing that the chief fault in the electric range used in this way is ineffective heat insulation or no heat insulation at all. Certain experiments further prolonged so that the heat stored in the heating-unit utensils and their surroundings could be more fully utilized gave, of course, a higher efficiency; but the plain fact is that a heating unit made and used after the similitude of the gas range or the coal range is much less efficient than an electric heating device ought to be. Roughly, more than half the energy is wasted. The obvious moral is that by better design, and particularly by the use of thorough heat insulation and special utensils adapted to make the best of it, one could do electric cooking with very much less energy than is necessary on the ordinary commercial range. The cause of this fault, it seems to us, is not generally lack of designing skill on the part of the maker of the heating apparatus, but an unfortunate disinclination to break away from the bad precedents established by ranges of the older kinds. The chief requirement is that the electric heat should be applied as directly as possible with as small losses from conduction and convection as are obtainable. In practice these losses are generally much greater than they ought to be. In electric ovens, which have relatively very large surface, heat insulation is even more important than elsewhere in the range.

Professor Kloeffler's tests were made by giving to the ovens fixed input until the internal temperatures became steady. Three different final temperatures, corresponding roughly to a quick, a medium and a slow

oven, were tried out. The results of these tests were particularly interesting and the details will well repay careful reading.

Output Coefficients for Small Direct-Current Motors

IN THE design of dynamo-electric machines of an already established type a question often arises as to the particular dimensions which should be adopted for intermediate sizes and ratings. If the dimensions are excessive, the machine when constructed is likely to be heavy and expensive for its output. If, on the contrary, the dimensions are chosen too small, the speed or efficiency may be unsatisfactory.

It is therefore very desirable to have guiding rules by which the principal dimensions of new sizes of machines can be laid down on a reasonable and scientific basis. In a general way, the output of a machine will be approximately proportional to the volume of the armature and to the rated speed, but the speed cannot be left open to final adoption after all the other particulars have been settled. In motor production the speeds of operation under rated load may indeed be divided into two or more groups, such as high-speed, low-speed and intermediate-speed types of motor; but in each of such groups the speed is expected to diminish with the size and output of the motor in some systematic way. Consequently the rating of any new motor will probably involve a definite associated rated speed, and the dimensions of the armature and field magnets must be such as to provide the assigned load and speed without undue weight, cost, heating or sparking.

The curves given in E. W. Kellogg's article in this issue supply information in convenient form for the design of a particular type of motor in intermediate sizes. Starting with a trial armature diameter, the designer determines the sizes and magnetic carrying power of the armature teeth and then adjusts the length of the armature core to provide the correct torque and speed at rated load. It is assumed that several designs will be attempted with slightly different armature diameters, so as to enable a proper selection to be made.

In order still further to guide the designer, a curve sheet is offered for arriving at a suitable starting diameter, having given the required output and speed.

What Shall We Do with Labor?

WAR'S wastage of labor means a loss to the industry which will have to be taken into account. The effect will be felt more acutely in those branches where labor is a large part of production cost than in, for instance, the central station, where it is relatively a small part. Nevertheless, no section will remain untouched by the growing independence of labor. Charles M. Schwab said a few days ago that the worker was to dominate the world. A more temperate statement, that of former Supreme Court Justice Hughes, a student of industrial relations accustomed to consider and weigh. Before the New York Bar Association last month he said: "Individual privilege [in the future] will have to show cause before a public to which old traditions are no longer controlling—a public trained in sacrifice—which will enforce its own estimate of the common right." And again he said: "The present e-

exercise of authority over the lives of men will hereafter find its counterpart in a more liberal exercise of power over the conduct, opportunities and possessions of men."

Two theories are advanced as to the future of labor supply. One is that this country will absorb Europe's supply; the converse is that a new-born Europe will attract its sons and grandsons from our foreign shores. Either theory recognizes that labor will be in keen demand and that, like commodities, labor will tend to flow to those markets which promise the largest return. Electrical industries will need to attract and hold their workers against all outside bidders, either here or abroad.

Mr. Schwab and Justice Hughes had the courage to recognize the changing order. Narrow minds, however, will rail and rant, urge that capital prepare to fight for its position, and declare that no man shall dictate how they shall run their plants. Such minds are not changed by dissertations on the reasonableness of the new order, which decrees that the public good shall take precedence over private gain, that the public cares for the individual and demands that he shall have a voice in determining the conditions under which he works.

Those who question the accuracy of the judgment that warns against new conditions in the realignment of labor and capital will do well to heed the words of Secretary of Labor Wilson at the great loyalty labor meeting in New York on February 10: "In all the legislation to fix prices there has never been one line for the limitation of the earnings of workers." What we are concerned with in these historic times is not whether it is just or unjust to fix the wages of capital and to leave deliberately untouched the wages of labor; what we are concerned with is the overwhelming fact that this situation is here, it is unescapable, there is nothing to do but accept the problem and solve it.

And what of efficiency, now at a low mark in industrial plants? Education is the answer—education through participation in management regarding the factors which affect profits; education engendering responsibility for success of the industry, a realization that there can be no labor prosperity without industrial prosperity—a realization that will be turned into effective action by confidence that labor will get "its share" of the profits it helps to create. A long process, yes, but necessary one.

Labor sells a service, capital buys a service. Seller and buyer continue to do business only when each is reasonably satisfied with the bargain. Far-seeing employers are ready to make sacrifice. So, too, are forward-looking labor leaders. The country demands that both sides look carefully to it that they be not misrepresented. Above all, let both be prepared for large concessions. In that direction lie peace and the country's good.

Motors in the Textile Industry

ANOTHER of Professor Clewell's capital articles takes up in the current issue the rapidly increasing use of motors in textile mills, an art which in its beginnings goes back very nearly five-and-twenty years, but which has been rapidly improved as conditions have gradually led to the adoption of more and more independent methods of motor driving. In the beginning the cotton industry clustered about water powers where motive power could be cheaply obtained. As the steam engine became more highly developed in efficiency and as mills outgrew their normal supply of water power and fell back upon steam auxiliaries, the waterwheel found relatively less and less use. In the forty years from 1870 to 1910 it had fallen from 60 per cent of the total to about 20 per cent. Steam power had increased from some 40 per cent to 60 per cent, and the remaining 20 per cent was furnished by electric power. It has been estimated that by 1920 the percentage of electric power will easily have doubled. In the earliest electrical mill drives the steam engines were replaced by fairly large motors employed for group driving. The steady tendency of late years has been more and more toward individual drive, which is easily employed in new mills and gives greater possibilities of power economy than have been afforded by the methods that it supersedes.

Probably the typical mill consists of a combination group and individual drive, the former for certain machinery operated, so to speak, in blocks, each consuming no very great amount of power in the aggregate; the latter for the heavier and more independent work. For mill work the induction motor is chiefly used, since for most classes of work unusual flexibility of speed regulation is not required. At the beginning of the art competition with direct-current machinery caused the building of induction motors with extraordinarily low speed variation, a tendency which has of late given way to more normal design. In a few places in mills motors of special type have to be employed on account of the presence of large amounts of dust and lint in the air, and in some cases because of troublesome vapors that arise.

Experience shows that the electric drive for this work has not only the usual advantages of facilitating a cheap supply of motive power but also leads to a larger and more uniform output on account of the better operating characteristics of subdivided motive power. There is every indication that the use of motor drive in mills is going to increase steadily, bringing the greater water powers into active use in this class of manufacturing and superseding not a few of the steam drives now in use.

ONE of the articles which will be presented next week will show the effect of wave form and frequency of a source of energy on the performance of mercury-vapor rectifiers. Mechanical features of the new power station of the New Bedford (Mass.) electric service company will also be described. This plant has some unusual coal-handling and boiler-room arrangements. Another article by Professor Clewell will be presented in that issue

The Coming Issues

on the advantages and disadvantages of flywheel effect with certain classes of electrical drive. The possibility of utilizing flywheel effect to perform a useful function in preventing disturbances on supply lines which serve fluctuating loads will be discussed at length. Professor Kloeffer's analysis of electric range operation will be concluded next week and will contain the results of efficiency tests on a number of ovens.

of auxiliaries attached to one unit are about 1500 kva. The stoker motors are not included in this aggregate since they are direct-current machines and are operated from 600-volt motor-generator sets which also supply cranes, hoists, automatic elevators and coal-mining equipment. Two separate 1800-kva. station auxiliary transformers, in addition to the one attached to each turbine, are operated from the 11-kv. bus section and supply motors about the station which are not directly connected with any particular unit. They also supply energy for operating the motor-generator sets which furnish energy for the direct-current auxiliaries.

FEEDERS AND HIGH-TENSION EQUIPMENT

From the switch house the energy is delivered to two separate high-tension yards owned by the West Penn Power Company and the American Gas & Electric Company respectively. The feeders leaving the station can be divided roughly into four groups, namely, 11-kv. feeders, which supply local industries; 25-kv. feeders, which supply a network of the West Penn system; 66-kv. feeders, which supply some of the lines of the American Gas & Electric Company; 66-kv. feeders, which will ultimately operate at 130 kv. and which serve a part of the West Penn system, and 130-kv. feeders, serving the longer lines of the American Gas & Electric Company. All of the feeders leaving the station are laid out on the radial system, arrangements being made for parallel operation of two lines in case of emergency. It is understood by the operators, however, that radial operation is preferred and that parallel operation is an emergency measure.

Each of the 11-kv. feeders is equipped with a 3 per cent current-limiting reactor. These reactors, like all other reactors in the plant, were not arbitrarily chosen but were selected to limit the current which might flow

buses in the high-tension yards of the two companies.

From the main 11-kv. bus the energy which is to be transmitted at 130 kv. leaves the station through 30,000-kw. banks of transformers, the low-tension switches for which are installed inside the station. No switches are provided on the low-tension side of the transformers in

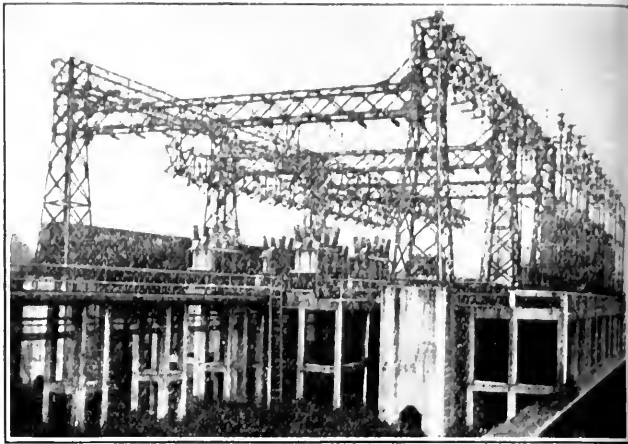


FIG. 5—ONE OF THE HIGH-TENSION YARDS WITH APPARATUS ELEVATED TO ESCAPE HIGH WATER

the high-tension yard. Here a high-tension transfer bus is provided, so that the load from any outgoing 130-kv. line can be distributed over other operating banks of transformers in case it is necessary to shut down one bank.

In the 66-kv. yard of the American Gas & Electric Company a double 66-kv. bus has been provided. It is at present supplied by a bank of 20,000-kva. transformers, as all outgoing 66-kv. feeders are connected to this bus. Provision is made for future installation of a bank of 66-kv. transformers when the load conditions

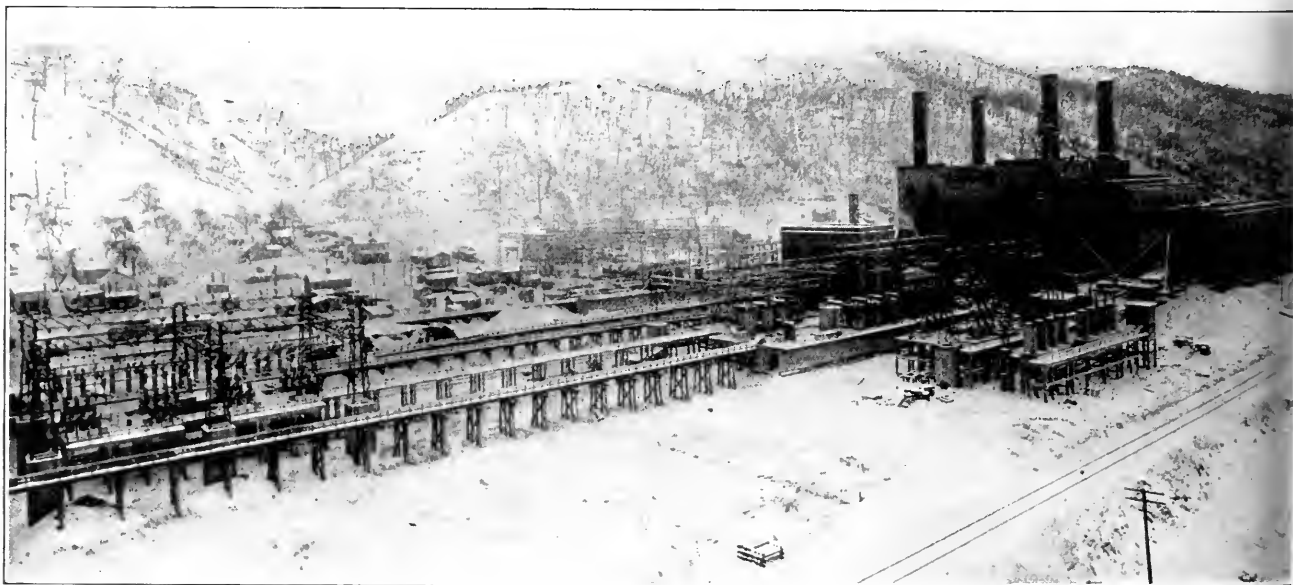


FIG. 4—HIGH-TENSION YARDS OF WINDSOR (W. VA.) POWER PLANT CONNECTED WITH STATION BY BUSBARS CARRIED IN TUNNEL

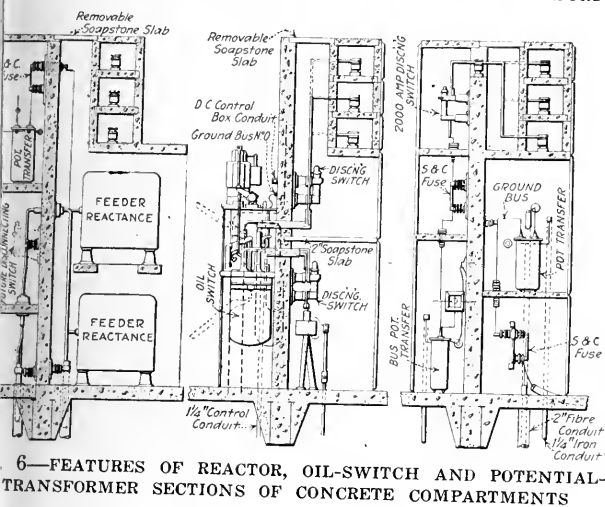
into a short to a value well within the rating of the smallest oil switch in the circuit.

All of the 66-kv. and 130-kv. transformers are wound so as to be interchangeable. Furthermore, the 66-kv. units are arranged so that they may be operated later at 130 kv. To provide further flexibility, arrangements have also been made for connecting together the 66-kv.

require it. In the West Penn high-tension yard the 66-kv. bus is normally only a transfer bus, the energy being supplied through a bank of 30,000-kva. transformers. The same provision for flexible operation is made in this yard as obtains on the 130-kva. bus of the American Gas & Electric Company.

The control of turbines, exciters and auxiliary trans-

termers is centered on a benchboard so placed in the operating room that the operator faces the turbine room while handling the equipment. A glass partition between the operating room and the turbine room permits view of practically the entire floor of the latter. Outgoing feeders are controlled from a vertical switchboard



the opposite side of the room from the benchboard. Voltage regulators and curve-drawing instruments are placed on pedestals at the center of the room. The 110-volt direct-current board and the watt-hour-meter board are at opposite ends of the operating room. This arrangement places the switchboards requiring the most attention at the most convenient location for the operator. It was also thought advisable to place the battery-charging equipment and panels in an alcove off the operating room where they are readily accessible to switchboard operators. One of the unusual features of this room is a provision for reading the temperatures of transformers in the high-tension yard and the temperatures of important parts of the 30,000-kw. generator. Alarm bells and lamps are also placed here to notify operators of any interruption in the flow of cooling water to the high-tension transformers.

The 11-kv., 25-kv., 66-kv. and 130-kv. feeders are all equipped with induction-type inverse-time-limit relays, and the transformers are protected by definite time-limit relays. The 25-kv. and 66-kv. relays are given a time setting of two seconds, the 130-kv. relays are given three seconds, and the transformer relays also three seconds. The settings for the 11-kv. feeders, which supply only local territory, are not determined. The turbo-generators, oil switches, switchboard equipment, auxiliary transformers, reactors, auxiliary motors, turbines and equipment in the high-tension yard of the American Gas & Electric Company were supplied by the General Electric Company. The condensers, pumps and all equipment in the West Penn high-tension yard were supplied by the Westinghouse Electric Manufacturing Company. The boiler-feed and service pumps were supplied by the Worthington Pump & Machinery Corporation; the bilge pumps by Yeoman Engineering Company with Cutler-Hammer control, and the traveling screens by the Chain Belt Company. The lighting system was supplied by the Richardson-Phenix Company, while the soot cleaners were supplied by the American Power Specialty Company and the cranes by the Whiting Foundry & Equipment Company. The construction of the station, including the

high-tension yard of the West Penn Power Company, were carried out by Sargent & Lundy, consulting engineers, Chicago. The high-tension yard of the American Gas & Electric Company was handled by the Electric Bond & Share Company. The sub-contract for the building foundations, the high-tension yard foundations and the railroad foundations were all awarded to the Foundation Company of America. The Riverside Bridge Company obtained the contract for the steel.

OUTPUT COEFFICIENTS FOR D.-C. MOTORS OF SMALL SIZE

Convenient Method of Arriving at Trial Values of Armature Diameter and Length Before Actually Designing the Winding

BY E. W. KELLOGG

THE accompanying curves were intended to supplement courses in dynamo design, but they may be of interest to motor designers in general, inasmuch as they illustrate a very convenient method of arriving at trial values of armature diameter and length. Some textbooks give curves showing average values for flux density as dependent upon armature diameter, and of ampere conductors per inch of circumference in terms of kilowatts rating. Inasmuch as a considerable error in the first assumed value of armature diameter makes only a slight difference in the permissible flux density, the curves mentioned furnish the necessary information for finding the value of D^2L for the armature.

In another curve the total ampere conductors are plotted against watts ÷ r.p.m. This information, in conjunction with the value of ampere conductors per inch already found, determines the armature circumference and hence the diameter. The diameter so found is to be considered as a trial value only, the general procedure* being to try several values above and below

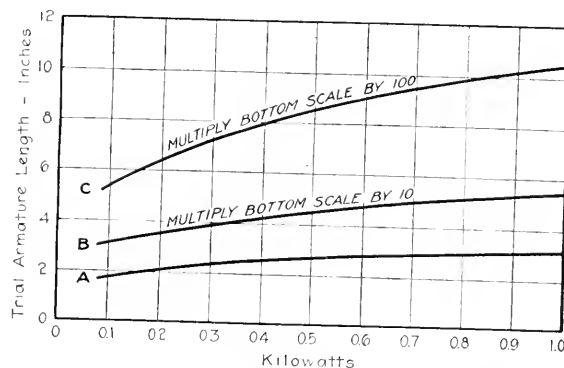


FIG. 1—AVERAGE VALUES OF ARMATURE LENGTH

this, carrying the trial designs to a point where one is seen to be definitely better than the others.

METHOD OF DETERMINING TRIAL PROPORTIONS

The plan of varying the proportions and carrying along several trial designs seems to the writer by far the most instructive way of handling the problem. The plan of first determining a value of D^2L and then trying different combinations of D and L presupposes that the flux density and the ampere conductors per inch of circumference will not be materially affected by

*Gray's "Electrical Machine Design."

the changes in diameter. This is true of large and medium-sized machines, but with armatures less than about 10 in. (25.4 cm.) in diameter the output coefficient falls off rapidly with decrease in diameter, so that an armature 4 in. (10.16 cm.) in diameter and 5 in. (12.70 cm.) long would in general show less capacity

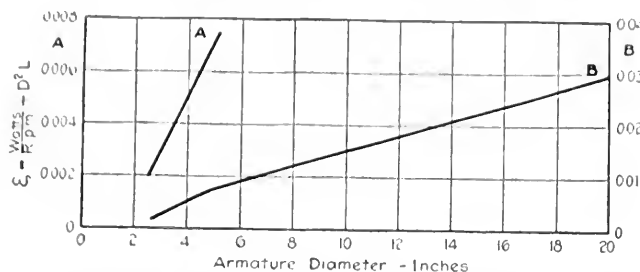


FIG. 2—AVERAGE VALUES OF OUTPUT COEFFICIENT FOR NUMEROUS MACHINES OF DIFFERENT MAKES, SPEEDS AND SIZES

at the same speed than an armature 5 in. in diameter and 3.2 in. (8.1 cm.) long, although the product D^2L is the same for the two. The reason for this lies principally in the fact that with small diameters the slots cannot be made so deep, the space factor is likely to be lower, and the teeth have a greater taper, which makes it generally necessary to use lower flux densities. On the other hand, within reasonable limits the capacity of the machine is directly proportional to the armature length.

A more satisfactory method of procedure for small machines is to select a trial diameter and determine the watts output per inch of length at the speed which has been selected and thus find the necessary armature length. Another diameter may then be tried, the corresponding length determined in the same way, and the designs compared. Instead of finding the volts per

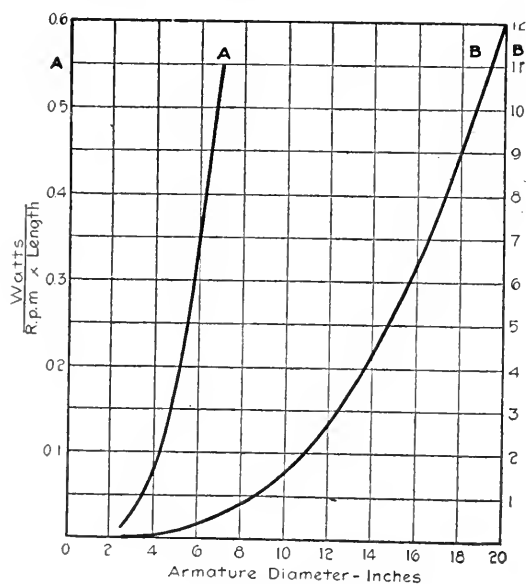


FIG. 3—OUTPUT (WATTS) PER R.P.M. PER INCH OF ARMATURE LENGTH

conductor first and then finding place on the armature for the necessary number of conductors, the type of winding, number of slots, size of wire, number of conductors per slot and their arrangement and insulation should be determined and the dimensions of the teeth and flux density worked out. The output per inch of

length can then be calculated and the armature length fixed.

A 2-hp., 110-volt, 1800-r.p.m. motor will be used to illustrate. Six inches (15.2 cm.) will be selected as trial diameter, and a two-hole winding, consisting of thirty-five coils of six turns each, of No. 12 B. & S. gap wire will be tried. This requires thirty-five slots, 0.2 in. (0.63 cm.) wide by 0.8 in. (2.03 cm.) deep, which gives a tooth width of 0.15 in. (0.38 cm.) at the root. An apparent flux density of 160,000 lines per square inch (24,800 lines per sq. cm.) at the tooth root corresponds to a gap density of 43,000, which with a pole inclosure of 0.65 gives 0.158 volt per inch (0.062 volt per cm.) of conductor. There are 210 conductors in series in each path, so that the necessary voltage per conductor is $110 \div 210 = 0.523$. The armature length must then be $0.523 \div 0.158 = 3.3$ in. (8.4 cm.).

Some guide is desirable in order that the diameter chosen for trial may not depart too far from normal. Average values of armature length expressed in terms of kilowatts rating appear to be as satisfactory a guide as can be found. For a given rating the best armature length is nearly the same for a high-speed machine as for a low-speed machine, the difference in speed being compensated for chiefly by a change in diameter, with only a slight change in length. Fig. 1 shows average values of armature length.

CURVE GIVING APPROXIMATE DIAMETER

Since with small machines the value of D^2L can hardly be calculated until the diameter is known, additional curves are needed from which the probable diameter can be found in terms of the power, speed and armature length. Such curves are given in Fig. 3. To use them the output in watts is divided by the speed in r.p.m. and by the approximate length as given in Fig. 1. This gives the ordinate of Fig. 3, from which the diameter can be obtained.

For example, in the 2-hp., 1800-r.p.m. motor mentioned before, taking the iron, windage and friction losses at 10 per cent, the power converted would be 1660 watts, and $\text{watts} \div \text{r.p.m.} = 0.92$. The armature length from Fig. 1 would be about 3.4 in. (8.64 cm.). The ordinate to the curve in Fig. 3 would be $0.92 \div 3.4 = 0.27$, which corresponds to a diameter of 5.6 in. (14.2 cm.).

The normal diameter and length found in this way are only intended to give an idea of what would be a reasonable size and proportions. The next step would be to select several trial diameters and determine the length corresponding to each by designing the winding and determining the flux density, and to work out several designs to the point where one appears clearly the best. The output coefficients may come out lower than those indicated in Fig. 2 if the slot space cannot be well utilized, or much higher output coefficients may be obtained, especially if greater losses are allowed.

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Reducing Costs of Fuel and Boiler Maintenance

How These Costs Can Be Reduced by Softening Boiler-Feed Water—Experiences of Different Users—Features of Different Systems and Operating and Investment Expenses

BY S. B. APPLEBAUM

Assistant Technical Manager the Permutit Company

WITH the increasing scarcity of coal due to increased consumption and congestion of transportation and with the generally higher cost of fuel it is the duty of every one to investigate every possible way that fuel is wasted and how the wastage may be prevented. There is no doubt that the general consideration of burning the coal efficiently in the boiler furnace comes first, but the heating surfaces of the boiler must also be kept clean, otherwise the heat produced in the furnace cannot be utilized fully. Every engineer and fireman knows these things, but they have not been watched carefully in the past owing to the great wealth of natural resources. The time has come, however, when ways must be changed and every pound of coal made to count.

Unfortunately, scale cannot be blown off the tubes by soot, it being necessary in a great many cases to

The individual boiler-tube tests with scale up to $\frac{1}{8}$ in. (3.175 mm.) thick showed widely varying losses up to 12 per cent, depending on the mechanical structure of the scale and the thickness.

An article by H. G. D. Nutting, published in the *ELECTRICAL WORLD* (Volume 66, No. 23, page 1257), described a water-softener installed in a central station in Wisconsin. The effect of the treatment was as follows: "The coal bill has been reduced 18 per cent of its former amount, based on the same load. The coal bill for July, the second month of use of the water softener, was \$514 less than for May, when the softener was not in use—i.e., based on the same output."

RAILROAD EXPERIENCE

Railroads are the largest users of fuel in boilers for the generation of steam, and their experience is most valuable to illustrate the various operating losses due to scale. In 1905 the American Railway Engineering and Maintenance of Way Association, which has a standing committee on water service, issued a report* on "Comparison of the Cost of Installing and Operating Water-Softening Plants, with the Benefits Derived from Their Use." From the experience of about forty railroads with water-treatment plants it selected several as furnishing the most authentic records, each of them having installed at least fifteen or more water-softening plants up to that time.

A summary of the data given in this report follows:

The Atchison, Topeka & Santa Fé Railway installed water softeners in 1903 on divisions in Kansas and Colorado. In December, 1902, it had 456 locomotive-boiler failures from leaking. By using softened water failures from this cause were reduced to only sixty-eight in December, 1903, and twenty-eight in July, 1904. The average annual reduction in such failures due to water softening was 74 per cent.

As regards saving of flues, the locomotives made 363,302 miles (about 584,500 km.) more in the year ended July, 1904, than in the year previous and the store department issued 109,937 linear feet (about 33,500 m.) of flues less than the year before, which was a saving of about 20 per cent in flues. The saving in the labor of boilermakers for repairs for the same time was \$7,000.

The Chicago & Northwestern installed seventeen water softeners in 1903 on its Iowa Division, and these took care of all the natural hard-water stations in the division. The saving in the cost of labor for boilermakers was 36 per cent. The number of failures due to leaks was 583 from August, 1902, to June, 1903. The corresponding number from August, 1903, to June, 1904, was only 120, representing a reduction in failures of 79 per cent. There was also a heavier ton-mileage in 1903 than in 1902, the increase being 7 per cent. The coal saving was 4.2 per cent, since in 1902 the tonnage was handled by 28.7 lb. (13 kg.) of coal per 100 ton-miles and in 1903 by 27.5 lb. (12.47 kg.) of coal per 100 ton-miles.

Furthermore 7 per cent more tonnage was handled by fewer engines, the saving being five engines out of 159, or 3.1 per cent. This item is of extreme interest during these

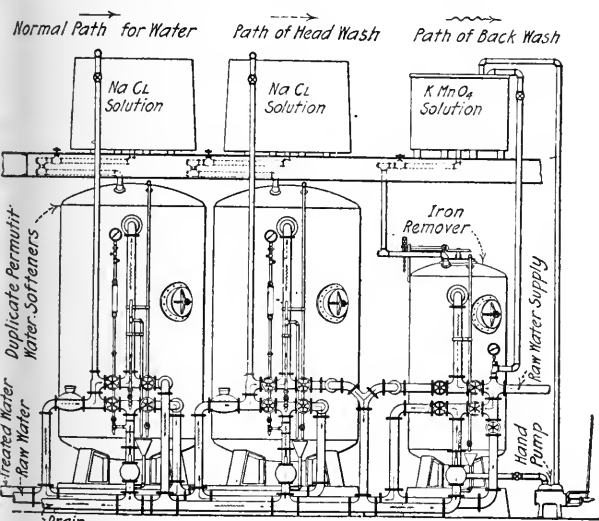


FIG. 1—ARRANGEMENT OF WATER SOFTENING AND PURIFYING TANKS USED BY ONE CENTRAL STATION

isil or turbine out the deposit. The question is how much fuel scale really wastes and whether the waste is efficient to warrant the investment in a water-softening plant to prevent the formation of scale.

PREVIOUS PUBLISHED DATA ON SAVINGS

Published experimental data on this subject are not in great abundance. Between 1898 and 1908 the engineering experiment station of the University of Illinois ran a series of tests on a locomotive and on individual boiler tubes in order to throw some light on the subject, publishing the results in its *Bulletin* 11 (1908). The locomotive, taken from the Illinois Central Railroad, was run with about $\frac{3}{64}$ in. (1.19 mm.) scale on it for about twenty-one months. Then the engine was cleaned and run for two days clean. The loss, based on equivalent water per pound coal evaporated at 212 deg. Fahr., amounted to 9.6 per cent.

*Volume 6, 1905, pages 597-611.

days of scarcity in the supply of trains and locomotives.

Besides the above, there are a number of benefits difficult to evaluate but extremely important as having a bearing on power-plant practice. For instance, there was a saving in time for engines to make their trips, due to fewer failures and therefore less expense for overtime labor and fewer delays for repairs on the road.

The results of eight years' use of softened water on the Southern Pacific Railroad system show a saving of 50 per cent in the expense of boiler repairs.

The average monthly locomotive mileage on the Union Pacific system has increased 27 per cent since the installation of the water-softening plants. Freight-train statistics also show "an increase in ton-miles per pound of coal of $7\frac{1}{2}$ per cent and a decrease in cost of repairs per locomotive mile of 34 per cent." The saving in repairs can be seen from the increased life of flues. "The average life of a set of flues in passenger locomotives with hard water was six months; since softening the water the average life is two and one-half years."

The committee's report in conclusion attempts to describe the general water conditions under which water softeners would produce savings by stating that "it would be a benefit to soften water used in locomotive boilers that contains 15 or more grains per gallon of hardening matter, or even less than 15 grains, if the hardening matter consists largely of sulphate of lime."

There are several cases in the writer's own experience, however, which illustrate the possibility of severe operating losses with a water having a hardness far below the committee's limit of 15 grains. A few weeks ago the chief operating engineer of one of our largest chemical manufacturing companies described to the writer conditions in one of its mills using the Delaware River water, having a hardness of between 3 and 4 grains per gallon in its eight 500-hp. horizontal water-tube boilers. The engineer of the plant showed tube charts which gave the average life of the tubes as six to eight weeks. The boilers were in constant danger of shut-down owing to tubes suddenly failing, and in several instances there was serious loss of life. The condition was due entirely to scale, which seemed to collect in sufficient quantity in tubes to prevent circulation and so cause overheating, blistering and bagging of the tubes. This same condition is probably familiar to other users of boiler-feed waters just as soft as the Delaware River wherever the boilers are operated at high overloads continuously. A boiler operating at 200 per cent rating with a 4-grain water has just as much scale deposited in it in the same period of time as a similar boiler operating at 100 per cent rating on an 8-grain water.

BENEFITS REALIZED BY OTHER CENTRAL STATIONS

That the installation of a water softener is warranted even with very soft natural waters is borne out by two other instances: A central station in Brooklyn, N. Y., installed a water-softening plant to obtain

water of zero hardness three years ago on the city supply of only 2 to 3 grains per gallon of hardness. The boilers (about forty of various types) develop a total of about 25,000 hp. and are run at high overloads during the peak periods. The use of the zero water has kept the boilers in such condition that these extreme peak ratings can be maintained with reliability and security at all times.

By installing the water softener this central power plant undoubtedly saved an investment for additional spare boilers which would be necessary to take up the load quickly in case of failure of some of the units in operation and actually saved about 50 per cent of the original investment in the cost of boiler repairs and the large amounts of soda ash formerly used directly in the boilers.

In a large textile plant at Bridgeport, Pa., using the Schuylkill River for its water supply (hardness, about 5 to 8 grains per gallon) the results of the first four months' run on "zero water," as compared with the same months of the previous year, showed a monthly saving in coal of 100 tons to 200 tons, compared with a consumption on hard water of 600 tons to 800 tons. The boiler plant consists of ten 150-hp. horizontal return-tubular boilers, the total horsepower developed being 1700. The same months in both years were chosen because the load was approximately the same during both periods.

It is interesting to note that the saving increased steadily during the four months in question because the scale was not completely removed when the water softener was started in operation. During the first month the saving was 102 tons, second month 166 tons, third month 208 tons, fourth month 216 tons. The soft water removed the old scale gradually, and the decreasing amount of scale present caused a corresponding decrease in coal used.

The old standards and ideals adopted for the quality of feed water are changing. The practice of maltreating boilers by using any water in them, then "doping" the boilers with some compound or soda ash and periodically cleaning the boilers with chisel and hammer is a thing of the past. With boilers costing to-day \$35 to \$40 per horsepower to install they are worth of the fine care and attention constantly given to engines. With the present practice of running boilers, especially in central stations, at 200 per cent to 300 per cent rating, and with the necessity for absolute reliability and certainty, the need for the best water with the least possible scaling contents is rapidly becoming realized.

The station operating committee of the N. E. L. & C. in describing the results obtained from a water softener in a large central steam company's plant in Manhattan operating on New York City supply of 2 to 3 grains per gallon, has this to say:

The results obtained develop a fact that is of great interest—that scale will form where boilers are operated at such high rating—200 per cent—if the water contains a hardness such as is usually obtained in the average water-softening plant. That is, boilers will not be free from scale if fed with a water of 4 grains hardness; therefore a greater refinement must be obtained to meet this condition. The demand for 200 per cent of rating is growing as more and more plants are being built to operate at that rating, and greater care will have to be taken to put into such boilers water containing the least possible hardness.

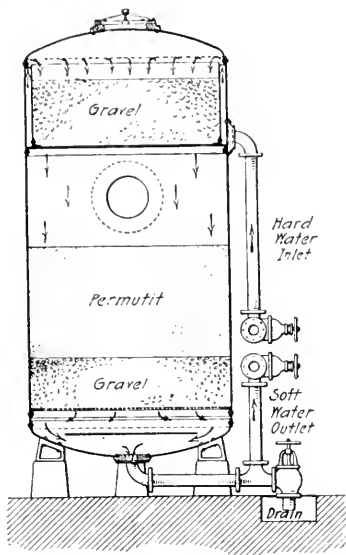


FIG. 2 — EXCHANGE - SILICATE
TYPE OF WATER SOFTENER

FEATURES OF VARIOUS SYSTEMS OF WATER SOFTENING

Lime-Soda Type.—In general there are two broad types of water softeners to consider. One is the lime-soda type, the other is the exchange-silicate type. The former consists of adding to the water lime and soda ash in fixed amounts depending on the chemical analysis of the raw water, allowing the dosed water, thoroughly mixed with the chemicals, to settle in large tanks, and then clarifying the settled water. This may be done with the water in a cold condition or by using a heater in advance so that the chemical reactions take place with hot water. The heater softeners permit of a smaller settling tank than the cold treatment, and the softened water if properly treated may have about 3 grains per gallon of hardness instead of the cold softened water of about 5 grains. But unless there is sufficient exhaust steam available to produce a temperature of over 200 deg. Fahr., there is no economy in the heater softener over the cold type because of the rapid radiation of heat from the large exposed area of the surface of the hot settling tank and separate hot filter. Furthermore, the washing of the filter and blowing off of sludge from the hot settling tank causes considerable loss of heat in the hot water wasted down the sewer.

The cold type of lime-soda softener may either be intermittent or continuous. The former consists of two or more settling tanks and filters with one tank being filled, dosed with the correct charge of chemicals, and then agitated in order to mix thoroughly while the other tank or tanks are settling and being used. The advantage of this type is that with waters of variable chemical composition the charge of chemicals may be suited to each tankful correctly. But the intermittent type naturally takes up a relatively large space and the foundations are expensive.

The continuous type feeds the chemical continuously into the water, which enters the settling tank at a constant rate, settling and then filtering, the water passing from chemical feed to filter without stopping. This type is as responsive as the intermittent with the average water supply where the chemical composition changes gradually, so that by analyzing the raw and treated water once a day the correct charges may be prepared for the day.

With all types of lime-soda water softeners the important things to watch are the size of the settling tank, the size and type of the filter and the allowable causticity in the treated water. In competition the size of the main parts naturally determines the cost, and unless these sizes are specified, competitive bids cannot be compared. It is just as necessary to check up a manufacturer's specification of a water softener as, for example those of a pump. With lime-soda softeners it is absolutely necessary to have a sufficient reaction and settling time to permit the chemical reaction to take place. If the settling period¹ is cut down, these chemical reactions take place after the water leaves the water softener, and clog up heaters, piping and boilers with the resulting precipitates.

Secondly, the filter should be of quartz and not of felspar or some other medium. Sand grains catch the precipitate best and can be easily washed by reversing the flow. The filters should be designed large enough to permit a low rate of filtration,² otherwise the precipitates may slip through.

As regards the allowable hydroxide causticity in the softened water, a limit should be set for this of about 2 grains per gallon, expressed as CaCO_3 . If no limit is set, it means that the water may be overdosed to get the guaranteed hardness. This overdosing is expensive with soda ash at 3 to 4 cents per pound, and a high causticity leads to other difficulties in boiler operation.

Exchange-Silicate Process.—The exchange-silicate process of water softening is a radical departure from the lime-soda type. The water is passed through a bed of granular insoluble sodium-aluminate-silicate, and all of the calcium and magnesium are exchanged for sodium. The exchange silicate takes the calcium and magnesium and in exchange gives its sodium to the water. The reactions are direct ex-

changes just as take place with soda ash in the lime-soda water softener. But the exchange silicate, being insoluble, is present in such high excess that all of the hardness is removed and a water of zero hardness results.

As explained previously, the addition of lime and soda ash reduces the hardness to 3 to 5 grains, and a causticity in the treated water results from the excess of soluble chemicals which was added to drive the reactions to those limits. Perhaps if the excess used and the resulting causticity were allowed to go high enough the hardness of the treated water might go lower. But with the exchange-silicate method the high excess is used and yet no causticity results because the silicate is insoluble. That explains why "zero" hardness water is possible by this method. The softening filters containing the exchange silicate are equipped with water meters, and when the designed capacity of a filter has been reached it is shut off and a solution of common salt or brine is introduced for about eight hours. This is called the "regeneration" period, and the salt solution restores the sodium to the exchange silicates, driving out the calcium and magnesium absorbed by the filter bed during the previous day's run. This salt is washed out and run to the drain in the morning, and the softening filter is then ready

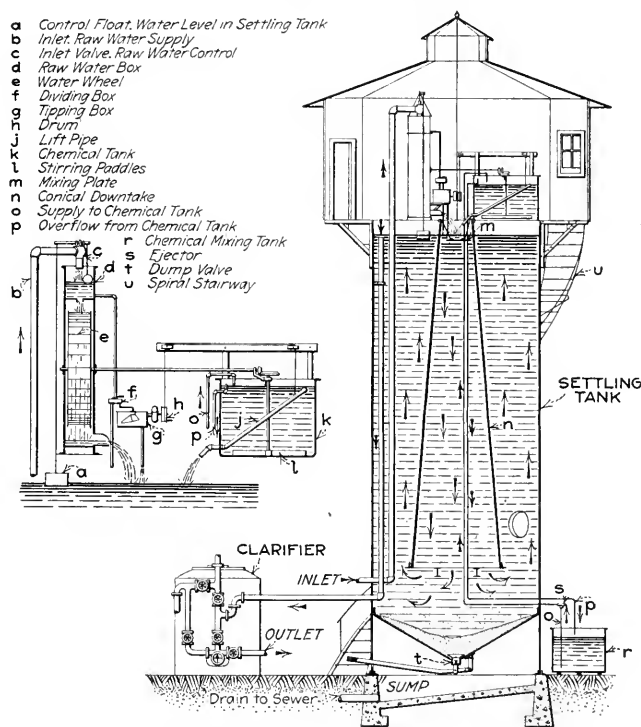


FIG. 3—ONE TYPE OF LIME-SODA WATER SOFTENER

for another day's run. For continuous twenty-four hours' service two units are used in alternate service.

There are some waters, however, which can most economically be softened by a combination of the lime pre-treatment followed by the exchange-silicate filtration. This combination treatment has been strongly developed in England. In the United States also there are quite a few combination lime-exchange-silicate plants, especially in the Middle West. The advantage of the combination process over the single methods is found in large water-softening plants with waters containing a high temporary hardness of calcium and magnesium bicarbonates. The lime actually removes the temporary hardness down to several grains per gallon and so reduces the total dissolved solids in the water.

With waters of high permanent hardness, however, there is no advantage in the combination process because soda ash works by exchange on the permanent hardness just as the exchange silicates do. Furthermore about 3 lb. to 4 lb. (1.36 kg. to 1.82 kg.) of salt is needed for regeneration as against 1 lb. (0.45 kg.) of soda ash. With salt at 1/3 cent a pound and soda ash at 3 cents per pound the comparative cost of removing permanent hardness by the two processes would be 1 1/3 cents for the exchange silicate and 3 cents for the soda ash.

¹The city of Columbus allows eighteen hours' settling in the municipal water-softener.

²In the city of Columbus a rate of 2 gal. per square foot per minute is allowed.

INVESTMENT AND OPERATING COSTS

The comparative investments in different water-softening systems depend entirely on the composition of the water. Lime-soda plants remain fairly constant in cost with varying compositions, whereas exchange-silicate plants increase in size and cost with increase of hardness in the raw water. Cost of treatment depends also on the water composition and the proportion of temporary and permanent hardness. The cost of lime treatment alone is about one-third to one-half the cost of the corresponding salt for regeneration, but, as pointed out in the foregoing, the cost of the soda-ash treatment is about three times the cost of salt for regeneration. In conclusion, a typical case will be analyzed to determine the actual savings that would result from installing a water softener without reference to the type used. Take a water of the following composition (same as water in the Bridgeport installation mentioned above):

		Grains per Gal.
Total hardness,	as $\text{CaCO}_3 = 130$ p.p.m.	= 7.7
Calcium hardness,	as $\text{CaCO}_3 = 80$ p.p.m.	= 4.7
Magnesium hardness,	as $\text{CaCO}_3 = 50$ p.p.m.	= 3.0
Alkalinity,	as $\text{CaCO}_3 = 80$ p.p.m.	= 4.7
Temporary hardness,	as $\text{CaCO}_3 = 80$ p.p.m.	= 4.7
Permanent hardness,	as $\text{CaCO}_3 = 50$ p.p.m.	= 3.0

Assuming a boiler plant of 3000 hp., consisting of ten boilers with no returns using 12,000 gal. (45,400 l.) per hour raw feed water, the first cost including foundations and connections would be about \$20,000. The cost of operation for chemicals would be about 3 cents per 1000 gal. (3785 l.). With a coal consumption of 1 lb. (0.45 kg.) per 8 lb. (3.62 kg.) of water evaporated, the average daily consumption of coal would be about 150 tons. Assuming a price for coal at \$4 per ton and a saving of 5 per cent for fuel, then the fixed and operating charges of water softener would be

288,000 gal. per day \times 3 cents	= \$8.64	Per Year	= \$3,150
Labor of operation			= 500
Interest and depreciation, at 10 per cent			= 2,000

Total..... \$5,650

SAVINGS:

Coal—150 tons \times 5 per cent = $7\frac{1}{2}$ tons per day = 2740 tons per year, at \$4.....	= \$10,960
Cleaning boilers.—Assuming that the boilers were formerly cleaned six times per year and are now only inspected, six cleanings saved, at \$30 per boiler, $6 \times \$30 \times 10 =$	1,800
Tube saving and repairs.....	1,000

Total	\$13,760
Deduct	5,650

Net saving

Therefore the return on investment = $\$8,110/20,000 = 41$ per cent, or the plant would be paid for in two and one-half years out of the savings.

If the plant were operating condensing at considerably above normal rating, as is usually the case in central stations, the net saving would be much greater and the softener would pay for itself more quickly, probably inside a year. This statement is based on the assumption that the percentage saving in fuel is the same in both cases and does not take into consideration the value of having more reliable service, the avoidance of damage from bursting tubes, the expense of shut-downs, or the investment otherwise required in reserve boilers. Each case should be studied individually and the water analyzed by a chemist.

TELEGRAPHS AND TELEPHONES
IN THE FIRST YEAR OF WAR

Extensive Communication Facilities of the Country
Are Fully Organized for War Service to
the Nation

BY JOHN V. L. HOGAN

Vice-President Institute of Radio Engineers, Commercial Manager
International Signal Company

SINCE the United States went to war the communication systems have been concerned mainly with establishing and maintaining their business and personnel upon a war basis. Naturally enough, the wire telephone and telegraph systems and the cables, as well as radio-telegraphy, have been strongly affected. Probably the greatest changes have occurred in the radio or wireless field, because of the peculiar utility of that mode of signaling for various military purposes.

WIRE AND CABLE LINES ACTIVE

On the whole, the wire and cable lines are carrying on "business as usual," except for the difficulties introduced by the loss of the trained civilian staff to the signal services of the army and navy and by the necessity of giving precedence to the immensely increased government traffic, which has grown in volume so rapidly. The telegraph companies have found it desirable to re-employ retired operators who had given up work at the Morse key. Many additional women employees have been placed in operating, clerical and supervisory posts formerly occupied by men. It seems likely that the desire to hold down plant expenses during unsettled times will be overbalanced by the scarcity of skilled operators, and that, consequently, the use of automatic and printing telegraphs will increase. Up to the present the installation of these modern and effective traffic channels has been limited to intercity lines over which abundant message business could always be had, since their expense seemed justified only in these instances. Looking ahead, however, the indications are that the quantity of available traffic will cease to be the only determining factor.

Increased use of the printing telegraph is also favored by the recent independent developments of devices in which much of the complication and expense of the older systems is avoided. The day is at hand, if not actually here, when keyboard transmitters and automatic type-writing receivers may be plugged in at the terminals of any normal simplex or duplex line and thereafter operated by untrained clerks at a message speed greater than that attained by the best hand Morse operators. The invention and perfection of machines whose operation is substantially independent of line conditions makes it feasible for a main office to use three or four sets of automatic apparatus for a dozen or more trunks, clearing congested traffic as necessity arises.

The telegraph systems of the country have become more heavily loaded in at least two ways—(1) because of the growing need for quick communication which results from the large amount of war-time production, and (2) on account of the daily increasing delays in the mails, which, of course, enforce larger use of telegraphic messages. On the other hand, telegraphic traffic is cut down by the natural stimulus to economy which accompanies uncertain financial conditions and also by the increased urgency which in many instances

necessitates telephonic communication, even at increased cost. Just how these several factors will finally affect the general traffic load cannot be determined until detailed message reports are available, but it seems likely that a marked growth in telegraph business, and especially that of the "night letter" classification, will be found.

Uncertainty in transatlantic mails, the essential close co-operation between our government and those of our European allies and the diversion of long-distance wireless stations for military uses have all tended to increase cable traffic. More stringent censorship regulations, which add to the burden of the cable staff, have come as a natural result of the state of war. However, nothing abnormal has been reported in the way of interruptions (perhaps because of the scarcity of enemy raiders left at large), and, in its entirety, the cable business seems to have been little changed. Certain technical advances, including the practical use of selenium and other relays, have been continued throughout the year, but no particularly sensational improvements have been announced.

HEAVY DEMANDS ON THE TELEPHONE SERVICE

Commercial long-distance telephony has suffered since the beginning of the war. In spite of careful plans for keeping essential members of the plant and operating organizations at their normal posts, on account of their value to the government communications in their usual daily work of providing good intercity telephone services, it is reported that so many have entered the Signal Corps and naval communication department that the telephone companies are actually handicapped. Moreover, a large number of long-distance trunk lines have been turned over directly to the government and are used entirely for official conversations. These are lost to the commercial service, since they have not been completely replaced by new lines in proportion to an increasing volume of long-distance traffic. Thus the usual business message service is not only somewhat poorer than in the past, but it also appears to be subject to more frequent and longer delays in times of storm. In consideration of the tremendous work the telephone organization is doing directly for the army and navy, however, the "non-essential" (from the war work viewpoint which must prevail to-day) uses of the telephone are in fact limited only very slightly.

The tremendous expansion of local government telephone service in large cities, and particularly in Washington, has crippled normal work to a considerable extent. New telephone instruments have been called for in such large quantities that companies have been forced to refuse to extend many private installations. Increased demands upon central offices and the larger private branch exchanges, as well as the withdrawal into military service of many men switchboard operators, have brought a large number of inexperienced girls into the work, and this naturally increases confusion and delay despite the best efforts of the companies. Without a doubt readjustments of plant and employees will relieve current difficulties where they are now most evident, and the telephone companies deserve full credit for the way in which they have continued to perform their important duties.

An interesting and relevant topic in connection with telephony is the extension of women's work into the

positions formerly held almost exclusively by men. Telephone companies have always had large numbers of women employees; but in common with many other industries they have not been fully cognizant of the availability of women for positions requiring long and technical training. It is most significant, though not generally known, that the complicated mathematical operations involved in transmission and other problems considered by the telephone engineering departments are worked out largely by women who specialized in mathematics at college and were employed thereafter as computers.

GREAT CHANGES IN WIRELESS FIELD

War conditions have brought great changes in the wireless-telegraph field. In the first place, all commercial shore stations were closed by order of the President immediately after the United States entered the war. This put a stop to actual and anticipated international and overland radio traffic. Wireless outfits were permitted to remain in operation on shipboard as a matter of safety to passengers and cargoes, but communication has been limited strictly to necessary position reports, warnings and similar maritime matters, all of which are sent in cipher. The Navy Department maintains a chain of land wireless stations along the shores of the country and has extended its service to comprehend essential commercial radio traffic, but since this must be entirely subordinated to governmental affairs the total number of private messages is extremely small.

In taking over and building many cargo ships the government has also acquired the ownership, control and operation of the radio apparatus upon them. Some hundreds of vessels using a large Eastern port are now entirely in the hands of the naval radio service as regards the inspection and maintenance of their radio apparatus and the supply of operators for them. The various wireless companies have largely become manufacturers for the army and navy, since their operating and research branches cannot continue on anything approaching the pre-war basis. Development of new inventions is directed almost entirely toward their utility in war work, and only those which are of the greatest actual or potential value to the military and naval services can justly be given full attention.

GRATIFYING ABSENCE OF WASTE

In view of their immense value and importance it is only natural that the communication facilities of the country should be so fully organized for war service, but it is especially gratifying to see that the radical changes in policy and operating methods throughout the several systems for transmission of intelligence have caused so little waste. So far as can be seen, the cable and wire channels will grow to be of even more utility to the government without seriously reducing their commercial value. The commercial future of radio, however, seems to be dependent largely upon its general technical development, and consequently the present period of military domination must be looked upon as a necessary setback resulting from the availability of wireless communication as a weapon. When the great war is won and conditions are more normal again, the useful future of radio signaling will come into sight once more, and this newest of the communication arts should progress rapidly to its fuller development.

Application of Motors to the Textile Industry

Increased Production Possible with Motor Drive Tends to Reduce Mill Investment per Unit of Output—Factors Affecting Selection of Motors and Control Apparatus

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

A brief statement of the power situation in the textile industry in reference to the increasing use of motors for this class of machinery. Types of motors now commonly employed are described, with notes on the control auxiliaries in standard practice; the economic advantages of the adoption of motors in preference to steam or water power are dwelt upon, and the principles outlined in the article are illustrated by reference to actual installations where examples of both belted and directly coupled motors are found.

THREE factors stand out prominently in the cotton textile industry that have an important bearing on the application of motors in this field: First, the enormous increase in the value of the products during the last fifty years; second, the large capital invested,¹ which makes a high rate of production essential to the economical operation of such plants, and, third, a decreasing proportion of water power used in terms of the total power together with an unusual increase in the use of electric power.

In the earlier days of the cotton-textile industry water power was the largest source for driving purposes, forming about 60 per cent of the total in 1870, with steam power about 40 per cent. In 1910 water power dropped to about 20 per cent of the total, steam power increased to about 60 per cent, and the remainder was largely electric power. Beginning about 1900, therefore, and with a rapidly increasing growth, elec-

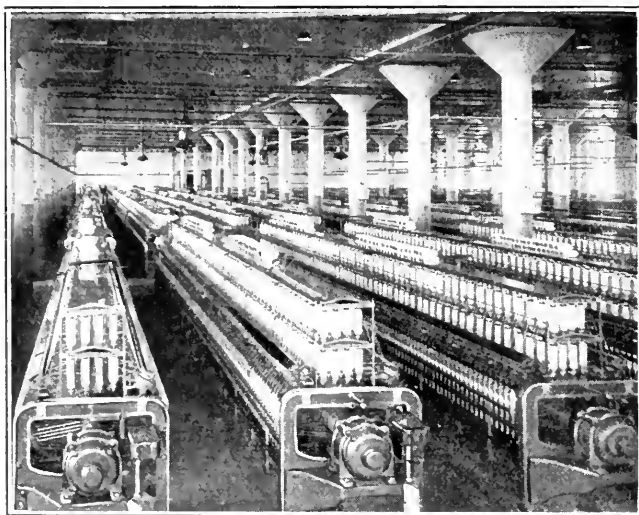


FIG. 1—EXAMPLE OF DIRECT-CONNECTED MOTOR DRIVE IN A SPINNING ROOM

tric power has been applied to textile machinery, this growth being so marked that Rickards² has estimated roughly 40 per cent as the probable proportion of elec-

tric power to be used in this industry two years hence.

To show the place held by the motor in the textile industry, the limitations experienced with the operation of these plants by mechanical means from steam and water power will be cited. Utilization of water power, which was a general method in the earlier

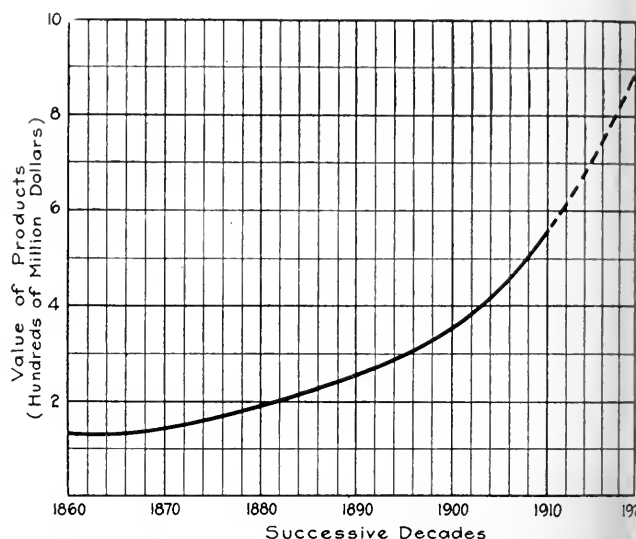


FIG. 2—INCREASE IN VALUE OF COTTON TEXTILE PRODUCTS

plants, usually made it necessary to locate mills at points inconvenient for shipping and resulted in a less flexible arrangement than when other motive power were employed. If the wheels are at one end of the mill, the long-line shafting thus required introduced high friction losses and other mechanical difficulties.³

The more flexible arrangements possible with a steam plant, its adaptability to central locations by which shafting may be extended on either side of a central tower, and the ability it gives to locate the plant at a point convenient for shipping make it a more favorable source of supply than water power. These advantages, together with the improvements of steam engines in recent years, have resulted in a considerable increase in the use of steam power, with a corresponding decrease in the growth of water-power plants.

Both of these sources, however, require mechanical transmission, and the exacting requirements of certain machinery, like looms, which must be stopped and started up under full load continuously, impose severe stresses on the belts connected with such drives. Added to this are the effects of speed regulation and presence of dirt, which may fly off from the belts, etc., on the quality of the product. In these directions motor drive has proved its superiority over the other power sources.

The motor has thus gained much headway in the

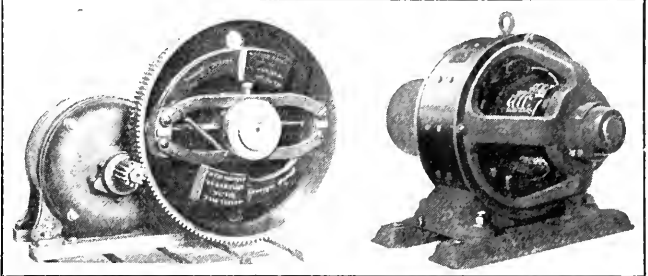
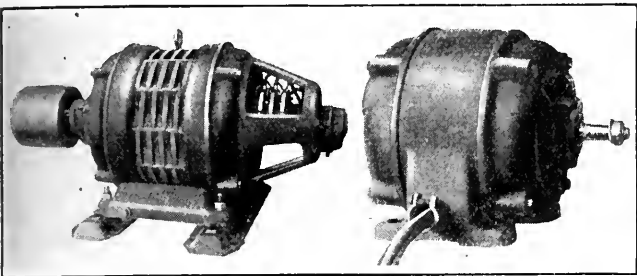
¹In recent years the amount of capital required per unit of output value has decreased, indicating that manufacturing efficiencies have increased.

²See *Electric Journal*, Vol. XI, No. 7, p. 404. Fig. 2 has been drawn from information in this article, and other references are made to it in this discussion.

³The reader is referred to a treatment of power in textile mills by William W. Crosby, "Standard Handbook for Electrical Engineers," fourth edition, p. 1267, to which several references have been made in the preparation of this article.

field as an aid to accuracy and uniformity in the manufacture of a more or less delicate product. The reduction or entire avoidance of speed fluctuations is a factor entering into both the quality and the quantity of the output. As usual in electrical developments of this kind, much effort has been expended by the motor and

Squirrel-cage induction motors are well adapted to the conditions because of their simplicity of structure and the absence of a commutator. Motors of this type, as used for textile work, are designed for operation at reasonably low temperatures and uniform speed and possess high efficiency, high power factor and low slip.



FIGS. 3 AND 4—SEVERAL TYPES OF TEXTILE-MILL MOTORS

The first is a wound-rotor motor on slide rails; the second is a typical loom motor with the frame cast for conduit connection;

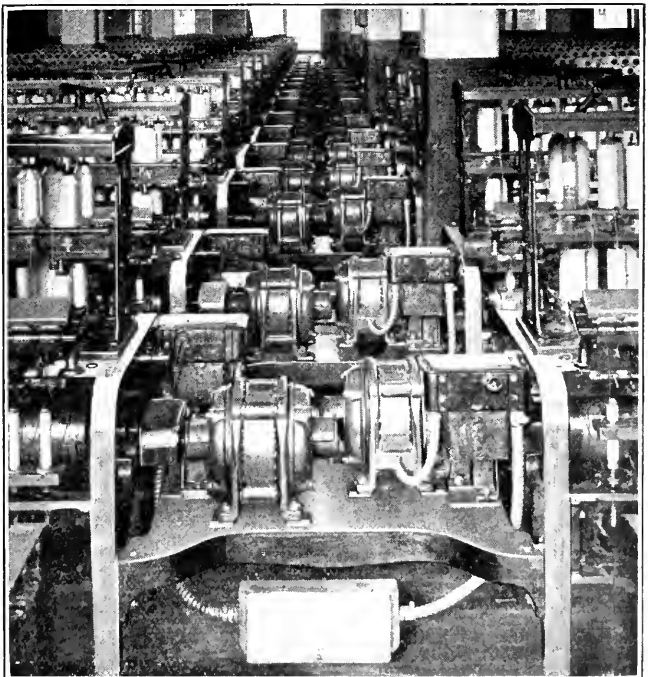
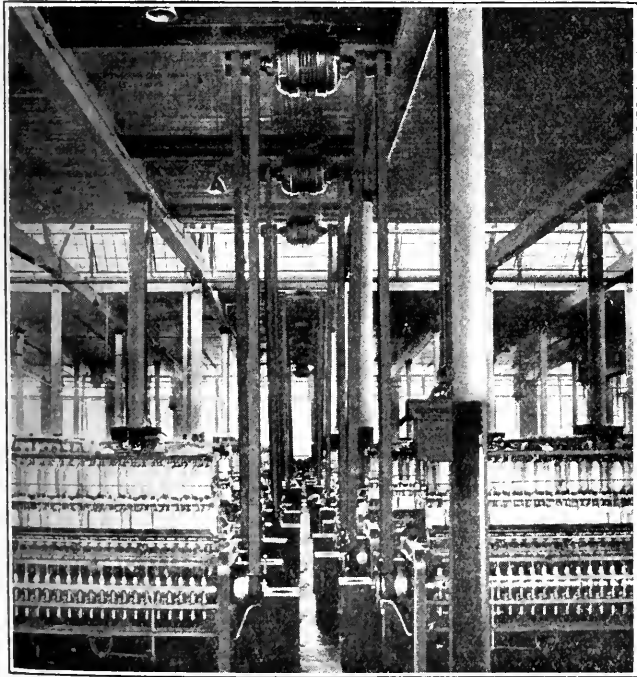
the third shows a loom motor connected with a loom clutch; the last is a direct-current motor arranged for conduit wiring.

control manufacturers to design motors and control apparatus with characteristics which adapt them to the particular machinery to be driven. In the following paragraphs, therefore, the principal points to be discussed are those which relate (a) to the types of motors now available for such service, (b) to interesting aspects of modern control apparatus for textile motors, and (c) to cases selected from actual practice which illustrate given motor applications.

From some standpoints the direct-current motor might be looked upon as suitable for textile machinery,

The practice of one leading motor manufacturer is to list these motors in two groups,¹ one group having a starting torque of at least three times full-load torque, and the other having starting torques ranging from one and one-quarter to two and three-quarters times full-load torque.

The slip for motors of this class varies somewhat with the service to which they are applied. Where uniform speed is required the motor is designed for a slip of about 4 per cent at full load. However, where the motors seldom, if ever, operate at less than half



FIGS. 5 AND 6—FOUR-FRAME BELT DRIVE AND INDIVIDUAL MOTOR DRIVE WITH GEAR CONNECTION

at least in many cases. The presence of lint and dust in the air, however, has had a tendency to increase the use of induction motors for such service. The constant deposit of dust and lint in the crevices of the motor and in uncovered bearings is such a serious objection that motors have been designed for the complete protection of the interior of the frame, the windings, bearings and oil wells.

load the actual gross speed variation is thus only about 2 per cent.

The tendency in the application of these motors is

¹Catalog 3002, Section 1, p. 44, Westinghouse Electric & Manufacturing Company. Figs. 3 A and B, 5, and 7 A, B, C, E and G are shown by courtesy of this company; Fig. 4 A, of the Wagner Electric Manufacturing Company; Figs. 7 D and E, of the Crocker-Wheeler Company; and Figs. 1 and 6, of the General Electric Company. Data and other information have been contributed by these companies.

for individual drive, which possesses decided advantages over the group method. Sometimes, however, a single motor may be used for driving a group of textile machines according to the usual group method, as shown, for example, in Fig. 5. In a case of this kind it is unnecessary to use line shafting.

In addition to the general precautions taken in the design of textile motors, as outlined above, for preventing the accumulation of dust and lint on operating parts of the motor, consideration is also given to other peculiar conditions found in the various departments of textile mills. Among them are the fire risk in picker rooms, the presence of acid fumes in the dye house, etc.

Typical loom motors are adapted also to such cases as warpers and winders, and special types are available for the class of machinery typified by the picker and

with its own individual motor, but the entire series controlled from one point.

Where starting conditions permit, synchronous motors may be used in conjunction with the standard induction motor equipment, a feature which is specially desirable in case the power factor of the induction-motor circuits is low.

The advantages of the motor depend to a considerable extent on the control facilities available. For individual drives a non-automatic "quick-make-and-break" oil switch (Fig. 7G) may be employed. The protective features of standard textile switches include overload protection only in some cases, low-voltage protection only in others, and both features in still others.

For frequent starting and stopping, and also where push-button operation is required, the practice is to

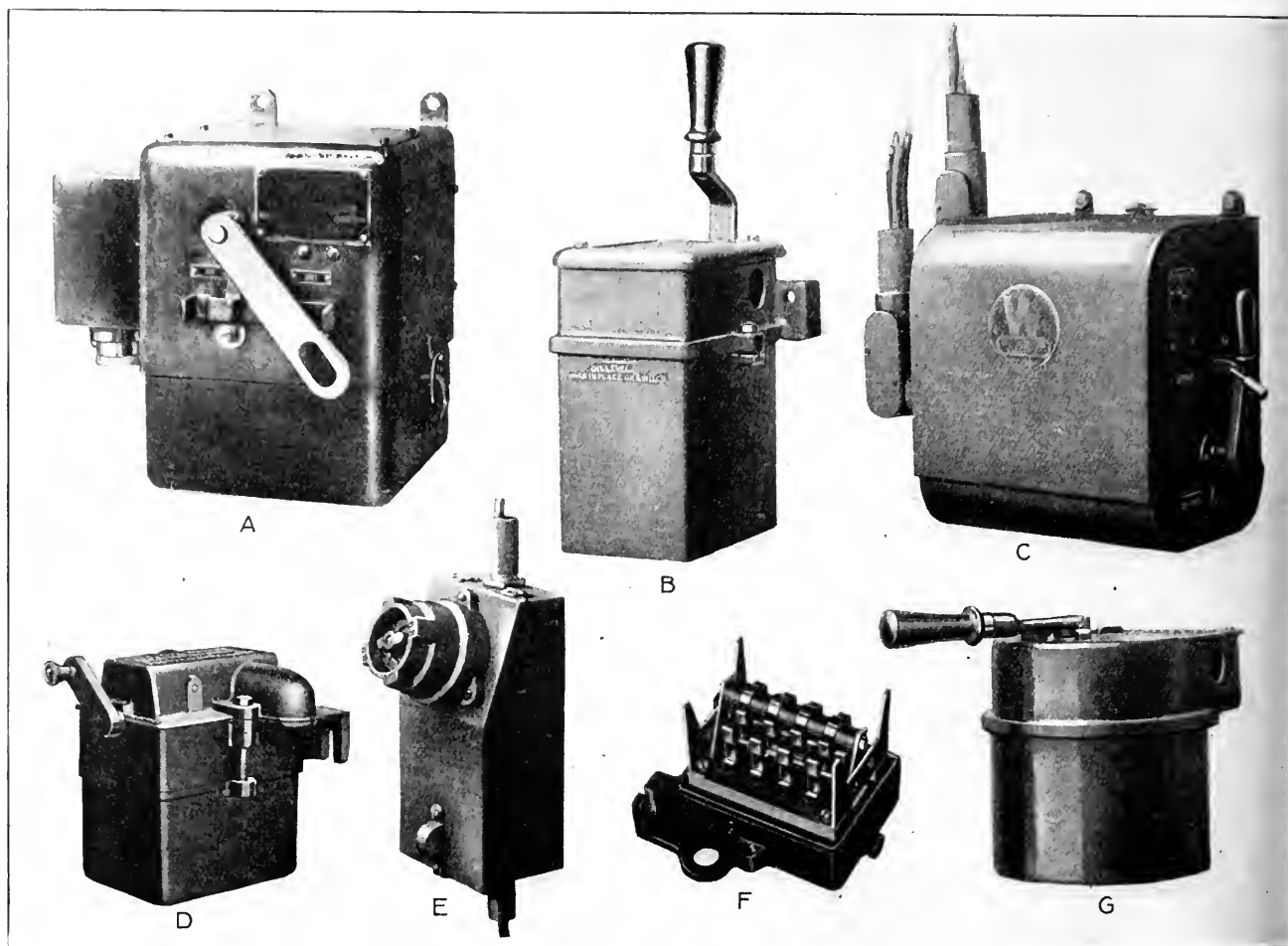


FIG. 7—DIFFERENT TYPES OF TEXTILE MILL MOTOR CONTROLLERS

A—Quick-make starting switch designed for conduit connection and provided with inverse-time-limit overload and low-voltage release; readily mounted on wall, post or ceiling. B—Another type of textile switch. C—Auto starter. D—Switch for loom

motor showing operating lever at front. E—Special snap switch with fuses designed for conduit wiring. F—Interior of switch. G—Starting switch designed for conduit wiring.

the roving frame. To meet particular conditions in yarn mills the double-extended shaft and the four-frame-drive have made it possible to drive four machines from one motor without line shafting.

Finally, some cases are found, as in finishing processes, where different qualities of goods worked upon call for different speeds. In such cases either the direct-current adjustable-speed motor or the wound-rotor alternating-current induction motor is used. The former is preferable where wide ranges of speed are necessary and also in cases where a number of productive machines are arranged in series, each equipped

make up regular contactor panels for the condition of any given case. In those mills where central-station power is purchased rules of the power company may not permit the starting of induction motors by throwing them directly on the line. In such cases starting switches like Fig. 7G may not meet the requirements and an auto-starter becomes necessary. With the starters overload and low-voltage protection is available, together with arrangement for conduit. Where direct-current adjustable-speed motors are used for series of productive machines operated from a central point automatic or semi-automatic control is advisable.

The agitation in the press at the present time concerning the textile situation places unusual emphasis on the small margin of profit derived by such concerns in comparison with some other industries. This being the case, there is every reason for the manufacturers of textiles to investigate each possible channel through which increased production may be realized for given manufacturing expense. Recent data indicate a rapid increase in the adoption of the motor for textile mills, and those responsible for the power supply will do well

to take advantage of the developments which have been made in the design of motors and control for the various classes of machinery which are met with in plants of this description.

The experience of the immediate past points to a gradual reduction in the capital required per unit of manufactured value of textile products. Every per cent of reduction along this line means just so much more leeway for the operators in profit margin, and the possibility of improving wage conditions.

A Study of Electric Range Efficiency*

Results Obtained by Means of Tests Made on Both Open and Inclosed Heating Units with Different Kinds of Utensils, as Well as from Experiments with Ovens of Different Size

BY R. G. KLOEFFLER

Assistant Professor in Electrical Engineering, Kansas State Agricultural College

AN INCREASED interest in the efficiency of the electric range has recently become evident. This has been the natural result of the widespread introduction of this modern cooking appliance during the last three years. The cost of operation is the thing which interests the prospective owner of an electric range and the central station supplying the electrical energy. The cost of operation and efficiency, however, are almost synonymous when applied to electric cooking.

In order to determine the efficiency and practicability of the electric range a series of tests was carried on during 1917 in the electrical engineering laboratories of the Kansas State Agricultural College. The important results of this investigation are presented below. Details of these tests and complete data will be published in *Bulletin No. 9* of the Engineering Experiment Station of the Kansas State Agricultural College.

SURFACE-HEATING UNITS

The efficiency of surface-heating units was obtained in a simple manner, as follows: One quart (0.94 l.) of distilled water at a temperature of 60 deg. Fahr. (15.6 deg. C.) was placed in a covered dish upon a unit. Current at a constant potential of 110 volts was turned on the unit (beginning cold) until the water rose nearly to the boiling point (206 deg. Fahr., or 96.7 deg. C.) as registered by a mercury thermometer. At the same time the energy consumption was recorded by a standardized watt-hour meter. The energy in B.t.u. utilized is the product of the pounds of water and the change in temperature, while the energy input (B.t.u.) is the product of kilowatt-hours and the constant, 3415. Efficiency = [pounds water \times change in temperature (Fahr.)] \div [3415 \times kilowatt-hours].

If the water should reach the boiling point and boil for some time, the efficiency could be again obtained with fair accuracy by reweighing the water and adding to the previously computed absorption that required to change the water into steam; thus: Efficiency = [pounds water \times change in temperature + pounds

evaporated \times latent heat of evaporation] \div [3415 \times kilowatt-hours].

According to these methods, the efficiencies of the surface units on eight different electric ranges were computed. Seven of these units are shown in Fig. 1. The eighth was omitted because of the difficulty in classifying it for the general work of comparison. The three units at the top of Fig. 1 are of the inclosed or disk type. The lower units are of the open or radiant type.

It might be expected that the efficiency would vary with the size, color and material of construction of the utensil used in the tests. In order to get an average value for such variations and also to get the data for desirable comparisons, the following utensils were



FIG. 1—INCLOSED AND OPEN UNITS FOR ELECTRIC RANGES

chosen: a small bluish-gray granite kettle having a diameter of 6 in. (15.2 cm.) on the bottom; a small aluminum kettle 6 in. (15.2 cm.) in diameter called "new" in this article since it had a bright, new luster and a perfectly flat bottom; a small aluminum kettle same as above except that it was discolored with use and dented at the bottom (called old); an aluminum fireless cooker pan 8 in. (20.3 cm.) in diameter and having a perfectly flat bottom (called new); an agate granite pan and a white granite pan each having a diameter of 8 in. (20.3 cm.) on the bottom. All of the above utensils were fitted with suitable covers before the experiments began.

The efficiencies on the seven units illustrated are

*Copyright, 1918, by R. G. Kloeffer.

condensed into Tables I, II and III for the purpose of specific comparisons.

Table I gives the values of surface unit efficiencies for granite and new aluminum utensils on the open and on the inclosed type of surface units. From the average percentages it is observed that the open type has 4.9 per cent more absolute efficiency when used with

TABLE I—COMPARISON OF SURFACE UNIT EFFICIENCIES

Type of Unit	6-In. Granite	8-In. Granite (Agate)	6-In. Aluminum (New)	8-In. Aluminum (New)	Average for Granite	Average for Aluminum	Average for All
Open	35.6	12.7	33.3	37.5	39.15	35.4	37.27
Open	43.6	52.1	33.3	43.5	48.0	38.4	43.2
Open	35.8	16.2	32.2	43.3	41.5	37.5	39.5
Open	42.4	17.2	37.2	47.9	44.8	43.55	43.67
Average	39.6	17.1	34.0	43.05	43.35	38.45	40.91
Inclosed	29.7	13.2	36.6	19.1	36.45	12.85	39.65
Inclosed	46.4	41.2	53.3	48.7	43.8	51.0	47.4
Inclosed	29.5	11.5	37.1	51.9	35.5	46.0	40.75
Average	35.2	11.97	42.33	50.9	38.6	46.6	42.6

TABLE II—COMPARISON OF SURFACE UNIT EFFICIENCIES

Type of Unit	6-In. Aluminum (New)	6-In. Aluminum (Old)	8-In. Aluminum (Covered)	8-In. Aluminum (Open)	30-Minute Test (Granite)	30-Minute Test (Aluminum)
Open	33.3	28.4	37.5	34.4	58.9	51.5
Open	33.3	33.6	43.5	34.2	58.7	51.2
Open	32.2	31.4	43.3	31.4	55.0	55.8
Open	37.2	32.8	47.9	39.3	55.7	60.8
Average	34.0	31.55	43.05	34.8	57.07	54.8
Inclosed	36.6	22.9	49.1	42.4	60.0	67.8
Inclosed	53.3	37.8	48.7	43.75	50.3	63.5
Inclosed	37.1	25.2	51.9	51.5	57.5	72.9
Average	42.3	28.6	50.9	45.9	55.9	68.1
General average	.....	.....	46.97	40.35	.....	.....

granite than with aluminum utensils. This figure relative to the efficiency with aluminum makes the granite utensils 12.7 per cent more efficient.

For the inclosed type of unit, however, the reverse of the above is true, and the average percentages show that the new aluminum utensil gives an 8 per cent higher absolute efficiency than the granite. This value in terms of relative efficiency makes the aluminum utensil 20.7 per cent more efficient. For the purpose of easier comparison the results of Table I are plotted in the chart (Fig. 2).

These facts can be explained in the following way: The open-type units give up their heat principally by radiation, though some convection and conduction will take place. On the one hand, the granite dishes will readily absorb the radiated heat, while the aluminum, if bright, will have a tendency to reflect the radiated heat downward again. On the other hand, the inclosed unit gives out most of its heat by conduction, with smaller amounts emitted by radiation and convection. Here the granite dish, because the coating of enamel is a poor conductor of heat, does not receive the heat readily while the aluminum dish, since aluminum is an excellent conductor of heat, acts more efficiently.

Columns 2 and 3 of Table II give the efficiencies on an old and a new 6-in. (15.2-cm.) aluminum utensil. For the open type of unit the new aluminum utensil has an average absolute efficiency of 2.45 per cent more

than for the old, and therefore the former is relatively 7.75 per cent more efficient. This percentage is to be contrasted with that of the inclosed group of units, where a difference of 13.7 per cent in absolute efficiency is noted; that is, relative to the old aluminum utensil the new one is 48 per cent more efficient. The efficiencies of this part of the table for the old aluminum utensil are also plotted in the chart of Fig. 2. It will be observed that the second open type of unit has a slightly higher efficiency with the old aluminum utensil than with the new one. This occurs because this unit, being of the reflector type, will absorb the heat more readily from the darker-colored utensil bottom. A study of Fig. 2 gives the inclosed units the maximum of all the efficiencies obtained, when used with the new aluminum utensils, but the big reduction in comparative efficiencies as the bottom of the utensil becomes discolored and dented offsets this advantage.

Columns 4 and 5 (Table II) show the efficiencies with and without a cover on the utensil. For the open type of unit the cover adds an average of 23.7 per cent to the relative efficiency; for the inclosed type the relative efficiency is increased by an average of 10.9 per cent, and for all seven units the average increase is 16.4 per cent.

Columns 6 and 7 of this table contain the computed efficiencies when, after being heated for thirty minutes, the utensil remains on the unit until the boiling of the water has ceased. A study of the averages here reveals that the inclosed units give the higher values, which might be expected since the heat stored in the

TABLE III—COMPARISON OF SURFACE UNIT EFFICIENCIES

Type of Unit	8-In. Agate Granite (Weight, 0.86 Lb.)	8-In. Blue Granite (Weight, 1.5 Lb.)	8-In. White Granite (Weight, 1.5 Lb.)	8-In. Blue Granite, 3 Qt. Water
Open	47.2	45.8	44.6	50.7
Open	52.4	50.7	50.0	57.2
Inclosed	43.2	40.2	39.1	46.3
Average	47.6	45.6	44.6	51.4

	1100-WATT UNIT		1500-WATT UNIT	
	Time	Efficiency, per Cent	Time	Efficiency, per Cent
Open	17 min. 20 sec.	32.4	15 min. 30 sec.	47.1
Open	21 min. 5 sec.	46.2	18 min. 20 sec.	39.4
Open	21 min. 8 sec.	45.8	16 min. 38 sec.	42.5
Average	19 min. 51 sec.	48.1	16 min. 40 sec.	43.0

Utensil	New Reflector	Dirty Reflector
6-in. granite	44.7	43.6
6-in. aluminum	36.9	33.3
8-in. aluminum	47.5	43.5
8-in. granite	55.3	52.4
Average	46.1	43.2
Per cent decrease in efficiency	.....	6.3

iron mass of the inclosed unit will be readily given up by conduction.

The first section of Table III gives a comparison of an agate, a dark-blue and a white granite dish, all containing 2 quarts (1.9 l.) of water. It might be expected that the color of the enamel would affect the amount of heat absorbed, particularly on the open type of unit. The results seem to bear this out, though the

difference is rather small. This does not explain the same difference found in the case of the inclosed unit. The last column in this section gives the efficiencies on the blue pan when 3 quarts (2.8 l.) of water are used. As expected, the efficiency increases with the quantity of water and the time required for a given change of

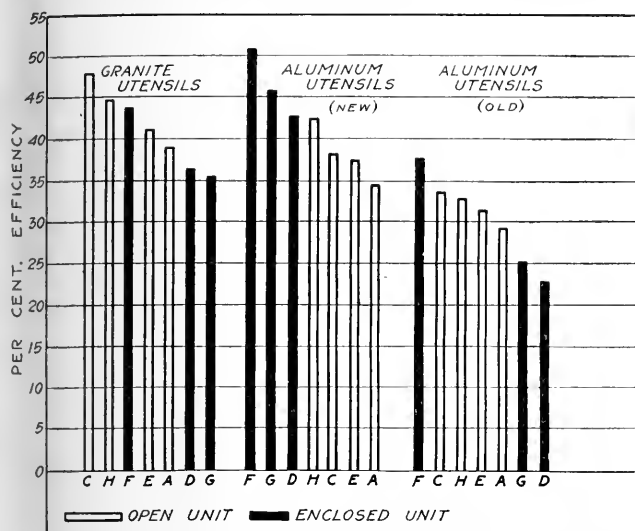


FIG. 2—CHART PLOTTING PART OF TABULATED DATA (TABLES I AND II)

temperature. The average increase in efficiency here is the same for the open and for the inclosed type of units.

The second section of this table compares the efficiency and time required for a given rise of temperature of 2 quarts (1.9 l.) of water on 1100-watt and 1500-watt units. The average of the results shows that

a bright new reflector and the discolored, dirty reflector which results from use. The average for four utensils on two different units shows a decrease of 6.3 per cent in relative efficiency after being in service for a time.

Thus far consideration has been given only to the efficiency obtained on raising the temperature of water from 60 deg. to 206 deg. Fahr., which requires from fifteen to twenty-five minutes. It would also be of interest to know how the efficiency has varied from the beginning, and to get this variation in efficiency readings of temperature and kilowatt-hours were taken at three, six, ten and fifteen minutes from start on two of the utensils tested. From these values the efficiencies were computed according to the method previously described, and they have been plotted in curves of Fig. 3.

With the new aluminum utensil both the open and the inclosed units have an average efficiency of about 17½ per cent at the end of three minutes. Beyond the three-minute point the efficiency of the inclosed units rises very rapidly, approaching a maximum in about fifteen minutes. The curves on the granite utensil show that at the end of three minutes all the open type of units have about 22½ per cent efficiency, while the average of the inclosed type at the same period is only about 7½ per cent. It takes about eight minutes for the inclosed type to reach the efficiency obtained by the open type at the end of three minutes. The open-type units rise to an average of nearly 40 per cent in the first ten minutes. The particularly rapid rise of unit C to almost a maximum in ten minutes should be noted, since there are some hasty operations in the kitchen where the surface unit may be in use for only five to eight minutes. This is more especially true where hot

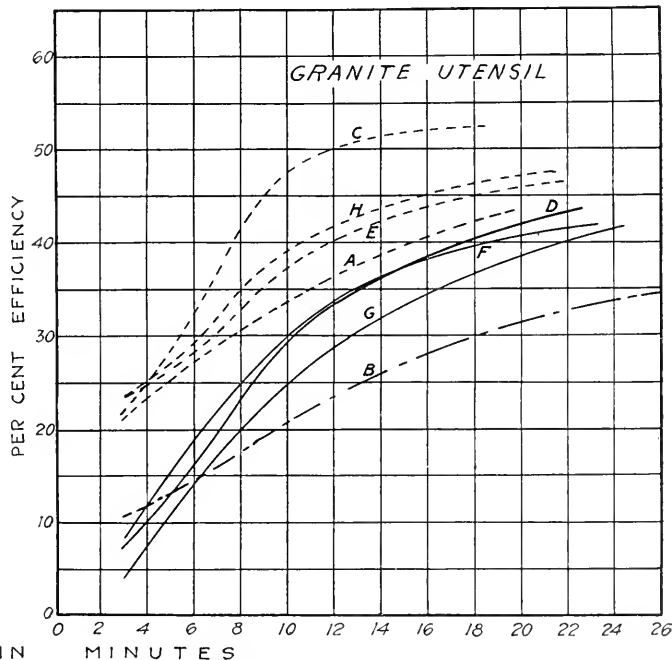
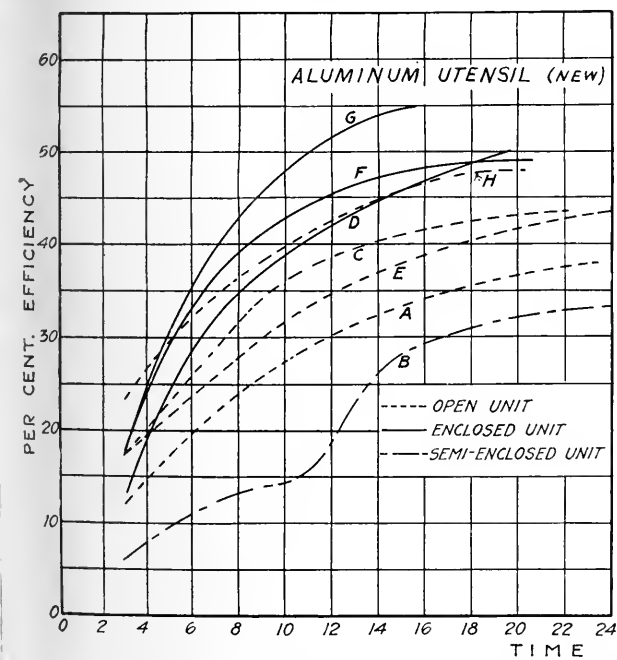


FIG. 3—CHART PLOTTING EFFICIENCIES AT STATED INTERVALS OF TIME

about three minutes in time is gained at a sacrifice of almost 12 per cent in efficiency by using the larger unit. Hence an effort to hasten results by using a surface unit of the higher wattage will increase the cost of operation.

The last section of Table III brings out the difference on units of the reflector type in efficiency obtained from

water is available at the tap. For such operations obviously the surface unit with the higher efficiencies obtained in a short time has a decided economical advantage.

In a future issue of the ELECTRICAL WORLD data and tables on the performance of electric ovens will be printed.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

INTERESTING INSULATION

TEST ON STEAM DRUMS

Experiment Showed that with Proper Heat-Insulating Material a Saving Resulted That Paid for This Extra Insulation

An interesting test for determining loss of heat by radiation from boiler settings and steam drums was recently made by C. A. Eastwood, superintendent of Station A, Pacific Gas & Electric Company, San Francisco, Cal. For the experiment a 560-hp. B. & W. boiler was selected, the steam drums of which were covered with one course of common brick. A rectangular can containing a measured quantity of water was placed on top of one drum and the boiler was run at its rated capacity for a period of three days. During this time the rise in temperature of the water was carefully noted.

To determine how much of the fuel loss could be saved by the use of an effective heat-insulating material, one 2½-in. (6.4-cm.) course of Armstrong nonpareil insulating brick was then placed on top of the common brick covering and readings were taken as in preceding tests. The result showed that with the nonpareil brick in place the loss of heat amounted to only 144 barrels of oil per year. With oil costing 70 cents per barrel, the saving amounted to more than enough to pay for the cost of the insulating brick and the labor required for installing it.

USE OF LIGHT-WEIGHT MOTORS A MEANS OF ECONOMIZING

Large Quantities of Copper and Steel Will Be Released Thereby for Other Purposes—
Freight on Light Motors Less

BY A. BRUNT

Engineer Westinghouse Electric & Manufacturing Company

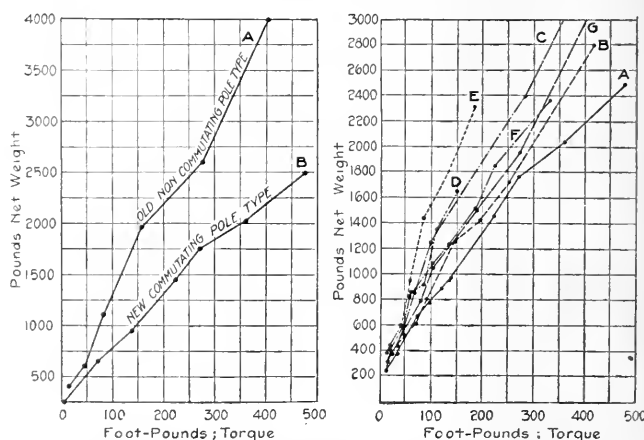
Economy with all the resources of the country is of the greatest importance under the present conditions, it being just as important to economize with copper and steel as it is to economize with food and coal. In order to pay off the immense war debts it will be imperative for this country to make the best possible use of its resources. Of these copper and iron ore form very prominent parts. Economy in these metals must be made at every point, and no part of a machine should contain metal not necessary for its proper operation. By giving preference to lighter motors of equal rating users will encourage manufacturers to seek out means of economizing metals and thus release a very substantial amount for other uses.

Records of a prominent manufacturing concern indicate that the average-size direct-current general utility motor sold has a torque of 65 ft.-lb. (8.97-kg.-m.), corresponding to 15 hp. at 1200 r.p.m. This size of motor can be bought with a weight varying between 605 lb.

and 1080 lb. (274.4 kg. and 489.8 kg.) (Fig. 2). Assuming the average weight of motors of 65-ft.-lb. (8.97-kg.-m.) torque to be 845 lb. (383.3 kg.), and further assuming a total production in this country of 30,000 motors per year, the waste of material by using the average motor instead of the lightest motor will be $(845 - 605) \times 30,000$, or 7,200,000 lb. (3,265,865 kg.) per year. This figure is appalling, especially under present conditions.

Improvements in the design of direct-current motors—chiefly the adoption of the commutating pole, a more thorough knowledge of allowable operating temperatures and more effective means of ventilation—have made it possible for progressive manufacturers to reduce the weight of their machines very substantially (Fig. 1).

Since all manufacturers sell in the same market, their prices for motors of the same rating must necessarily be nearly the same. The purchaser of a motor natu-



FIGS. 1 AND 2—RELATION BETWEEN WEIGHT AND TORQUE FOR COMMUTATING-POLE AND NON-COMMUTATING-POLE MOTORS; ALSO FOR SEVEN VARIOUS MAKES OF MOTORS

rally will ask, "Should I buy the light or the heavy motor?" The motors will all be designed to have the same temperature guarantees, and, assuming that the speed characteristics will be satisfactory and the efficiencies equally good, it may be asked, What are the advantages of the one over the other?

Naturally many purchasers of direct-current motors will think that by buying the heavy motor they are getting more for their money. A careful comparison of the two motors, however, will show that this is not so. If the heavy motor should have more excess capacity, this should also show itself in dimensions of shaft and bearings. However, an examination of the pulley-end bearing diameter for two competitive lines of motors manufactured by prominent concerns shows that there is very little difference between shaft diameters of competitive motors.

The lighter motor necessarily must be the better ventilated one, which means that the motor is so con-

structed that the cooling air comes in thorough contact with those internal parts in which the heat is generated. Thus it follows that the excess of actual external temperature over the temperature measured by applying a thermometer to outside surfaces must be smaller in the light, well-ventilated motor than in the heavy motor, with consequent smaller danger of damage to the insulation. In this respect the light, well-ventilated motor is much to be preferred over the heavier one.

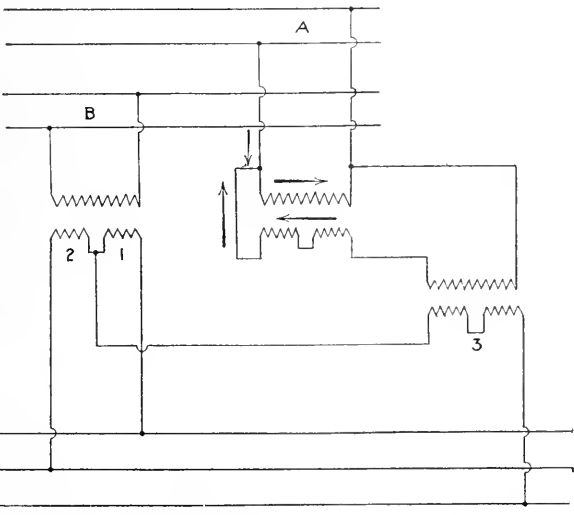
Light motors further can be handled more easily and also have a lower freight rate, which is an advantage to the purchaser in case the motor is to be shipped outside of a free-delivery zone. That great weight is not necessarily an equivalent of superior qualities is well illustrated by the weight curves of Fig. 1. Efficiency and especially commutation of the commutating-pole motor are decidedly superior to the same qualities of the very much heavier non-commutating-pole motor.

FROM TWO- TO THREE-PHASE WITH STANDARD TRANSFORMERS

Balanced Voltages by Connecting Two Transformers in T and Using a Third to "Buck" Voltage Across Unit Corresponding to Leg of T

BY E. CHARLES SEARS

Where two-phase service is supplied and three-phase energy is desired, but only standard transformers are available, the following plan can be followed: Assume that the primary voltage is 2200 and that 2200/220-110-volt transformers are available. Connecting the primary windings of two transformers across the two phases and joining the secondary of one transformer with the mid-point of the other transformer's secondary will not give balanced three-phase voltages, since the secondary windings do not have the proper number of turns, relatively, for T-operation. In fact, operating



METHOD OF CONNECTING THREE STANDARD TRANSFORMERS TO CONVERT FROM TWO-PHASE TO THREE-PHASE

the transformers mentioned above in T the phase voltages* would be 228, 261 and 261.

By connecting a third transformer across phase A to "buck" the primary voltage of transformer 3 by

*Based on actual measurements for a specific installation—voltages across windings 1 and 2 were both 114, while voltage across winding 3 was 235.

220 volts, however, the voltages across phases are made nearly equal, as shown by the following calculations: Voltages across both windings 1 and 2 were 110 volts and the pressure across winding 3 was 198 volts. Thus the voltage across windings 1 and 2 would be 220 volts, while both the other delta voltages would be

$\sqrt{110^2 + 198^2} = 227 \text{ volts.}$

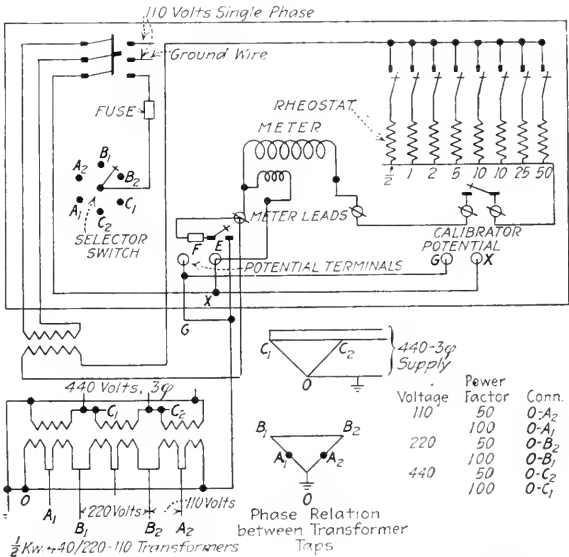
METHOD OF TESTING METERS AT TWO POWER FACTORS

Transformer Taps Provided to Give 110-220-440 Volts and 50 and 100 per Cent Power Factor—Diagram of Connections

BY JOSEPH N. M'CLURG

Foreman Meter Department Scranton Electric Company

The writer recently developed a meter-testing panel for testing single or polyphase meters of 0.5-amp. to 100-amp. ratings at 110, 220 and 440 volts. The panel



WIRING DIAGRAM AND PHASE RELATION BETWEEN TRANSFORMER TAPS

is of transite wood. The main switch is a 60-amp. single-throw, triple-pole instrument, and the load switches are 30 amp. single-throw, single-pole.. The load consists of old direct-current arc-lamp resistance coils connected with an old 5-kw., 2200/110-volt transformer operated at reduced voltage to obtain 20 volts on the secondary.

The selector switch gives 110-220-440 volts, 50 and 100 per cent power factor. The connections for giving different voltages and power factors are indicated in the accompanying diagram. Switch E is closed when testing single-phase meters, one potential lead being fastened to the line terminal of the series coil in the meter. This switch is opened if the potential coil is not joined with the current coil. It has individual terminals.

From the vector diagrams at the bottom of the illustration it may be seen that if the load current is in phase with vector OC₁, OA₁ or OB₁, 100 per cent power factor will be obtained by connecting selector switch with contact A₁, B₁ or C₁, the voltages being 110, 220 and 440 volts respectively. When connected with A₂, B₂ or C₂, however, the voltage is 60 deg. out of phase with the current, so 50 per cent power factor will be obtained.

SAFETY BULLETIN BOX FOR PREVENTION OF ACCIDENTS

Provides Receptacle for Suggestions, Display of Safety Council Bulletins and Opening for Lantern Slides

The United Gas Improvement Company of Philadelphia has developed the safety bulletin box shown herewith to attract the attention of its employees. In addition to serving as a receptacle for suggestions, the box provides a new arrangement for the display of standard letter-size safety-council bulletins. There is also a standard opening for lantern slides and descriptive notes, which are made prominent by a flashing light. The box is strongly made of light sheet metal and contains a flashlamp, double glass sides, necessary electrical connections and a short section of insulated



BULLETIN BOX FOR PROMOTION OF SAFETY

cable which may be extended through an insulated bushing at the upper corner on either side of the box. The exterior is enameled in safety green, and the interior is painted in aluminum. The box measures 12 in. by 22 in. by 20 in. (30.5 cm. by 55.9 cm. by 50.8 cm.).

THE TREMENDOUS FORCE EXERTED BY SHORT CIRCUIT

Conductors and Insulation Expelled from Sheath—Bulge Produced in Cable 150 Ft. from Point of Rupture

BY GEORGE W. TEFFEAU

Some indication of the enormous force exerted when a short circuit takes place close to a station was given recently when cable trouble occurred on the lines of a large Western company. In searching for the damage done a slight bulge was observed on the joint sleeve where the cable joined a submarine cable. The joint was opened and it appeared that the conductors had been crowded forward into the joint 2 in. (5.1 cm.).

On testing the damaged submarine cable from the street end it was found that the conductors showed all three legs short-circuited and grounded, while a test from the station end showed the three conductors short-circuited but free from ground, indicating that the cable had burned apart. Resistance tests indicated that the failure had taken place three-quarters of the way between the station and the street end. The cable was dug up at this point, the break discovered and the cable found to be damaged for a distance of about 4 ft. (1.2

m.), with no damage to adjacent cables. At the point of failure the lead sheath and steel jacket were badly ruptured, while on the station end the copper conductors with their paper insulation had been forced out of the lead jacket for a distance of 2 ft. (0.6 m.). The mighty force which caused the rupture was great enough to push the cable in its jacket of steel forward, causing the bulging in the sleeve referred to before. The distance between the failure and the sleeve was 150 ft. (45.7 m.).

TEST POINTS IN SERIES

CIRCUITS SAVE TIME

Installation of Test Points Required Modification of Trouble-Hunting Methods—Details of Methods and Instructions Given

Suitable test points in series circuits are time savers in trouble hunting. One central station which recently changed from inclosed carbon arcs to Mazda C units modified its overhead construction at the same time to minimize line trouble. The first improvement was the installation of absolute cut-outs at the lamps. This not only made patrolling and renewals safer but also permitted the service wires to each lamp to be pulled up tight permanently, since these wires no longer swung down when the lamp was lowered. As it was no longer necessary to provide for clearances with cross leads in lowering the service wires, vertical runs on poles were obviated and construction on poles was much simplified. Further safety was secured by the use of duplex feeds.

However, the new installation required a modification of trouble-hunting methods previously in force. Patrolmen looking for grounds or opens had made a practice of lowering an arc into the street, disconnecting a terminal and ringing out in the usual way to ground. The new absolute cut-outs precluded this method, and even where cut-outs were not installed it was impossible to trace back through the duplex feed. It was therefore decided to install test switches at convenient points. These consist of ordinary knife-type "disconnects" suitably chosen for outdoor service at the maximum voltage of the constant-current circuit. Shorter circuits are divided into five parts by four switches, longer into seven or more sections. Switches are, where possible, mounted on poles where both sides of the circuit are available, since this aids in trouble location. A ground pipe is driven at the base of the switch pole and a ground wire is run up the pole to a point near the switch and terminated in a connector convenient for testing. Instructions to trouble men using sectionalizing switches are as follows:

Ground.—Have substation operators clear circuit terminals. Open sectionalizing switch and ring out each side to ground connection with a magneto. Grounded section rings. If there are two switches on test pole, open both, thus cutting circuit into three sections.

Open Circuit.—Have substation operator ground circuit terminals. Open sectionalizing switch and ring out each side to ground connection. Open section will not ring. If there are two switches on test pole, open both and ring terminals toward substation. If both ring, break is in loop beyond switches. Check this by attempting to ring across loop terminals.

Short.—Trace by observing dead lamps.

Cross.—Open sectionalizing switch or switches and test for hot section by grounding.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

RATES FOR THAWING

FROZEN WATER PIPES

Average Return per Service in Binghamton, N. Y.,
Is Approximately \$13—Eighty Jobs Are Under-
taken in One Cold Week

Owing to the extremely cold weather which has recently been experienced there have been a great many applications made to central stations and contractors for thawing out frozen water pipes. During the week of Jan. 5 to 12 there were eighty requests for this class of work in Binghamton, N. Y. The Binghamton Light, Heat & Power Company's methods of accomplishing these thaw-outs have been very successful, and the practice is a source of revenue. The minimum charge for the work is \$10 per service, to which is added \$1 for each mile that the customer is from the company's stockroom, \$1 for each 100 ft. (30.4 m.) that it is necessary to run service wires, and \$1 for 0.5 in. (1.27-cm.) increase in size of pipe over 1½ in. (3.81 cm.). The average return from thawing a pipe by the electrical method is approximately \$13.

HOW ONE CENTRAL STATION ENCOURAGES ECONOMY

Records of All Labor and Materials Are Kept on a
Series of Forms and the Success of Each
Foreman Is Checked

A scheme which encourages employees to economize time and material has been successfully developed by the Spokane (Wash.) Heat, Light & Power Company. The idea developed primarily in connection with construction work, but has been extended to include practically all operations where labor and materials are involved, even to firing boilers in the central heating plant.

The plan simply requires an advance estimate of the cost of any work to be done, and this estimate, embodied in a written work order, is given to the foreman or that employee who has the particular work in hand. Thus the work order becomes a bogie to the foreman and he endeavors to keep within it if he can. If he exceeds the figure set, he has to secure authorization for more expenditure, and his explanation of this situation brings out either (1) unforeseen conditions, which aid the estimating department in future work, or (2) evidence of waste which the foreman must clear up to the satisfaction of his superior.

The advantages claimed for the scheme are that, in addition to the actual money saving, the psychological effect is excellent. Foremen dislike to exceed estimates and be obliged to explain why, and on the other hand they take pride in keeping the cost below the estimate. There are also the advantages of an accurate record of costs conveniently arranged, an allocation of all charges

for labor, a constant check on materials on hand, and a means of making up the payroll easily at any time by totaling work-order records.

There are several forms about which the system centers. These begin with a letter size form known as the A. F. E. ("authority for expenditure"—Fig. 1), on which are entered the name of customer and a brief statement of the work to be done, with a list of the more important items that will be required on the work. It also states the amount which the work is estimated to cost. Before this A. F. E. sheet receives a work-order number and the work is classified it must be signed by officials of the sales department and the accounting de-

FORM 100 210 5-10-17

SPOKANE HEAT, LIGHT & POWER COMPANY
AUTHORITY FOR EXPENDITURE
HEAT-LIGHT-POWER

DEPT. _____

TO GENERAL OFFICE:

AUTHORITY IS HEREBY REQUESTED FOR EXPENDITURE TO CONNECT THE FOLLOWING BUSINESS AND TO PROCEED WITH THE WORK DESCRIBED BELOW

CONTRACTED LOAD _____ ESTIMATED ADDITIONAL OBTAINABLE LOAD _____

" CONSUMER'S _____ " CONSUMER'S _____
" REVENUE \$ _____ PER YEAR " REVENUE \$ _____ PER YEAR

IN THE ESTIMATED AMOUNT OF _____ CHARGEABLE TO _____
IN THE ESTIMATED AMOUNT OF _____ CHARGEABLE TO CONSTRUCTION AND _____
IN THE ESTIMATED AMOUNT OF _____ CHARGEABLE TO MAINTENANCE OR OPERATION OR OTHER THAN TO CONSTRUCTION
TOTAL \$ _____

DESCRIPTION IN DETAIL MUST ALWAYS BE GIVEN ABOVE

DURATION OF WORK _____ 13. APPROVED _____ 14. EST. NO. _____
11. PROPOSED _____ 12. APPROVED _____ 15. GENERAL MGR. BY _____
16. APPROVED _____ 17. APPROVED _____ 18. APPROVED _____
19. APPROVED _____ 20. APPROVED _____ 21. APPROVED _____

100-1000-100 5-10-17

FIG. 1—FORM USED TO EMBODY "AUTHORITY FOR EXPENDITURE" IN CENTRAL STATION OPERATION

partments, as well as by the estimator and some one in a managerial position, either the general manager or the president. These A. F. E. sheets are made out in triplicate, one copy going to the superintendent, who usually prepares the estimates, one copy to the engineering department and one to the accounting department. By using different colors the three forms are readily kept separate.

Next in order comes the work order (Fig. 3), a square 4-in. (10.16-cm.) slip, also made in triplicate, or which the most important entry is simply the work-order number. Of course, it also carries date and résumé of the work to be done. The copy of the work-order sent to the superintendent is on white paper and is simply his notification. It is not preserved or required again in the records. The yellow and blue copies, however, going to the accounting department and the foreman respectively are carefully kept, and by them the progress of the work is checked on the ledger

sheet. This sheet (Fig. 4), which enters the scheme at this point, is a page from a loose-leaf file. It also bears the work-order number which identifies each individual job all through the records and carries the accounting department's detailed record of all materials and labor. It carries the figure which the work was estimated to cost, so that as the items of labor and material charges to the job increase their total can be compared with the estimate for the job. Thus the approach to the limit is readily seen and checked with the progress of the work.

As soon as the accounting department gets a yellow work-order slip, this is attached to a blank ledger sheet made out for the job, thus showing that it has been approved for construction. When the work is finished the blue work-order slip, duly signed by the foreman, is also attached. Thus a glance through the file shows what work is authorized and what is completed.

When a foreman requires materials he gets them from the warehouse by signing a small form called a warehouse slip (Fig. 5), on which the materials are itemized and which bears the work-order number. This

small time slip (Fig. 2) filled out for every workman every day by his foreman. It bears the signature of workman and foreman and indicates the number of hours each man put in, the work-order number to which his work is to be charged and the total charge on each work order. The accounting department enters these data on the ledger sheet bearing the corresponding work-order number. Thus the system simplifies to the point that practically all data of permanent value are carried by the ledger sheet and a convenient means of completely checking the estimate, cost or progress of any job is thus afforded.

What are known as standing work orders are assigned to such work as firing boilers and any other plant maintenance work, so that the daily reports can be simplified and yet keep the records standard for all kinds of work in which the company uses labor and material.

The system is a new feature, having been worked out in its present form only a few months ago, and minor changes have been made in it up to a recent date. However, company officials express great satisfaction in its

The image displays four forms used in a systematic accounting system for construction work.
1. **DAILY TIME SLIP (Fig. 2):** A form for recording daily work hours. It includes fields for 'Spokane Heat, Light and Power Co.', 'SPOKANE, WASH.', a date field (191...), and a section for 'WORKMAN NO.' with columns for 'RATE', 'HOURS', and 'AMOUNT'. It also has a 'FOREMAN' signature line.
2. **WORK ORDER (Fig. 3):** A form for authorizing work. It features the company name 'Spokane Heat, Light and Power Co.', a 'No.' field, and a 'FOREMAN' signature line.
3. **LEDGER SHEET (Fig. 4):** A large ledger with multiple columns for tracking costs. It includes sections for 'MATERIAL' and 'LABOR', each with sub-columns for 'DATE', 'W I', 'AMT.', 'No WKM N', 'No Hrs', and 'AMT.'. It also has a 'REMARKS' column.
4. **WAREHOUSE SLIP (Fig. 5):** A form for issuing materials. It includes the company name, a 'No.' field, a 'Dated' field, and a section for 'Issue and charge the following Supplies to W. O.' with columns for 'DESCRIPTION', '@', and 'AMOUNT'. It also has a 'FOREMAN' signature line.
The forms are shown overlapping, illustrating how they are used together in the accounting process.

FIGS. 2, 3, 4 AND 5—TIME SLIP, WORK ORDER, LEDGER SHEET AND WAREHOUSE SLIP USED BY PACIFIC COAST COMPANY TO SYSTEMATIZE OPERATION

is a notice of materials to be charged to a job and is sent to the accounting department and copied on the ledger sheet carrying the corresponding work-order number. Credit for materials returned from a job is later given on a similar slip and likewise listed on the ledger sheet.

One more form enters into the scheme. This is a

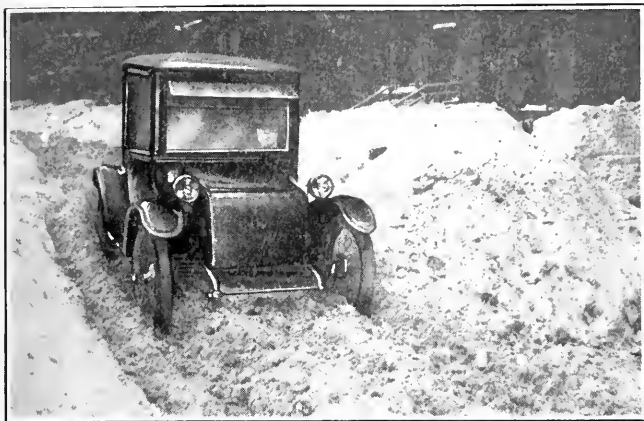
effectiveness and point to notable reduction in construction costs since its adoption.

The system described in the preceding paragraphs has been worked out by Ludwig Kemper, president of the Spokane Heat, Light & Power Company, in conjunction with H. W. John, who is secretary-treasurer of the company.

ELECTRIC VEHICLES MAKE RECORDS IN SNOW DRIFTS

Blizzards and Coalless Days in Chicago Fail to Tie Up Storage-Battery-Driven Passenger and Commercial Cars

Owners of electric vehicles in Chicago are enthusiastic over the "cold-weather" results that their cars have given this winter. Commercial car users have had considerable faith in the snow-fighting ability of their electric trucks, but such an opportunity as the recent



AN INSTANCE OF PARTICULARLY HEAVY GOING THROUGH BLIZZARD-STRIKEN STREETS

blizzards afforded for the supreme trial of the trucks has not been given the owners before. The trucks and passenger cars came out of the tests successfully, and as a result have gained more staunch supporters.

The firm of Case & Martin, a pie company, has operated sixty-three trucks through two severe blizzards in which the snow has drifted to depths of from 3 ft. to 10 ft. (0.9 m. to 3 m.) all over the city. In spite of these severe conditions the trucks have made from 32 miles to 52 miles (51 km. to 83 km.) a day. The regular trips to Evanston, Oak Park, West Pullman and other suburbs were made daily. Marshall Field & Company stated as their experience that the electric trucks on short hauls in the city would conquer drifts that gasoline cars would not dare attack. When snow did clog around the battery box and stop a car the drivers had only to clear the snow away from the box, put a small shovelful of ashes under the wheels and go ahead. When some of the company's big gasoline trucks stuck in drifts on the south side of the city an electric was sent out to pull them out, and succeeded in the job. The company has maintained two deliveries a day in spite of the weather, except on the two days when there was no street traffic. The cars averaged 30 miles (48.2 km.) a day in the snow.

HOW SNOW PLOWS WERE HAULED

The Commonwealth Edison Company used one of its trucks in an ingenious manner to pull a snow plow. No truck could pull a plow through the drifts with a direct hitch. In fact, it was a feat for a truck to get through itself. This particular vehicle was fitted with a winch for pulling cable. In its snow-plowing operations it would plunge through the drifts for a few hundred feet, its drivers would dig down to a manhole and anchor the truck. Then the snow plow attached to the end of a hauling line would be pulled up to the truck by the

cable-pulling winch. This operation was repeated over the full length of street to be cleaned.

In the passenger-car field equally satisfactory service was given. Harry Salvat, president of the Fashion Automobile Stations, reported that his men were skeptical about sending out customers' cars. Mr. Salvat was not skeptical. Taking his own car, without even equipping it with chains, he went out the first morning after the heavy snowfall and drove 52 miles (83.7 km.) through the drifts. Since that incident all of the Milburn cars operating out of the Fashion garages have been continuously in service. But, what is more important, every employee of the Fashion stations is now enthusiastic about electric cars. On coalless days the Fashion company's battery-exchange plan proved its worth, permitting customers to get charged batteries at any time without violating the Garfield order.

GOOD RECORD AT DETROIT

The Anderson Electric Car Company also reported that its customers found no difficulty in negotiating the deep snows anywhere in the Middle West. A. C. Downing, who went to the Chicago Automobile Show after a trip from Detroit through Louisville, Ky., Evansville and Indianapolis, Ind., stated that the performance of electric cars in the snow has surprised even the Detroit company's agents. At Detroit the company after the first severe snowfall telephoned customers telling them to go ahead and use their cars and to call the factory for aid if they got into trouble. As the result of this the company had only four "pull-ins" in Detroit, as against seventy-eight "pull-ins" which a certain eight-cylinder gasoline car with an equal number of cars out had to its credit. At Evansville, Ind., the company's dealer enlarged its list of prospective customers by going into the residential districts on mornings when other means of transportation failed and inviting pedestrians to ride downtown.

From the owners of electric cars the statement is



ELECTRIC TRUCK PULLING SNOW PLOW TO CLEAR STREET FOR OTHER VEHICLES

heard in all quarters that the cars will pull through almost any depth of snow. This takes a little more energy than usual, but that is true of any car. The usual speed will not be attained, but with the condition of the streets as it is after a blizzard the electric will go as fast as it is safe to drive.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Iron Commutators.—FREDERICK MURGATROYD.—The fact that war conditions in Germany have necessitated a limitation of the use of copper and enforced the manufacture of iron commutators in certain classes of machines raises the whole question of the commercial possibility of iron for this use after the war. Presuming that an iron commutator will always be cheaper than one made of copper, then, provided there are no insuperable commutation or mechanical difficulties in operation, it can be safely assumed that the iron commutator as a commercial proposition has come to stay. The author points out that while British engineers will naturally watch developments in Germany, it would be wise for manufacturers in England to tackle seriously the question of iron commutators on their own account. The problem appears to be one for the brush engineer to solve. Sparkless commutation would be attained with much greater difficulty in view of the increased reactance voltage and the extra attention required to maintain a good polished commutator surface. With regard to the difference in friction coefficients and contact drops as a result of the change from copper to iron, it may be noted that German experience seems to show that there is practically no difference in the temperature rise of iron and copper commutators working under identical conditions. Whether this should be taken as a fact, or whether German engineers are merely making a virtue of necessity, is certainly doubtful. That iron commutators would require careful watching in operation is obvious, and in certain situations, such as in hygroscopic atmosphere, the formation of rust may forbid the adoption of iron. Trouble may occur with recessed mica owing to an accumulation of rust or of an oil-and-rust paste in the slots of the segments, but this is a detail which should not present any great obstacle.—*London Electrical Review*, Jan. 18, 1918.

Parallel Performance of Static Transformers.—Remarks made upon an article on this subject in the *Revue Générale de l'Electricité* for Sept. 29, 1917. It is entirely possible, the writer holds, to manufacture transformers that will operate in parallel with existing equipment if attention be paid to the following points: (1) Strength of the apparatus; (2) polarity; (3) short-circuiting voltage; (4) ratio of transformation with no load; (5) ratio of transformation with load; (6) resistances of primary and secondary windings; (7) ohmic fall of voltage or output and losses when operating at no load.—*Revue Générale de l'Electricité*, Jan. 5, 1918.

Lamps and Lighting

Calculations in the Use of Projectors.—WALDO C. COLE.—In the protection of industrial plants as well as in ornamental illumination the question of how many projectors to use at a given distance is one of the utmost

importance. A combination of theoretical calculations under ideal conditions corrected by practical factors produces very accurate results, according to the problems considered by the author. The curve presented for the determination of light intensity at given distances should prove of great value in actual use.—*Journal of Electricity*, Jan. 15, 1918.

Problems of Factory Lighting.—ROMAINE W. MYERS.—The speeding up of production processes by means of more adequate shop lighting is always a live subject with electrical men, and to-day it has come to be one of the important war services. The article in question is on the elements of successful illumination as applied to the shops of the Judson Manufacturing Company of Oakland, Cal. The author points out that the proper maintenance of a good lighting system after installation should be carefully considered. The deterioration of tungsten lamps and reflectors due to accumulations of dust on the lamp and reflector surfaces amount to as much as 40 per cent if not properly cleaned. In one installation it was found under test that 25 per cent of illumination was lost by the accumulation of dust on the lamp alone.—*Journal of Electricity*, Jan. 15, 1918.

Generation, Transmission and Distribution

Emergency Substitutes for Coal.—J. F. SPRINGER.—The author points out that when a shortage of coal occurs the factory that is equipped to utilize a substitute is not likely to suffer much delay, for the other kinds of fuel are certain to be available. He tells the characteristics of these substitutes for steam coal: Fuel oil, tar, natural gas, producer gas, charcoal, coke from refuse coal, powdered coal from refuse, and refuse coal.—*American Industries*, January, 1918.

Design of High-Voltage Insulators.—C. E. OAKES.—(Third installment.) The author takes up the effect of the application of high frequency to porcelain insulators. A summary of insulator requirements follows: (1) Sound vitrification, resulting in high-puncture strength and low porosity, obtained by better manufacturing methods. (2) The highest surface resistance that is compatible with other requirements. A high surface resistance should not be obtained at the expense of short air spaces between petticoats or flanges. A uniform distribution of electrostatic stress is as important as high-surface resistance. (3) A uniform distribution of stress obtained by a symmetrical arrangement of metallic surfaces. (4) Provision of large air spaces at the junction of petticoats in the pin types. (5) As far as possible the air and porcelain, being dielectrics of different constants, should not be placed in series. (6) Provision of the maximum thickness possible together with the requirements in (3). The voltage at which corona first appears can be raised appreciably by judicious designs in this direction. (7) The radius of curvature of the head of the porcelain cap

in the cap and pin type insulator should be as large as possible.—*Sibley Journal of Engineering*, January, 1918.

Traction

Electric Tractors in Municipal Service.—A description of various types of tractors adopted for municipal service by the city of Wiesbaden, Germany, on account of the scarcity of horses. The machines still need perfecting, especially as regards the extinction of the arcs. For light vehicles with small batteries forty elements (80 volts) are enough. Two motors rated at 5 hp. are satisfactory for most vehicles, four motors being desirable for the heaviest ones. These motors should withstand an overload of 50 per cent for long periods. Motors of high speed and double reduction are recommended.—*Revue Générale de l'Electricité*, Jan. 5, 1918 (abstracted from *Zeits. V. D. I.*, April 28, 1917).

Installations, Systems and Appliances

Calculation of Energy Absorbed by Starting Rheostats.—J. SAINT-GERMAIN.—In this article a graphical method is described by which, in every case, one may calculate the energy absorbed in rheostats used to start direct-current and induction motors in terms of acceleration and resistance and of the duration of the starting period. Algebraic formulas are given which permit the same result to be obtained more rapidly.—*Revue Générale de l'Electricité*, Jan. 5, 1918.

Electrical Mining Machines.—F. ROBIN.—An extended technical article on electricity as employed in the extraction of coal and iron. The author seeks to reduce to the minimum the I^2R losses in the armature of the motor and the generator used for this service by properly proportioning the periods of acceleration of operation and of slowing down.—*Revue Générale de l'Electricité*, Jan. 5, 1918.

Electric Cargo Winches.—E. F. WHITNEY.—The use of electricity on shipboard is increasing rapidly in both the variety and the extent of its applications. Most ships to-day are electrically lighted, have their fans, pumps, etc., electrically driven, and are equipped with a radio outfit. In addition to these applications, the galleys of many ships are electrically equipped, and a considerable number of ships are electrically propelled. A comparatively recent but equally successful development is the application of electric drive to cargo winches. The magnitude and characteristics of winch work are defined, the electrical equipment is described, and the superiority of its operation over steam-winch operation is discussed in terms of reliability, speed control, cost and efficiency.—*General Electric Review*, February, 1918.

Wires, Wiring and Conduits

Cable Fault Localization in Practice.—D. M. W. HUTCHISON.—The writer gives some actual results from his own experience in the locating of faults in underground cables. Loop tests, with the dial resistance boxes supplied in so-called "mains testing sets," and "search-coil tests," were found to be very inaccurate and were abandoned. The writer points out that for the difference of potential tests a 4-volt storage battery, a bank of lamps, a reversing switch, an arc-lamp resistance, and a galvanometer like that used in loop tests were all the apparatus required. On the occurrence of a fault the procedure was as follows: All service fuses were removed, both ends cleared, and a megger test and

lamp tests were made. The faults were then classified as follows: (1) All cores shorted and earthed; (2) all cores shorted but not earthed; (3) two cores shorted, third good, no earth; (4) two cores shorted and earthed, third good; (5) one core earthed, others good, and (6) total disconnection. The author explains in four examples the calculations necessary. Example 1 is a loop test, class 3 fault, three-core V.B. cable-megger tests. Example 2 is a loop test, class 3 fault. This has been given because it is a good example of how the megger tests may be misleading if not supplemented by lamp tests. Example 3 is a difference of potential test, method 1, class 4 fault. Example 4 is a difference of potential test, method 2. This is an example of the method which was used for faults of classes 1 and 2.—*London Electrical Review*, Jan. 18, 1918.

Electrophysics and Magnetism

Graphical Representation of Resistances and Reactances in Multiple.—H. C. STANLEY.—Frequently a number of resistances or reactances are connected in multiple and it is desired to know their total or combined value of resistance or reactance. The calculation necessary to obtain this combined value is usually simple in principle but at times laborious in practice. For approximate results and as a check on the more accurate calculations a graphical solution is given in this article for some representative cases.—*General Electric Review*, February, 1918.

Units, Measurements and Instruments

Electromagnetic-Clutch Indicating Device.—V. KARAPETOFF.—This is a device for predicting the performance of the Entz electromagnetic clutch and transmission used on motor cars propelled by internal-combustion engines. This device is one of the several kinematic models, partly built and partly designed by the author, for the general purpose of quantitatively imitating the performance of various types of direct-current and alternating-current machinery. He hopes to bring them to a degree of convenience and perfection such as to do away with tedious analytical computations, or complicated graphical diagrams used in the design and predetermination of performance of electrical machinery. It is pointed out that the designer will simply have to select provisionally the constants of his proposed machine and to set certain types of a kinematic device to correspond to these constants. Then by moving certain levers he can obtain and read to scale various performance characteristics of the proposed machine, such as speed, power factor, output, etc. If the performance is not satisfactory, he can easily change the setting of constants and after a few trials get the desired characteristics.—*Sibley Journal of Engineering*, January, 1918.

Telegraphy, Telephony and Signals

Electrical Signaling and Control on Railways.—C. M. JACOBS.—A comparison of British and American signaling with details of control.—*London Electrical Review*, Jan. 18, 1918.

Reis Telephone and Nature of Sound.—ARTHUR BESSEY SMITH.—This is a discussion of the "break-and-make" theory of the Reis telephone in regard to its relation to nature of sound. The structure of the Reis telephone, its intended action and its occasional action are discussed. It is pointed out that this is not a practical instrument.—*Telephony*, Jan. 26, 1918.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

FEATURES OF BRITISH PRACTICE IN RESEARCH

Taken from Report of British Committee for Scientific and Industrial Research as Suggestions for Formulating American Practice

Some points are brought out in the report of the British Privy Council committee for scientific and industrial research which might be utilized in organizing research in this country. The report covers features of organization, administration and policies of the committee.

Funds Available.—The Imperial Trust for the Encouragement of Scientific and Industrial Research holds £1,000,000 that Parliament has voted for research purposes. Manufacturers' associations, the London County Council and some governmental departments have also contributed funds for specific purposes.

Personal Grants to Research Workers.—Thirty-six awards in the nature of maintenance grants were made to individuals, of which twenty-four went to students being trained in the methods of research, ten to independent research workers and two to research assistants. Grants will also be made for apparatus and materials.

Industrial Versus Pure Science Research.—During the past year the committee has devoted its chief effort to the organization of industrial research rather than to the prosecution of work in pure science; first, because it felt the paramount importance of arousing the interest of manufacturers and, second, because of the influence of the war. It emphasizes the hope that the absence of references to pure science should not be taken as indicating a lack of appreciation of its importance.

Trade Research Associations.—Many trade associations have lately come into existence, some of which include research among their objects. The committee has helped in their organization and has assisted and co-operated in their research activities.

Research in the Universities.—Hearty co-operation of the principal universities, technical schools and trade schools in England has been secured, and their resources have been co-ordinated for the important problems on hand. A closer connection is being established between these institutions and the industries which rely upon results of research in the manufacture of their products.

Technical Societies.—The committee is co-operating with the electrical, mechanical and mining engineers' institutions and other professional societies, in some cases subsidizing the researches originated by the institutions and extending their scope.

Information Collected and Published.—In co-operation with technical societies and institutions of learning

the committee has collected and published available information and is continuing this useful work, which will greatly simplify that of future investigators. It is also preparing memoranda on various fields for research, with an analysis of the problems involved and the proposed program for research.

Assistance to Individual Manufacturers.—An arrangement has been made with the Royal Society by which it will assist the committee in selecting the institution or research workers best fitted for a particular investigation. If the investigation progresses satisfactorily, the manufacturer is invited to contribute part or all of the expense in exchange for the exclusive use of the results over a given period. Another proposed way is to attach an investigator to the works laboratory and share expense with the manufacturer.

Summary of Investigations, Available Apparatus and Research Suggestions

INVESTIGATIONS UNDER WAY OR COMPLETED (RESEARCH WORK REPORTED SINCE JAN. 19)*

GASES, COMBUSTIBLE, IN THE AIR.

Development of an electrical method of measuring the amount of combustible gases in the air.—*E. R. Weaver and E. Weible, Bureau of Standards, Washington.*

HEAT TRANSMISSION.

Rate of heat transmission from the surfaces of hot bodies to fluids passing over them. The primary object is a reduction in the weight of gasoline engines for aircraft by a more efficient design of the cooling surfaces, but the data obtained will also have other important industrial applications.—*National Physical Laboratory, England.*

RESONANCE IN ALTERNATING-CURRENT CIRCUIT.

A suitable combination of series and parallel circuits makes it possible to secure two maximum values of the current, while the voltage is kept constant and the frequency is being varied. A considerable control can be exerted on the nature of the variation of the total impedance and power factor with change of frequency. If the total impedance is plotted as a vector in a polar diagram, the hodograph can be made to assume the form of a strophoid with the loop embracing the current axis. In such a case the current hodograph has the form of a limaçon and the power factor passes through unity at three different frequencies and can be made to hover near unity over a large range. The considerations involved are of interest in connection with non-harmonic currents in complex circuits.—*H. K. Dodge, University of Iowa.*

SYNCHRONOUS MACHINES, SHORT CIRCUIT.

(1) Flux distribution in alternators with salient and non-salient poles, under sustained short-circuit conditions. (2) Calculation of phenomena accompanying sudden short circuits in such alternators. (3) Experimental and theoretical study of electro-mechanical phenomena occurring under sudden short-circuit conditions.—*N. S. Diamant, Rice Institute.*

APPARATUS AVAILABLE FOR RESEARCH

SALT LAKE CITY, UTAH.

An artificial transmission line is available which on a small scale duplicates in considerable detail the actual transmission system of the old Telluride Power Company. The artificial line consists of inductance coils, plate condensers and wires of high resistivity, which represent to a certain scale the inductance (self and mutual), the capacity and the resistance of the actual line. The transformers, the load and the generators are also imitated, so that the performance of the actual line may be studied under many normal or abnormal conditions. An oscillograph and other measuring instruments are available. Some tests have been made on this artificial line to elucidate the action of reverse-power relays under various short-circuit conditions. (See A. I. E. E. *Proceedings*, Vol. 36 (1917), p. 713, where a detailed description of the line will also be found.)—*M. Cheever, Chief Engineer Utah Power & Light Company.*

SUGGESTIONS FOR RESEARCH

INSULATION, THERMAL CONDUCTIVITY.

Investigation of the thermal coefficient of the insulating medium in which copper coils are embedded in electrical machinery.—*B. A. Behrend, Boston, Mass.*

PHASE BALANCING.

Investigation, theoretically and experimentally, of the extent of balancing possible with polyphase induction motor connected across polyphase circuit and also the motor constants that are conducive to most accurate balancing. Would a synchronous motor accomplish the same purpose with the additional advantage of phase correction?—*Editorial suggestion.*

VENTILATION OF ELECTRICAL MACHINERY.

The flow of air and its convective capacity at different velocities and at different temperatures; the effect of eddy currents and vortex motion in such air currents on their convective capacity; obstacles to the motion of air and the creation of eddies at edges due to discontinuous motion.—*B. A. Behrend, Boston.*

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

INTERCONNECTION SAVES POWER AT SCHENECTADY

Co-operation of Five Utility Companies and One
Manufacturing Company Relieves Critical Power
Situation on Short Notice

Under normal conditions the Schenectady Illuminating Company and the Schenectady Railway Company receive all of their power from the General Electric Company, which generates part by steam and receives part from the Schenectady Power Company. The latter company has a hydraulic station at Schaghticoke. Owing to the abnormal winter the water supply at the Schaghticoke plant is practically frozen up. After carrying for some weeks this burden on the steam plant of the General Electric Company, combined with the enormous load brought on by the large amount of government work which has been done in Schenectady, it became imperative at once to relieve the steam plant of the General Electric Company of from 2000 kw. to 4000 kw. during the day.

In the emergency General Manager Henry W. Peck of the Schenectady Illuminating Company immediately got in touch with Carl H. Graf, Municipal Gas Company of Albany; W. A. Buttrick, Adirondack Electric Power Corporation; E. B. Doen, Schenectady Power Company, and A. L. Rohrer, General Electric Company. Within twenty-eight hours of the time that Mr. Peck was notified of the urgent need he was receiving, with the most hearty co-operation of the officials mentioned, the necessary supply in Schenectady.

This supply was transmitted to Schenectady indirectly. The Adirondack Electric Power Corporation, with hydraulic plants at Spier Falls and Mechanicville, normally supplies electric energy to Albany, as well as to Troy, Glens Falls and other places. The shortage of water had already required the supplementary operation of the 15,000-kw. steam-turbine plant of the Municipal Gas Company. Upon receipt of the request from Schenectady this station assumed more of the Albany load to the approximate amount required by Schenectady, thus relieving the Adirondack company of that load.

The Adirondack company, in turn, having an open-air switching connection with the high-tension line of the Schenectady Power Company near Mechanicville, made connections and supplied the needed power from its line over one of the lines of the Schenectady Power Company to a section of the busbars in the power house of the General Electric Company, whence it was conveyed on the lines of the Schenectady Illuminating Company and Schenectady Railway Company to their substation.

This co-operation of five utility companies and one manufacturing company is noteworthy, and undoubtedly its successful accomplishment is an indication of the advantages that accrue through a consolidated power system.

SIDELIGHTS ON THE EVENTS AT WASHINGTON

Criticism from Congress, Which Demands Action
and Does Not Act Itself—The Bills
Which Are Not Passed

(By Our Washington Correspondent)

This is the day of criticism. It has been inspired in Congress—to what extent at the behest of the people back home remains to be seen. On every side one hears that Congress is demanding action, reorganization and co-ordination. What is Congress doing to keep the war machine moving, besides blowing the hot breath of criticism? In two precious months, while American lifeblood is taken in the trenches and on the high seas, while business is straining behind the lines, Congress has not placed on the legislative books one single big constructive act.

* * *

Money is needed. Authorization is needed to spend money, to plan, prepare, act, co-ordinate. As this is written the House of Representatives has passed but three of the big money-supply bills—post office, Indian and agricultural—and those, in the large sense, are not war money bills. By the time this is printed the legislative, executive and judicial appropriation bills may be passed by the House. The Senate has not passed any of the appropriation bills. The only measures of consequence passed by the Senate so far are the coal and oil lands leasing bill and the Shields water-power bill. These have not been passed by the House. In other words, literally nothing has been done. Industries need the apparently unobtainable passage of the conference report on the Webb bill, which would permit combination for export trade, as well as a real law permitting water-power development.

* * *

Secretary Baker is to go to France for an indefinite period, to take his seat on the Supreme War Council. In his place the President must find another man who, under the President's proposed legislation, will fill the post which Senators have been trying to create—Ministry of Munitions, or its equivalent. Is not this the place for Mr. Stettinius, and is it not time to bring forward business men of his type?

* * *

There has been too much let-up in many fields already. Highways must be maintained and developed as a war measure. With the failure of steam transportation, truck lines are coming more into use. There must be money for more power plants. It is not at all certain that the power-from-coal question will be solved by good weather and restoration of steam-traffic facilities. More power plants, or expansion of present power plants, is indicated. Capital must be obtained and a properly founded and administered "War Finance Corporation" could be of the greatest service.

CURTAILMENT OF LIGHTING
MEANS SMALL COAL SAVING

Preston S. Millar, in Paper Before Illuminating Engineering Society, Says Other Methods Will Save More Fuel

In a paper on "Lighting Curtailment," presented before a special meeting of the Illuminating Engineering Society, New York, on Feb. 14 and at a meeting of the Philadelphia Section on Feb. 15, Preston S. Millar, gen-

eral manager Electrical Testing Laboratories, New York, said that the amount of coal used in the production of electric light is less than 2 per cent of the total coal output of the country. Curtailment, therefore, can accomplish relatively little in saving coal.

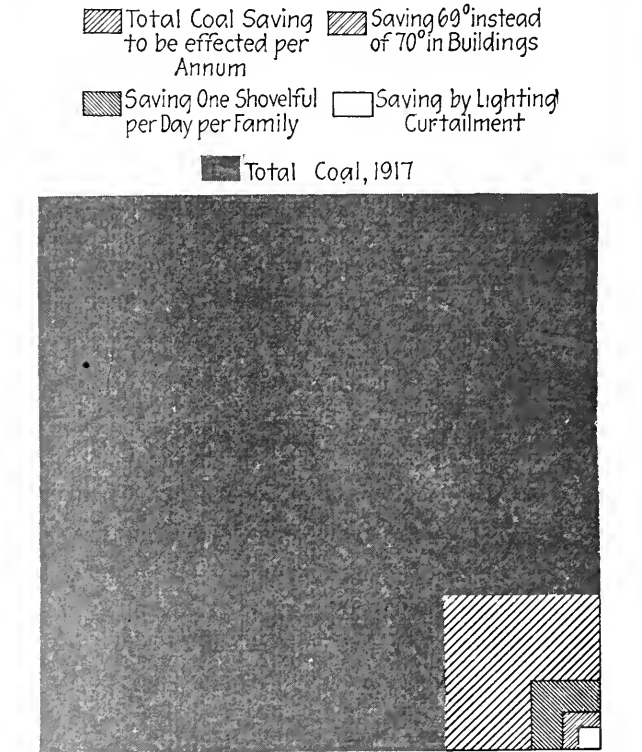
Mr. Millar made prominent in the discussion his belief that in general the standards of illumination intensity before the war were too low. In view of the war and fuel shortage, he believes that lighting ought to be reduced in some classes of service and increased in others. Any practicable curtailment is about 7 per cent net for all classes of lighting service, or a trifle more than one-tenth of 1 per cent. Declaring that it is practicable to effect much larger fuel savings by other methods with less disadvantage to the public, Mr. Millar called attention to a number of points, including the elimination of small power plants, with their "inherently lower efficiency," estimated to be "responsible for the use of one-third more coal than necessary."

RECOMMENDED ADJUSTMENT OF ILLUMINATION INTENSITIES IN VIEW OF THE WAR AND THE FUEL SHORTAGE

Class of Lighting Service	Per Cent Distribution	Desirable Adjustments in Intensity, Per Cent	
		Per Cent	Per Cent
Street	15	—	5
Public building	3	—	10
Industrial	18	+	50
Protective	1	+	200
Commercial	20	—	20
Residence	26	—	20
Recreational	7	—	40
Advertising	5	—	80
Miscellaneous	5	—	10
Total	100	Net	7

shortage, the equivalent of which must be saved, is 50,000,000 tons; the estimated saving in coal during 1914 if all private plant power could have been replaced by central station power, 13,000,000 tons, and the estimated saving in coal by maintaining temperature of building interiors at 67 deg. Fahr. instead of 70 deg. Fahr. comes to 10,000,000 tons.

It is evident therefore that the total consumption of coal in the production of all electric light is relatively



not a very large item in the coal consumption of the country. If the entire electric lighting of the country were cut off, the saving in coal would be only 24 per cent of the required saving and no more than would be accomplished by a reduction of readily practicable extent in the heating of buildings.

The author has prepared the table in this column, which roughly estimates how artificial light is dis-

Cost of artificial illumination, one-half of 1 to 2 per cent of the total expenditure of the people, compares with other expenditures as follows: Illumination, \$500,000,000; liquors, \$665,000,000; tobacco, \$490,000,000.

The significant figures to have in mind when discussing this subject, said Mr. Millar, are as follows, all being rough approximations: Total coal output of the country, 640,000,000 tons; total employed in production of electric light and power (traction excluded), 36,000,-

000 tons; total employed for production of light by electricity, 12,000,000 tons.

According to these estimates, about 2 per cent of the coal consumption of the country goes into electric light. Some comparisons may assist to provide a proper perspective for the consideration of these data: The coal

tributed among the several classes of service adopted as a classification for this purpose.

Beside these figures showing approximate distribution of lighting among the several classes of service are figures representing the consensus of opinion of ten qualified observers as to the extent to which lighting in each class of service ought to be curtailed or increased in the present emergency. The values are thought to be reasonably indicative of expert opinion on this subject at the present time.

One may ask, says Mr. Millar, why this net saving should be adopted as the conclusion from this survey instead of 17½ per cent, which is the gross saving from which no deduction is made to cover the desirable increases. The author says that he would consider himself unworthy to discuss this important subject before the Illuminating Engineering Society if he failed to insist that except in the presence of an actual coal shortage which could not be compensated by saving elsewhere, the increases in intensities which are recommended for certain classes of service are more important to the public welfare than is the coal saving which it is desirable to effect in other classes of lighting service. The net saving therefore is the value which should enter into our calculations.

In his conclusions Mr. Millar says:

After careful consideration of this subject, including study of the statistics presented in this paper, the author has reached the personal conclusion that to curtail lighting generally would result in damaging the eyesight and impairing the efficiency of our people. He believes that the country cannot afford to incur such a risk for the sake of the small coal saving which may result—a saving which may be accomplished otherwise with much less disadvantage.

UTILITIES MUST CONSERVE THEIR FINANCIAL STRENGTH

**California Railroad Commission, in Case Affecting
Pacific Gas & Electric Company, Favors
Expenditures to Win the War**

The California Railroad Commission, in a decision permitting the Pacific Gas & Electric Company to use \$771,348, proceeds of the sale of bonds for capital expenditures in the recent past, passes for the first time on the vital question of public utility financing in the war emergency.

A proposed issue of \$3,000,000 bonds is considered unwise now on account of the money market, and the company has so stated. The commission says:

It is a matter of common knowledge that many public utilities as well as other enterprises will have considerable difficulty in financing new construction during the war. The general welfare requires that our electric utilities, which play so vital a part in the nation's efficiency, shall in so far as possible conserve their financial strength so that they may continue to be able to secure such funds as are imperatively needed to increase their production and maintain their efficiency.

Expenditures which otherwise might be considered desirable, even though not immediately necessary, should be deferred in favor of expenditures most urgently necessary at the moment to increase the efficiency of these utilities to help win the war. Furthermore, while the cost of materials and money is abnormally high, it is in the interest of both the utility and its patrons that all work not clearly now necessary be deferred. This situation requires an analysis of proposed large expenditures from a different point of view from what was the case before the war.

PROBLEMS OF UTILITIES PRESENTED AT WASHINGTON

**Prominent Executives of Companies Appear Before
Capital Issues Advisory Committee of Federal
Reserve Board and Senate Committee**

Representatives of the public utility companies have had two opportunities in Washington within the last few days to present their problems to government legislators and officials and are much encouraged with the reception of their views.

On Feb. 8 these problems were presented before the capital issues advisory committee of the Federal Reserve Board, with Governor Delano and Governor Hamlin present and Allen B. Forbes, chairman, presiding. On Feb. 12 representatives of the utility companies appeared before the Senate committee on finance to discuss the proposed "War Finance Corporation" bill.

The argument before the capital issues advisory committee was presented by P. H. Gadsden, member of the war board of the American Electric Railway Association, at the request of John Stanley, president of the association. Mr. Forbes, chairman of the advisory committee, had requested heads of large utility organizations to be present, and in addition to Mr. Gadsden among those present were the following:

John W. Lieb, New York Edison Company, president National Electric Light Association; Alfred Forestall, president American Gas Institute; E. K. Hall, Electric Bond & Share Company, New York; H. H. Crowell, Commonwealth Power, Railway & Light Company, New York; C. M. Clark of E. W. Clark & Company, Philadelphia, and H. G. Bradlee, Stone & Webster, Boston.

At the hearing before the Senate finance committee statements were made by S. R. Bertron of Bertron, Griscom & Company, New York; Mr. Crowell and Mr. Gadsden. The argument, which was substantially the same at both hearings, was in effect as follows:

First—Public utility rates must be increased. Labor and materials are eating up equities in those properties. The fundamental remedy is to restore values by increase in rates.

Second—During the war the companies should be relieved of franchise requirements, such as paving streets and putting wires underground, regarded as unnecessary capital investment at this time.

Third—Companies are being called upon to make large expenditures for extensions and betterments to meet the war program. It is estimated that these expenditures for the year will be between \$100,000,000 and \$200,000,000 required for government purposes. Some way must be provided for the government to furnish this money.

Fourth—The public utilities—railway, gas and electric companies—have maturing obligations in 1918 of about \$225,000,000. Under present conditions, where the government has monopolized the whole money market, it is impossible to finance these maturities through the banks, and if the companies are to continue to perform their essential part in furnishing facilities for speeding up industry in this country the government must furnish utilities some relief in taking care of the maturing obligations.

It is understood that the Senate committee on finance was evidently impressed seriously by the situation which confronts the companies. On the question of rates members of the committee frankly asked the gentlemen before them if it is not possible for Congress to grant some relief. It is felt that the committee practically unanimously saw the force of the rate question, as well as sympathized with the suggestion

that the companies be relieved from non-essential expenditures; also there was apparently no question that the committee realizes that much new capital will be required by the companies in order to meet government war needs.

The committee by its questions indicated an apparent unwillingness to grant such unlimited powers as those conferred in Section D of the proposed "War Finance Corporation" bill.

Mr. Gadsden took the position before the committee that public utility securities are a class which must be taken care of and suggested to the committee that the words "public utilities" be inserted in this section of the bill to leave no doubt that it was the intention to provide for them.

A hearing at which representatives of public utilities will be present will be held soon on this bill before the House committee on ways and means.

RELATION OF THE WAR

TO JOBBERS' BUSINESS

Atlantic Division of Electrical Supply Jobbers' Association, Meeting at Philadelphia, Discusses Timely Problems—E. C. Graham Chairman

War in its economic relation to business was the keynote of the Philadelphia meeting of the Atlantic division of the Electrical Supply Jobbers' Association held on Wednesday of the present week at the Bellevue-Stratford Hotel.

The session opened in the morning with the presentation by M. A. Curran, general credit manager Western Electric Company, of a plan for the practical application of trade acceptances in a comprehensive manner. Mr. Curran emphasized the fact that there must be an intelligent introduction of trade acceptances if they are to prove to be of value in the long run.

Touching briefly on the opportunities for profitably increasing the business of electrical jobbers, J. M. Wakeman, general manager Society for Electrical Development dwelt largely on the growing strength of the electrical appliance market. He expressed the thought that wider distribution of electric ranges would leave its impression on the nation's domestic coal supply through more economical and efficient utilization of fuel.

Considerable enthusiasm arose over the paper entitled "What the War Means to American Business," read by G. E. MacIlwain, specialist of the Babson statistical organization. Mr. MacIlwain pointed to the industrial leveling of Europe and what it means to American business. Through the industrial-awakening of Europe the United States will face after the war a more efficient competition. The author showed a four-period condition: First, good business during the war, limited by priorities and curtailment of great private profits; second, a temporary lull to accompany real peace proceedings; third, a short, sharp peace boom at the immediate end of the war, and, fourth, a very marked decline and depression to follow. In closing, the speaker drew attention to the changing relation of labor to capital, predicting that the solution of the labor problem will come about through participation with capital in profits.

C. E. Patterson, comptroller, and J. F. Zoller, tax

attorney for the General Electric Company, went somewhat into detail on the accounting and legal aspects generally of the preparation of returns under the war tax law. The members of the division were urged to secure copies of regulation No. 41 relative to the war excess profits tax issued by the Treasury Department and corporation tax form No. 1031. Excess profits tax form No. 1103 is not yet ready for distribution.

At the close of the session officers for the ensuing year were elected. E. C. Graham, Washington, was elected chairman.

WORKLESS MONDAY ORDER

SUSPENDED BY GARFIELD

State Fuel Administrators, However, Still Have Authority to Enforce Restrictions and Reservations—Embargoes Hold

Dr. Garfield announced on Feb. 13 that the order for heatless and workless Mondays until March 25 had been suspended. However, state fuel administrators will retain the full authority heretofore conferred upon them to establish and enforce such restrictions and regulations as may be made necessary by coal conditions in their respective communities.

The Fuel Administrator said: "Conditions to-day warrant the conclusion that with the continued enforcement of the preferential delivery of coal under Section 1 of the order of Jan. 17, and continued transportation improvement, further restrictions on the consumption of fuel will not be necessary."

Director General of Railroads McAdoo concurred in the suspension of the order, but warned that it should not be assumed that there is no further need for economy in coal.

MOBILIZATION PLAN FOR THE

EDUCATIONAL INSTITUTIONS

Committee on Education and Special Training Is Created in the War Department with Advisory Civilian Committee

With a view to mobilizing educational institutions and their facilities for special training there has been created in the War Department a committee on education and special training. Associated with this committee will be five civilian educators, known as an advisory board of educators.

The committee will be composed of Col. Hugh S. Johnson, deputy provost marshal general; Lieut. Col. Robert I. Rees of the General Staff, and Major Greenville Clark of the Adjutant General's department.

The five advisory members of the committee, whose selection has been approved by Secretary of War Baker, are: Dr. Charles R. Mann of the Carnegie Foundation for the Advancement of Teaching and the Massachusetts Institute of Technology; Dr. James R. Angell of Chicago, dean of the faculties of the University of Chicago; J. W. Dietz of Chicago, director of education Western Electric Company, president National Association of Corporation Schools; James P. Munroe of Boston, member of the Federal Board for Vocational Education (which appointment will include the interests of the trade schools and schools of secondary grade), and Dr. Samuel P. Capen of Washington, specialist in higher education.

PORTABLE ELECTRIC TOOL MANUFACTURERS ORGANIZE

**Majority of Firms in Field Are Charter Members—
Standardization Planned—Walter Friedlander
of Cincinnati Elected President**

Manufacturers of portable electric tools organized the "Portable Electric Tool Association" at Indianapolis on Jan. 11 and 12. Already the new organization has fourteen members, leaving as prospective members only about six more important firms, most of which have expressed interest and will probably become members before the next meeting.

The constitution and by-laws of the association follow closely those of the Electric Power Club. There is no conflict between aims and purposes of the new association and the Electric Power Club, it is said, as the Portable Electric Tool Association will confine itself to tool problems. Briefly stated, the aims and purposes of the association are: First, discussion of subjects of interest and value to members; second, advancement and improvement of the portable-tool industry; third, collection and dissemination of statistics, and, fourth, standardization of design, manufacture and application of portable electric tools.

In the past this branch of the tool business has suffered greatly from those ills likely to be found in any young and actively competitive industry. When business was not flourishing, some manufacturers would get out a freak portable electric tool and by clever salesmanship would probably sell a few hundred. Frequent repetition of this process by many manufacturers has created a condition wherein there are many times the number of styles and sizes of portable electric tools needed to do any kind of work. Government departments sometimes contributed to this condition by requiring special tools built on bureau specifications, when a standard tool would have done as well.

The association, it is expected, will correct this, its standardization committee working with the government to establish proper and adequate standards. Portable electric drills, which will probably come first in the standardization program, will, it is likely, be reduced to ten standard sizes between 3/16 in. and 2 in. (0.47 cm. and 5.08 cm.). The motors required by the machines will, of course, be of sizes less than 2 hp. or possibly 3 hp.

Other evils which the association may attempt to correct later are the much-overworked free trial and free-repair "bugaboos." The goods of each association member are guaranteed, so it is argued that ten days' free trial with frequent extensions should not be necessary. Likewise it is believed that a just method can be found for dealing with the unfair customer who purchases a few tools from each manufacturer, then systematically reviles each set of tools to its manufacturer for the sole purpose of securing concessions in the way of free-repair parts.

The officers of the Portable Electric Tool Association are: President, Walter Friedlander, Hisey-Wolf Machine Company, Cincinnati; vice-president, F. Schneider, Van Dorn Electric Tool Company, Cleveland; treasurer, James Clark, Jr., James Clark, Jr., Electric Company, Louisville; secretary, R. S. Cooper, Independent Pneumatic Tool Company, 1307 South Michigan Avenue, Chicago.

LOCAL COMMITTEES ON CAPITAL ISSUES

**Committee of the Federal Reserve Board Announces
Formation of Local Bodies to Assist in
Passing on Applications**

The capital issues committee of the Federal Reserve Board announces the formation of twelve local committees organized for the purpose of assisting the central committee in passing upon applications originating in their respective districts.

In each Federal Reserve district there will be a sub-committee on capital issues, with headquarters at the Federal Reserve bank of the district. The sub-committee will consist of the Federal Reserve agent as chairman, the governor of the Federal Reserve bank as vice-chairman, and three other members chosen because of special qualifications for the work.

Bankers and others having broad experience in the financing of municipal, manufacturing or public utilities securities have been invited to become affiliated with the sub-committee as an auxiliary body, one or more members of which from time to time, as their advice and experience may be useful or helpful, will be asked to join with the sub-committee in investigating and passing upon specific applications. No committee member will give advice or report upon any application in which he has a direct or indirect personal interest. Members of these committees have undertaken this duty as a patriotic service to the country.

All applications for the approval of security issues are expected to be made direct to the capital issues committee, Federal Reserve Board, Washington, which will refer them to the particular district concerned.

Among the members of the local permanent or the auxiliary committees are a number familiar with utility problems.

NEW YORK CITY JOBBERS ELECT OFFICERS FOR YEAR

**New Constitution and Bylaws Also Adopted by the
Electric Club—J. E. McClernon the
President**

At the second annual meeting of the New York Electric Club, held on Feb. 6, officers were elected and plans discussed for the coming year's work. The membership comprises practically all electric jobbers of New York City. A new constitution and bylaws were adopted. The purpose of the club is stated as follows:

The object of the club shall be the advancement of the social, professional and commercial interests of the members, the elevation of the standard of electrical work, a furtherance of the use of electricity and the general development of the electrical industry.

A paid secretary-treasurer, W. J. Krieger, Marbridge Building, New York, has been employed to centralize and promote the work. Officers for 1918 were elected as follows: President, J. E. McClernon, Northwestern Electrical Supply Company; vice-president, Charles E. Benz, Holloway & Benz Company; executive committee: J. J. Hartt, Hartt & Morrison; G. P. La Shelle, W. R. Ostrander Company; J. H. Hughes, Alpha Electric Company; J. H. Owen, E. B. Latham Company; M. Zucker, A. Shemel & Company, and L. D. Bailey, Bailey Electric Supply Company.

INCREASING ECONOMY OF POWER IN CALIFORNIA

**Southern Group of Systems Now Under One Power
Dispatcher—All Feasible Tie-ins Are Con-
sidered—Water Shortage Will Be Serious**

At a hearing before the California Railroad Commission on Jan. 31 there was further detailed discussion of the interconnection of transmission lines and conservation of fuel oil. A detailed statement was presented by companies in the northern and southern divisions into which the State has been divided. The report of an earlier hearing appeared in the ELECTRICAL WORLD for Jan. 26, page 218.

A supplement to the report of the northern division, presented by John A. Britton, Pacific Gas & Electric Company, pointed out that northern California hydroelectric power companies are facing one of the most alarming situations in their history. "Not only are we faced with the necessity of generating about 30,000 additional horsepower to take care of the normal increase in amount of power needed each year," said the report, "but the lack of rain and snow may make it impossible to maintain the present output." Priority orders on a 15,000-kw. steam turbine unit now being built for the Pacific Gas & Electric Company have been secured. It is understood that this action has not only been approved by the Fuel Administration, but sufficient fuel oil to operate the unit has been guaranteed.

The report of the northern division, presented by J. E. Woodbridge, stated in detail where power could be exchanged to advantage from system to system, what new projects could probably be developed at once, and where additional interconnections were needed. The several methods of effecting greater economy which the committee recommended are expected to afford a combined saving on all systems in the northern division of 1,758,000 bbl. of oil per year.

The most important interconnection recommended is that which would tie in the Northern California Power Company system with the Pacific Gas & Electric lines at Colusa. This would add to the central group about 12,000 kw. at 80 per cent load factor. To accomplish this, however, an exchange of energy between the California-Oregon Power Company and the Northern California Power Company is necessary and an investment of about \$980,000 in an interconnecting line.

The committee from the northern division specially urged upon the Railroad Commission "the necessity for some affirmative action which will tend to the further development of possible hydroelectric plants in California, both along the lines of financial encouragement to the companies and affirmative aid in Congressional legislation regarding the occupancy of public lands such as would be calculated to make hydroelectric developments attractive to those who must finance the development."

The report from the southern division stated that the Southern Sierras Power Company and Southern California Edison Company systems had been put under a single power dispatcher so far as exchange of energy is concerned. In its previous report the southern division committee reported that 1917 fuel consumption, amounting to 1,056,000 bbl. of oil, could be reduced in 1918 to 600,000 bbl. The report of Jan. 31, however, states that more recently means have been found for reducing 1918 consumption to 275,000 bbl.

These additional economies have been worked out after running tests on steam-plant efficiency in order to determine where fuel oil can be used to best advantage, by comparing power transmission systems and load curves to find where and when energy can be exchanged advantageously, and by increasing the load on plants where additional capacity is available.

PROGRESS TOWARD TYING IN THE CALIFORNIA SYSTEMS

**Results of Inquiry Into Possibilities of War Conser-
vation and Economy by Co-operation in
Southern California**

Negotiations between California electric generating systems and the California Railroad Commission looking to the combination of transmission lines and other means of co-operation to save fuel were reported in the ELECTRICAL WORLD for Jan. 26, 1918, page 218. Reference was made in that article to the report submitted by R. H. Ballard, general manager Southern California Edison Company, for the committee which has been studying conditions in the southern part of the State.

The inquiry into the possibilities of war conservation and economy by co-operation in the use of resources and facilities by power companies of the southern San Joaquin Valley and southern California covered the following properties: Southern California Edison Company, Los Angeles Gas & Electric Company, Los Angeles Aqueduct, San Joaquin Light & Power Corporation, Mount Whitney Power & Electric Company, Southern Sierras Power Company and San Diego Gas & Electric Company.

For the purposes under consideration, the Santa Barbara Gas & Electric Company and the Ventura County Power Company were considered part of the Edison system.

The accompanying table shows the amounts of power generated by steam in 1917 and which must be generated by steam in 1918 to 1921 inclusive, and the amount of natural gas and fuel oil that must be burned to generate the required steam power in the event that no additional hydroelectric developments are completed during the period. The amounts of natural gas listed are those used by the Edison company and Los Angeles Gas & Electric Company, and include amounts which the San Joaquin company is now preparing to utilize. The table is based on average water conditions. A low-water year would increase the steam power necessary.

Year	Millions of Kilowatt-hours			Per Cent Steam	Fuel Necessary	
	Total	Available Water Power	Balance by Steam		Millions of Feet of Gas Available	Bbls. Oil for Balance
1917	1,146	911	235	21.5	1,400	1,056,000
1918	1,270	1,087	183	14.4	1,800	600,000
1919	1,410	1,110	300	21.3	2,100	1,150,000
1920	1,565	1,110	485	29.1	2,100	1,925,000
1921	1,715	1,110	605	35.3	2,100	2,675,000

The table shows a notable reduction in steam power for 1918 under 1917. The causes of this reduction as stated in the report are:

The Edison company has completed an increase in its Huntington Lake reservoir which will enable it to store an additional 35,000 acre-feet.

Arrangements were made some time ago for interconnection between the Edison and Southern Sierras companies,

the San Diego and Santa Barbara companies. A 5000-kw. frequency changer has been installed for interchange of power between the Edison and Southern Sierras. A line is being constructed to supply all the requirements of Santa Barbara Gas & Electric and is now carrying part of the load of that company; the balance will be carried as soon as the construction work can be completed. Substation apparatus has been purchased and lines are now in process of construction for the installation of two 5000-kw. frequency changers at Capistrano for interconnection between Edison company and San Diego company. By the foregoing means all the companies mentioned will be able to share in the benefits of diversity of load and power resources.

The Edison company has arranged to transmit a small amount of natural gas to its Redondo plant.

The San Joaquin company has purchased and is preparing to lay a pipe line to its Bakersfield steam plant, which will enable it to utilize 600,000,000 ft. of gas per year, one-half of which will be available in 1918 and the whole amount in 1919.

Increases in load will enable Southern Sierras to utilize about 9,000,000 kw.-hr. and San Joaquin 26,000,000 more kw.-hr. from the available water during the run-off season. During 1918 it will be possible for the companies to make some additional arrangements for utilizing flood-water kilowatt-hours.

	Kw.-hr. per Year	Equivalent Barrels of Oil
1. The city of Los Angeles has some small plants in Owens River valley which can be connected to the Southern Sierras system, furnishing	10,000,000	50,000
2. Some of the San Joaquin surplus can be used by Mount Whitney.....	7,000,000	35,000
3. Arrangements can possibly be made for Edison company to use any surplus power San Joaquin may be able to generate from gas at its Bakersfield plant, equal to	30,000,000	150,000
4. It is possible that the Edison company can do some of the regulating for Southern Sierras, which will not amount to any large quantity of kilowatt-hours, but will save standby oil. No value can be put on this until it is tried.		
Total	47,000,000	235,000

The allowances for 1919 and following years take into consideration the utilization of at least 23,000,000 kw.-hr. additional water power from the above sources. Any further betterment of conditions must come from additional hydroelectric developments.

For the years following 1918 the various companies have under consideration possible hydroelectric developments, which in conjunction with the available natural gas resources could save the equivalent of the entire oil requirements for 1921.

	Kw.-hr. per Year	Equivalent Barrels of Oil
1. The most immediate of these is the possibility of installing certain plants on the Los Angeles aqueduct which are partly developed and which could be ready by 1919, capable of supplying..	100,000,000	500,000
2. The Edison company has a program of development on Kern River and Big Creek for completion in 1919, 1920 and 1921, which can supply.....	400,000,000	2,000,000
3. San Joaquin can construct plants on the San Joaquin and Kings River, which can supply	200,000,000	1,000,000
4. Southern Sierras can complete plants to supply	150,000,000	750,000
Total	850,000,000	4,250,000
The total estimated cost of the proposed developments is approximately.....	\$30,000,000	

It will be noted that with proper interconnections between the companies the developments considered in the last table are capable of producing 850,000,000 kw.-hr., or 245,000,000 more than the 605,000,000 which must be produced by steam in 1921 if hydroelectric development is not carried out. This surplus would be available for additional growth of the

companies and it would not be necessary to complete some parts of the proposed developments until the load became sufficient to absorb the output.

Extensions of distributing systems are taken up in the report. During the emergency created by the war, and in view of the present shortage of money and expected shortage of materials, extensions of distributing systems, aside from very minor extensions, should be confined to extensions to serve consumers whose business contributes directly or indirectly to the winning of the war, the committee says. For the present, and until the shortage of materials becomes more acute, extensions to prospective consumers willing to deposit a substantial part of the cost of extensions, to be refunded in service, or the gross income from which will equal the cost of the extension in two years or less, might be made.

In southern California approximately 90 per cent of the electric energy sold is used for street and inter-urban railways, irrigation for agriculture, cement manufacture, oil-well pumping, shipbuilding and minor power service, all of which are war necessities.

It is suggested by the committee that the commission consider the question of passing upon applications of the utility companies for priority shipments for the purpose of giving the applications more standing before the Priority Board in Washington and eliminating the present apparent necessity for individual efforts in securing priority.

The financing problem, says the report in conclusion, is by far the most important one to be met. Large amounts of money are needed to permit of either the conservation of fuel oil or the development of water power for war purposes. No practical method of financing has as yet developed to provide funds for additional water-power plants contemplated. If a priority board were created by the United States government to pass upon the sale of securities, precedence would undoubtedly be given the sale of those securities which would provide funds for hydroelectric developments and the requisite extensions for the conservation of fuel oil, the development of agricultural lands, or other war necessities. The question of necessity might be certified by the commission for submission to such a priority board.

HIGHER RATES TO COVER COAL, MATERIALS AND LABOR

Sayre Electric Company Increases Schedule to Take in Other Elements of Increased Operating Expense Besides Fuel

The Sayre (Pa.) Electric Company has filed an increased-rate schedule with the Pennsylvania Public Service Commission. It covers higher costs of coal, other materials and labor. All meter rates, other than those for temporary service, are to have variable charges added, as follows:

A charge of 0.6 mill per kilowatt-hour will be added for each 25-cent increase in the cost of coal above \$3.70 per gross ton delivered at the plant of the company.

A charge of 1.5 mills per kilowatt-hour will be added to cover the increased cost of labor and material.

In like manner for every 25-cent decrease in the cost of coal below \$3.70 per gross ton delivered at the plant of the company the price shall be reduced 0.6 mill per kilowatt-hour of electricity consumed.

ILLINOIS COMMISSION ACTS ON CREDITS AND DEPOSITS

Tentative Rules Promulgated for Hearing at Springfield This Week Governing Electric, Gas, Water and Heating Service

The Public Utilities Commission of Illinois set Feb. 13 as the date for a hearing at Springfield on tentative rules governing the establishment of credits and the collection and handling of consumers' deposits for electric, gas, water and heating service.

The features of the tentative rules which the commission has worked out are that before rendering service the utility shall require each customer to establish his credit, that the amount of the cash deposit shall be equal to the average bill, including prompt payment discount for a periodic billing period plus thirty days, that the minimum cash deposit is fixed (except for power and heating service) at \$3 for residence customers and \$5 for business customers, that twenty days is established as the period which shall elapse between the issuance of a bill and the date on which the customer is adjudged delinquent, that prompt payment of all bills for twelve months permits the customer to demand and receive his cash deposit, and that interest at 6 per cent shall be paid on all deposits held by the utility for more than six months.

ALLOWING HIGHER RATES TO RELIEVE EMERGENCY

Method of Illinois Commission in Giving Relief to Utility Which Must Raise Power Rates to Meet Rising Costs

The State Public Utilities Commission of Illinois, deciding on the petition of the East St. Louis Light & Power Company for authority to increase wholesale power rates, expedited the case by making a comparison of the rates with other rates. The commission said in part:

There is submitted in the record no valuation. The usual procedure might involve a valuation and an analysis of the operating expense. The record contains little such information except that relating to increased expenses of operation.

It must be realized that, owing to high prices of fuel, labor and the materials necessary for carrying on utility operation, public utilities must have experienced increases in operating expenses. This fact in itself, however, does not offer justification for an increase of rates, since it is possible that the rates heretofore charged under more normal conditions which have previously existed were exorbitant or excessive. If, however, it can be reasonably shown that the rates heretofore in effect under normal conditions have not been unreasonably high, then the problem is narrowed down to a determination of whether the rates proposed will give increased revenue of an amount which will adequately, but not unreasonably, reimburse the utility for the increases of operating expense that obtain, and whether the proposed rates are of a non-discriminatory and equitable character. In a number of such cases the commission has entered orders fixing rates for utility service. A comparison with rates so fixed and determined offers an opportunity for the formation of judgment which may be sufficiently accurate in many cases.

Testimony shows that the average cost of coal delivered at the company's plant during the first nine months of 1916 was \$1.25 per ton; during the first nine months of 1917 the cost was \$1.87 per ton. The company estimates, upon the basis of contracts which it has and the present prices prevailing, that the average cost of coal used by it from Nov. 1, 1917, to April 1, 1918, will be \$2.69 per ton, and that after

April 1, 1918, when all of its present coal contracts will have expired, this cost will be \$2.74 per ton.

After a comparison of the power rates with those in other communities and finding that East St. Louis rates were lower, the commission pointed out that the rates it contemplated were applicable only to wholesale power service, and stated:

Power service in general, and wholesale power service in particular, is a competitive class of service for the reason that consumers of power service are usually in a position to utilize power furnished by other means. The "value of the service" to the consumer is an element to be properly recognized in the development of rates for utility service, at least to the extent that it fixes a maximum above which rates cannot be fixed with the hope of securing business.

The commission ordered suspension of the company wholesale rates in order that new and higher rates might be effective as of Jan. 1, 1918. The commission will retain jurisdiction in order that changes of conditions as they may arise may be cared for adequately. The commission reserves the right to re-open this case if in its opinion conditions warrant.

CONSTRUCTIVE REGULATION IN THE PUBLIC INTEREST

Empire State Gas and Electric Association, Calling Attention to Destructive Railroad Regulation, Urges Efficiency

Declaring that the suspension of industries is due to freight congestion arising primarily from railroad regulation and urging the importance of constructive regulation of utilities to promote efficiency and prosperity, the executive committee of the Empire State Gas and Electric Association has sent the following resolution to the United States Chamber of Commerce:

Whereas the federal government, through the United States Fuel Administration, has found it necessary temporarily to close down business in the eastern part of the country in order to relieve freight congestion and insure thereafter a continuous flow of coal and other articles necessary for domestic use, for the use of our army and navy, and for export to our allies in the war; and

Whereas the present freight congestion is, in our judgment, due to a long period of regulation of the railroads, by state and federal authorities, of a character which has been unnecessarily burdensome and restrictive and which has impaired the credit of the railroads, thereby preventing them from securing promptly and at reasonable prices the capital needed for extensions, additions and improvement; and

Whereas all other public utilities, including electric railways, gas corporations, electric light and power corporations, telephone and telegraph companies, water companies, etc., are also of vital necessity to the country not only in times of war but also in times of peace and are now almost everywhere subject to regulation by governmental bodies; and

Whereas these utilities can render the maximum service only if their credit is maintained and they are enabled to secure capital promptly and at reasonable rates, now be it

Resolved, that we request the Chamber of Commerce of the United States to lay this matter before the business men and business organizations of the country, suggesting that they as users of the service rendered by such utilities express themselves to federal and state legislative and regulatory bodies in opposition to restrictive regulation but in favor of regulation which will encourage efficiency, prosperity and co-operation as being in the public interest, and which will see to it that such prosperity and efficiency inure to the benefit of the public, to the end that further calamities due to the inability of the public utilities to meet the demands of the public may be averted.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

The Southwestern Electrical and Gas Association.—This association will hold its annual convention April 15 and 16 at Galveston, Tex. H. S. Cooper of Dallas, Tex., is secretary of this association.

New York Chapter of American Association of Engineers.—Hudson H. Bubar of the National Aniline & Chemical Company addressed the New York Chapter of the A. A. E. recently on "The Engineer: His Present and Future."

Los Angeles Synchronous Club.—"Illumination" was the subject of Lecture No. 8 in the synchronous electrical course given at the Feb. 7 meeting by Prof. A. W. Nye, head of the physics and electrical engineering department, University of Southern California.

Pittsburgh Section A. I. E. E.—On Feb. 13 C. E. Wilson, automotive engineer, Westinghouse Electric & Manufacturing Company, addressed the Pittsburgh Section of the American Institute of Electrical Engineers on the subject of "Electrical Equipment on Government Standardized Trucks." G. M. Baker is secretary of this section.

San Francisco Electrical Development and Jovian League.—The league at its Feb. 6 meeting celebrated the birthday of Thomas A. Edison. Frank D. Fagan, Pacific Coast manager Edison Lamp Works, gave an interesting talk on incidents in Mr. Edison's life, illustrated by moving pictures. E. M. Cutting, Pacific Coast manager Edison Storage Battery Supply Company, was master of ceremonies.

Louisville Jovian League.—At the annual meeting and banquet of the Louisville (Ky.) Jovian League there was an attendance of nearly 100. A spirited election with two tickets, a so-called regular ticket and a "camouflage" ticket, was held. Walter S. Clark of the James Clark, Jr., Electric Company, was elected to serve a year as president, succeeding himself. He was elevated to the presidency last fall on the removal from the city of F. V. Gantt, the previous president. On the ticket with him were elected C. C. Childers of the Childers Electric Company, vice-president, and Paul C. Tafel of the H. C. Tafel Electric Company, a director. From the other ticket were elected S. B. Storm of the local branch of the General Electric Company, secretary-treasurer, and the following directors: James Clark, Jr., of the James Clark, Jr., Electric Company; C. A. Klemm, branch manager of the Westinghouse Electric & Manufacturing Company, and I. Dreyfus of the Louisville Gas & Electric Company.

Officers of the American Washing Machine Manufacturers' Association.—At the second annual meeting of the American Washing Machine Manufacturers' Association, Jan. 23 and 24, 1918, the following officers were elected: President, W. H. Eden, Brokaw Eden Manufacturing Company, Alton, Ill.; first vice-president, H. W. Barker, 1900 Washer Company, Binghamton, N. Y.; second vice-president R. D. Hunt, Drexler Company, Fairfield, Iowa; third vice-president, John Rocks, Meadows Manufacturing Company, Pontiac, Ill.; treasurer, W. H. Voss, Voss Brothers Manufacturing Company, Davenport, Iowa. The executive committee members are W. J. Conlon, Conlon Electric Washer Company, Chicago; W. L. Rodgers, Pittsburgh Gage & Supply Company, Pittsburgh; J. D. A. Johnson, Michigan Washing Machine Company, Muskegon, Mich.; F. H. Bergman, One-Minute Manufacturing Company, Newton, Iowa, and H. G. Braunlich, H. F. Brammer Manufacturing Company, Davenport, Iowa. On the advisory committee are Sam T. White, White Lily Manufacturing Company, Davenport, Iowa; L. E. Dietz, Boss Washing Machine Company, Cincinnati, Ohio, and E. H. Maytag, Maytag Company, Newton, Iowa. Messrs. Eden, White, Dietz, Johnson and Rodgers are the war service committee. Raymond Marsh, 10 South LaSalle Street, Chicago, is secretary.

Gilchrist Speaks on Financial Problems.—John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, speaking at a recent meeting of the Indiana Engineering Society at Indianapolis, characterized the financial problem of the public utilities as the most important before them. The government has become aware, he said, that power is of use in the war and that it must call out a greater power than man power to maintain the men at the front. Public utilities, therefore, are among the essential industries as regards war work. In the discussion H. O. Garman of the Indiana Public Service Commission stated that a number of Indiana companies are already insolvent on account of increasing cost of operation. Mr. Garman also argued against extensions to outlying districts, stating that these are not necessary inasmuch as the average American city has not been built up intensively and contains much waste space. G. W. Hubley of Indianapolis cited figures on increasing costs to show that the more common materials had increased all the way from 20 per cent for common brick to 199 per cent for copper, while the wages paid laborers had advanced from 25 to 50 per cent with a decrease in the effectiveness of the workers. W. S. Moore, state highway engineer for Indiana, was elected president of the Engineering Society; G. A. Young of Lafayette was elected vice-president, and J. S. Wilkins of Connorsville and W. H. Insley of Indianapolis were made members of the board of trustees. Charles Brossman of Indianapolis was re-elected secretary.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rates Suspended in Illinois.—The Illinois Public Utilities Commission has suspended the increase asked by the Madison County Light & Power Company, Carlinville, until March 31; also, to the same date the increase in rates proposed by the Abbott Light & Power Company for Petersburg, Mason City, Tallula and Ashland.

Need of Proper Capital Authorization.—A decision has been rendered by the New York Public Service Commission, Second District, on the petition of the Groton Electric Power Corporation for permission to construct a plant in Groton and near-by communities. The commission ruling, in brief, follows: "An electric company applied for permission to construct and for approval of franchises in certain villages and towns where there is a decided need for electric service. The company was not yet fully organized as a corporation. It had filed its certificates but had obtained no authorization for capital stock from this commission. In the circumstances it was held that the application should be granted but that no construction should be undertaken until proper capital authorization from the commission should be secured."

Power Supply in Portland, Ore.—The power situation is discussed incidentally in a decision of the Oregon Public Service Commission affecting the Portland Railway, Light & Power Company. "It is evident," says the commission, "that even at this time the power supply is but little, if at all, in excess of the demand, after making allowance for a proper reserve. But now, after a period of comparatively slow growth, the demand for power is increasing rapidly. The Northwestern Electric Company has just announced its intention to build a 10,000-kw. steam plant in the city, and it is reported that it will also add a small hydro plant on the White Salmon River. But these will not more than take care of the anticipated increase of the next one or two years. With the advent of the shipbuilding industry and the great improvement in the lumber business and kindred lines, a large increase in industrial activity is confidently looked for. If this growth is not to be blighted by inability to supply power for it, it is essential that the development of additional power on a large scale be undertaken in the very near future, and to this end it is necessary that the utilities engaged in the supply of power shall be maintained in such credit as will enable them to obtain the funds required for such development."

Doherty Headquarters in Washington.—The Doherty Men's Club has been established at 1329 K Street, N. W., Washington, for the convenience of men of the Doherty Organization who have occasion to visit Washington.

Purdue Includes More Army Work.—As the result of a conference held in Washington upon the request of the Signal Corps, U. S. A., Purdue University decided to inaugurate an additional signal course. It began with the second semester of the school year, Feb. 1. The course will be under the direction of Prof. C. Francis Harding, professor of electrical engineering.

Byllesby Men in National Service.—A "national service record" of employees of H. M. Byllesby & Company and affiliated employees as of Jan. 1, 1918, shows: Number of male employees at properties, all ages, 4839; number enlisted, 317; number drafted, 79; number subject to draft not yet called, 996; total number of men in active service, 393; percentage of men in service of entire male forces employed, 8.1 per cent.

Research Fellowships in the Engineering Experiment Station, University of Illinois.—To extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen engineering experiment station research fellowships. One other such fellowship has been established under the patronage of the Illinois Gas Association. The fellowships, for each of which there is an annual stipend of \$500, are open to graduates of approved American and foreign universities and technical schools.

Asks Suspension of Extension Regulations.—A. D. Mackie, general manager Springfield (Ill.) Gas & Electric Company, has asked the Illinois Public Utilities Commission to suspend general rules Nos. 19 and 31 as applied to public service corporations. Section 31 provides generally that an individual or group of individuals may compel building and maintenance of lines for transmission of electric power, subject to certain regulations. Section 19 applies similarly to gas installations. Mr. Mackie asks suspension of these during the war. He says that cost of construction, materials and labor is so high as to make service extensions unprofitable in most cases.

University Extension Course in Fuel Economy.—To overcome the great wastage in fuel in Massachusetts because of lack of expert knowledge by firemen and others who use coal in large quantities, the Department University Extension, State Board of Education, organized a class in power plant economics, scheduled to begin sessions on Feb. 4, at the State House, Boston. James A. Moyer, director of the department, said that the principal object is the distribution of easily understood information of how to obtain full worth from every pound of fuel in industry. The course is to be given by J. J. Eames, instructor in mechanical engineering in the department of university extension, under the auspices of the Massachusetts Institute of Technology.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Increase Rates in Mobile.—The Mobile (Ala.) Electric Company has increased electric rates, effective Feb. 1, owing to increased operating expenses caused by the war.

Illinois Rate Increases.—The petition of the Public Service Company of Northern Illinois to increase electric light and gas rates in 140 towns and cities has been received and reviewed by the Illinois Public Utilities Commission. The commission has postponed the effective date of the increase until June 28, 1918.

Guide for Electric Vehicle Owners in New York.—The New York Edison Company, through the automobile bureau, is distributing the 1918 edition of the charging station booklet. The book is especially valuable as it shows several new charging stations in the suburbs. In addition it describes the electric vehicle route to Atlantic City. There are several additions of interest in the 1918 compilation.

Cleveland Rate Case Before Commission.—The hearing on the city of Cleveland appeal for reduction of the Cleveland Electric Illuminating Company rate was resumed before the Ohio Public Utilities Commission on Jan. 29. After partial cross-examination of Robert Lindsay, general manager, the hearing was adjourned to Feb. 20. The city contended that its engineer, F. W. Ballard, had not had sufficient time to prepare his review. Company attorneys informed the commission that the company would probably be compelled to discontinue the steam-heating business unless allowed to raise rates.

Water Power at Sault Ste. Marie.—The Sault Ste. Marie (Mich.) Civic and Commercial Association writes to the ELECTRICAL WORLD: "All the large industrial plants at Sault Ste. Marie are running as usual under special exemption by Dr. Garfield and W. K. Prudden from their recent drastic fuel orders. These plants are operated by electricity produced by water power from the rapids of the St. Mary's River. The Michigan Northern Power Company and Edison Sault Electric Company produce and distribute about 40,000 hp. from these rapids. This power is used to operate all industries of any size at the Sault. There is now immediately available at the Sault about 1500 hp., which can be increased to 4500 hp. upon very short notice and the installation of the type of machinery most efficient for the operation of any particular industry. Under the present fuel conditions this available water power is of great economic advantage to manufacturers who are or may be embarrassed for lack of fuel."

New Rules for Priorities.—The priorities division of the War Industries Board of the Council of National Defense has issued new rules and regulations governing priority. They set forth that "the paramount purpose of priorities is the selective mobilization of the products of the soil, the mines and the factories for direct and indirect war needs in such a way as will most effectually contribute toward winning the war. In requesting priority the petitioner should join the committee in applying this test: To what extent, if at all, will the granting of this application contribute, directly or indirectly, toward winning the war; and if at all, how urgent is the need?"

Appeal to the Public in Illinois.—A united appeal to fair and unbiased public opinion has been made by the Illinois State Electric Association, the Illinois Gas Association and the Illinois Electric Railways Association. The three associations are using direct newspaper appeal to the people for a fair deal in the matter of rapidly increasing costs of operation in view of a steady and inflexible revenue account. They point out especially that while utilities should not be allowed to make unjust profits on large amounts of watered stock, they should be allowed to earn a revenue fully commensurate with greatly increased costs of operation and should be protected against soaring prices of labor and materials by higher rates. The appeal has appeared in a number of prominent Illinois daily newspapers.

Engineers in Government Service.—During the last few months the Engineering Council, through its American engineering service committee, has supplied to various government departments and bureaus several thousand names of engineers from which men were to be selected for positions in uniformed and civilian service for the army and navy and other government activities in connection with the war, as well as for indirect service for manufacturers and contractors in government war work. To meet these demands the American engineering service committee assembled in its offices, Engineering Societies Building, New York, extensive lists and detailed information concerning engineers in all branches of the profession throughout the land. If these lists are to be maintained in the most useful condition to the government and the Engineering Council the committee should receive prompt information concerning each engineer who has gone into any kind of government service, direct or indirect. Engineers to whom this request applies are urged to send at once their names, present addresses and occupations in the government service, with brief statement as to whether or not they are available for other service, to the American engineering service committee, Room 901, 29 West Thirty-ninth Street, New York. Other readers are asked to bring this request to the attention of such engineers or to send information directly to the committee named.

Henry Bostwick, formerly secretary to the vice-president and general manager of the Pacific Gas & Electric Company, has been chosen to succeed G. C. Holberton as manager of the San Francisco district of the company.

George C. Holberton, for several years manager of the San Francisco district of the Pacific Gas & Electric Company, has handed in his resignation, effective Feb. 1. Mr. Holberton is retiring in order to devote all of his time to private affairs.

J. M. Hannaford, Jr., vice-president and sales manager of the Northwestern Electric Equipment Company, St. Paul, Minn., has resigned to enter the firm of Gordon & Ferguson, St. Paul. Mr. Hannaford has been with the Northwestern company for nine years.

Z. Starr Cohen, who has been connected with the Northern New York Utilities, Inc., at Watertown, has been appointed manager of the Wetmore Electric Company at Lowville, N. Y., a subsidiary of the Northern New York Utilities, Inc. Mr. Cohen succeeds George R. Dorsey, who has resigned.

H. W. Deininger, for several years vice-president and general manager of the Sac City Electric Company and for the last two years manager of the Sac City district for the Iowa Light, Heat & Power Company, has resigned to become general superintendent of the Iowa Southern Utilities Company, with headquarters at Centerville, Iowa. Prior to entering the electric utility field Mr. Deininger was general manager of the Globe Machine & Supply Company.

Frank L. Lucas, president-elect of the Western Association of Electrical Inspectors, started in the electrical busi-



F. L. LUCAS

ness in 1884 as an electrician in Detroit, Mich. Later he went to Toledo as superintendent of construction for a contracting firm. In Toledo he helped to organize the inspection department of the city and made the first municipal electric inspection. In July, 1917, after eleven years of service, he resigned to go into business for himself in Toledo. In addition to his inspection activities, he was also connected with the La France Electrical Construction & Supply Company of that city.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

J. J. Gorman has been appointed new-business manager of the Citizens' Gas & Electric Company, Waterloo, Iowa.

W. Porter Jones has resigned as manager of the Oklahoma Gas & Electric Company at Norman, Okla. Prior to becoming manager at Norman a year ago Mr. Jones was new-business manager of the company.

B. E. Morrow, who has recently been elected a director of the National Safety Council, has always been an ardent advocate of safety work and the prevention of industrial accidents. He has been very active in this work, having been a member of the committee on dangerous machinery appointed by the Department of Labor, New York City; a member of the committee on accident prevention of the National Electric Light Association and chairman of the safety practices committee of the public utilities section of the National Safety Council. Mr. Morrow is one of the pioneers in the electrical industry, having been connected with the Edison Electric Company at Schenectady in its early days. After the consolidation of that firm with the present General Electric Company he had charge of the electrical testing department. In 1902 he resigned from the General Electric Company to take charge of the operating department of the Hudson River Power Transmission Company, the principal generating station of which at that time was on the Hudson River at Mechanicsville, N. Y. In 1903 this company, with several others, was merged into what was known as the Hudson River Electric Power Company, with hydroelectric plants at Spier Falls, Mechanicsville and Schoharie Falls and a 6000-kw. steam generating station at Utica, N. Y. While connected with this company Mr. Morrow made an extended trip to the Middle Western States and to Canada with Dr. Steinmetz, Professor Creighton and other prominent engineers to inspect lightning arresters on high-tension transmission lines. This was before the advent of the aluminum-cell lightning arresters, and the multigap arresters then in use were the cause of much anxiety on the part of engineers. In 1910-11 he was chairman of the N. E. L. A. committee on protection from lightning and other static disturbances, and he has served on many other important committees. At the present time he is a member of the N. E. L. A. committee on inductive interferences. In 1915 Mr. Morrow was appointed manager of the production and transmission department of the Consumers' Power Company, Jackson, Mich., a post he still holds.

F. D. Beardslee has resigned as sales manager of the Union Electric Light & Power Company, St. Louis, Mo., to become manager of the department of public relations of the Mercantile Trust Company of St. Louis. He will retain the position of assistant secretary of the Union company on consultation matters. Mr. Beardslee has been connected with the lighting company since 1889, having started as a boy.

A. B. Boynton, district manager of the Electric Machinery Company for New York and New England, has re-



A. B. BOYNTON

cently been commissioned captain in the Engineer Officers' Reserve Corps. Captain Boynton is a graduate of Cornell University in electrical engineering and for the last twenty years has been engaged in engineering and sales work in the electrical field.

H. E. Hobson, an electrical engineer, who was superintendent of construction for Sampson & Allen of Lynn, Mass., for seven years, general manager of the Central Hudson Construction Company for three years and general manager of the Poughkeepsie Utilities Corporation for the last four years, has been appointed by the Underwriters' Association of New York State as an electrical inspector. Mr. Hobson will have charge of the electrical department in the branch office of the association at 45 Market Street, Poughkeepsie, N. Y.

Obituary

M. G. Potts, formerly connected with the Lykens Valley Traction Company, Williamstown, Pa., in the capacity of treasurer and general manager, died Jan. 18 at his home in Harrisburg, aged seventy-three years.

B. Frank Hires, formerly connected with the Bridgeton & Millville Traction Company and the Bridgeton Electric Company, Bridgeton, N. J., in the capacity of general manager, died Jan. 18, aged fifty-nine years. Mr. Hires was appointed special agent in the spring of 1917 for the American Railways Company, which operates the above properties.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

SERVICE CHARGE FOR THE SMALL ACCOUNTS

Suggestion Is Made that Customers Be Advised to
Trade with a Lesser Number of
Distributing Houses

A Middle Western jobber, through circular letters and through his salesmen, is telling customers the cost of handling small orders and is giving the reason for asking a 10 per cent service charge on returned goods. This jobber recently stated that he had yet to find an instance wherein a customer objected to such policy. Moreover, he expressed a high appreciation of the attitude taken by competitors, who evidently instructed salesmen not to use the knowledge of this campaign against his company. Evidently the competitors believed it to be constructive work which would promote their best interests as well as his.

This jobber is of the opinion that if every distributor would analyze his account, he could do much to overcome this fault by writing those customers who continue to send small orders repeatedly. He could ask for fewer orders but larger amounts at a time. In some cases it would be money actually saved if these jobbers would request the customer to trade with fewer houses. In this way some customers would cease trading; others would cease trading with competitive houses, and on the whole, it is believed, everybody covering the territory would be benefited. There is only a given amount of merchandise to be sold; each buyer has only a certain volume to place. If he places it with fewer houses, each house should profit because each will eliminate many small orders. Most distributors and salesmen, this jobber believes, get too anxious to sell merchandise, and overlook the necessity of analyzing their accounts and of discontinuing business that is not profitable to them.

FEDERAL RULES FOR OBTAINING PRIORITIES

Circular No. 3 Defines Rules for Determining Precedence in Orders and Work and Describes the
Methods of Administering Them

The priorities division of the War Industries Board of the Council of National Defense has made public Priority Circular No. 3, defining the regulations which the priorities division now has in effect for determining precedence in orders and work and describing the methods of administering them. The regulations are subscribed to by the Secretary of War, the Secretary of the Navy, the chairman of the Shipping Board and president of the Emergency Fleet Corporation and the chairman of the Council of National Defense. The circular discloses a much wider field of operations than that defined in the first circular issued in September of last year. The priority regulations apply to all individuals, firms, associations and corporations engaged in the production of copper, iron and steel and in the manufacture of their products; of chemicals, cotton duck and woolen cloth, and all such other raw materials and manufactured products as the committee may deem necessary from time to time.

Under the new regulation all orders and work are divided into four general classes instead of three as heretofore: Class AA, class A, class B and class C, with such subdivisions as class AA-1, class AA-2, etc., class A-1, class B-1, etc. Class AA comprises only emergency war work of a special or urgent nature.

The new regulations in no way change or modify any priority orders previously issued. The rule of procedure from now on is that orders and work in class AA shall take precedence of those in all other classes, orders and work in class A preceding those in class B and those in turn orders and work in class C, irrespective of the dates the orders were placed. The committee's work does not cover transportation, and it does not attempt to expedite transportation.

No industry, plant, material or commodity will be classified as such. Only specific orders for materials, commodities or work are classified according to their importance in war preparation or in work necessary to the public interest and essential to the national welfare, or otherwise of exceptional importance.

SUGGESTIONS FOR EXPANDING SOUTH AFRICAN EXPORT TRADE

Preference for Higher-Class Merchandise — The
Manufacturer's Agent Is Found a Better
Medium than Exclusive Sales Houses

A manufacturer's agent at Johannesburg, South Africa, in writing of trade conditions to the *ELECTRICAL WORLD*, makes some observations that are intended to be of direct interest to American manufacturers in the advancement of their export business. In a preliminary way he asks how American manufacturers are viewing the coming keener competition that they must necessarily meet after the war from Great Britain and continental Europe, not to mention Japan, all now competing in electrical goods in this and other markets. The belief expressed is that American producers will have largely to change their methods.

Following a brief description of the peculiar character of the population and of the communities, the correspondent says that largely the towns began where the Old World left off. Apart from three or four, gas is unknown, and even in these electricity has the foremost place because of its convenience and moderate cost. The smaller towns, some of which cannot be described otherwise than as villages, are installing both electric light and electric power, while the great gold mines of Johannesburg and the diamond mines of Kimberley are worked from electric power stations.

The demand for the conveniences which electricity makes possible is rapidly growing and the preference is for the higher-class articles. In meeting this demand America is well represented, but there are still possibilities untouched. A more intimate knowledge and a closer survey of the field would benefit American manufacturers, and provided that they would admit that policies adapted to their domestic market may not always be the best for the export territories, they could do still better. South Africa is emphatically a market in which the manufacturer's agent should be employed as opposed to the practice common with American firms of granting sole agencies. The outlook for the next few years is undoubtedly brighter than it has been hitherto in that country.

Individual electric lighting plants are in growing demand, and these will be followed by a desire for the various conveniences which help to lessen the labor of housework, as the servant question is as acute over there as it is in the United States. Such plants must be non-complicated, of strong construction, and use kerosene as fuel, for gasoline costs to-day \$1.02 per imperial gallon. If equipped with storage batteries and attachments for driving the churn or butter worker, this would be an additional selling point.

Unfortunately, South African electric service has not been standardized, and the merchant has to provide for the fact that the voltage in the different towns is not alike. Even in Johannesburg it differs in different portions of the town. It might also be well to remind American manufacturers that only the bayonet socket is in use in South Africa, the screw, so common in the States, being unknown.

THINGS TO BE CONSIDERED IN TAKING GOVERNMENT WORK

Information Concerning Localities in Which Orders Will Not Be Placed and Effect of Other Government Orders

In the matter of placing contracts for goods for government use, the General Engineering Depot, Washington, D. C., in asking for bids is requiring of bidders, "because of the known shortage of power in certain manufacturing districts and in order to conserve this power for the rapid completion of government contracts already under way," to state on demand the localities from which the materials entering into the manufactured articles are obtained. The purchasing officer in this way reserves the right in making awards to discriminate against those bidders who are dependent for their materials upon the manufacturers in congested districts.

In addition, in order that there may be no congestion in factories and that there may be more equitable distribution of goods, bidders are required to state in writing upon the request of the purchasing officer, after proposals are opened, the total money value of uncompleted orders placed with them by the United States and the allied governments. In addition, bidders must also state at that time the class and number of principal and subsidiary priority orders which may have been issued on their manufactured goods affecting directly or indirectly articles upon which they are bidding.

METAL MARKET SITUATION

Copper Shipped Regularly—No Strain to Meet the Demand—Wire Steady and Firm

With the change in weather conditions shipments of copper are being made more regularly. An authority states that if surface appearances are to be trusted, the trade, as regards supply and demand, will be under no strain for the metal in the near future. Wire is now figured on a 30-cent base, with practically negligible fluctuation. A large distributor reports that a special discount is conceded to heavy buyers of rubber-covered, base, weather-proof or cable. Each transaction is considered individually. The embargoes are upsetting all calculations on shipments and deliveries. An improvement, however, is looked for.

Shortage of tin is causing anxiety in metal circles. None is expected before March, only 200 tons having reached here from the Straits from Feb. 1 to Feb. 8. Old metals are steady, with a better price being quoted for heavy brass and scrap zinc.

NEW YORK METAL MARKET PRICES

	Feb. 4			Feb. 11		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	27.00			27.00		
Lead, trust price	6.75			6.75		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter	19.00			19.00		
Spelter, spot	7.92½			7.92½		
Tin, Straits	85.00*			85.00*		
Aluminum, 98 to 99 per cent....	34.00 to 36.00			34.00 to 36.00		

OLD METALS

Heavy copper and wire.....	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.75 to 15.00	14.00 to 15.25
Brass, light	10.00 to 10.50	10.00 to 10.50
Lead, heavy	6.00 to 6.25	6.00 to 6.25
Zinc, old scrap.....	5.00 to 5.50	5.50 to 5.75

*Nominal.

THE WEEK IN TRADE

BARRING the embargoes and freight congestions which in some sections, particularly along the Atlantic seaboard and Pacific Coast, are distressing, business in the electric line is most encouraging. Contracts for equipment and goods of every description for shipyards, industrials and housing are running into the highest figures known. In the distribution of sales the entire trade is participating, either directly or indirectly. The approach of spring is therefore regarded with equanimity by manufacturers, distributors, jobbers and dealers.

Stocks are reported in satisfactory condition, with a few exceptions. A shortage of small motors is noted in some sections, with an ample supply and better deliveries elsewhere. Conduit of every size is in bad shape, with an increasing demand. Heating appliances, especially radiators, are having the best sale on record. Household specialties, especially sewing and washing machines, are also easy sellers.

Collections are holding up well, being reported as ranging from excellent to slow. Applications for credit are bearing the closest scrutiny, with jobbers refraining absolutely from financing doubtful prospects.

NEW YORK

A spirit of buoyancy is noted in the electrical goods field which freight congestions, embargoes, backward deliveries and fuelless days seemingly fail to affect. Jobbers and distributing companies are fortifying their stocks, and while it is difficult to keep all lines at full strength, owing to curtailed production in some instances and in other cases to transportation embargoes and delays, still the quantity of merchandise on the shelves or in warehouses represents a fair supply. Business is at least 50 per cent better than last year. Orders on hand are very heavy, in industries allied with iron and steel, for engineering equipment and electrical staples and specialties. Improved buying conditions are reported in the trade. Prices have been expected to recede in certain goods, but no tendency in that direction is yet noticeable.

Collections are accepted as being about as good as conditions will warrant, with dealers buying cautiously in view of the high level of prices. Credits are carefully looked after, so that the financial aspect of affairs is regarded as favorable.

CODE WIRE.—With building operations at the lowest ebb in several years the sale of code wire is not brisk. Rubber-covered, weatherproof and cable are in sharp demand, the price being figured on a 30-cent to 32-cent base. Producers are busy with large government orders, and their plants are taxed to meet specified shipping dates.

TORCHES.—There is an active market for torches for outdoor use by electricians and linemen. The advance of 10 per cent made Dec. 1 still rules. Deliveries by express are put through in a few weeks. To nearby points shipments are prompt.

COLLECTIONS AND CREDITS.—With the approach of spring an effort to place their collections in a strong position is reported among jobbers. Dealers are also taking the cue in their relations with the consumer. Credits continue to receive the attention their importance demands at this time.

MOTORS AND TRANSFORMERS.—Prices are unchanged, but up to 20 hp. motors are quite prompt in shipment. Transformers also show a like improvement.

LIGHTING FIXTURES.—Sales are reported as increasing in bowls, basins and shades with the approach of spring. Deliveries are subject to embargoes. On Feb. 1 the pack-

ing charge at the factory was advanced from 25 per cent to 33 1/3 per cent. Goods in this class are all quoted f.o.b. factory at buyer's risk.

CONDUIT.—Stock is running low. Prices are not considered, jobbers report, when buying. Delivery is the main question. There is no fixed price, and only emergency orders are now accepted by jobbing houses, which are not allowing any more conduit to pass out of their hands than cannot be avoided. There is any quantity of conduit at the mills, but embargoes cut off shipments. This applies to all sizes. When the weather eases off a few weeks of mildness will change the entire outlook. An order for 50,000 ft. was recently placed by a local utility, f.o.b. mill. The jobber who booked this nice piece of business said this is the only way to sell conduit nowadays. The risk is too great otherwise.

LAMPS.—Manufacturers are said to have caught up with the shortage variously described a short time ago. There is no stringency now, reports say, the producers having gone over stocks and made a better assortment for all concerned.

RADIATORS.—Goods have been coming into this market in such quantity that the heavy demand is now being taken care of.

HEATING CORD.—No. 16 heating cord is scarce. It is said the price is high and fluctuating. One manufacturer quotes \$38 to \$38.50, another \$29.70.

CHICAGO

Heatless Mondays, transportation troubles and inclement weather are leaving their marks on the trade in the Chicago territory. Among the manufacturers it is freely stated that the elimination of working days has cut down production. This decrease, moreover, has not been in direct proportion to the number of days involved. The decrease is greater than that ratio. This is due to several causes. First, it takes the men some time to get into the swing again after a day and a half lay-off. Moreover, electrical manufacturers find that other factories which supply semi-finished parts or raw materials are also hard hit by the shut-down delays and transportation tie-ups, so that hindrance arises here again.

This same situation can be traced through into the jobbing industry, where it will be found that goods promised for three weeks' delivery are taking five weeks or more to arrive at jobbers' warehouses. This, of course, increases the value and usefulness of jobbers' stocks in this territory. Certain jobbers are out of some lines that they themselves say they have no business to be out of. So far there has been no effort on the part of jobbers to raise prices to the trade on items in stock. As long as stocks hold out, it is said, they will be sold at existing prices.

In the city of Chicago for the week ending Feb. 6, 1918, there were issued 395 electrical permits, as against 620 for the same week last year. The 395 permits involved installations of 5044 incandescent lamps and 736 hp. in motors. Electrical permits for this year are running behind those of last year on the average, as is shown by the fact that 1850 were issued for the five weeks ended Jan. 30, 1918. Two thousand six hundred and twenty-three were issued for the five weeks ended Dec. 26, 1917, and 3260 were issued for the five weeks ended Jan. 30, 1917.

It is definitely known that one gun-carriage factory and two shell plants have signed up for central-station service in Chicago. The gun-carriage plant will have a total connected motor load of 2000 hp., and the shell plants will have 1500 hp. and 2800 hp. connected respectively. Two other similar plants are in contemplation which will have an aggregate of 5000 hp. These are expected to be signed up at any time.

COPPER WIRE.—The prices remain unchanged. Deliveries from jobbers to manufacturers are uncertain. Cars in transit are more than two weeks overdue.

CONDUIT.—Deliveries are still in a difficult state. "Shopping" is usually necessary to get any quantity of varied sizes.

PORCELAIN.—Owing to frequent warnings issued by manufacturers several months ago, the trade is well stocked in porcelain. It is not moving rapidly.

BOSTON

Jobbers report a fair volume of business this week, with a tendency toward less general trade. Government orders occupy the center of the stage and show no signs of diminution. The boom in shipbuilding is reflected in electrical sales along the coast. Collections are still slower than normal, and the use of trade acceptances is being discussed here and there, though as yet little appears to have been done toward their actual adoption. Credit men among the jobbers are making a study of trade acceptances, and some educational work is being done to acquaint jobbing-house salesmen with their principles and practice. Jobbers are carrying rather large stocks at present and are well prepared in most lines for the spring trade. The recent extremely cold weather resulted in another spurt in electric radiator sales. There is little improvement as yet in the New England coal situation, but the prospect for large shipments arriving by water at Boston this week was better than for some time. With New England more than 7,000,000 tons short, more or less industrial curtailment must be expected during the rest of the winter.

WASHING MACHINES.—Increasing interest on the part of the public is reported. While spectacular sales are absent, these machines are steadily coming into favor, and demonstrations by central-station solicitors and supply houses are yielding good results.

ELECTRIC RADIATORS.—These are among the season's "best sellers." One Boston jobber imported 1500 heaters just prior to the recent sub-zero weather and sold all but thirty in a week. Price advances earlier in the winter do not appear to have curtailed sales. These devices have been a godsend to New England in the period of coal famine.

LAMPS.—The situation is constantly improving. At present there is a heavy government demand for carbon incandescents for emergency work, because the supply of tungstens is low. A prominent manufacturer says that factory stocks are not accumulating much, except in "unpopular" sizes. Late price advances appear to have had little effect on the volume of business.

MOTORS.—Stocks are improving in sizes up to 15 hp.; in fact, something like normal conditions can be seen approaching in the small-motor market. No price changes are noted. About 80 per cent of the motor orders now placed are for alternating-current equipment. Motors of 50 hp. and over are still very scarce, and government demands continue unabated and beyond the capabilities of the manufacturer for prompt delivery.

MOLDED INSULATION.—Increasing difficulties in obtaining raw materials are noted at the factory, and the Monday shutdowns combined with railroad embargoes are hampering deliveries. Factory stocks are low. Price tendencies are upward, because of labor shortage.

ATLANTA

The Southeast is enjoying warmer weather this week, and a spirit of optimism prevails. The rising temperature will facilitate the railroads in moving quantities of freight that has been accumulating during the cold weather and which has been sidetracked for fuel movement. Some large shipments of electrical goods are being received by manufacturers and jobbers, which is evidence of the fact that good has come out of the fuel order. The rail embargoes and congestion in the East are being felt here, but on the whole goods are moving fairly well in this section.

Current opinion is that 1918 will be even better than 1917. It is true that 1917 sales were swelled by cantonment construction in the South, but the fact must not be overlooked that the government is just beginning to establish shipbuilding yards at the Southeastern ports. Jobbers already report good business from these centers, which may be considered as only a starter. The Foundation Company, Savannah, Ga., has just received an order for thirty-six mine sweepers. While the coastal cities will boom, a great deal of governmental activity will be felt inland also.

The wood distillates industry is coming along very fast and several plants are projected in Tennessee, two being at

Kingsport and one at Collinwood. These plants are capitalized for approximately \$4,000,000. It is also reported that a large amount will be expended in the phosphate business near Centerville, Tenn.

From figures available at this time the sale of wiring devices and small miscellaneous supplies in the Southeast showed a gain of approximately 60 per cent over 1916, and 2300-volt distributing transformers a gain of about 35 per cent.

CONDUIT.—Reports received from manufacturers indicate that a few factories are catching up on their stocks. Stock shipment has been promised from these sources, deliveries, of course, depending on transportation conditions. Although there is no evidence of a general reduction in price, favored purchasers and distributors can secure conduit at prices slightly shading the market from manufacturers whose stocks are accumulating.

PANELBOARDS AND CABINETS.—Manufacturers and jobbers report that business in this line is excellent. The government demand in the Southeast for this class of goods has been very heavy, which has tended to slow up deliveries somewhat.

SWITCHBOARDS.—Business in the smaller distribution type shows a marked improvement. Prices are steady, but deliveries are slowing up.

ARMORED CABLE.—The demand has lessened lately owing to a temporary decrease in apartment-house construction and old-house wiring. Local stocks are in good shape.

SEATTLE

The second week of the month finds wholesalers and retailers enjoying a continuation of satisfactory volume in practically all lines. The outstanding feature of the week's business was an increasing sale of sewing machines. The largest jobber in Seattle reports machines are going like wildfire with no evidence of a let-up, and the demand is being met. Other appliances, with the exception of ranges, are moving very satisfactorily. Range sales are expected to increase materially within the next thirty days. Sales to shipyards and industrial plants are much heavier than in the past three weeks, and transactions with lumber and logging companies are showing renewed activity. Jobbers in the large Northwest cities report many inquiries for motors and electrical equipment for numerous proposed bulk grain elevators for eastern Washington and for Oregon.

The contract for 500,000 incandescent lamps for the Seattle lighting department was awarded to a Seattle firm. The residence building boom in Seattle and Tacoma is continuing unabated. Portland's housing problem has been taken up, and immediate steps are projected to remedy the situation. Lumber production for the week was approximately 21 per cent below normal. Production was 14 per cent above orders and 5 per cent below shipments. Northwest lumbermen assure the government that the maximum output of spruce for airplanes will be reached, starting March 1. The required minimum will be exceeded two or three times. Rural trade in the Middle West promises to be the chief source of private lumber orders this spring, according to present indications. The reported basic eight-hour day is highly objectionable to Northwest lumbermen, and is not to be imposed upon the industry, provided that lumbermen can produce sufficient spruce and fir for government needs in airplane and ship construction.

The immediate appointment by the United States Shipping Board of a district purchasing agent, with headquarters in Seattle, is foreshadowed.

Local jobbing houses report that the freight situation is more distressing than ever, if possible. The free time for intercity switching is cut from forty-eight to twenty-four hours, causing additional grief. Oregon jobbers report the situation considerably improved, although shipments are slow.

Camp Lewis army officials announce the immediate erection of a five-hundred-thousand-dollar hotel. The concession is let to Tacoma capitalists. Lamps are steadily increasing in demand from shipyards, mills and industrials and to care for new residences and remodeling of dwellings.

Floodlamp sales are decreasing perceptibly. In flashlamps the demand is sustained.

While jobbers are contending with shortages and slow, irregular deliveries, they are meeting the demand better than could be expected. Conduit jobbers are experiencing difficulties in meeting heavy demands, with stocks in very poor condition. Slow deliveries and increasing demand are causing justifiable uneasiness. During the week the government buying was lighter, although sales to the yards and industrials increased.

The electric heater movement at present is very light. If the present favorable weather prevails, sales will be negligible. Dealers report that the season's sales set a record and were very satisfactory. Dealers' stocks of house-furnishing material are going rapidly and jobbers are feeling the impetus on account of increasing residence building, particularly in Seattle and Tacoma. This applies to sales of chandeliers, sockets, switches and glassware. Collections are easy. New applications for credit are scarce. Ample financed concerns encounter little difficulty in obtaining credit. Jobbers refuse absolutely to take chances and finance prospects.

SAN FRANCISCO

A rainfall that was general all along the Pacific Coast has brought invaluable relief to California farmers. If this is followed up by heavy rains in late February and March, business conditions will improve very materially. The precipitation in the mountains, however, has not been enough to relieve the shortage of stored water for power purposes and hydroelectric companies are still facing a most serious situation.

The wide separation between California and Eastern centers, both as to distance and conditions under which business is carried on, is emphasized by the fact that the "heatless Monday" order, which is not effective in California, is not even felt there as a reflex action from Eastern shutdowns. The one notable effect is the co-operation of power companies in combining transmission systems to save fuel.

The action at Washington in discouraging building will have little effect in San Francisco, since actual building in the month of January was only about 30 per cent of the normal volume. On the other hand, a very material improvement in building conditions has been indicated by the large number of recent inquiries at the Bureau of Buildings, and the possibility of interfering with that has brought out adverse comment on the Washington view.

An aviation camp is to be built at Riverside, Cal., it is announced, which will call for some large orders for electrical supplies. Government construction at other points is also active, and the volume of trade in government work, already very large, is still increasing. Shipbuilding activity is steadily increasing. The latest announcement in this line is that contracts for several more concrete steamers have been awarded. The first of this type is to be launched in a few weeks at San Francisco. Several I. W. W. plots have been prevented in the last week, and aside from the activities of that organization, which are now being effectively checked, labor conditions are in better shape than they have been for some time.

INTERPHONES.—A falling off of apartment-house construction and the tendency to classify interphones among the non-essentials in many buildings have kept this line inactive. There was no accumulation of business in the line during the time the production of interphones was practically discontinued because of the rush of government business.

ELECTRIC RANGES.—The lack of stored water this year, the price of fuel and conditions generally, which have caused sweeping reductions in the sales forces of various California companies, indicate that this will be a poor season for electric ranges of the household type. However, the same fuel and economy problems which hold back this line give impetus to the hotel-type ranges, and that line is very active, with bright prospects. Further announcement of the plans of the new consolidation of range manufacturers is awaited with much interest.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must

increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil.....	List to \$61.00
Coil to 1000 ft.....	10% to 59.17
	No. 12 Solid
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	10% to 68.87

Twin-Conductor

	No. 14 Solid
Less than coil.....	List to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
	No. 12 Solid
Less than coil.....	List to \$135
Coil to 1000 ft.....	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil.....	List to +20%
Coil to 1000 ft.....	—10% to 5%
	No. 12 Solid
Less than coil.....	List to +20%
Coil to 1000 ft.....	—10% to 5%

Twin-Conductor

	No. 14 Solid
Less than coil.....	List to \$115
Coil to 1000 ft.....	—10% to \$80
	No. 12 Solid
Less than coil.....	List to +20%
Coil to 1000 ft.....	—10% to 5%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1 1/2 std. pkg.....	10% to \$24.00
1/5 to std. pkg.....	20% to 19.80
Std. pkg.....	34% to 18.75

DISCOUNT—CHICAGO

Less than 1 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	20% to list
Std. pkg.....	28% to 44%

BATTERIES, DRY

NEW YORK

	No. 6 Regular	No. 6 Ignitor
Each Net	\$0.40	\$0.40
Less than 12.....	.35	.35
12 to 50.....	.31	.32
50 to barrel.....	.28 to .285	.29 to .295
Barrel lots		

CHICAGO

	No. 6 Regular	No. 6 Ignitor
Each Net	\$0.40	\$0.40
Less than 12.....	.35	.35
12 to 50.....	.3175	.3275
50 to barrel.....	.2875	.2975
Barrel lots		

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/4-in. s. stp.....	Net to \$75.00	—15% to \$69.75
3/8-in. d. stp.....	+10% to 75.00	List to 72.00
1/2-in. s. stp.....	List to 100.00	—15% to 93.00
1/2-in. d. stp.....	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/4-in. single strip.....	\$75.00	\$63.75
3/8-in. double strip.....	78.25-78.75	71.25-71.75
1/2-in. single strip.....	100.00	85.00
1/2-in. double strip.....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$25.00-\$55.00	\$20.50-\$24.50	\$20.00-\$21.50
1/4-in.....	\$28.00-\$60.00	\$22.50-\$27.00	\$20.00-\$23.50

NET PER 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.....	\$36.00-\$55.00	\$25.00-\$37.50	\$22.50-\$24.75
1/4-in.....	\$40.00-\$60.00	\$27.00-\$30.00	\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.27
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.20

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	4% to 6%	7% to 9%
2500 to 5000 lb.....	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	1.3% to 4.7%	4.3% to 7.7%
2500-5000 lb.....	3.3% to 6.7%	6.3% to 9.7%

(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50
	600-Volt		
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B.	100	\$0.30
60-watt—B.	100	.35
100-watt—B.	24	.70
75-watt—C.	50	.70
100-watt—C.	24	1.10
200-watt—C.	24	2.20
300-watt—C.	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4 1/4 in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$24.90 to \$31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$29.00 to \$35.60
Coil to 1000 ft.	21.50 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	\$20.00 to \$29.06
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CHICAGO

Net per 100	\$19.75 to \$24.00
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, AX, 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2.	25.00
106—F.A., 7, C.S. 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%-37%	20%-32%
\$10.00 to \$50.00 list.	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.				

Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
5 1/2 N.C.—Solid Nail-it—N.C.				

Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10 to \$11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/8-in. cap key and push sockets	500	\$0.33
1/8-in. cap keyless socket.	500	.30
1/8-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	14% to \$25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:		
30-amp. S. P. S. T.	1.20	\$0.80
60-amp. S. P. S. T.	1.20	1.20
100-amp. S. P. S. T.	2.25	2.25
200-amp. S. P. S. T.	3.48	3.48
300-amp. S. P. S. T.	5.34	5.34
30-amp. D. P. S. T.	1.20	1.20
60-amp. D. P. S. T.	1.78	1.78
100-amp. D. P. S. T.	3.38	3.38
200-amp. D. P. S. T.	5.20	5.20
300-amp. D. P. S. T.	8.00	8.00
30-amp. 3 P. S. T.	1.80	1.80
60-amp. 3 P. S. T.	2.68	2.68
100-amp. 3 P. S. T.	5.08	5.08
200-amp. 3 P. S. T.	7.80	7.80
300-amp. 3 P. S. T.	12.00	12.00

Low Grade:		
30-amp. S. P. S. T.	0.42	
60-amp. S. P. S. T.	0.74	
100-amp. S. P. S. T.	1.50	
200-amp. S. P. S. T.	2.70	
30-amp. D. P. S. T.	0.68	
60-amp. D. P. S. T.	1.22	
100-amp. D. P. S. T.	2.50	
200-amp. D. P. S. T.	4.50	
30-amp. 3 P. S. T.	1.02	
60-amp. 3 P. S. T.	1.84	
100-amp. 3 P. S. T.	3.76	
200-amp. 3 P. S. T.	6.76	

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.	List to + 5%
\$10 to \$25 list.	11%
\$25 to \$50 net.	14% to 15%

	Low Grade
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.	+ 5%
\$10 to \$25 list.	10% to 11%
\$25 to \$50 list.	14%

	Low Grade
Less than \$10 list.	5% to + 5%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to list
1/5 to std. pkg.	List to — 15%
Std. pkg.	List to 30%

SWITCH BOXES, SECTIONAL CONDUIT

	List
Union and Similar—	Each
No. 155.	\$0.34
No. 160.	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.	List	Net
\$2.00 to \$10.00 list.	10% to 20%	5%
\$10.00 to \$50.00 list.	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25%	15% to 20%
\$2.00 to \$10.00 list.	25% to 35%	20%
\$10.00 to \$50.00 list.	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/4
No. 18, full spools.	0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.65
No. 18, full spools.	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	
11..	\$15.00-\$18.00	\$13.00	\$10.25-\$11.50	
12..	23.25- 25.41	21.30- 21.78	15.97- 19.35	
10..	32.40- 35.21	29.70- 30.18	22.13- 27.00	
8..	45.70- 49.12	41.90- 42.12	30.88- 38.00	
6..	72.40- 77.84	66.35- 66.72	48.93- 60.30	

CHICAGO

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.	
14..	\$18.00	\$13.00	\$13.50	\$11.50-\$12.00
12..	25.33-\$26.28	22.48	27.02	18.35- 20.93
10..	30.48- 36.54	27.94- 31.26	27.86- 29.23	
8..	47.54- 51.57	38.99- 44.13	31.90- 41.36	
6..	66.46- 88.38	56.15- 71.61	50.53- 70.70	

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$33.50 to \$40.35
25 to 50 lb.	34.50 to 39.35
50 to 100 lb.	33.50 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Medium-Base, Brass-Covered Receptacle

A medium-base, brass-covered receptacle is being offered to the trade by Pass & Seymour, Inc., of Solvay, N. Y., this receptacle to be known as P. & S. 60,020. Its shell or cover is in one piece and is made especially rigid by an addi-



PORCELAIN FOUNDATION CAST IN ONE
PIECE

tional bead which is spun on the skirt of the cover.

The shell proper of this device is threaded to receive the standard types of the "Uno" shade holder. The brass shell or cover is anchored to the porcelain interior by means of twin screws, and these in turn are held in place by means of special washers. The porcelain foundation for the interior is cast in one piece, and on this the keyless interior is mounted—providing the freedom of accessibility and wiring room so much desired by the practical wireman.

The supporting screw holes for this device are spaced 1½ in. and 2 in. (4.1 cm. and 5.08 cm.) on center. The holes for introducing the wires from the back of this receptacle are of ample size to accommodate heavy wires, and the terminal screws will be found of sufficient size and strength to grip and hold the wires. The lamp-screw shell is of special copper alloy and is secured to the porcelain base by a heavy horseshoe reinforcement.

Master Switch

The Igran Electric Company, Ltd., of London, Eng., has developed the mas-



BUTTON FOR STARTING AND LEVER FOR
STOPPING

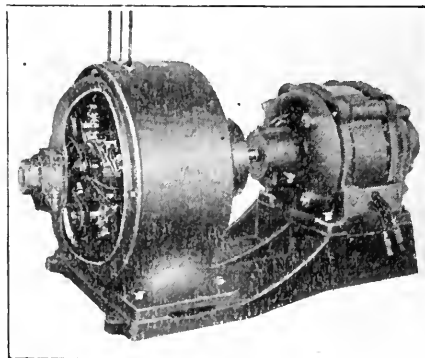
ter switch shown herewith. This switch has a countersunk push-button at the side for starting and a lever at the front for stopping. This type is much favored by those who

consider that it is more safe to have starting and stopping devices of dissimilar shape than to have buttons which are distinguishable from each other only by the marking.

Series Type A.-C. to D.-C. "Compensarc"

The General Electric Company, Schenectady, N. Y., has recently developed an a.-c. to d.-c. "Compensarc" equipment which permits series operation of two arc-type projection lamps while projection is being changed from one lamp to the other. This "Compensarc" is known as the series type. It is made in capacities of 35, 50 and 70 amp. for all standard alternating-current circuits and can be used in nearly all installations.

Series operation was desirable to simplify wiring and to save energy by eliminating the steadying resistance in series with each arc lamp that was found necessary with previous methods



PERMITS SERIES OPERATION OF TWO
PROJECTION MACHINES

where lamps were connected in parallel across the generator armature. Complete equipment includes the "Compensarc," a steel cabinet control panel and a short-circuiting switch for each projection lamp. The 50-amp. and 70-amp. outfits have in addition a starting compensator. The control panel has an ammeter and a generator field rheostat, which are inclosed in the cabinet. The handle of the field rheostat comes through the panel just beneath the ammeter where it is convenient to regulate the arc-lamp current.

The ammeter, the field rheostat and all the wiring are mounted on the front wall of the cabinet, which is removable for mounting and for attention. Wiring may be either at the top or the bottom, as knock-outs are provided. Simple control is attained through the elimination of steadying resistance, use of few parts and compact arrangement.

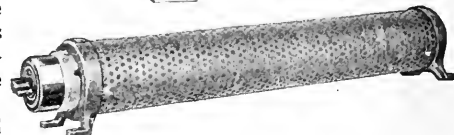
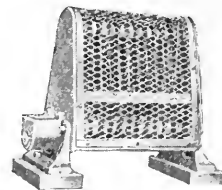
Time Switch

The Hartford Time Switch Company, 71-73 Murray Street, New York City, is bringing out a new type of time switch in order to meet the government requirements of lightless nights. This switch is so designed that after the present emergency has passed it can be readily changed over and become a switch operating each day. These switches are made in sizes ranging from 10 amp. to 200 amp. They are single, double and triple pole and are declared to be dust-proof and weather-proof.

Electric Air Heaters

The Cutler-Hammer Manufacturing Company of Milwaukee has developed and is now marketing a line of electric air heaters designed to supplement the furnace or steam-heating system in the home, office, store, factory or large industrial plant. These electric air heaters are found useful in heating crane cabs, outhouses, valve, pump and meter houses, exposed remote corners or rooms, watch or signal towers, for shearmen and tablemen in steel plants, in theater ticket booths, as well as for scores of miscellaneous applications, and in such uses they effect a distinct saving in coal. Flexible electrical conductors will carry heat cheaply and efficiently to the most inaccessible points.

These air heaters are self-contained, easily moved from one point to another and possess the inherent advantages of all electrical heating devices—heat under perfect control and absolute freedom from dust, ashes, soot, unpleasant odors and vitiation of the air. The perfect control possible allows efficient use of the heat. As soon as a location is warmed, a turn of the switch cuts



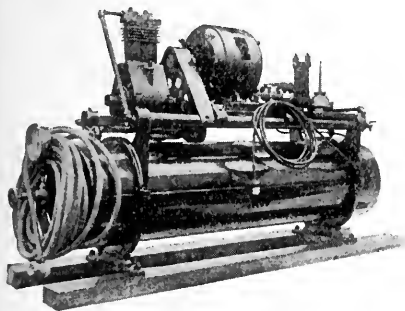
GRID AND UNIT TYPE HEATER

off the current and the heater can be moved to warm another part.

C-H heaters are made in various shapes, sizes and capacities, and a heater to fit almost any space or condition of mounting may be selected.

Automatic Air-Pressure Outfit

The M. L. Bastian Auto Engineering Works, Olney, Philadelphia, has developed the outfit shown herewith, for service in garages and other places



FOR USE IN GARAGES

where air is required. The outfit contains a pump, motor, storage tank, pressure gage and the necessary air and electrical connectors.

The pump is gear-connected to a $\frac{1}{2}$ -hp. Robbins & Myers motor which is equipped with a cord and plug for connection to a lamp socket. A rawhide pinion is provided on the motor shaft to eliminate unnecessary gear noise.

Floor-Polishing Machine

The Dale-Rey Corporation of 25 Church Street, New York City, has developed the polishing machine for waxed floors, of wood or linoleum, shown in the accompanying illustration. It is pointed out that this machine is easy to operate; a boy or woman can easily handle it and quickly obtain a uniform result. The outfit weighs approximately 100 lb. (45.4 kg.). Its height over the case is $9\frac{1}{2}$ in. (24.1 cm.), and the width is 19 in. (48.3 cm.). It is mounted upon rollers, and moves around with little effort. It will go under desks—an important feature, it is pointed out.



CAN ALSO BE USED FOR SCRUBBING FLOORS

The essential apparatus consists of a cylindrical brush, propelled by a $\frac{1}{4}$ -hp. motor. The brush revolves at high speed, and not in the same plane as the floor, but at right angles thereto. This buffing action produces a hard surface

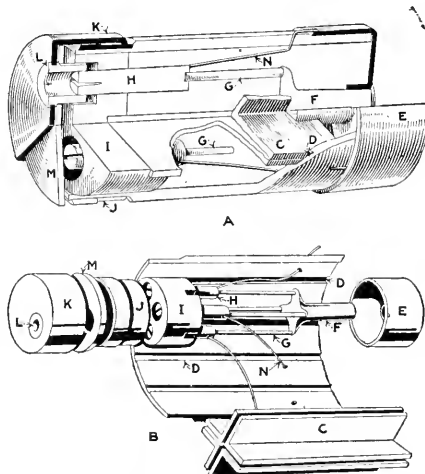
—resulting in a reduction in the amount of wax required.

The brush is made up of two semi-circular aluminum cylinders, mounted upon an aluminum drum, running upon Hess-Bright ball bearings, and is propelled from the motor by a chain and sprocket. A counterbalanced weight upon the handle of the machine may be adjusted so as to alter the pressure upon the floor.

Four-in-One Cartridge Fuse

A four-in-one cartridge fuse, known as the Atlas fuse, has been placed on the market by the Atlas Selling Agency of New York City. A sectional view A and an exploded view B of this fuse are given in the accompanying figure.

From the outside this type of fuse looks the same as the standard type of cartridge fuse, and it can be used anywhere that standard fuses are used. However, instead of one single chamber, as in the ordinary type of cartridge fuse, the inside of the shell is divided into four compartments by four pieces of fiber, then bent and assembled, as shown at C in both views. The fiber compartments fit into grooves D in the fiber-containing shell, making a strong construction.



SECTIONAL AND EXPLODED VIEW OF FUSE

One end of the fuse shell is equipped with a stationary brass cap E. From the center of this stationary cap is a copper extension F, from which four fuse wires G run through the four separate compartments to four copper terminals H, held in a short shell fiber cylinder I at the opposite end of the fuse. A stationary brass ferrule J is placed on the end of the fuse shell containing the four fiber terminals H and fiber cylinder I. Fitted over the stationary ferrule is a movable brass cap K containing a copper receptacle L that fits over one of the copper fuse terminals H, as shown in the sectional view. This completes the circuit through the fuse from the movable cap K to the stationary cap E. The copper terminals H are slotted in the end that the receptacles fit over, to give them a spring and make a good contact in the receptacle.

If a fuse blows, all that is necessary is to remove the cartridge from the clips, pull cap K out about $\frac{1}{4}$ in. (6.4 mm.), and give it a quarter turn, push back the cap, and another fuse element is in circuit. Replace the cartridge in the clips, and the circuit is again ready for service. To prevent making contact with any fuse element other than the one that is intended to be in circuit, a fiber washer M is placed in the top of the movable cap K. The blowing of a fuse element is indicated, as in a standard fuse, by a fine steel wire N that extends from the copper terminal H to the stationary cap E. Each fuse element is solidly packed in its chamber with an insulating powder. This new type of fuse is approved by the Underwriters' Laboratories, and is made with ferrule contact in all amperages up to and including 60. All measurements and dimensions are N. E. C. standard, thus assuring perfect fit in every type of N. E. C. standard panel, switchboard and inclosed-fuse cutoff.

Sign and Outlet Receptacle

Pass & Seymour, Inc., of Solvay, N. Y., are about to place on the market a receptacle that will be known to the trade as their No. 437. This device is of the screw-ring type which fits the common $1\frac{1}{2}$ -in. (3.8-cm.) hole. Its principal advantage lies in the fact that the body of the receptacle proper is but $\frac{13}{16}$ in. (2.06 cm.) in depth. This allows the wires to be carried the proper distance from the surface wired over and effects a material economy of space because it does not extend back far from the face of the sign, and when used in outlet boxes it does not extend from the outlet-box cover as far in the box as the common receptacle.

Provision is made in the back for pouring weatherproofing compound, thereby entirely covering the metal parts. It is also pointed out by the manufacturer that the receiving shell for the lamp is very rich in copper and yet has sufficient alloy to render it a dependable and rigid member. This lamp shell is retained in the receptacle by means of phosphor-bronze screws of special strength, which readily permit the removal of the receiving shell for the lamp without disturbing the terminal plates in the back of the receptacle.

A ball-tipped spring-center contact of phosphor bronze guarantees continuous contact with the base of the lamp. This is an important item because the usual



METAL PARTS ARE ENTIRELY COVERED

location of these receptacles, when installed, is remote and hard to get at. Any feature which adds to the durability and permanency of the device, it is pointed out, makes frequent attention unnecessary.

Trade Notes

THE GILPIN V. C. COMPANY, formerly of 2010 Broadway, has removed its offices to the warehouse at 50 Columbia Heights, Brooklyn, N. Y.

J. W. TAMM has been transferred to the New York City office of the Western Electric Company. He was formerly manager of the San Francisco branch of that company.

LYMAN C. REED, 821 Union Street, New Orleans, La., has been appointed district sales agent for the alternating-current motors and fans of the Century Electric Company, St. Louis.

C. M. SCOTT, formerly Cleveland representative of the Detroit Fuse & Manufacturing Company, is now associated with the Western Electric Company and will continue to make Cleveland his headquarters.

THE ALAN ELECTRIC COMPANY, recently incorporated in Jersey City, N. J., has acquired property at Montgomery Street and Baldwin Avenue, about 95 ft. by 100 ft., for the manufacture of electric generating machinery.

LEO H. GAMP, formerly manager of the F. E. Newbery Electric Company, announces that he has organized the Gump Electric Company, with offices at 1625-26 Chemical Building, St. Louis, Mo., for the purpose of doing a general electrical construction business.

E. I. WILLIAMS, recently with the Canadian General Electric Company, has been engaged by the Estate Stove Company of Hamilton, Ohio, as a representative of its electrical department. Mr. Williams has been identified with the electric heating industry for many years.

FRED WILMARTH of Rockford, Ill., has been selected to represent the Greusel-Quantof Electric Company of Milwaukee, Wis., in northern Illinois and southern Wisconsin. Mr. Wilmarth has just completed a long service with the firm of E. F. Pendergast & Company of Rockford.

THE COOPER HEWITT ELECTRIC COMPANY of Hoboken, N. J., announces that its Cincinnati office has been moved into larger quarters at No. 1406 First National Bank Building. George W. Walker, who has been with the company for the last ten years, continues as district sales manager.

THE INDEPENDENT LAMP & WIRE COMPANY has transferred its automobile and miniature lamp business to the Miniature Incandescent Lamp Corporation of Newark, N. J., where the production will be increased to approximately 30,000 lamps per day, enabling the company to take care of the greatly increased demand for its products.

JAMES B. OLSON has resigned as assistant secretary and general sales manager of the Habirshaw Electric Cable Company, Inc., of New York City. Mr. Olson expects to continue in the insulated wire and cable business, resuming business relations in the near future. In the meantime his address will be Hotel Chatelaine, Bedford Avenue, Brooklyn, N. Y.

THE GROSSMAN MANUFACTURING CORPORATION, Brooklyn, N. Y., announces that while the government has taken over the Bush Terminal property in Brooklyn, this will not affect its business. The government has only requisitioned the Bush docks and warehouse buildings, which does not in any way affect the industrial building in which the Grossman company is established.

H. W. WISWELL, recently manager of the apparatus department of the Brown & Hall Supply Company, St. Louis, and formerly with the St. Louis sales office of the Westinghouse Electric & Manufacturing Company for about ten years, has gone into business, under the style of H. W. Wiswell Company, as manufacturers' sales specialist, handling motors, generators, transformers, meters, electrical equipment and supplies.

ROBERT S. PARRETT of Alexandria, Va., has been appointed commercial attaché to the American embassy at Buenos Aires, Argentina, according to an announcement made Feb. 7 by the Bureau of Foreign and Domestic Commerce, Department of Commerce. He will also act as the War Trade Board's representative in Argentina. The commercial attachés are "business diplomats" stationed permanently at the principal foreign capitals. Their work is particularly important at this time, when careful attention must be given to present abnormal conditions and plans laid for maintaining the position of the United States after the war.

JOHN F. GILCHRIST has been elected president of the Federal Sign System (Electric), succeeding John H. Goehst, who died on Jan. 1, 1918. Mr. Gilchrist was one of the organizers of the Federal Electric Company, predecessor of the Federal Sign System (Electric), and served as treasurer for a number of years. Mr. Gilchrist is also vice-president of the Commonwealth Edison Company, vice-president of the Middle West Utilities Company, and assistant to the president of the Public Service Company of Northern Illinois. James M. Gilchrist has been elected secretary and treasurer of the Federal Sign System (Electric), succeeding as treasurer John F. Gilchrist, and Ralph T. Schuetz has been elected a director to succeed Mr. Goehst.

THE HURLEY MACHINE COMPANY of Chicago is offering for investment \$500,000 of 7 per cent cumulative preferred stock, par value \$100 per share. It is redeemable at \$110 and accrued dividends, carrying with it 15 per cent in common stock. The Hurley company manufactures a large line of electrical labor-saving devices for the home, under the trade name "Thor." Through this new capital the company will be provided with facilities to increase its output from 400 to 600 per cent over its 1917 sales, which totaled about \$1,650,000. The new plant of the company, which it purchased early in the year, at Twenty-second Street and Fifty-fourth Avenue (Cicero), just outside the city limits, is 256 ft. by 636 ft., the buildings containing 65,000 sq. ft. of floor space.

THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE, Department of Commerce, Washington, D. C., in a report made public lately, points out America's opportunity of increasing its sales of electrical goods in Ecuador and Peru during the absence of German competition. Before the war this trade was divided between Germany and the United States, the advantage being with the American manufacturer. The government's report is concerned with the market as it exists to-day and the opportunities it offers for the future. Copies of "Electrical Goods in Ecuador and Peru," Special Agents' Series No. 154, can be purchased, at the nominal price of 10 cents, from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from any of the district or co-operative offices of the Bureau of Foreign and Domestic Commerce.

EXPORT LICENSES.—The War Trade Board has announced that all export licenses issued on and after Jan. 22, 1918, shall be valid for a period of ninety days except in the case of special commodities where a different period is specifically prescribed or allowed. Heretofore the term of an ordinary export license has been sixty days from the date of issuance, and the new ruling has been adopted in order to aid manufacturers who contract for future delivery and to avoid congestion at ports of exit due to the expiration of export licenses pending shipment and the delay involved in obtaining new licenses or extensions of the originals. No extensions whatsoever of the new "ninety-day" licenses will be granted. If it becomes evident that goods cannot be shipped during the term of the license, a new application for license should be filed in ample time stating the probable date of shipment. In such cases the original license should not be returned with the new application but should be held until it has expired. Extensions of licenses issued on or before Jan. 21, 1918, will be granted as heretofore. It is announced that the Bureau of Exports has discretion to grant licenses valid for a period not exceeding six months in cases where the article to be exported must be specially manufactured and there is satisfactory evidence that more than ninety days are required for its manufacture and shipment. No extensions whatsoever of these licenses will be granted, and in case of expiration before shipment a new license must be applied for.

Trade Publications

FANS.—The Eck Dynamo & Motor Company of Belleville, N. J., has prepared a leaflet descriptive of its Eck hurricane fans.

PIPE BENDER.—The Martin portable vise stand and pipe bender is illustrated and described in a leaflet prepared by H. P. Martin & Sons, Owensboro, Ky.

SYNCHRONOUS MOTORS.—Bulletin No. 182, descriptive of synchronous motors, has been prepared by the Electric Machinery Company of Minneapolis, Minn.

PIPE VISE.—The Gerold Manufacturing Company of Old Colony Building, Chicago, is distributing a leaflet descriptive of its Chaining pipe vise.

AMMONIA CONDENSERS.—The De La Vergne Machine Company of New York City has prepared a folder descriptive of its counter-current ammonia condensers.

FANS.—The Racine Electric Company of Racine, Wis., is distributing a leaflet descriptive of its 12-in. desk and wall fan, its 8-in. desk and wall fan and its table fan.

LIGHTING FIXTURES.—The Luminous Unit Company of St. Louis, Mo., is distributing its catalog No. 6, descriptive of its "Brascolite," "Aglite," "Projectolite" and "Industrolite" units.

STREET-LIGHTING FIXTURES.—Type CL Luxeolite fixtures are illustrated and described in catalog 7-A, supplement 3, issued by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

PROJECTOR DEVICES.—The Argus Lamp & Appliance Company, 322 Euclid Avenue, Cleveland, Ohio, is distributing a booklet of sales information and prices, in effect Feb. 1, 1918, covering Argus units, consisting of the Sheek universal adapter and Argus current regulators, for operating all types of Mazda projector lamps for motion-picture projection.

STOKER EQUIPMENT.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing a folder containing leaflets on its stoker equipment. The subjects taken up in these leaflets are cost of steam, the Westinghouse Roney stoker applied to tubular boilers, air distribution of underfeed stokers, efficiency and capacity of underfeed stokers and the construction of underfeed stokers.

ILLUMINATION.—In a bulletin entitled "Fundamentals of Illumination Design" the engineering department of the National Lamp Works of General Electric Company has presented in simple and readable language a discussion of the broad principles which underlie illuminating engineering practice. The bulletin should prove of exceptional value to schools and colleges, particularly to those in which a course in illumination is included as a part of the regular study program. Its value is not limited to students, however, for much of the material presented is the result of very recent investigations and the data will bear the closest scrutiny of the practicing illuminating engineer. This bulletin on the fundamentals, the bulletins on specific applications, such as industrial lighting, store lighting, show-window lighting, light projection, tennis-court lighting, protective lighting, etc., together with the bulletins on Mazda lamps, comprise an accurate, practical and up-to-the-minute reference work on illumination.

New Incorporations

THE OSBORNE STORAGE BATTERY COMPANY of Cleveland, Ohio, has been chartered with a capital stock of \$10,000 by Carroll K. Osborne and Earl H. Jaynes.

THE SPENMAN ELECTRIC VALVE GRINDING COMPANY of Worcester, Mass., has been incorporated with a capital stock of \$50,000 by B. T. Spenman, A. W. Larson and J. N. Sandberg, all of Worcester.

THE TECHNICAL PRODUCTION COMPANY of New York, N. Y., has been incorporated by G. H. Hyman, J. Lampel and H. Lampel, 580 Fifth Avenue, New York, N. Y. The company is capitalized at \$25,000 and proposes to manufacture electrical supplies.

THE STORAGE BATTERY DISTRIBUTING COMPANY, 678 Montgomery Street, Jersey City, N. J., has been incorporated by Frederick S. Moore, 258 Springfield Avenue, Newark, N. J.; Howard C. Chase, 2560 Boulevard, Jersey City, and John H. Bauer, 48 Bergen Avenue, Jersey City. The company is capitalized at \$6,500 and proposes to equip and deal in electrically-propelled and other vehicles.

THE PAGE WIRE FENCE COMPANY OF CANADA, of Walkerville, Ont., has been incorporated with a capital stock of \$250,000 to manufacture iron, steel, metals, hot and cold ingots, billets, rods, bars, wire, cable, etc. Arrangements are being made by the company to erect a plant at Three Rivers, Que., to cost about \$150,000. The incorporators are: Arthur R. W. Plimssoll, Reigner Brodeur, Adolphe Chouinard and others of Montreal, Que.

THE ALMA (MICH.) ELECTRIC & BATTERY COMPANY has been incorporated with a capital stock of \$20,000.

THE MAJESTIC ELECTRIC SUPPLIES, Ltd., of Toronto, Ont., Can., has been chartered with a capital stock of \$150,000 by Jacob H. Greenberg, 24 King Street West, Toronto, and others.

THE McDANIEL ELECTRIC COMPANY of Mansfield, Ohio, has been incorporated with a capital stock of \$10,000 by William McDaniels, Roy J. McDaniel, F. Frank, E. McDaniel and William F. Gill.

THE UNITED STATES MAGNETO COMPANY of New York, N. Y., has been incorporated with a capital stock of \$10,000 by C. R. Allison, J. J. McGrath and A. L. Story, 128 Broadway, New York, N. Y.

THE MARVIS MACHINERY COMPANY of New York, N. Y., has been chartered by Arthur P. Davis, David M. Mahood and John H. Noll. The company is capitalized at \$10,000 and proposes to do electrical work.

THE APPEL BATTERY SERVICE COMPANY of St. Louis, Mo., has been chartered with a capital stock of \$6,000 by Victor R. Appel, Robert G. McCurdy and Harry W. Pohle. The company proposes to deal in auto storage batteries.

THE AKRON (OHIO) ELECTRIC REGULATOR COMPANY has been incorporated with a capital stock of \$100,000 by William

H. K. Stephens, H. K. Raymond, William F. Pfeiffer, C. W. McLaughlin, W. Franklin Clark and John W. Thomas.

THE NEW YORK ELECTRICAL LABORATORIES of New York, N. Y., have filed articles of incorporation with a capital stock of \$10,000. The incorporators are: F. C. Hoops, T. B. Hazleton and S. Morgan, 47 West 125th Street, New York, N. Y.

THE CHINA ELECTRIC COMPANY of Dover, Del., has filed articles of incorporation with a capital stock of \$1,000,000 to construct and operate electric plants. The incorporators are: W. F. O'Keefe, G. G. Speighler and E. E. Wright of Wilmington, Del.

ALBERT F. GANZ of New York, N. Y., has filed articles of incorporation with a capital stock of \$12,000 to manufacture apparatus for the mitigation of electrolysis, etc. The incorporators are: E. L. Hegeman, R. J. Jacobus and F. L. R. Francisco, 511 Fifth Avenue, New York, N. Y.

THE ELECTRIC COMPANY of Hartford, Conn., has been incorporated by George H. Cooper, J. G. Peterson, both of Hartford, and Theodore Birath of Jersey City, N. J. The company is capitalized at \$50,000 and proposes to manufacture and deal in electrical devices, etc. The company will begin business with \$3,500.

THE SCHROEDER HEADLIGHT & GENERATOR COMPANY of Evansville, Ind., has been chartered with a capital

stock of \$150,000 by William H. McCurdy, John D. Craft, William A. Carson, Albert F. Karges, Marcus S. Sonntag, J. H. Schroeder and S. W. Cook. The company proposes to manufacture and deal in headlights.

THE ELECTRIC WELDING & MANUFACTURING COMPANY of Milwaukee, Wis., has been chartered with a capital stock of \$10,000 by George F. Luehring, Joseph Stika and Oscar Greulich. The company proposes to operate a machine shop and specialize in repairs by the oxy-acetylene process, as well as manufacture seamless goods.

THE EQUITABLE MACHINERY CORPORATION of New York, N. Y., has been incorporated by C. E. McManus, 400 West 160th Street; T. F. Hussa, 50 Church Street, New York, N. Y., and C. W. Hussa of Montclair, N. J. The company is capitalized at \$25,000 and proposes to manufacture engines, electric supplies and mechanical apparatus.

THE ARMA ENGINEERING COMPANY of New York, N. Y., has been chartered with a capital stock of \$50,000 by A. P. Davis, 542 West 112th Street; P. C. Verner, 202 Riverside Drive, New York City, and D. M. Mahood, 4821 Fort Hamilton Parkway, Brooklyn, N. Y. The company proposes to do a general electrical and mechanical engineering and general contracting business, etc.

New England States

BOOTHBAY HARBOR, ME.—The property and holdings of the Boothbay Harbor Electric Light & Power Company have been taken over by the Lincoln County Power Company, which plans to enlarge the plant. Contracts for the construction of a new power station at Boothbay Harbor have been awarded and work is being pushed on the new 11,000-volt transmission line now being erected to connect Damariscotta, Bristol and Boothbay Harbor.

LYNN, MASS.—The Lynn Gas & Electric Company contemplates the installation of a 7500-kw. turbine. Orders have been placed for the machine to be delivered in June. J. F. Dubois is manager of the electric department.

NEW BEDFORD, MASS.—The Board of Gas and Electric Light Commissioners has granted the New Bedford Gas & Electric Company permission to issue 4770 shares of capital stock at \$150 a share (par value \$100) and also to issue \$885,000 in bonds, the proceeds to be used to take up outstanding indebtedness and to pay for the cost of the new Cannon Street station now under construction.

PLYMOUTH, MASS.—The Plymouth Electric Light Company has petitioned the Selectmen of Kingston for permission to erect poles on Brookdale Avenue from the Duxbury town line to Brackett's Mill for the purpose of operating a three-phase, 11,000-volt transmission line.

WORCESTER, MASS.—The City Council is considering the installation of additional street lamps on Fairmont Avenue and on Plantation Street from the Boston and Albany railroad bridge to Franklin Street.

NORWICH, CONN.—Contracts have been signed by the Water and Light Commissioners for one 4000-kw. General Electric turbine, two Babcock & Wilcox boilers (510 hp.), C. H. Wheeler condensing apparatus, two sets of type "E" stokers and forced and induced draft apparatus for the municipal electric-light plant. A new building will be erected for the boilers. S. J. Kehoe is manager of the municipal gas and electric plant.

Middle Atlantic States

ALBANY, N. Y.—A portion of the plant of the Esco Electric Company of Albany was destroyed by fire on Jan. 30, causing a loss of about \$75,000.

ALBANY, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 27 for conduit and wiring, gas piping and lighting fixtures in the United States custom house and post office at Albany. Specifications may be obtained at the above office or at the office of the custodian at Albany.

BINGHAMTON, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until March 6 for renewals of electric wiring, main building. Binghamton State Hospital, Binghamton. For details see Searchlight Department.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company of Buffalo, which recently took over the Salmon River Power Company, has been authorized by the Public Service Commission to issue \$1,300,000 in notes, the proceeds to be used for extensions and improvements and to take up outstanding obligations. The company has begun work on the installation of a 15,000-hp. steam-driven electric generating unit at its Lyons plant.

HUDSON, N. Y.—Work has begun on the new electric power cable to be erected across the river, just below Hudson.

LYONS, N. Y.—The output of the steam electric generating plant of the Niagara, Lockport & Ontario Power Company in Lyons is being increased from 25,000 hp. to 40,000 hp. It is expected to have the new unit installed by June 1, 1918.

OGDENSBURG, N. Y.—The City Council is considering entering into an agreement with the Ogdensburg Power & Light Company to furnish electricity to operate the pumping station. Tentative terms are being considered by the Council for renewing the contract for street-lighting which expires some time next year. Mayor Frank is said to be in favor of extending the cluster-lamp lighting system from Ford Street to the New York Central depot.

SCHENECTADY, N. Y.—A certificate of extension of service has been filed in the office of the county clerk by the Schenectady Illuminating Company, which provides for supplying electricity for lamps and motors and also manufacturing and dealing in all kinds of electrical appliances and apparatus in towns in Schenectady, Albany, Fulton Herkimer, Montgomery, Rensselaer, Schoharie, Saratoga and Washington counties.

UNION SPRINGS, N. Y.—The Union Springs Light & Power Company is erecting 12 miles of electric transmission lines to supply electrical service to the country between Auburn and Union Springs. Energy will be secured from the Niagara Power Company, through the Empire Gas & Electric Company (Auburn division). The line will be completed early in the spring of 1918. The local plant, it is expected, will be closed down when the line is finished. Transmission lines are also being erected to the towns of Plournoy, Mapleton and the summer resort at Farley's, N. Y. Douglas A. B. Smith is general manager.

NEWARK, N. J.—The Gamon Meter Company, 286 South Street, is contemplating the construction of a boiler plant and engine house at its works.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for furnishing under specifica-

tions No. 2809 one electric traveling crane at the navy yard, Philadelphia. The cost is estimated at \$25,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for furnishing an electrically-operated traveling crane, of the overhead type, installed on the runways in the addition to the boat shop at the navy yard, Philadelphia. Drawings and specifications (No. 2809) may be obtained on application to the above bureau or to the commandant of the navy yard named.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for addition to boat shop, consisting of a new building, 100 ft. by 400 ft., and an extension of existing building, about 62 ft. by 116 ft., including lighting and heating systems, etc. Drawings and specifications (No. 2806) may be obtained on application to the bureau or to the commandant of the navy yard named.

PLYMOUTH, PA.—Plans, it is reported, are being considered by the American Gas Company for rebuilding the electric-light plant of the Luzerne County Gas & Electric Company of Plymouth, which it controls.

SINKING SPRING, PA.—Application will be made to the Public Service Commission by the Berkshire Electric Company of Sinking Spring for approval of a contract with the borough of Wernersville and the borough of Robesonia for street lighting.

BRIDGEVILLE, DEL.—The Eastern Shore Gas & Electric Company is erecting an electric transmission line from Bridgeville to Greenwood to supply electricity to the latter place. When the line is completed the plant at Greenwood will be closed down. The local plant will then supply energy in Laurel, Blades, Seaford, Bridgeville and Greenwood.

CHARLESTON, W. VA.—Extensions and improvements are under way by the West Virginia Water & Electric Company, which will greatly increase the output of both the electric and water plants. The company has recently closed a contract with the United States government to supply water and electricity for lamps and motors at the new government projectile plant now being erected in Charleston. W. C. Davisson is vice-president.

FAIRMONT, W. VA.—The board of directors of the Monongahela Valley Traction Company, it is reported, have approved an issue of \$3,000,000 in notes, the proceeds to be used for improvements. The proposed work includes a large power plant at Rivesville, already reported under construction.

WHEELING, W. VA.—The City Council is considering changing the street-lighting system from direct to alternating current. A consulting engineer has been engaged to make investigations relative to same. W. B. Kain is superintendent of the municipal electric-light plant.

WASHINGTON, D. C.—Bids will be received by the general supply committee, Treasury Department, Washington, D. C.,

until March 6 for furnishing as may be ordered from time to time during the fiscal year beginning July 1, 1918, and ending June 30, 1919, supplies as follows: Class 5—Laboratory apparatus and hospital appliances; and surgical instruments; Class 6—Electrical, engineering and plumbing supplies; Class 15—Incandescent electric lamps; Class 16—Incandescent gas lamp supplies; Class 17—Motor trucks; Class 18—Machines, office, labor-saving; addressing, computing, duplicating, folding, sealing and typewriting, supplies for addressing machines and typewriter equipment, etc., of the general schedule of supplies for use by the executive departments and other establishments of the government of the United States. Proposal blanks may be obtained on application to the general supply committee, Auditor's Building, Fourteenth and B Streets, S. W., Washington, D. C.

North Central States

DETROIT, MICH.—Bids will be received by the lighthouse inspector, Detroit, Mich., until Feb. 19, for furnishing an 18 to 24-hp. marine gasoline engine. Further information may be obtained at the above office.

FLINT, MICH.—The office building of the Michigan Light Company and the Consumers' Power Company was damaged by fire recently, causing a loss of about \$30,000.

FLINT, MICH.—Bids will be received by the Board of Water Commissioners of the city of Flint until March 5 for furnishing and installing one 15,000,000-gal. 150-ft. total head-gear turbine-driven centrifugal pumping unit with condenser and auxiliaries. F. N. Baldwin is superintendent.

MORENCI, MICH.—The Southern Michigan Light & Power Company is planning to extend its electric transmission line, three phase, 6600 volts, to Alverton, Ohio, and Waldron, Mich., work on which will start early this spring. The company will furnish energy to operate the Avis Milling Company at Waldron, which operates a flour mill and lighting plant. C. J. Avis is treasurer.

CLEVELAND, OHIO.—Bonds to the amount of \$350,000, it is reported, have been sold by the city of Cleveland, the proceeds to be used for improvements to the municipal electric-light plant.

DAYTON, OHIO.—Arrangements have been made whereby the Dayton Power & Light Company will furnish electricity to be used in the construction work by the Miami Conservancy District. The power will be used on the Germantown, Englewood, Taylorsville and Huffman dams and for river channel excavation in Dayton. The company will begin work at once on the erection of electric transmission lines to the various dam sites. At Dayton two large drag-line excavators, operated by electric motors, will be the principal power users. All motors to be used in the work have been purchased.

NORTONVILLE, KY.—The Norton Coal Mining Company is planning to build an addition to its power house, brick commissary house and supply house, for which bids have been received. B. Price, Empire Building, Birmingham, Ala., is architect.

BRAZIL, IND.—The Terre Haute, Indianapolis & Eastern Traction Company of Indianapolis has filed a petition with the Public Service Commission for authority to purchase the plant and holdings of the West Indiana Utilities Company of Brazil.

MARION, IND.—The capital stock of the Delta Electric Company has been increased from \$90,000 to \$115,000.

WHITING, IND.—Bids will be received by the Board of Public Works of Whiting, Ind., until Feb. 25 for construction of a sewage pumping system in accordance with plans and specifications now on file at the office of the Board of Public Works.

SALEM, ILL.—Work has begun on rebuilding the local machine shop and engine house of the Chicago & Eastern Railroad Company, recently destroyed by fire. The cost of the new buildings is estimated at about \$300,000.

APPLETON, WIS.—The Patton Paper Company, it is reported, is considering the construction of a hydroelectric power plant.

BAYFIELD, WIS.—Preparations are being made by the Booth Fisheries Company of Chicago, Ill., to build a new cold-storage warehouse and refrigerating plant at Bayfield to replace the group of buildings destroyed by fire on Jan. 13, causing a loss of about \$50,000.

BLOOMER, WIS.—The transmission line of the Wisconsin-Minnesota Light & Power Company, which supplies energy to the Bloomer Electric Light & Power Company, is being changed from 6600 to 13,200 volts to be delivered at the substation at

Bloomer. Three-phase, 220-volt motor circuits will be available upon completion of the line about March 15. The plant may possibly be taken over by the municipality, which is now considering establishing a municipal electric-light and power plant. F. E. Walrath is secretary and manager.

LA FARGE, WIS.—The La Farge Electric Company will install a 125-hp. Corliss engine this year. Machinery has already been purchased.

OWEN, WIS.—The J. S. Owen Lumber Company has been granted a franchise to supply electricity in Withee. The company has taken over the municipal electric plant and will soon supply energy from its local plant to operate the Withee system. A. R. Owen is president.

WITHEE, WIS.—Electricity for operating the local system will be furnished from the plant of the J. S. Owen Lumber Company of Owen, which has been granted a franchise in Withee and taken over the municipal electric plant.

CROOKSTON, MINN.—At an election to be held Feb. 20 the proposal to issue \$535,000 in bonds for the purchase of the property of the Crookston Water Works, Power & Light Company will be submitted to the voters.

ELY, MINN.—The Hines Lumber Company, it is reported, contemplates developing the water power at the Kawishiwi Falls to furnish power for mines and other local industries.

LANESBORO, MINN.—Plans have been prepared by the Power Engineering Company, Corn Exchange, Minneapolis, for a municipal hydroelectric plant. The city will build superstructure for power house and, it is said, will call for bids on water wheel, generator and governor. The plant will be changed from direct to alternating-current system. A transformer and transmission supplies will be purchased.

VIRGINIA, MINN.—The contract for electrical work for the high school building has been awarded to the Sterling Electric Company, 33 South Fifth Street, Minneapolis, Minn., at \$38,906.

CEDAR FALLS, IOWA.—The city of Cedar Falls is planning to install a 150-hp. horizontal boiler in the water works pumping station.

GREENFIELD, IOWA.—The Council has adopted a resolution authorizing the construction of 6-in. water mains and the erection of a transmission line to supply electricity for pumping water.

SIGOURNEY, IOWA.—The Sigourney Electric Company has applied to the Board of Railroad Commissioners of Iowa for a franchise to construct and operate an electric transmission line on the roads and highways of Keokuk County for the distribution of electricity for lamps and motors.

FAIR PLAY, MO.—Steps have been taken to organize a stock company for the purpose of building a hydroelectric plant on Bear Creek to supply electricity in Fair Play and neighboring towns. The cost of the proposed plant is estimated at \$20,000. W. C. Elrod of the Fair Play Roller Mill Company and others are interested in the project.

BRADLEY, S. D.—The Dakota Northern Power Company of Bradley is contemplating erecting 15 miles of electric transmission line to connect its system with transmission systems of the Spink County Power Company, which it controls. The electric plant at Henry has been discontinued and is now being served by the transmission line of the Dakota Northern company. The power station at Raymond has also been closed down and is being served by the Spink County Power Company. E. H. Lewis is secretary and manager.

BROOKINGS, S. D.—Bids will be received by the Regents of Education of the State of South Dakota, addressed to the president of the State College of Agriculture and Mechanic Arts, Brookings, S. D., until Feb. 25 for the electric wiring of the armory building to be erected at the State College of Agriculture and Mechanic Arts, Brookings. F. H. Ellerbe of St. Paul, Minn., is architect.

LESTERVILLE, S. D.—The contract for construction of the proposed municipal electric-light plant has been awarded to Otto S. Oleson of Sioux Falls.

BROKEN BOW, NEB.—Preparations, it is reported, are being made to install a new 100-hp. Loomis engine in the local electric-light plant for the purpose of extending the commercial lighting service.

DUNBAR, NEB.—The new municipal electric-light plant has recently been completed and put into commission.

FALLS CITY, NEB.—At an election held recently the proposal to issue \$60,000 in bonds for extensions to the municipal elec-

tric-light plant and water-works system was carried.

JUNIATA, NEB.—The City Council is considering calling an election to submit to the voters the proposal to issue \$7,000 in bonds for the construction of an electric transmission line to Hastings.

DODGE CITY, KAN.—The Midland Water, Light & Ice Company has petitioned the City Council to submit a proposal to extend its franchise for a period of ten years to the voters. The company is asking for an extension of its franchise to enable it to make improvements in order to maintain electric transmission lines from Dodge City to neighboring towns in the Arkansas River Valley. The request for a 20-year franchise was defeated last fall.

KINGMAN, KAN.—The old millrace and power plant has been purchased by the Independent Milling Company of Kingman, which will utilize the power to generate electricity to operate its mill.

LEAVENWORTH, KAN.—Arrangements have been made by the Victor Manufacturing Company, manufacturer of electric washing machines, to erect a new building and double the output of its plant.

Southern States

JACKSON, GA.—Improvements are contemplated to the municipal electric-light plant, including rebuilding 1½ miles of pole line (2300 volts) and the installation of a high-pressure centrifugal pump, two stage, electrically driven. W. E. Merck is general manager of the water and light plant.

JEFFERSONVILLE, GA.—The Council is considering calling an election to vote on the proposal to issue \$15,000 in bonds for the installation of a municipal electric-light plant.

SHELLMAN, GA.—Another well is being installed to furnish water for the boiler in the municipal electric-light plant. E. C. Pemberton is superintendent.

WAUCHULA, FLA.—The Council will soon call an election to submit the proposal to issue \$42,000 in bonds to purchase or to build an electric-light plant and for other municipal improvements to the voters.

WHIDDEN, FLA.—The Kissimmee Cattle Company is reported to be considering the installation of an electric-light plant and ice factory. W. E. Ward of Kissimmee is manager. Whidden has not a post office.

BRISTOL, TENN.-VA.—The power dam which was nearing completion for the Rosedale Power Company, on the Holston River, near Bristol, was recently damaged by the flood.

CLINTON, TENN.—The local electric-light plant has been purchased by the Clinton Power Company. The new owners will improve the plant and extend the service. E. C. Cross is president.

COLLINWOOD, TENN.—Contract has been awarded by the Tennessee Valley Iron & Railroad Company to the Thompson-Starrett Company, 51 Wall Street, New York, N. Y., for the construction of a wood distillation plant. The cost of the entire plant is estimated at \$1,500,000. Various improvements including construction of dwellings, water supply, electric-lighting systems, sewers, etc., will cost about \$500,000. W. J. Summers of New York City will have charge of the construction work in Collinwood.

FRIENDSHIP, TENN.—The plant and equipment of the Friendship Electric Light & Power Company, it is reported, has been purchased by the Marvel Milling Company. A new generator has been purchased, it is understood, by the Marvel company which will be installed in the Main Street mill.

BIRMINGHAM, ALA.—Plans are under way for the construction of an interurban railway to be operated by electricity or other power from Birmingham to the Warrior River, a distance of about 21 miles. Two routes are under consideration, one of which would necessitate the building of only 16 miles of line, about 5 miles of existing railroad being utilized. The other plan is to construct an entirely independent line. A company to be known as the Alabama Interurban Railway Company, capitalized at \$5,000,000, will be incorporated to build and operate the proposed railway. G. R. Harsh is general counsel.

GURLEY, ALA.—The Alabama Power Company is erecting an electric transmission line from Huntsville to Gurley. When completed electricity to operate the local system will be supplied from the Huntsville plant.

MOUNTAIN HOME, ARK.—The Zinc & Iron Ore Company, recently organized, it is reported, proposes to construct a hydroelectric development on the North Fork River and build smelters.

LAVERNE, OKLA.—Arrangements are being made by the City Council for the installation of a municipal electric-light plant, for which \$13,000 in bonds were recently voted.

MIAMI, OKLA.—Preliminary steps will be taken at once by the City Commissioner to start work on extensions and improvements to the municipal electric-lighting system, involving an expenditure of about \$45,000.

WEWOKA, OKLA.—The installation of an electric-lighting plant is under consideration by the City Council.

BRYAN, TEX.—The City Commission has adopted an ordinance authorizing the city manager to purchase additional transformers for the light and power systems. The privilege of erecting an electric line beyond the city limits to connect with the city system has been granted by the City Commission.

DEL RIO, TEX.—The construction of a series of dams across Devil's River to provide for water storage for irrigating large areas of land is being promoted by Charles A. Lindsay of Wichita, Kan., and associates. It is also proposed to install one or more hydroelectric plants in connection with the irrigation project.

EAGLE PASS, TEX.—J. R. Sanford and associates are planning to install two centrifugal pumps of 75 hp. each, driven by electric motors, for the purpose of pumping water to irrigate 2000 acres of land about 7 miles from Eagle Pass.

SAN ANGELO, TEX.—The Interstate Electric Corporation is planning to extend its electric transmission lines to a number of towns in Western Texas in addition to those that are already being served. The line which now runs from San Angelo to Ballinger will be extended to Coleman and Brownwood.

Pacific and Mountain States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 4 for the erection of telephone and power transmission lines at the navy yard, Puget Sound. Drawings and specifications (No. 2805) may be obtained on application to the above bureau or to the commandant of the navy yard named.

TACOMA, WASH.—Surveys of four sites tributary to the Nisqually River are being made by Llewellyn Evans, superintendent of the city lighting plant, for an additional power plant to develop 17,000 hp. The cost is estimated at \$1,000,000.

BAKER, ORE.—The electric transmission line of the Idaho-Oregon Light & Power Company, extending from Homestead on the Snake River to Pine Valley, has been completed and is serving electricity for lamps and motors in the towns of Halfway, Carson, Langrell and Cornucopia. The company is also erecting a line into Eagle Valley to furnish electricity in the towns of Richland and New Bridge.

EUGENE, ORE.—Improvements to theume and forebay at the municipal electric generating plant at Waterville is under consideration by the Water Board. C. W. Geller is secretary and general superintendent.

GOLD HILL, ORE.—The placer mining property known as the Hydraulic Mining Company's mine has been purchased by W. A. Sharp of Grants Pass, and brother, L. S. Sharp. The new owners, it is said, will install hydro-electric precipitating value-recovering mining machinery.

McMINVILLE, ORE.—The installation of the new street-lighting system, consisting of 75 series incandescent lamps of 75 cp., is nearly completed. F. E. Thornton is superintendent.

SALEM, ORE.—Two applications have been filed with the state engineer for power developments on the Deschutes River by H. S. McGowan of McGowan, Wash., who is identified with P. J. McGowan & Sons, large salmon packers. One is for an appropriation of 4500 cu. ft. of water of the Deschutes River at a point known as the reclamation power site in Sherman and Wasco Counties. It is proposed to construct a dam 118 ft. high and 300 ft. long at the bottom and 800 ft. at the top, to cost approximately \$2,000,000. The other application is for an appropriation of 3500 cu. ft. per second of water of the Deschutes River at the Metolius power site in Jefferson County, where it is proposed to build a dam 236 ft. high, 90 ft. long at the bottom and 420 ft. long at the top. The cost is estimated at \$4,000,000.

ALPAUGH, CAL.—The new substation of the San Joaquin Light & Power Company,

which is to supply electricity to operate the pumps for irrigating 8000 acres in the Alpaugh Irrigation district, has been completed. The substation is equipped with three 500-kw. transformers and is supplied with electricity from the Corcoran generating station.

EL SEGUNDO, CAL.—The City Council has granted the Southern California Edison Company a franchise to erect electric transmission lines, conduits, cables, etc., for the distribution of electricity in El Segundo for a period of 40 years.

FRESNO, CAL.—The Board of Trustees has awarded the contract for installing 118 electroliters on Fresno Avenue from G to A and from A on Kearney Boulevard to Te-hama to the Lewis Electric Company of Fresno.

LOS ANGELES, CAL.—Plans are being prepared by the Pacific Electric Railway Company of Los Angeles for the construction of 14 new shop buildings, including machine shops and forge works at Torrance. The total cost is estimated at about \$1,000,000.

OLIVE, CAL.—Steps have been taken by the Olive Improvement Association for establishing the Olive lighting district.

RICHMOND, CAL.—The installation of an ornamental street-lighting system is under consideration by the Richmond Retail Merchants' Association.

SAN DIEGO, CAL.—A petition has been filed with the Board of Supervisors asking for the formation of a public highway lighting district, to be known as the Sierra Vista public highway.

WOODLAND, CAL.—The Pacific Gas & Electric Company contemplates extending its electric transmission lines to Guinda, Rumsey and Brooks.

YOSEMITE, CAL.—The Treasury Department at Washington has petitioned Congress for authority to use \$5,000 of the revenues of Yosemite National Park to complete the new hydroelectric power plant in the park.

KENDRICK, IDAHO.—The Potlach Consolidated Electric Company has placed orders for copper wire to replace the iron wire for the electric transmission line between Kendrick and Troy. The company is now installing three new transformers at its Troy station. A. Wilmot is president.

GOLD HILL, UTAH.—Frank W. Ferris of Gold Hill, it is reported, is building a power plant on Trout Creek, about 48 miles from Gold Hill, to cost between \$40,000 and \$50,000. Electricity generated at the plant will be used at the mines in the Gold Hill, Clifton, Willow Springs, Fish Springs, Ferber and other mining districts.

SALT LAKE CITY, UTAH.—Application has been made to the State Engineer by Joseph Lippman and Henry Strauss for water rights in the north and west forks of the Duchesne River near Stockton. The plans filed provide for a hydroelectric development of about 12,000 hp. Electricity generated at the plant will be transmitted to Salt Lake City over a high-tension line.

KINGMAN, ARIZ.—The Desert Power & Water Company is planning to erect an electric transmission line to Hackberry and another line extending to Cyclopic mine, 30 miles north of Chloride. The cost of both lines is estimated at about \$90,000.

MALTO, MONT.—Arrangements are being made for the installation of a new generator in the local electric-light plant, which has already been purchased.

EUREKA, NEV.—Handley Brothers, it is reported, have decided to erect a power sheep-shearing plant (to cost about \$3,000) at the Charley Minoletti ranch, about 9 miles north of Eureka.

LAMOILLE, NEV.—The Elko-Lamoille Power Company is contemplating improvements to its local system. The proposed work includes the construction of a new reservoir and piping the waters of the west fork of the stream into it with a pipe line 5000 ft. long.

LAS CRUCES, N. M.—Formal application will soon be made to the United States government for the advancement of \$2,000,000 to be used in the construction of an irrigation canal that is to lead from the diversion dam of the Elephant Butte reclamation project at Lasburg to Montoya, and for the installation at the latter place of a large hydroelectric plant. All money required for the proposed work is to be repaid by the project. The proposed hydroelectric plant is to provide power for operating industries and to supply energy in El Paso, Las Cruces and other towns along the transmission line.

ROSWELL, N. M.—The Roswell Gas & Electric Company is installing two 256-hp. Erie vertical boilers with Erie stokers, two boiler-feed pumps, with heaters and all auxiliaries, a 1200-sq. ft. surface condenser

on Allis-Chalmers engine, erecting a steel stack, 150 ft. high, 6 ft. in diameter, and also moving and raising three 200-hp. Babcock & Wilcox boilers for stokers. C. M. Einhart is secretary.

Canada

CHILLIWACK, B. C.—The cost of reconstruction of the telephone lines of the Chilliwack Telephone Company, recently damaged by storms, is estimated at \$19,500.

PORT MOODY, B. C.—The construction of a new rolling mill on Rocky Point is under consideration by the Port Moody Steel Works. The equipment will include a 6-ton, three-phase electric furnace.

WINNIPEG, MAN.—Tenders, it is reported, will be asked by the Provincial Bridge Commission for lamp standards and for furnishing electricity for lamps and motors required for the bridge, which will be completed about June 1.

BASSANO, ONT.—The purchase of an electrically-driven pumping unit is under consideration by the Waterworks Department.

BEETON, ONT.—Debentures to the amount of \$15,000 have been authorized for the installation of a hydroelectric system in Beeton.

BRADFORD, ONT.—Plans are being considered for the installation of a hydroelectric system in Bradford, for which \$15,600 in debentures has been authorized.

GUELPH, ONT.—Steps, it is reported, have been taken for the development of the unused power on the Speed River. R. H. Clemens, district representative, it is reported, has taken the matter up with the Hydro-Electric Commission and an inspection will soon be made.

LEAMINGTON, ONT.—Negotiations are under way between the Essex County Light & Power Company and the Hydro-Electric Power Commission of Ontario whereby the latter will take over the plant and system of the former.

MERRITTON, ONT.—Tenders, it is reported, will be asked for the construction of a power plant for the Meridian Pulp & Paper Company. The head office of the company is at 355 Beaver Hall Square, Montreal, Que.

NEWBORO, ONT.—The ratepayers have approved a by-law awarding a contract to J. P. Tett & Brothers to supply electricity in Newboro. Energy to operate the system will be obtained from Bedford Mills.

PORT COLBORNE, ONT.—The Town Council is considering the construction of a water-works pumping station and equipment.

TOTTENHAM, ONT.—Arrangements are being made for the installation of a hydroelectric system in Tottenham, for which \$9,000 in debentures has been authorized.

COLERAINE, QUE.—The contract for the entire electrical equipment of the Bennett-Martin Asbestos & Chrome Mines, Ltd., has been awarded to the Canadian General Electric Company.

COLERAINE, QUE.—The contract for wire for the erection of an electric transmission line between the Black Lake station of the Shawinigan Water & Power Company and the Bennett-Martin Asbestos & Chrome Mines, Ltd., has been awarded to the Canadian Wire & Cable Company, and for insulators to the Canadian Force-lain Company of Hamilton.

MONTREAL, QUE.—The Montreal Tramways Company, under the terms of the new 35-year franchise, has been instructed to construct double tracks on about 13 miles of new line. The work is to be begun in June and completed by November.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 26 for furnishing bronze, copper, copper and brass tubing, steam traps, Klaxon signals, electric grinders, arc lamps, globes, reflectors, power hack saw, copper cable, etc. Blanks and information relating to this circular (No. 1200) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

HONOLULU, HAWAII.—Preparations are being made by the Hawaiian Electric Company for the construction of a new electric plant, to be located on Allen Street, between Bishop and Alekele Streets. The cost of the building exclusive of equipment is estimated at about \$300,000.

(Issued Jan. 1, 1918.)

- 1,253,726. INSULATOR. Ferdinand Stebeo, Charlotttomburg, Germany. App. filed July 12, 1914. "Sleeve" insulators for transformer leads carrying currents at very high voltages.
- 1,253,788. ELECTRIC LOCKING DEVICE; Floyd J. Collar, Alameda, Cal. App. filed July 1, 1916. Permutation-lock-controlled switch especially adapted for insertion in the ignition system of internal-combustion engines.
- 1,253,807. AUTOMATIC SIGNALING MECHANISM FOR STARTING ELEVATORS; Allen A. Fuller, Birmingham, Ala. App. filed

Record of Electrical Patents

Notes on United States Patents

Willis R. King, Newark, N. J. App. filed April 16, 1917. For plating articles in bulk.

1,254,056. PROCESS OF MAKING METAL POWDER; William C. Moore, Lakewood, Ohio. App. filed July 29, 1915. Relates to the making of metal powders and also to current-collecting brushes made from the same.

1,254,067. ELECTRIC SWITCH; Clarence D. Platt, Bridgeport, Conn. App. filed June 23, 1917. Entrance switch.

1,254,077. ELECTRIC FURNACE; Frederick T. Snyder, Oak Park, Ill. App. filed Jan. 19, 1911. Tilting.

1,254,079. ELECTRIC SMELTING FURNACE; Frederick T. Snyder, Oak Park, Ill. App. filed March 1, 1917. Improved ore feed adapted for use in connection with smelting furnaces.

1,254,080. ELECTRODE HOLDER; Frederick T. Snyder, Oak Park, Ill. App. filed Sept. 19, 1917. Applies particularly to side holders.

1,254,081. TELEPHONE SYSTEM; Franklin A. Stearn, Paterson, N. J. App. filed July 5, 1916. Type in which automatic switches are employed for distributing to a plurality of operators' positions the calls originated by the telephone lines of the exchange.

1,254,083. MEASURE-SERVICE TELEPHONE SYSTEM; Samuel S. Stolp, Chicago, Ill. App. filed Feb. 29, 1912. Applies particularly to a party line.

1,254,114. PORTABLE ELECTRIC LIGHT; Bernard Benedict, New York, N. Y. App. filed June 14, 1917. Tubular type.

1,254,117. SIGNALING CIRCUIT; George A. Campbell, Montclair, N. J. App. filed Aug. 18, 1917. Systems wherein signals may be either transmitted from or received at the same station.

1,254,118. SIGNALING CIRCUIT; George A. Campbell, Montclair, N. J. App. filed Aug. 18, 1917. Telephone.

1,254,122. SWITCH-OPERATING MECHANISM; Roy V. Collins, West Newton, Mass. App. filed March 9, 1915. Permits the electric motor for operating the switch point to be put in a sealed box in the ground, since it avoids the making of arcs in the motor box.

1,254,135. ADJUSTMENT OF RELAY CONTACT FINGERS; Clinton C. Harrington, Swissvale, Pa. App. filed Sept. 11, 1917. Improvements.

1,254,139. RAILWAY SIGNALING SYSTEM AND RELAY ADAPTED FOR USE THEREIN; John S. Holliday, Wilkensburg, Pa. App. filed June 22, 1916. Improvements.

1,254,146. SIGNALING CIRCUIT; William H. Martin, New York, N. Y. App. filed Aug. 27, 1917. Telephone.

1,254,152. ELECTRIC SIGNAL SYSTEM; James D. Nelson, Cincinnati, Ohio. App. filed Feb. 26, 1917. Produces a signal system in which the resistance of the controlling magnets of the device to be supervised is normally out of the circuit until momentarily introduced therein upon actuation of any one of the supervised devices.

1,254,167. TELEPHONE-EXCHANGE APPARATUS; Charles A. Stickney, Chicago, Ill. App. filed May 15, 1916. Means whereby a coin deposited in a coin box will be under control of the subscriber depositing the coin until the party called has answered the control of the coin then passing from the subscriber automatically.

1,254,168. TELEPHONE-COIN BOX; Charles A. Stickney, Chicago, Ill. App. filed May 15, 1916. Means whereby the subscriber depositing a coin maintains control of the coin until the connection called for by him is completed.

1,254,172. ELECTRIC CONNECTOR; Frederick A. Tefft, Toledo, Ohio. App. filed May 21, 1917. Used to connect a lead line to a battery terminal.

1,254,182. IGNITION SYSTEM; Leo J. Werner, Newark, N. J. App. filed May 29, 1917. Overcomes the difficulty of hard starting by providing means of ob-

taining a spark or shower of sparks at the proper time, no matter how slow the rotative speed of the engine is.

1,254,198. SIGNAL ALARM FOR SWITCHES; Gabor Blesi, Gary, W. Va. App. filed Dec. 19, 1916. Combines with the movable portion of a switch rail means whereby to notify the switchman or other workman when the switch is in open position.

1,254,210. ELECTRIC LIGHT FIXTURE; John H. Dale, New York, N. Y. App. filed April 3, 1915. For use with nitrogen-filled lamps.

1,254,221. ALTERNATING-CURRENT MOTOR; Valere A. Fynn, St. Louis, Mo. App. filed Feb. 14, 1917. Constitutes the motor itself so as to make it possible to derive from its primary the direct current necessary for the speed regulation of the machine.

1,254,223. LOW-VOLTAGE ELECTRIC SWITCH; Monroe Guitt, Hartford, Conn. App. filed June 22, 1917. Automobile.

1,254,242. DIRECTION INDICATOR; Howard J. Lambert, Portland, Ore. App. filed Nov. 18, 1914. Automobile.

1,254,254. INDICATING SYSTEM; William H. Matthies, Hackensack, N. J. App. filed Dec. 29, 1916. Provides an improved arrangement for testing senders.

1,254,265. BELL; Victor W. Page, Bristol, Conn. App. filed Nov. 16, 1911. Motor-driven gongs.

1,254,274. EXPANDING DEVICE FOR SPEC-TACLE RIMS; George E. Pryor, Los Angeles, Cal. App. filed March 6, 1916. Of the class generally known as composition rims.

1,254,288. CABLE TESTER; Christopher D. Stewart, Ottawa, Ill. App. filed June 22, 1916. Improvements.

1,254,290. TELEPHONE METER-SERVICE SYSTEM; Harold D. Stroud, Chicago, Ill. App. filed April 3, 1913. Meter which, instead of registering the number of calls, registers the total time during which the telephone is in use.

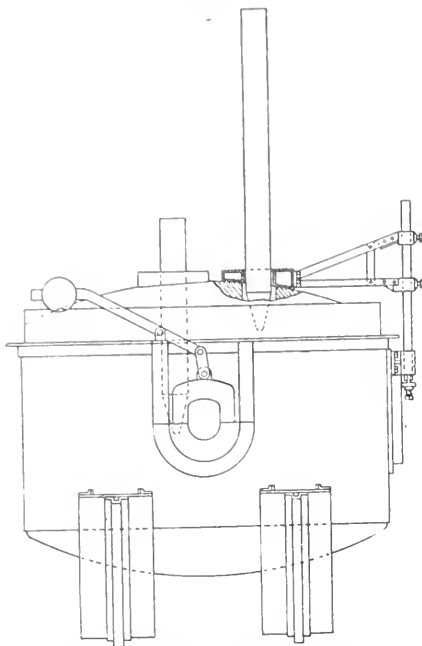
1,254,308. METALLURGICAL FURNACE; William Buhl, Carnegie, Pa. App. filed Aug. 20, 1917. Electric type.

1,254,330. SOUND-RECORDING AND REPRODUCING MACHINE; David F. McQuire and Kenneth D. McQuire, Hornchurch, England. App. filed June 1, 1917. Adapted for domestic and office use.

1,254,331. ELEVATOR SIGNAL SYSTEM; Alexis Le Blanc, New York, N. Y. App. filed April 16, 1913. Improvements.

1,254,405. ELECTRIC HORN SWITCH; Edward E. Johnson, St. Paul, Minn. App. filed Sept. 21, 1914. Improvements.

1,254,411. METHOD OF MANUFACTURING METAL FELLIES; Rudolf Kronenberg, Ohligs, Germany. App. filed Oct. 30, 1917. Used on bicycles and other wheels of automotive and any other cars, carriages and vehicles.



1,254,510—Water Jacket for Electric Furnace Electrodes

Aug. 13, 1915. For starting and controlling the movement of a battery of elevators.

1,253,818. TAPE-TRANSMITTING APPARATUS FOR TRANSMITTING ELECTRICAL IMPULSES; Henry Kingsford, Westminster, London, England. App. filed June 7, 1915. Improvements.

1,253,846. COMBINATION CASE FOR FLASH-LIGHTS; Anker S. Lynne, Bridgeport, Conn. App. filed Oct. 19, 1915. Improvements.

1,253,873. WIRELESS RECEPTACLE; Henry T. Paiste, Philadelphia, Pa. App. filed July 24, 1913. Provides a novel form of lamp or plug receptacle which, in addition to being of relatively simple and substantial construction, shall have the connections between its various terminals made of permanently mounted strip metal pieces to the exclusion of wires.

1,253,874. ATTACHMENT PLUG; Henry T. Paiste, Philadelphia, Pa. App. filed July 24, 1913. Adapter or connecting device for interposition between a socket.

1,253,885. ELECTRICAL EXERCISING DEVICE; Alfredo Quinones, New Orleans, La. App. filed March 24, 1917. Improved.

1,253,915. ELECTRIC HEATING ELEMENT; Clifford R. Wassell, Chicago, Ill. App. filed May 3, 1916. Improved.

1,253,983. BRACKET FOR ELECTRIC LAMPS OR THE LIKE; Adolph W. Kuebler, Chicago, Ill. App. filed July 26, 1915. Improvement.

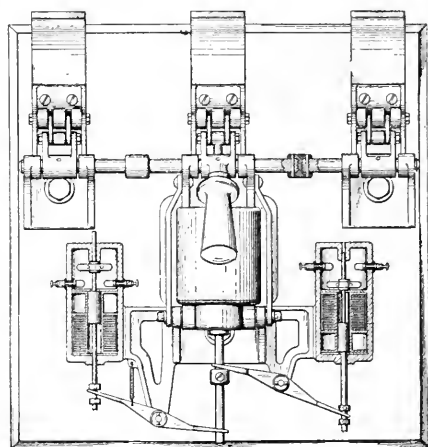
(Issued Jan. 22, 1918.)

1,254,034. COMBUSTION-ENGINE LOCOMOTIVE; Rudolf A. Furrer, Winterthur, Switzerland. App. filed Aug. 17, 1916. The combustion-engine plant is divided, with its two parts or halves in parallel and the shaft of the driven electric generator connected between them, instead of having the generator coupled in line with the engine as is usual with undivided power plants.

1,254,038. RAILWAY SIGNALING; Henry W. Griffin, New York, N. Y. App. filed July 31, 1912. Improvements.

1,254,045. ELECTROLYTIC APPARATUS; James T. King, Toronto, Ont., Canada. App. filed April 19, 1917. Improvements.

1,254,046. MECHANICAL PLATING MACHINE;



1,254,534—Remote-Control Electric Switch

1,254,416. ENGINE-TROUBLE DETECTOR; Samuel Lazarus, Cleveland, Ohio. App. filed Oct. 18, 1915. Particularly adapted for use with an engine having six or a less number of cylinders.

1,254,510. WATER JACKET FOR ELECTRIC FURNACE ELECTRODES; Harold J. Kitchen, Luton, England. App. filed March 7, 1917. Improvements.

1,254,534. REMOTE-CONTROL ELECTRIC SWITCH; Charles E. Pelletier, New Orleans, La. App. filed Feb. 2, 1915. Improved.

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Our Proselytizing Neighbor

IT MAY be that only a master musician can appreciate the genius of Beethoven, but a mere novice in the power business can detect dissonance in the hum of American industries. For want of fuel from which to manufacture electricity factories in the great industrial state of New Jersey, for instance, are compelled to shut down completely every other day. Industries in other states have been confronted with a like predicament. Such a condition in the power market is not healthy for American industries, and our neighbor to the north is quick to take advantage of it. One of the banks in the prairie provinces, in an advertisement in one of the large metropolitan dailies, called attention last week to Canada's water-power resources, which are at present only about one-tenth developed. As indicative of the possibilities for future industrial expansion, it pointed out that there is 7,000,000 hp. still commercially available in the Dominion and offered to furnish information regarding sites, labor conditions, transportation facilities, etc., to American firms seeking to establish branches or factories there. It is well known that many industries which could not obtain sufficient electricity at Niagara Falls found the authorities on the other side of the border willing to oblige them with power. Others are likely to succumb to the propaganda unless Congress acts quickly on measures now before it. Dr. Steinmetz has a viewpoint on Niagara which we publish this week.

The Curtailment of Lighting

PRESTON S. MILLAR'S paper before the Illuminating Engineering Society last week on this important topic is one of the most valuable contributions to war economics that have yet appeared. The central-station men of the country knew well enough that the resounding calls for saving coal by economizing on electric light had no substantial basis in economic efficiency, but were gags for the gallery, drawing attention to trivial although easily observable savings while the great drains on our coal supply went unchecked. Mr. Millar's study of the facts not only fully upholds these impressions, but leaves the man on the street no excuse for misunderstanding the real truth of the situation. Baldly the facts are these: Of the total coal consumption of the country a beggarly 2 per cent goes to the production of electric light and 1 per cent more would more than cover the additional quantity required for gas lighting. Therefore even the entire abolition

of artificial lighting would save less than 3 per cent of the fuel output. The first point of attack chosen in making a reduction of lighting was the electric sign. Now, granted that the electric sign represents in considerable measure an unnecessarily flamboyant phase of an art in many respects offensive to taste, and which could be curtailed without serious public inconvenience, even if electric signs were wholly abolished the total amount of energy that would thus be saved is not in excess of 5 per cent of the energy used for lighting—that is, one-tenth of 1 per cent of the country's fuel output.

Granting that slight reductions may be made in certain other classes of lighting without serious inconvenience, all these curtailments together would amount to only a few tenths of 1 per cent, far less than if the customary room temperature of buildings were cut down two degrees, enormously less than could be saved by the most casual attention to the wastes of fuel in its ordinary domestic use. Even daylight saving, if carried out at once and on the most liberal scale proposed, would not reduce the total coal required for electric lighting by an amount of the slightest importance in comparison with other and familiar wastes. The truth is that nowhere is coal used more efficiently than under the boilers of a well-conducted central station, nowhere is the energy of coal made available with less difficulty and cost than in the electric distribution proceeding from such stations, and, the trouble with our fuel supply being far more in transportation than in lack of raw material, electric transmission and distribution should be encouraged in every possible way in order to relieve the railroads for the transportation of necessary things which cannot be sent over a wire as big as one's little finger.

Lest it be for a moment thought that the central stations are putting in a plea for the preservation of their own particular business, it should be added that they have cheerfully taken their share of the medicine, although knowing full well that it was everywhere being administered ineffectively. Further, experience has already shown in the months since the beginning of hostilities that the enormous industrial demands for power and for lighting necessary work at night are actually going on to increase the business of the central stations beyond their peace-time requirements, and to an extent in which the savings called for by lighting curtailment of all sorts kindly suggested by the Fuel Administration disappear as a drop in the bucket. Beyond this the central-station industry is a regulated one in which all attempts at profiteering can be checked by legal mechanism now existing and in first-class fighting trim. Can this be said of any other industry necessary to the

public welfare? The attempt at price regulation in foods has merely increased as a whole the cost of living, since turning consumption from controlled to uncontrolled channels is merely a new and compelling temptation to the profiteer, as the results have shown. The necessities of war will take care of the business of the central stations without serious effort on their part. Indeed, their chief difficulty will be in meeting the demands for service and in getting the fuel necessary for that part of their output concerning the importance of which there can be not the slightest question.

If it is necessary to save 50,000,000 tons of fuel per year, the place to save it is in the checking of indiscriminate waste in the ordinary utilization of fuel, waste which is at a minimum in electric light stations, and by curtailing with grim determination the use of fuel in industries the continuance of which is not absolutely necessary to the successful prosecution of the war. That these are somewhat difficult to pick out, in face of the opposition of the loud-crying interests involved, is perfectly true; but this does not excuse the Fuel Administration for not using every possible effort to this end. If it is thought necessary in addition to squeeze out what little saving may be made in electric lighting, good and well, let the authorities go to it, and they may be assured that the central stations will not seriously suffer thereby and will not raise a storm of protest. On the contrary, the central-station industry will go the limit in backing the country, on the safety and prosperity of which its own future depends.

Power for a Textile District

THE rapidly increasing dependence of the textile industry on electric power is strongly emphasized by the large developments recently undertaken in the New Bedford territory which are described in the current issue. The demands of war orders and the need of cheap and reliable power co-operated in an unprecedented demand on the capacity of the New Bedford Electric Supply Company, with the result that in three years it has jumped from 8000 kw. to 52,000 kw., of which the major portion is already in operation. The result has been not only great increase in local service, but extension into distant territory and intercommunication with other utilities. The new plant here described was started in April, 1916, and was originally laid out for three 4000-kw. units and one of 10,000 kw., all turbo-generators of the ordinary type. In seven months from the beginning of construction commercial power was being delivered from this plant. An additional 15,000-kw. unit has recently been put into operation, and another of the same size is shortly to be delivered.

An interesting feature of the plant is the thoroughness with which the question of coal supply has been considered. Events of the past few months have emphasized this particular matter, but it was undertaken with foresight, and adjoining the station is a storage yard of 20,000 tons of coal. Transportation is by water, and the barges are unloaded at the water front by a hoisting tower with a capacity of 150 tons an hour. This fuel is crushed or by-passed as necessary and then either stored in bunkers or distributed to the yard. At present fuel is withdrawn from the yard by a loco-

motive crane with a 50-ft. (15.2-m.) beam, but the full provision presently to be installed will include an electric crane of 250-ft. (76.2-m.) span, covering the whole central portion of the yard, with a capacity for 100 tons an hour. The proper organization of coal-storage supply is likely to be for some time a very vital question in station design, and investment in storage facilities is strongly to be recommended. The general description of the plant contains numerous details of interest to the constructing engineer, but the larger phases of the matter and the relation of this great new plant to the surrounding territory are of particular industrial importance.

Measuring Power Loss in Dielectrics of Three-Conductor High-Tension Cables

IN INDUSTRIAL power transmission the importance of high-tension cables increases year by year because population densities increase year by year. In sparsely settled districts and in open country it is advantageous and economical to transmit power over aerial lines. Within city limits, however, it becomes impracticable to transmit power by high tension except over subterranean cables. Consequently, the characteristics and the design of high-tension cables are constantly assuming greater economic importance.

The losses of power in a cable maintained at constant temperature are due to I^2R losses in the conductor and to E^2G losses in the insulator. The linear conductance G includes, however, more than the mere transfer of electrons through the dielectric. It includes also a component due to dielectric hysteresis. Both R and G increase with temperature, although their rates of increase are not the same. Consequently the higher the temperature of the cable the greater the linear loss and the greater the linear production of heat. Each and every cable dielectric has a certain limiting temperature beyond which it is not safe to operate because of rapid ensuing deterioration. The economic problem of operating efficiently any cable once installed consists in working it as nearly continuously as possible up to its safe temperature, but never above this value. The cable temperature at its hottest spot is thus the essential criterion of operation.

In studying experimentally the dielectric power loss in a cable under adjustably varied voltage or temperature it becomes important to measure the power loss, with satisfactory precision, in a test cable sample only a few meters long. In the common case of three-cored cable it is also important to measure this loss by three-phase methods, lest there should be a discrepancy between three-phase and corresponding single-phase dissipation. It is not easy, however, to measure a few watts at a dozen kilovolts three-phase and at a power factor of only a few per cent. Special wattmeter apparatus has to be used and calibrated for such measurements.

In a paper on this subject recently read by F. M. Farmer before the American Institute of Electrical Engineers the preparation and use of a high-sensitivity three-phase reflecting wattmeter is described in connection with such tests. By this means satisfactory wattmeter tests are reported on 3-m. lengths of three-phase cable in the laboratory.

It appears from the paper that the linear watt loss increased somewhat more rapidly than the square of the

voltage, between 5 kv. and 17 kv., and more rapidly than the third power of the cable temperature, between 50 deg. and 120 deg. C. These results are such as might have been expected in regard to voltage, but are very surprising in regard to temperature. When it is considered that doubling the cable temperature within this range may increase the linear power loss more than ten times, the importance of an accurate knowledge of the working temperature of such cables becomes self-evident. We may expect to see recording cable thermometers come into extensive use in central-station operation.

The Selection of Circuit Breakers

THE oil circuit breaker has become a very essential part of electrical equipment, and inasmuch as it is the chief defense against the disastrous results of short circuits its capacity for doing its work is all-important. Therefore the A. I. E. E. paper by Messrs. Hewlitt, Mahoney and Burnham on this topic is one of direct and vital interest to the central station. It is comparatively easy to find out experimentally in the light of experience what a given circuit breaker will stand. The difficulty of the situation lies in estimating the burden which will be suddenly thrust upon it. The capacity of a breaker has been commonly stated in terms of the alternator capacity at a specified reactance, assuming generally normal operating pressure. The actual conditions which may be imposed on the apparatus depend on a far greater number of factors, including several which cannot be readily foretold.

The line of attack upon this difficult problem made by the authors is an approximation, involving only reactance and a somewhat conventionalized time-current decrement ratio. Curves representing the latter are based by the authors on effective current values rather than corresponding peak values and also take into account the increased flux due to the assumed load conditions. The data concerned have been founded on careful experimental study, and a series of examples covering common and typical cases are worked out to show the short-circuit currents for which allowance must be made and therefore the necessary capacity of the circuit breaker. The method seems to lead to an approximate solution of direct value to the engineer and to represent a material advance in a particularly difficult line of investigation. With the great increase in the capacity of generating stations and in the extent of the distribution networks, results of a breakdown are so serious that investigation of the circuit breaker problem cannot be too thorough, and the one before us appears to represent a long step in the right direction, since it puts the working data for ordinary cases upon a sound experimental basis.

Effects of Frequency and of Wave Form on Vapor Rectifiers

THE mercury-arc rectifier for obtaining direct currents from a single-phase alternating-current circuit is a valuable piece of apparatus and is especially useful for charging storage batteries when direct-current mains are not available. The great advantage of such a rectifier is that it employs no rotating machinery. If any motion of parts can be said to exist in the rectifier, it is the rectilinear motion of electrons within the evacuated chamber.

The behavior of a mercury-arc vacuum tube in a simple direct-current circuit may be outlined fairly well for most practical purposes by saying that the tube introduces a nearly steady drop of potential or counter emf.; so that the power lost in the tube is likewise steady and the output bears a simple relation to the power input when the current and voltage at either end are known. When, however, an alternating-current circuit is the source of power the behavior of a rectifier is not so simple. Two rival theories have developed for arriving at an expression of the tube losses. The first theory minimizes the influences of frequency and of wave form at the alternating-current input terminals and concentrates attention on the apparent voltage drop taking place in the tube. This apparent voltage drop is held to remain roughly constant over the range of working currents employed, so that the tube loss and tube efficiency can be readily computed to a first and ordinarily sufficient degree of approximation when the terminal conditions are known. The second theory magnifies the influences of frequency and of wave form and holds that any proper estimate of the tube losses must take both of these considerations into account.

It is doubtful whether there is any serious discontinuity between the two theories above mentioned. The first theory does not seriously deny the possible influences of frequency or of wave form. It merely seeks to overlook these, as of relatively minor importance, for ordinary practical purposes. If, indeed, the losses in a mercury-arc rectifier were entirely independent of frequency or wave form, the device would in these respects be entirely different from any employed in connection with alternating-current circuits. There is always some effect of frequency and some effect of wave form. The only question from an engineering point of view is as to the amount of such influence.

The article by Dr. William Tschudy which we print this week goes to show that the tube loss is very appreciably increased by irregularities in wave form, as well as by increase in frequency, between the limits at least of 40 and 110 cycles per second. We hope that the question will be discussed further in our columns. There is undoubtedly room for more investigation in this matter.

IN THE next issue of the ELECTRICAL WORLD a representative of a Middle West electric service company will tell how he avoided a considerable loss when it became necessary to change the frequency of the system. He will outline in a very convenient way the modifications which were made in all different types of meters to adapt

The Coming Issues

them to the change. Prof. C. E. Clewell will again contribute to this issue, his subject being the use of graphic meters in motor application work. Among other subjects which will be discussed will be the initial current and voltage rush in incandescent lamps of the vacuum and gas-filled types when first connected with the supply circuit.

New 52,000-Kw. Station of New Bedford Company

Engineering Features of Largest Steam-Turbine Plant in South Massachusetts, Which Supplies Important Textile District with Power and Is Interconnected with Other Utilities in Buzzards Bay and Cape Cod Region

THE increased production demanded of Massachusetts textile plants by war orders and a growing appreciation of the value of central-station power have resulted in the expansion of the generating facilities of the New Bedford Gas & Edison Light Company from a rating of 8000 kw. in 1915 to a designed capacity of 52,000 kw. in 1917, 37,000 kw. of which is now installed in a new station on Cannon Street, New Bedford, the largest turbine plant in southern Massachusetts. The output of the company shows an increase for the first six months of 1917 of 86.7 per cent to 207.1 per cent above the corresponding months of 1916. Among the factors that have led to the sudden general realization of the value of central-station service are the present high cost of fuel and the shortage of capital for industrial plant development. From a company giving purely local service on

kw. unit was authorized in the summer of 1916 and is now being operated in the station; a second 15,000-kw. unit will be delivered shortly, the building having been extended last fall to house the machine and its auxiliaries. The old Coffin Street station is being dismantled and the equipment disposed of with the exception of four boilers, two 4000-kw. turbo-generators and auxiliaries, which have been scheduled for service in the new plant.

The Cannon Street station is situated on the shore of Buzzards Bay, which assures an ample supply of condensing water and coal delivery by barges. The plant is near the company's load center, within about one-half mile (0.8 km.) of the business section and practically half way between the groups of textile mills at the north and the south ends of the peninsula on which the city stands. A side track of the New York, New Haven & Hartford Railroad enters the turbine room. The plant is well outside the residential district, away from the fire risk associated with that part of the city. Adjoining the station is a yard with a storage capacity of 20,000 tons of coal, at present equipped with an automatic railway, locomotive crane, tracks, hoisting

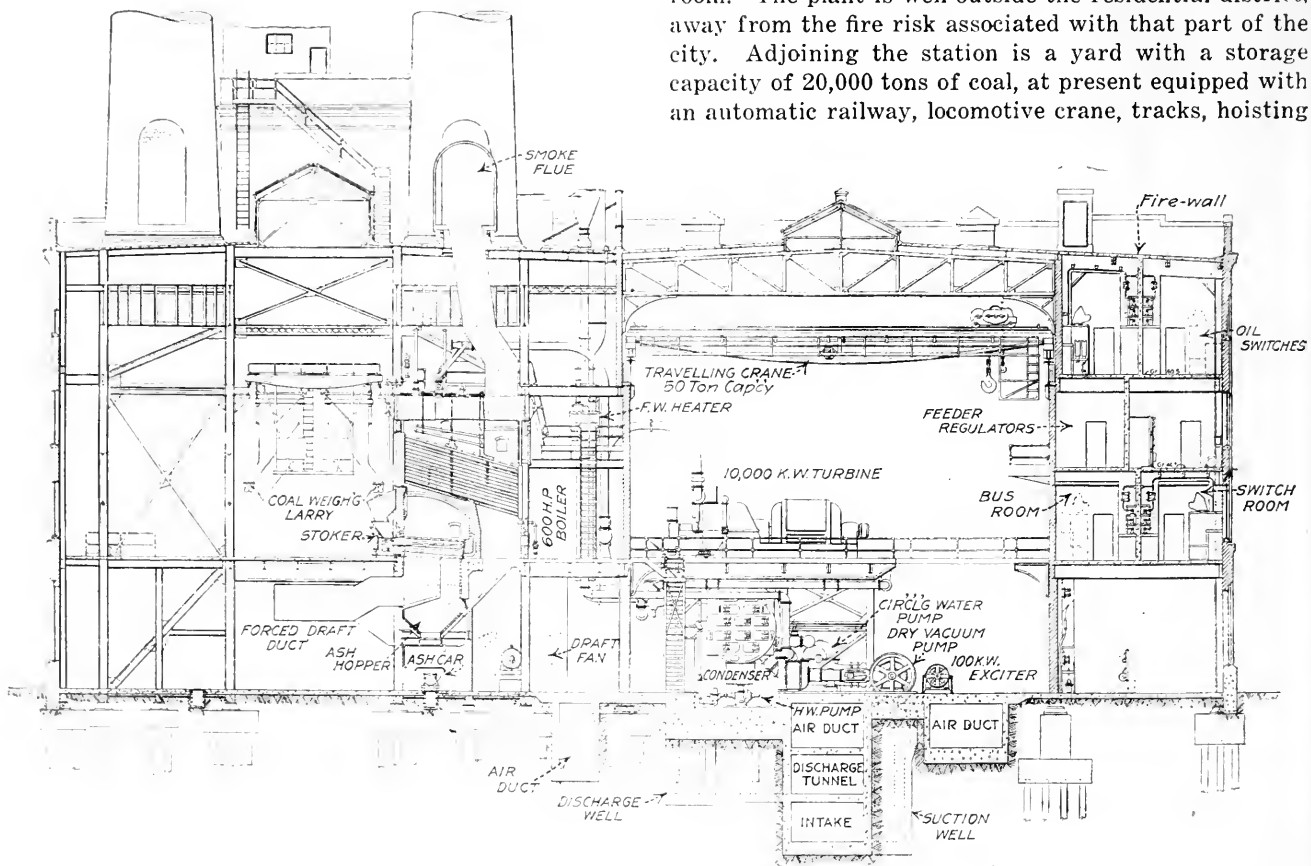


FIG. 1—ARRANGEMENTS FOR DISTRIBUTING COAL TO BOILERS; SMOKE BREECHINGS ON ROOF ARE AMONG FEATURES SHOWN

a small scale this organization has lately developed to a point where its service extends into distant territory. Through interconnection with other utilities maximum efficiency of electrical supply is afforded over a wide area of utilization.

The Cannon Street station was laid out for three 4000-kw. units and one 10,000-kw. set. A 15,000-

tower and other facilities for fuel supply on a large scale.

Coal is now temporarily stored in a 1000-ton bunker situated at the east end of the boiler room on the center line of the firing aisle, but sufficiently above it to enable coal to be handled from the bunker to the boilers by an electrically operated traveling larry run-

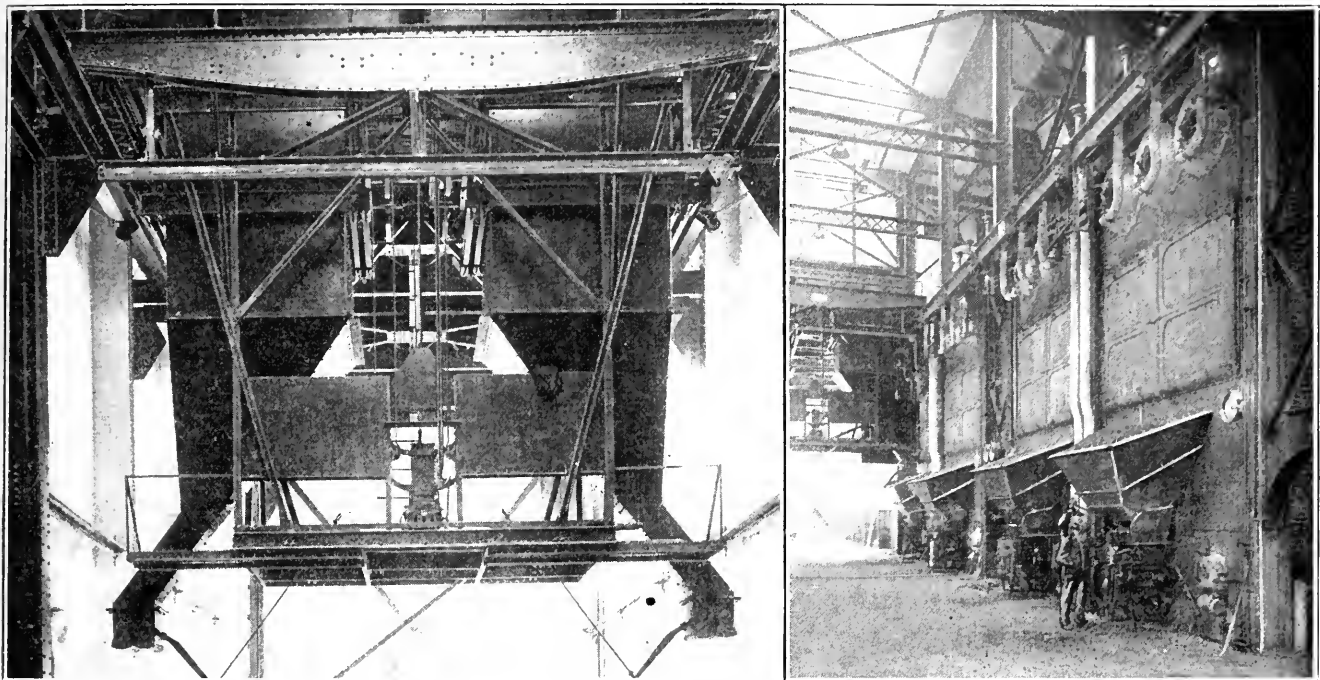
ning from end to end of the building. A basement 20 ft. (6-m.) high extends under all sections of the station.

ELABORATE COAL-HANDLING FACILITIES

Coal is brought to the station in barges and unloaded at the waterfront by a hoisting tower built by the Maine Electric Company, Portland, Me., its capacity being 150

recently purchased a second crane of the locomotive type for yard service. This unit is a McMyler 20-ton outfit and, with the first crane, will be used in trimming and reclaiming the coal and also in handling ashes outside the station.

This coal-handling installation is to be improved later by the removal of the automatic industrial railway and



FIGS. 2 AND 3—DOUBLE-ENDED COAL-WEIGHING AND DISTRIBUTING LORRY AND ONE SIDE OF BOILER-ROOM AISLE

tons per hour. The tower is equipped with a 50-ft. (15-m.) boom, the main hoist being provided with a 1½-cu. yd. (1.26-cu. m.) Haywood clamshell bucket and driven by a 225-hp. General Electric 550-volt induction motor. The trolley on this hoist is driven by a 50-hp. motor. The tower is equipped with a Robbins two-roll coal crusher driven by a 30-hp. motor. The coal is fed to the crusher or by-passed immediately after being hoisted from the barge and is then delivered by gravity into a 3.5-ton receiving hopper, from which it is discharged into an automatic industrial railway car and distributed around the storage yard by gravity dumping and automatic tripping or else fed into an elevated receiving hopper near the north wall of the station. The industrial railway has a capacity of 120 tons per hour. From the receiving hopper outside the plant a swiveling belt conveyor driven by a 7.5-hp., 550-volt motor delivers the coal into either of two track hoppers set in the ground just outside the coal bunker section of the power house. Two 1-ton Hunt skip hoists driven by two 30-hp. motors elevate the coal to the bunker, the hoists being operated by Cutler-Hammer push-button control and solenoid-type switches.

Coal is reclaimed from the yard by a 15-ton steam-driven Link-Belt locomotive crane with 50-ft. (15-m.) boom and 1.5-cu. yd. (1.12-cu. m.) bucket, running on a standard-gage track serving the various parts of the yard and carried over the track hoppers adjoining the bunker house. From the storage yard coal is loaded into a 20-ton hopper-bottom gondola car by the locomotive crane for delivery to the track hoppers, the crane being used to drill the car about the yard. The company has

the provision of an electric crane of 250-ft. (76.2-m.) span which will cover the central portion of the yard and enable fuel to be handled directly from the storage piles to the track hoppers and reclaimed with maximum convenience. The crane will have a capacity for handling about 100 tons per hour and will be equipped with a bucket of about 2 cu. yd. (1.52 cu. m.) capacity. The present locomotive crane can transfer about 60 tons

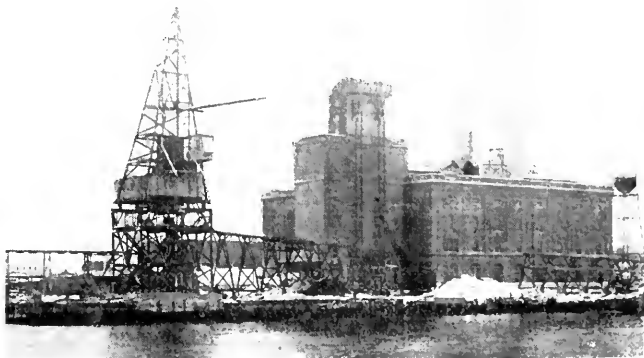


FIG. 4—OUTDOOR COAL-HANDLING FACILITIES

per hour into the skip-hoist pit. A second unloading tower will also be required in the future, when both towers will be equipped for service on a track system to be constructed on the waterfront, following the completion of bulkhead improvements now under way.

Coal is discharged from the bunker at the end of the

boiler house into a Mead-Morrison larry with two 12-ton hoppers which are equipped with Fairbanks ticket-registering scales. The larry is operated along the firing aisle at a maximum speed of 100 ft. per minute by a 7.5-hp., 550-volt General Electric induction motor, and discharges into the stoker hoppers on either side of the boiler room. The convenience of this arrangement is illustrated by the fact that when the boilers were first placed in service and before the full staff of the station was transferred from the Coffin Street station one man operated the larry, cleaned the fires and supplied four boilers with 60 tons of coal in eight hours, also looking after the service of the four units.

FEATURES OF BOILER AND FURNACE EQUIPMENT

The boiler room is designed to accommodate sixteen 600-hp. boilers set in eight batteries, four on each side of a firing aisle 16 ft. (4.8 m.) wide. Ten Babcock & Wilcox boilers are now in place, each being designed for operation at 200 lb. (14.2 kg.) steam pressure and 125 deg. Fahr. (51.7 deg. C.) superheat. Four of the sixteen

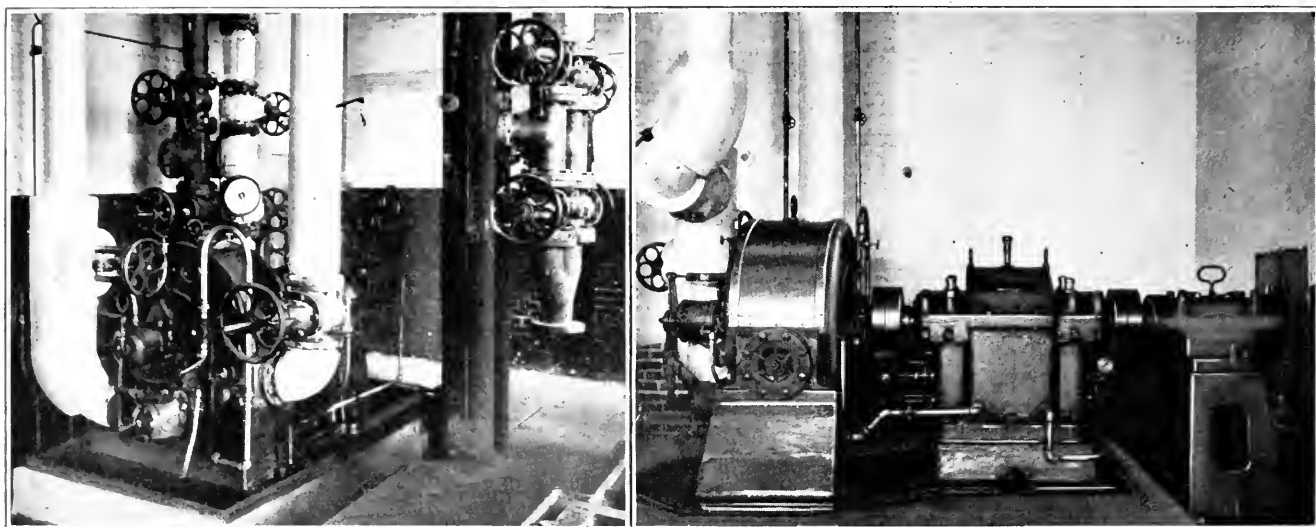
hopper-bottomed car running on a narrow-gage track leading to a 30-ton ash pit outdoor. This service will shortly be provided by an Elwell-Parker 2-ton industrial electric truck.

Another useful feature is the provision of 18-in. (25.72-cm.) nipples in place of the usual 9-in. (12.86-cm.) connections between the header and the steam drum. This gives much more room than is ordinarily the case for inspection and repair work around superheater and drum and makes it possible to rivet or calk a drum without removing the superheater.

The hopper above each stoker is designed to hold about 2.5 tons of coal. A slot-shape opening has been left between the upper and lower parts of the hopper which enables the fireman to see when the coal is low.

The air supply for the furnaces is taken from the basement and forced into a duct system under the firing-aisle floor which feeds the stoker wind boxes. Four Green fans driven through Falk reduction gears by Terry steam turbines provide the forced draft.

The products of combustion are discharged from the



FIGS. 5 AND 6—SOME OF THE AUXILIARY DRIVES

boilers will be equipped with Babcock & Wilcox superheaters and the remainder with Foster superheaters. The boilers are designed for operation at 300 per cent of their rating, their maximum efficiency being attained at 160 per cent of rating. The boilers equipped with B. & W. superheaters came from the Coffin Street station. All the boilers are equipped with the Combustion Engineering Company's type E underfeed stokers.

An unusual feature of this installation, suggested by R. H. Barber, chief engineer of the station, is an arrangement whereby the dust chamber of the rear pass at the back of the bridge wall can be cleaned by opening a damper discharging into the ash hopper, as shown in the station cross-section reproduced herewith. A windlass is provided in the basement below each damper for operating the latter by hand. The arrangement, in the opinion of the operators, is far superior to the usual method of cleaning out the dust chamber by shoveling or vacuum system. With the New Bedford arrangement a boiler dust chamber can be cleaned when the boiler is in service, the fire room is relieved of the dirt and dust usually associated with cleaning, and the staff is saved a vast amount of personal discomfort.

Ashes are dumped from the furnace ash pits into a

boiler uptakes into inclined breechings leading through the boiler-house roof to horizontal smoke ducts running along the roof and joining two reinforced-concrete stacks. The first 75 ft. of the stacks (22.86 m.) is brick-lined to resist the action of the gases. By placing the stacks midway between each end of the firing aisle and discharging smoke into them from each side the steam generating equipment does not have to be separated for stack foundations, the symmetry of station is improved, the size of building for a given boiler capacity is minimized, and some of the boilers can be placed directly under the stacks. The stacks were built by the New York Concrete Construction Company and are equipped with lightning rods. The flue-gas temperatures in this station ordinarily range between 550 deg. and 575 deg. Fahr. (about 293 deg. C.), or about 15 deg. below the steam temperature, including superheat at the boiler uptake. The stoker fan engines are controlled by the steam pressure and the stoker engines by the air pressure in the wind boxes; the system being the so-called balanced-draft type, furnished by the Engineer Company, New York.

This article will be continued in a subsequent issue of the ELECTRICAL WORLD.

Mobilizing Niagara to Aid Civilization

All Its Power Is Urgently Needed by the State and Nation, and Tourists Could View the Mighty Cataract on Sundays and Holidays

BY CHARLES P. STEINMETZ



THE unprecedented and acute shortage of power which now confronts us and threatens seriously to interfere with the efficient prosecution of the war again turns our eyes to Niagara, where water capable of producing millions of kilowatts rushes uselessly over the cliffs.

At the same time we must realize that the present situation is not unexpected, nor was it unavoidable. The emergencies of war times have merely made a sudden and acute condition of a situation which has been coming on for a long time and would sooner or later have overtaken us. We thus turn again to a fuller use of Niagara's power, too late indeed to get the full benefit of it in our present emergency.

In the discussion of the development of Niagara's power versus the preservation of the natural beauty of the falls two features have to be recognized:

(1) The falls are doomed in any case, and sooner or later, with the increasing power demand of modern civilization and increasing shortness of power, self-preservation will force us to use Niagara's power to the fullest extent; that is, let the falls run dry.

(2) It is too late to preserve the natural beauty of the falls. That could have been done a hundred years ago, but not now, when there is no place at or around the cataract where one's sense for nature's wild beauty is not offended by the sight of some ugly modern hotel, some tower or steel bridge.

About fifteen years ago I proposed a plan which, while using the full power of the falls, would preserve their beauty to the sightseer. At that time the suggestion was not taken seriously—the demand for the

power was not then so urgent as to-day—and therefore I repeat it now.

Suppose we permit the complete development of Niagara's 10,000,000 kw., more or less, for electrical purposes, let the falls run dry, but on every holiday and Sunday have the power houses shut down, the power consumption reduced to the minimum possible—say 10 per cent of the full capacity—and so have the falls running again in their ancient grandeur. We could thus satisfy the demands of modern industry and at the same time satisfy the lovers of nature; and, more than that, we would then see a sight which can be seen nowhere in the world—the starting of the falls, when on Sunday morning the water would first begin to trickle over the bare cliffs and then gradually rise to be the giant falls of old.

As the government controls the falls, it would involve no serious difficulty, probably not even require legislation, to give the license for the unlimited use of power with the condition that during Sundays and holidays the power consumption must be reduced to 10 per cent of the maximum.

In considering the full development of Niagara's power we must remember that some hydraulic engineering work will be required to insure uniformity of the flow of water, for Niagara fluctuates in its quantity with the shifting of the winds on Lake Erie. However, the cost of such a development per kilowatt would be insignificant. It probably would mean a movable dam across the Niagara River at Buffalo to restrict the flow when the lake was high and open it wide when the lake was low.

Applications of Flywheels in Motor Operation

Theoretical and Practical Consideration of the Effect Which They Exert—Good Results Are Achieved Where Load Equalization Is an Object—Excess Inertia Disadvantageous with Some Machines

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

Theoretical notes on the use of flywheels for the equalization of loads, with a reference to cases where flywheel effect may be a disadvantage. Outline of applications of flywheels to motors, with descriptive notes on the Ilgner system as an example. Value of flywheel effect in the operation of hoisting-machinery reversing rolls in steel mills and for improving service conditions.

FLYWHEEL effect is sometimes favorable and other times unfavorable to the operation of motors and motor-driven machinery. The former is true where flywheels are used for load equalization, some cases being referred to in the following notes. The disadvantages of flywheel effect become evident in connection with some machine tools like the planer, where an excess inertia in pulleys and in the motor armature increases the difficulty of reversing the movement of the platen.

Some idea of the dimensions which may occur with pulleys on planer equipments may be gained from Fig. 3, which refers to a non-reversing motor-driven equipment. To reduce the flywheel effect aluminum has been used to some extent for planer pulleys. Reduction of the diameter of the motor armature may also make a considerable reduction in the flywheel effect. Calculations indicate that changing the diameter of a 19-in. (39.26-cm.) armature only 5 in. (12.7 cm.) changes the flywheel effect about 100 per cent (Popcke). The same authority points out the rather remarkable fact that a 7½-ton planer platen when moving at a speed of 100 ft. (30.5 m.) per minute has only about one-twenty-fifth of the inertia of a 35-hp. motor when operating at a speed of 1000 r.p.m. These figures give some idea of the possible magnitude of the flywheel effect from the rotational elements of motor-driven ma-

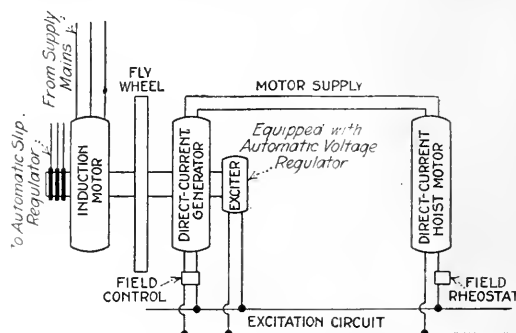
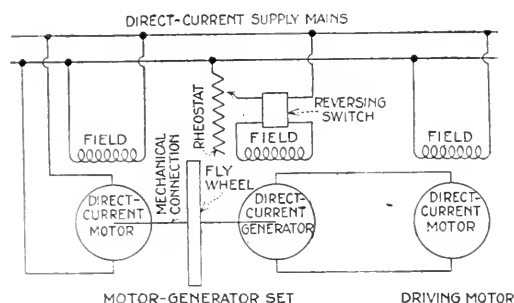
period the flywheel effect can be made to perform a useful function, as will be described later.

Of the two general methods for preventing disturbances due to excessive load fluctuations—by storage battery and by flywheel—the former is applicable to carrying peak loads in central stations, but the latter is not suited to such conditions, since the peak loads exist too long. The flywheel is strictly a "momentary load" absorber or carrier. This is well illustrated by the fact that a given flywheel may be able to handle, say, a 100 per cent overload for a period of one second, while the same flywheel might be entirely incapable of handling even 50 per cent overload for, say, five seconds.¹

The so-called "flywheel effect" is the product of the weight of the flywheel and the square of the radius of gyration, while the amount of energy which such a wheel can give up depends on the difference of the squares of the initial and final speeds. A good idea of the flywheel action upon a motor in which the load torque suddenly changes from a lower to a higher value may be gained from the following equation:

$$T = T_1 - (T_1 - T_0)/e^{at},$$

where T_0 represents the initial constant opposing or load torque and T_1 a new constant and higher value of the opposing or load torque, the change from T_0 to T_1 taking place suddenly. In this equation T represents the torque developed by the motor t seconds after the opposing torque was T_0 . The constant a is defined by the following relation: $a = 308R/K^2WN$. R is the ratio of the torque in pound-feet to the slip (an induction motor is assumed) for the given motor, obtained from the motor characteristic curves; K is the radius of gyration of the flywheel in feet (ignoring the inertia of the other rotating parts, which are usually negligible



FIGS. 1 AND 2—SIMPLIFIED DIAGRAMS OF ILGNER SYSTEM FOR DIRECT-CURRENT AND ALTERNATING-CURRENT SUPPLY

chinery and indicate the extent of their disadvantage in reversing applications.

It should be clearly noted that the objection to flywheel effect in reversing service as just outlined refers merely to the difficulty in accomplishing the reversal. Another and important characteristic of reversing service is the excess momentary demand made on the motor-supply circuits at the time of reversal. During this

when compared with that of the flywheel); W is the weight of the flywheel in pounds and N the synchronous speed of the motor in r.p.m.

In the original equation e is the base of the natural logarithm, and hence the torque T developed by the

¹"American Handbook for Electrical Engineers," p. 547; section by D. B. Rushmore and E. A. Lof. The discussion of the following equation is based on this section.

motor does not change instantly when the load torque increases from T_0 to T_1 , but it increases slowly, depending on the factor a . An inspection of the elements which constitute this factor shows that a may be made small (the condition for a slow increase in the motor torque T for a sudden increase in load) by the use of a flywheel possessing a large flywheel effect, by using a

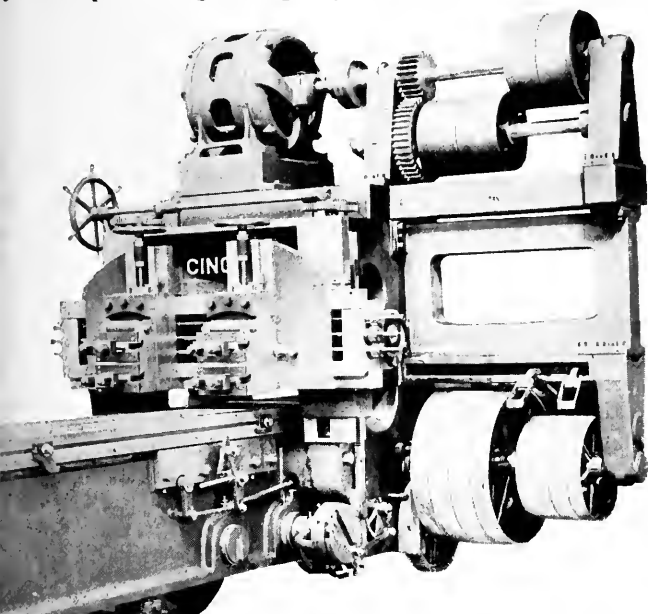


FIG. 3—TYPICAL PLANER DRIVEN BY NON-REVERSING MOTOR

high-speed motor, or by using a motor with large slip for a given torque. Hence if the flywheel effect is made large enough the motor torque may change only slightly when the load increases momentarily, and the load requirements may be back to normal conditions again before the motor torque has had time to change to any extent.

PRACTICAL CASES

To illustrate these theoretical points several practical examples will be given. In the operation of reversing rolling mills in steel plants direct-current motors are commonly employed for driving the rolls. To prevent excessive fluctuations in the supply circuits during the

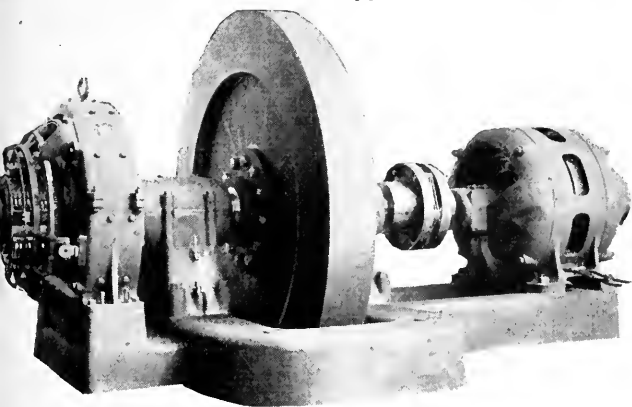


FIG. 4—250-KW. INDICATOR-MOTOR GENERATOR SET

reversing periods the Ilgner system, consisting of a flywheel motor-generator set, is commonly employed. The motor of this set may be either direct-current or alternating-current, although in large outfits the motor of the set is of the polyphase induction type, with arrangements for automatic changes in the rotor resistance so as to increase the slip for excessive loads.

The generator of the set is of the direct-current type with a field reversing switch and a rheostat, permitting wide adjustment of the excitation. The armature of the direct-current generator and that of the driving motor are connected directly to each other, as in Figs. 1 and 2.² Changes in speed of the driving motor are thus effected by changing the direct-current generator voltage through adjustments of its field rheostat, and reversal by changing the polarity of the direct-current generator.

The function of the flywheel in such cases is to minimize fluctuations in the supply circuits which furnish current to the motor of the motor-generator set. For successful operation there must be a sufficient drop in speed of the left motor in Figs. 1 and 2 to enable the flywheel to give up the required amount of its stored energy according to the equation³ $W(V_1^2 - V_2^2)/(2g \times 550) =$ energy available from the flywheel in hp.-seconds. W is the weight of the flywheel in pounds, V_1 is the maximum velocity of the flywheel at its radius of gyration in feet per second, V_2 the minimum velocity at its radius of gyration in feet per second, and g the acceleration due to gravity (32.2 ft. per second per second). This equation implies that some arrangement must be provided for the control of the motor of the motor-generator set.

SAFE SPEEDS FOR CAST-IRON FLYWHEELS WITH SOLID RIMS
(SEE FOOTNOTE 8)

Diameter of Fly-wheel (Ft.)	Maximum Safe Speed (R.p.m.)	Diameter of Fly-wheel (Ft.)	Maximum Safe Speed (R.p.m.)	Diameter of Fly-wheel (Ft.)	Maximum Safe Speed (R.p.m.)	Diameter of Fly-wheel (Ft.)	Maximum Safe Speed (R.p.m.)
1	1680	8	210	15½	108	23	73
1¼	1344	8½	198	16	105	23½	72
1½	1120	9	187	16½	102	24	70
2	840	9½	177	17	99	24½	68
2½	672	10	168	17½	96	25	67
3	560	10½	160	18	93	25½	66
3½	480	11	153	18½	91	26	65
4	420	11½	146	19	89	26½	63
4½	373	12	140	19½	86	27	62
5	336	12½	134	20	84	27½	61
5½	305	13	129	20½	82	28	60
6	280	13½	124	21	80	28½	59
6½	258	14	120	21½	78	29	58
7	240	14½	116	22	76	29½	57
7½	224	15	112	22½	74	30	56

While the flywheel motor-generator set is the equipment most widely used for load equalization, other types are commercially available, such as the flywheel motor balancer and the use of the auxiliary induction motor drive for large hoists with flywheel equalization. Taking up the flywheel motor generator equipment, the practice of one manufacturer⁴ is to use a wound rotor induction motor for driving the set. An adjustable rheostat is connected to the collector rings of this motor (Fig. 2) and its control governed by the input to the induction motor. One type (a usual form) of this rheostat is known as the "liquid slip regulator," which is controlled by a small auxiliary induction motor, the phases of which are each connected in series with one of the mains which supply the main induction motor.

Utilization of the stored energy in the flywheel is accomplished as follows: If the current supplied to the

²Figs. 1 and 2 are simplified diagrams based on standard diagrams for these systems as found, for example, in the "Standard Handbook for Electrical Engineers," pp. 565 and 1215. Figs. 3, 4 and 5 are shown by courtesy of the Crocker-Wheeler Company.

³Wilfred Sykes, "Standard Handbook for Electrical Engineers," p. 1250.

⁴General Electric Company. See Bulletin No. 48,014, pp. 18 and 19.

main induction motor (Fig. 2) rises above some prescribed value, the torque of the small auxiliary induction motor, whose phases are in series with the main supply leads, increases, and this in turn lifts the electrodes of the liquid slip regulator, thus inserting additional resistance in the rotor circuit of the main induction motor.

This action causes the set, and consequently the flywheel, to slow down; the input to the main induction motor is limited, and the flywheel gives up its stored energy. This helps out the main induction motor and prevents excessive peaks in its load. When the load on the set is reduced the reverse action takes place, since the reduced torque of the auxiliary regulating motor causes a decrease in the rotor adjustable resistance, an increase of the main motor speed, and energy is thus again stored in the flywheel for use at the time of the next peak load on the driving motor (to the right in Figs. 1 and 2).

In rolling-mill practice the speed variation to permit storing and utilizing energy in the flywheel may amount to 15 or 20 per cent. Test curves of a flywheel set of this kind show that the flywheel is capable of limiting the load taken from the supply mains to about one-fourth of the maximum output of the generator of the motor-generator set.

This description of the flywheel set, as commonly

in quantity and quality, on the work to be performed.

From the standpoint of the flywheel an increase in the factor ($V_1^2 - V_2^2$) may mean (a) a lower cost for the flywheel and (b) reduced power for its operation. Obviously, therefore, the design of the flywheel and of the motor as a unit involves factors which are opposed to each other and necessitate an engineering balance.

One of the largest and most interesting examples of a flywheel-set installation is that of the motor-driven 35-in. (88.9-cm.) blooming mill at the Lehigh plant of the Bethlehem Steel Company.* This flywheel set is capable of handling a 19-in. by 23-in. (39.26-cm. by 39.42-cm.) ingot weighing 10,000 lb. (4535 kg.). Direct motor drive is employed with two 600-volt motors, which develop a maximum torque of 1,550,000 ft.-lb. (214,000 m.-kg.) and a maximum horsepower of 12,000. Two generators are employed. The rated power of the driving motor is 2000 kw. From the flywheel end, two points are of special interest, namely, the weight of the flywheel, 100,000 lb. (45,359 kg.), and its speed of 375 r.p.m.

Considerable attention was given the choice of this speed, which not only affects the operation of the flywheel, but also the design of the generator. It is pointed out that a speed of 500 r.p.m. might have been used for this Bethlehem set as far as the design of the generators was concerned, but that the use of the lower

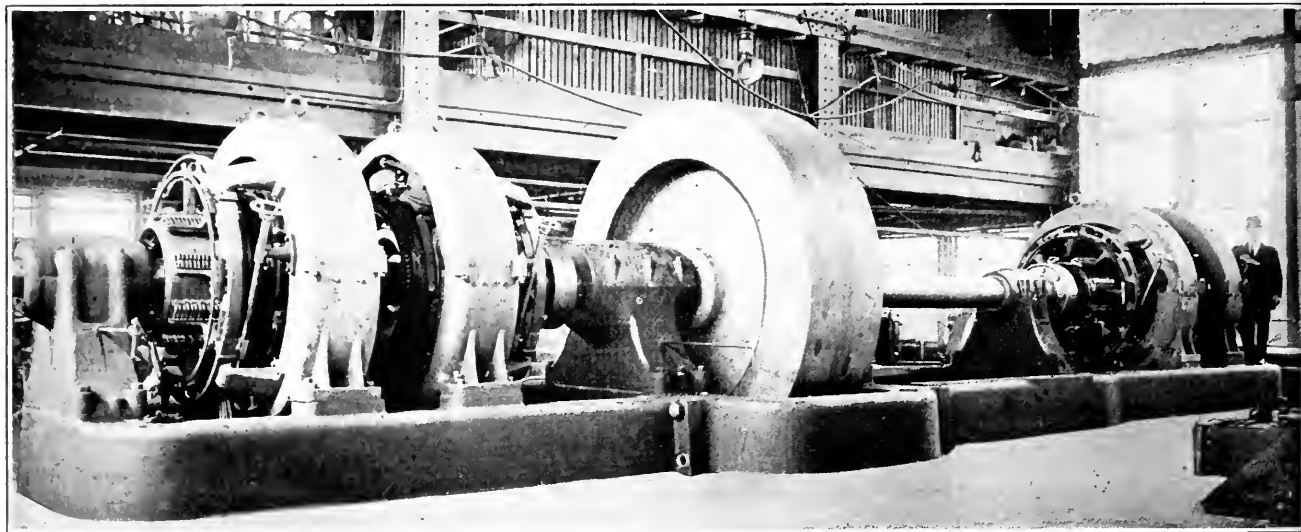


FIG. 5—2000-KW. FIVE-UNIT FLYWHEEL INDUCTION-MOTOR GENERATOR SET (WITHOUT MOTOR)

used, indicates that the use of the flywheel has an influence on the design of the motor to which it is applied. It has been pointed out³ that the design of the motor and flywheel as a unit ought properly to be a compromise between (a) the advantages sought by the use of a flywheel and (b) those disadvantages which result from the special features required in the design of the motor if the flywheel is to be effective. Summarizing, Mr. Pauly says, in effect, that to increase the range of speed over which the flywheel motor unit is to operate for the purpose of increasing the ($V_1^2 - V_2^2$) factor in the equation for energy given up by a flywheel may have the following effects: (a) Higher cost of the motor, (b) reduced motor efficiency, (c) extra complications in the control scheme, and (d) a considerable effect, both

speed (375 r.p.m.) gave a greater margin as an allowance for uncertainties in operating this equipment.

Cast-iron flywheels are most commonly used in installations comparable with rolling-mill drive, and have a limiting peripheral speed of about 6000 ft. (1828.8 m.) per minute. With special construction peripheral speeds as high as 30,000 ft. (9144 m.) per minute are used.⁴ Some idea of the safe maximum speeds in r.p.m. for various diameters of the flywheel may be gained from the table⁵ for cast-iron flywheels with solid rims. This table, however, is merely illustrative, since the maximum safe speeds are a function of the kind of flywheel and of the allowable stresses in the wheel.

*Discussed by W. Sykes and D. Hall, *Transactions A. I. E. E.*, Vol. 35, p. 501.

³"Standard Handbook for Electrical Engineers," fourth edition, p. 1251.

⁵From "Machinery's Encyclopedia," Vol. III, p. 163.

³Discussion by K. A. Pauly, *Transactions A. I. E. E.*, Vol. 34, p. 211.

Factors Affecting Vapor-Rectifier Performance

Bulb Losses Greatly Dependent on Wave Form, Frequency and Anode Current—
Refutation of Some Other Conclusions That Have Been Erroneously
Drawn from Imperfect Investigations

BY DR. WILLIAM TSCHUDY

SOON after the results of the writer's extensive investigations¹ with mercury-vapor rectifiers were published, the Physikalische Reichsanstalt² presented some investigations on the same subject which seemed to contradict³ those made by the writer. Since it is not only

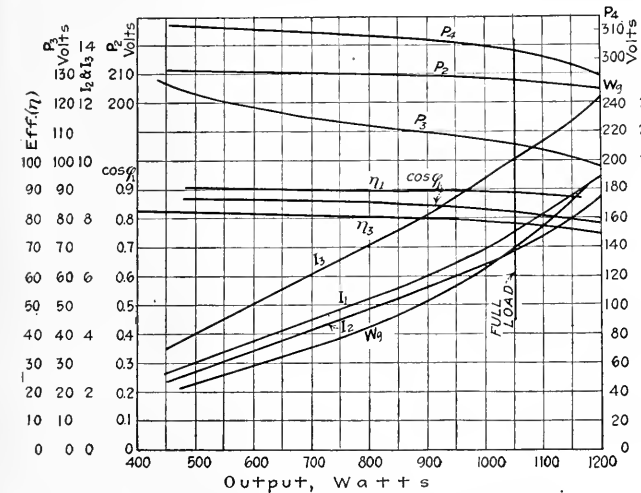


FIG. 1—LOAD CHARACTERISTICS OF A RECTIFIER FOR CONSTANT PRIMARY VOLTAGE AND NORMAL FREQUENCY (SEE TABLE III)

of theoretical interest but of practical importance to have correct ideas on this matter, the writer thinks it worth while to make a detailed comparison of the two investigations in order to demonstrate the correctness of his earlier conclusions.

The Physikalische Reichsanstalt draws the following conclusions: (1) The watts loss in a rectifier bulb can be represented by the voltage drop in the mercury arc; (2) this drop or loss decreases slightly with an increase of the anode current and (3) is independent of the wave form and frequency of the current which is rectified.

To sustain these claims the following reasoning and tests (Tables I and II) were presented: If *i* represents the instantaneous value of the anode current and *e* the instantaneous value of the anode voltage, then the watts loss is

W_g = \frac{1}{T} \int_0^T i e dt

where *T* is the length of one period. During the time when the instantaneous current values are greater than zero, the instantaneous voltage values are considered constant⁴, therefore

W_g = \frac{e}{T} \int_0^T i e dt

or *W_g* = *eI_m*, where *I_m* is the average value of the anode

current and *e* is identical with the voltage drop in the mercury arc and is considered constant.

In connection with Table 1,⁵ from which conclusions (1) and (2) were drawn, it was apparently assumed, although not definitely stated, that the primary voltage of the rectifier was constant. In Table II,⁶ from which conclusion (3) is drawn, it must be pointed out that the primary voltage of the rectifier and the output are not recorded. Furthermore, no data confirming the conclusion that the bulb loss is independent of the wave form are given.

From investigations⁷ made by the writer, however, he is led to believe that the bulb losses are greatly dependent on the wave form, frequency and anode current, and that the Physikalische Reichsanstalt conclusions are incorrect. Assuming that the reader already knows the correct definition⁸ of bulb loss, it is evident that it is incorrect to consider the voltage drop in the mercury arc as a loss. Neither is voltage drop *e* constant for all anode currents, since there is a variation of 18 per cent as shown by Table I. Besides, there is a difference between measured and calculated values of *e*, so that in total there is a difference of about 20 per cent. Therefore the assumption that the voltage drop *e* is constant has to be made with precaution.

With the arrangements shown in Fig. 3 the writer obtained the data⁹ shown in Table III for an absolutely constant primary voltage of 110 volts and a frequency of 50 cycles when the load was increased step by step. Results¹⁰ were also secured with a constant primary

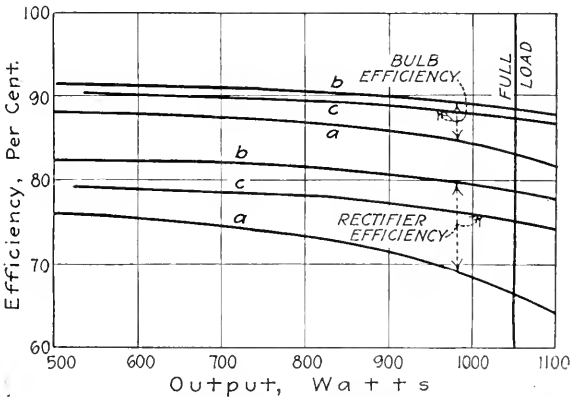


FIG. 2—BULB AND RECTIFIER EFFICIENCIES AT DIFFERENT OUTPUTS AND WITH THREE WAVE FORMS

voltage and different frequencies. The transformer bulb and rectifier efficiencies η_1 , η_2 and η_3 respectively are shown in Fig. 5 as functions of the normal frequency (50) and a constant primary voltage (110).

To study the influence of wave form upon the efficiency of a mercury-arc rectifier, the writer used two

¹"Experimentelle Untersuchungen am Quecksilberdampfgleichrichter," Technical University of Zurich, 1912. See Figs. 1 and 2.
²"Mittlungen der Physikalischen Reichsanstalt," G. Schulze, Archiv für Elektrotechnik, 1913.
³ELECTRICAL WORLD, June 17, 1916.

⁴See Fig. 4 in writer's article, ELECTRICAL WORLD, June 17, 1916.
⁵See footnote 2. ⁶See footnote 2. ⁷See footnote 1.
⁸See footnote 3. ⁹See footnote 1. ¹⁰See footnote 3.

generators which had approximate sine-wave emfs. that differed only slightly as shown by their equations:

$$e = 142.2 \sin (2\pi nt - 0^\circ 29') + 0.997 \sin (6\pi nt + 9^\circ 30') + 0.341 \sin (10\pi nt - 9^\circ 30') \quad (1)$$

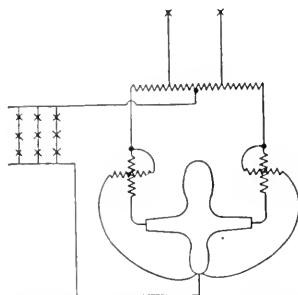
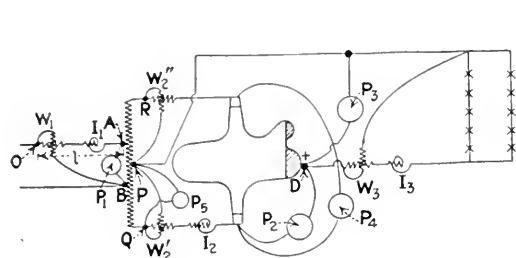
$$\text{and } e = 142.0 \sin (2\pi nt + 0^\circ 23') + 2.19 \sin (4\pi nt - 8^\circ 45') + 2.67 \sin (10\pi nt + 0^\circ 25'). \quad (2)$$

TABLE I—RELATION BETWEEN BULB LOSS, VOLTAGE DROP AND ANODE CURRENT (G. SCHULZE)

I_m is the average value of the anode current; I_{dyn} , which means the current determined by a dynamometer, represents the effective value of the anode current; W_g is the bulb loss determined by method shown in Fig. 1; $W_g/I_m = e$ is the calculated voltage drop; while the last column shows the voltage drop measured directly for different values of anode current.

I_m	I_{dyn}	W_g	$W_g/I_m = e$	e
9.45	9.87	99	15.5	15.4
7.09	7.47	110	15.9	15.7
4.96	5.23	114	17.1	16.5
3.27	3.48	128	18.7	17.8

Still the bulb losses differed as shown in Fig. 6 even



FIGS. 3, 4 AND 5—METHOD OF MEASURING TRANSFORMER AND BULB EFFICIENCY SEPARATELY AND COMBINED; METHOD OF DETERMINING BULB LOSSES DIRECTLY, AND RELATION OF TRANSFORMER, BULB AND RECTIFIER EFFICIENCIES TO OUTPUT

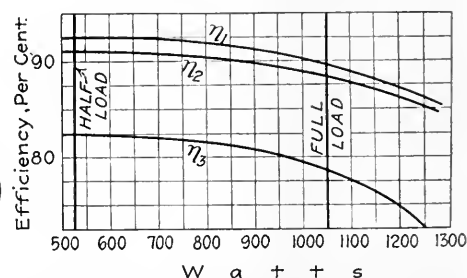
I indicates effective current; P the effective voltage; W power or loss; W' corrected power values. The rectifier input $W_1' = W_c + W_i + W_g + W_s'$, where W_c is the copper loss, W_i the iron loss in the transformer, W_g the bulb loss, and W_s' the corrected output. The bulb output $W_2 = W_1' -$

in a high degree on the wave form. To gain more evidence an analysis was made of the anode-current and anode-voltage curves obtained with a contact-maker using the first-mentioned generator. As mentioned in

TABLE II—EFFECT OF FREQUENCY ON BULB LOSSES (G. SCHULZE)

I_m	I_{dyn}	Frequency	W_g	$W_g/I_m = e$
9.64	9.89	18	146.9	15.2
9.76	9.93	30	150.8	15.5
9.45	9.87	50	146.4	15.5
9.76	9.77	100	149.8	15.1
9.51	9.51	500	146.0	15.4

a previous paper, the bulb losses per anode relative to the wave amplitude may be represented by the formula: $W_g/2 = I_a E_0 + \Sigma I_k E_k/2 \cos \alpha_k$, where $K = 1, 2, 3$, etc. For a given anode current and voltage $W_g/2 = 411.3 + 65.8 - 539.2 + 7.7$. The conclusion to be drawn is that the second and third harmonics affect the bulb losses and efficiency considerably.



$W_c - W_i = W_g + W_s'$. W_i can be measured by wattmeters W_2' and W_2' , making the necessary corrections. The bulb losses are then determined directly by $W_g = W_2 - W_s'$, since both members of the second term are given by the wattmeters. See Fig. 2.

with constant primary voltage and normal frequency. From these curves it may be noted that for 900 watts

Still another test was made to sustain this conclusion. Three generators with the wave forms shown in Figs.

TABLE III—EFFECT¹¹ ON EFFICIENCY OF INCREASING LOAD WHILE VOLTAGE (110) AND FREQUENCY (50) ARE HELD CONSTANT

$W_1 - I_1^2 r$; $W_2' - I_2^2 r$; $W_3 + (P_3^2/r)$, and $W_4 + (P_4^2/r)$ are the corrected wattmeter readings; I_1, I_2 and I_3 were measured by dynamometers, and P_1, P_2 and P_3 with electrostatic (Kelvin) instruments. Since a pulsating current (I_2 and I_3) was flowing through the wattmeters, it might be expected that the readings would be influenced by the earth's magnetic flux, but it was found that the effect was very small (0.5 per cent). Neither did frequency have an appreciable effect on the wattmeter readings. η_1, η_2 and η_3 represent the transformer, bulb and rectifier efficiencies respectively.

No. of Lamps	P_1	I_1	W_1	$W_1' = W_1 - I_1^2 r$ $r = 0.022$ Ohm	$\cos \phi_1$	P_4	I_2	P_2	W_2'	$W_2' - I_2^2 r$ $r = 0.052$ Ohm	W_2	$W_2 + \frac{P_2^2}{r}$	W_g	$\frac{W_g}{2}$	P_3	I_3	W_3	$W_3 + \frac{P_3^2}{r}$	$I_3 P_3$	Average of Two Preceding Columns	Efficiency (per Cent)		
																					η_1	η_2	η_3
3	110.0	6.10	588	587	0.870	311.5	2.64	211.1	265	265	530	534	45	22	123.8	3.92	482	485	485	485	91.0	91.5	82.6
5	110.0	9.00	860	858	0.866	310.0	4.13	210.6	385	384	768	772	69	35	114.8	6.10	696	699	700	699	89.9	91.0	81.5
7	110.0	11.72	1093	1090	0.847	306.5	5.40	210.0	493	441	982	986	100	50	111.0	7.95	880	882	882	882	90.4	89.9	81.0
9	110.0	14.05	1274	1270	0.822	304.5	6.58	208.4	570	567	1134	1138	129	64	106.8	9.45	1003	1005	1005	1004	89.7	88.6	79.1
11	110.0	16.10	1440	1434	0.810	301.3	7.48	206.5	633	630	1260	1264	156	78	101.9	10.85	1102	1104	1104	1104	88.2	87.6	77.0
13	110.0	18.28	1600	1593	0.792	299.8	8.48	204.3	700	696	1392	1396	189	95	98.8	12.20	1200	1202	1205	1203	87.5	86.5	75.5
15	110.0	20.00	1720	1712	0.778	298.0	9.15	202.0	732	728	1456	1460	212	106	93.8	13.26	1242	1244	1244	1244	85.2	85.5	72.6

output there is a difference in losses of about 7 per cent, despite the fact there is slight difference in the wave form.

This discovery led the writer to believe that the bulb losses, and therefore the efficiency, must be dependent

10, 11 and 12 were used, the bulb losses and bulb and rectifier efficiencies being determined (Figs. 8 and 9) at constant voltage (110) and normal frequency (50) in each case.

As a general observation it might be said that the efficiency of mercury-arc rectifiers is generally estimated

¹¹See footnote 1.

too high. It is easy to explain why an increase of bulb losses is to be expected if the impressed wave form is

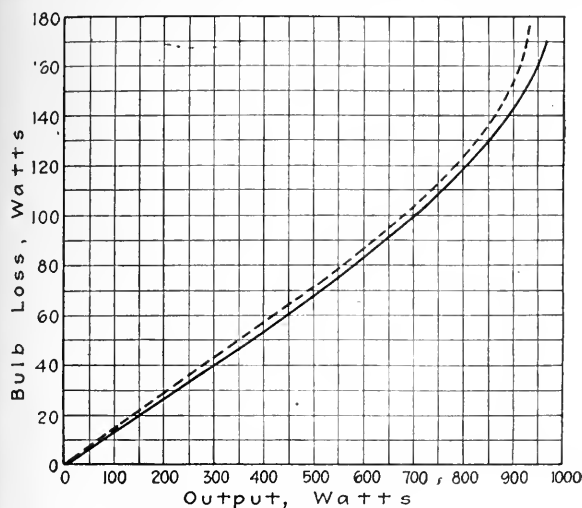


FIG. 6—EFFECT OF WAVE FORM ON BULB LOSSES

(Dotted curve refers to losses with wave form represented by equation (2), while the full-line curve was obtained with the wave form indicated by equation (1). Voltage, 110; frequency, 60 cycles.)

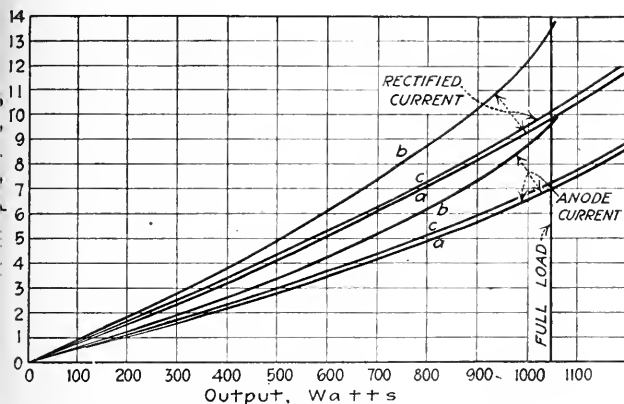
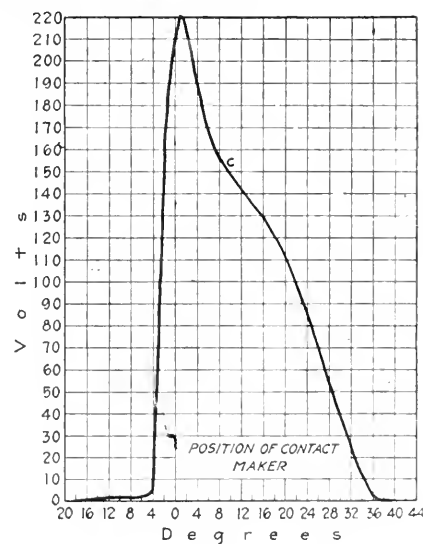
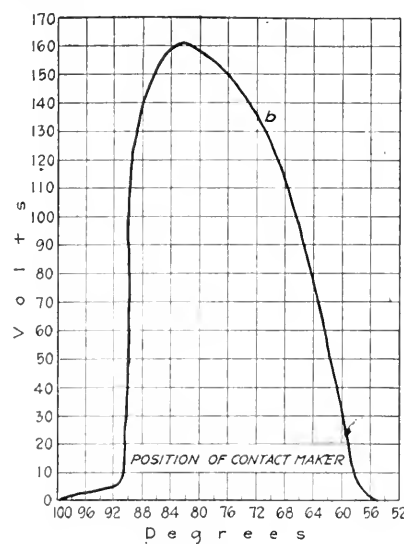
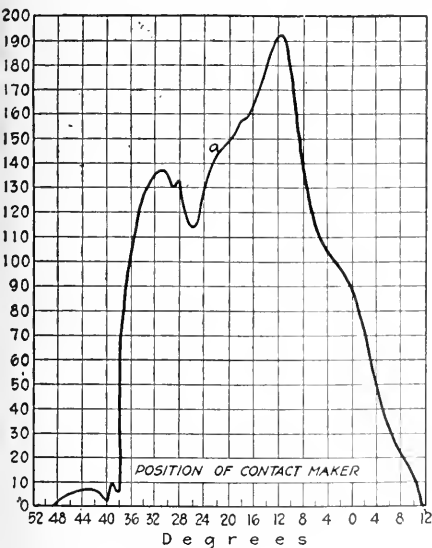


FIG. 7—RELATION OF ANODE AND RECTIFIED CURRENTS TO OUTPUT FOR THREE DIFFERENT WAVE FORMS



FIGS. 10, 11 AND 12—THREE DIFFERENT WAVE FORMS EMPLOYED TO STUDY EFFECT ON RECTIFIER PERFORMANCE

different from the sine form, because for constant primary voltage the watts loss per anode is $W_g/2 = I_2^2 + BI_2$, where A and B are constants and I_2 the anode current.

In refutation of G. Schulze's conclusions that fre-

quency has no influence on the bulb losses the curves of Fig. 8 are presented. While the relations¹² represented have been questioned by some scientists, their opinions were based on investigations made with direct-current mercury arcs, whereas the data presented here refer

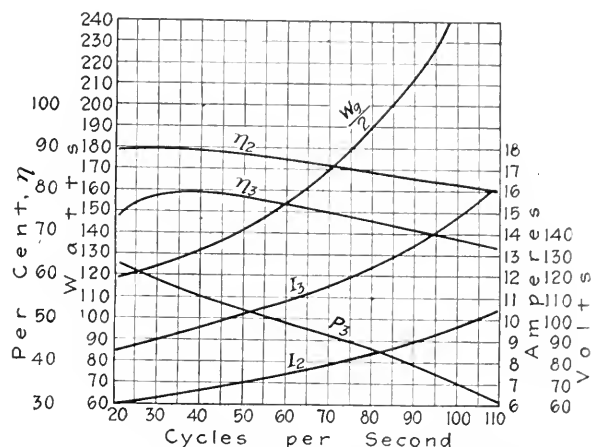


FIG. 8—RELATIONS BETWEEN BULB AND RECTIFIER EFFICIENCIES

(η_2 and η_3) bulb loss per anode (W_g), anode and rectified currents (I_2 and I_3) and rectified voltage (P_3) at different frequencies for a constant normal output (1050 watts) and a constant primary voltage ($P_1 = 110$ volts)

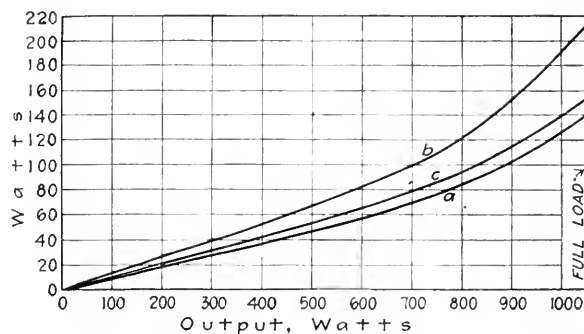
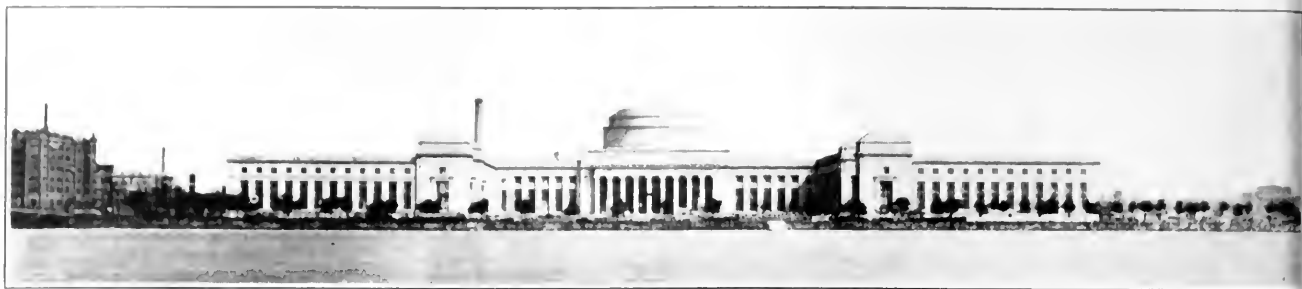


FIG. 9—RELATION OF BULB LOSSES TO OUTPUT FOR THREE DIFFERENT WAVE FORMS

to pulsating current mercury-arc rectifiers with which transformers are used that modify the operation of the arc.

¹²Elektrotechnische Zeitschrift, 1912, p. 1088; La Lumière Electrique, 1912, p. 116; Science Abstracts, 1912; Beiblatter der Annalen, 1913, p. 608; Elektrotechnische Zeitschrift, 1913, p. 254.



Massachusetts Institute of Technology in War

Many Forms of Service to the Nation Are Rendered—Training Technical Men for Land, Sea and Air Activity, Including Duties in Industrial Production

A number of universities are rendering conspicuous service to the nation. Boston "Tech" is especially fortunate in the fine technical organization which enables it to be of notable assistance in the war.

UNUSUALLY varied service is being rendered the United States government by the Massachusetts Institute of Technology in the war. This great engineering university is not only aiding through confidential research work and by the service of graduates under arms, but it is also carrying on an extended program of intensive training to prepare technically qualified men for war service on land, sea and in the air, including duties behind the lines and in communication, transportation and the production of munitions.

For eighteen months before the declaration of war an engineering corps, composed of seniors and instructors, gave time to the study of military engineering at the institute. At the moment war was declared President Maclaurin offered to the United States government the entire facilities of the institute, its faculties and laboratories, pointing out that the use of the latter by a staff familiar with them would be of the greatest advantage.

When war was declared a student committee was appointed to consider the situation and advise the undergraduates as to their most helpful course of action. This committee reported that undergraduates had better "sit tight" and that on graduation they would be worth more to the government than at the time war was declared or while remaining as students. Seniors were advised to seek places where technical men would be of advantage. Summer camps for military work were organized at East Machias, Me., and at Cambridge, Mass., the former, for sophomores, having an attendance of 200, lasting twelve weeks and having uniforms and military routine. The latter camp was for juniors, and in addition to the military work anticipated some of the senior study, to fit the men earlier for national service. The attendance was also 200.

By these means the institute, instead of being "shot to pieces" by the natural excitement and desire to enlist in the ranks, was held together, and last September at the registration nearly 90 per cent of the students were back in school ready again to take up their studies.

Speeding up of the regular courses was undertaken as soon as war was declared, although this development

in its highest degree is still under consideration. The vacation courses were to such an extent anticipatory of the senior work that qualified men in the 1918 class were ready for degrees about New Year's, early placing at the service of the government and of industries allied with the war a strong group of competent engineers, young, enthusiastic, well grounded in the fundamentals of engineering practice and not without knowledge of the bearing of such practice on modern war methods.

AN ALL-YEAR ENGINEERING COLLEGE

By recent faculty action the institute becomes an all-the-year-round school of engineering, and the lower classes will be advanced toward graduation, not only by the elimination of some of the less important items of study, but also by continuous work throughout the year. In this way the present juniors will be ready for degrees in the fall of 1918, anticipating the normal graduation by about nine months, while the second-year students will be similarly accelerated.

These undertakings on the part of the faculty to prepare enthusiastic students willing to work are based on the belief that the war is to last three or four years longer, and that the Technology student who leaves the institute at the end of his junior year to enter military work is but half an engineer in efficiency compared with what he would be at the end of the fourth-year courses.

At present there are about 2000 regular students in the institute. An advance battalion of senior classmen has been organized and put into khaki, more than 400 men being in the organization. A freshman battalion has also been put into uniform, and a four-year military option has been established in accordance with plans formulated just after war was declared, with the organization of two R. O. T. C. units.

In connection with the latter the institute courses were examined by a commission of army officers, whose report showed that with the addition of a small amount of special military work the graduates of the institute would be of a grade meriting commissions. There have recently been established two units, coast artillery and signal corps, open to sophomores, which will lead direct to commissions. It is hoped to establish two other units, ordnance and engineering, in the near future.

By this action the institute becomes a school parallel with West Point as far as the engineering attainments

are concerned, and equally with the latter a school for the development of material suitable for officers. The faculty has voted to admit freshmen this month, taking a picked group from the high schools graduating in January, who by studying during the summer vacation may overtake the men entering last fall.

On the declaration of war the entire group of students in the naval architecture course and some of the faculty went into the employ of the government or into shipyards. An intensive course in this specialty open to seniors was at once inaugurated, covering eight hours daily for eight weeks. Graduates went into government service and are now performing work of the utmost value in shipyards or in construction work at navy yards. A second intensive course in naval architecture was scheduled to begin on Feb. 4, with an estimated attendance of fifty men.

The faculty has volunteered gratuitous assistance to any seniors wishing to take military examinations by establishing "cram" courses leading up to such tests and many members of the staff have given free intensive instruction during the summer season for patriotic purposes.

OFFICERING THE NEW MERCHANT MARINE

For the United States Shipping Board, Prof. Edward F. Miller, head of the department of mechanical engineering, organized nine schools in principal ports of the United States to educate licensed land engineers in special studies for officering the engine rooms of the new merchant marine. Locomotive and stationary firemen also form the "raw material" of this work. Under the auspices of the institute no less than forty schools for deck officers for the merchant marine have been organized by Dean Burton.

There are now about 2500 "old salts" who have taken the course outlined by Professor Burton and are competent to navigate vessels on the ocean, and more than 1000 men prepared by Professor Miller's schools to care for the motive power of the vessels. Many of these men are already gaining their deep-sea experience in vessels on the Atlantic.

Two aviation schools, one each for the army and navy, have been established, and several hundred aviators have already been trained at Technology in the principles of ground work, bearing in mind in particular the fact that some eight men are required on the ground per flyer to keep the equipment in first-class condition for air service. The institute established the first course in aeronautical engineering in the United States.

Nearly 100 men are also taking an intensive course in a government school for naval inspectors of materials and construction of airplanes and motors, this course being repeated every six weeks.

Plans have also been completed to establish a course in radio engineering for students desiring to enter the United States Signal Corps, open to fourth-year men only. It is expected that the students will be enlisted in the signal corps and placed in Class 5 of the draft list as being in the service of the country. Fifteen weeks of twenty-eight hours each are planned, under the direction of Prof. A. E. Kennelly.

Few details can be published regarding the research work for the government proceeding under the direction of the institute staff, but an important and suc-

cessful poison-gas investigation has been carried out which appears to rob gas warfare of many of its dangers. It has also become possible to manufacture hydrogen gas in about one-tenth the space formerly necessary, and with correspondingly lighter apparatus—a point of great value in connection with balloon work.

In common with many other institutions, Technology has co-operated with the government in placing accurate and complete lists of its qualified alumni in the hands of Uncle Sam, under the title of "Who's Who in Tech Brains," the list now being in Washington and in the service of the government.

About 1600 Technology men are in military or naval service, including 117 officers in the United States Army. This is said to be more than from any other college. Twelve hundred are officers in training camps or elsewhere. Sixteen Technology men have already died in the service, and more than 2000 men are actively at work in industries allied to the war.

MASSACHUSETTS BOARD SEES STABILITY OF DIVIDENDS

No Occasion for Alarm as to Intrinsic Investment
Worth and Permanency of Reasonable Dividends
on Approved Shares

In the forthcoming annual report the Massachusetts Gas & Electric Light Commission expresses confidence as to the permanency of reasonable dividends and the intrinsic worth of shares of stock of gas and electric light companies approved by the board, saying:

As the war preparations of the government have progressed and difficulties of transportation, shortage of fuel and increased prices have developed, the vital relation of the gas and electric companies not only to the community but also to the industrial life of the commonwealth has become more clearly manifest than ever before. The necessity for conserving the capital as well as the natural fuel resources of the country has made evident the desirability of tying together the existing sources of power, both steam and water, and so co-ordinating their operation as to utilize all plants to their utmost capacity. Substantial steps in this direction have been taken upon the initiative of different companies involved. More may still be accomplished as necessity and a broader spirit of co-operation develop. In any event the present exigency has amply justified the encouragement given during the past ten years to the important hydroelectric developments supplying power to the industries of the Commonwealth.

The stimulated industrial activity of 1915 and 1916 encouraged many of the electric and certain of the gas companies to make substantial extensions of their plants. The declaration of war found them engaged in or committed to such undertakings, with floating debts representing capital expenditures which had not been permanently financed. The paramount claim of the government upon the financial resources of the nation, the steady increase in interest rates, the correspondingly steady decline in the selling price of gas and electric stocks, and the growth of a feeling of uncertainty and distrust with respect to all public service securities, have embarrassed such companies in making suitable provision for capital requirements. It is gratifying to note that while readjustments in prices and in operating conditions, due to exceptional costs beyond the companies' control and unusual demands for heat and power, have been necessary, yet net earnings have been on the whole well sustained, and no occasion exists for alarm on the part of individual holders of shares approved by the board as to the intrinsic worth of their investments and the favorable prospects for increased business and for the permanency of reasonable dividends.

A Study of Electric Range Efficiency*—II

Results Obtained by Means of Tests Made on Both Open and Inclosed Heating Units with Different Kinds of Utensils, as Well as from Experiments with Ovens of Different Size

BY R. G. KLOEFFLER

Assistant Professor in Electrical Engineering, Kansas State Agricultural College

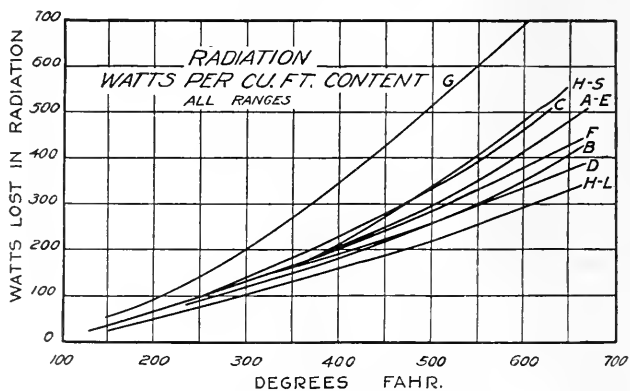
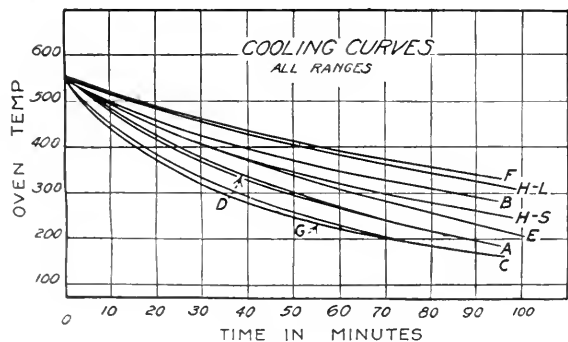
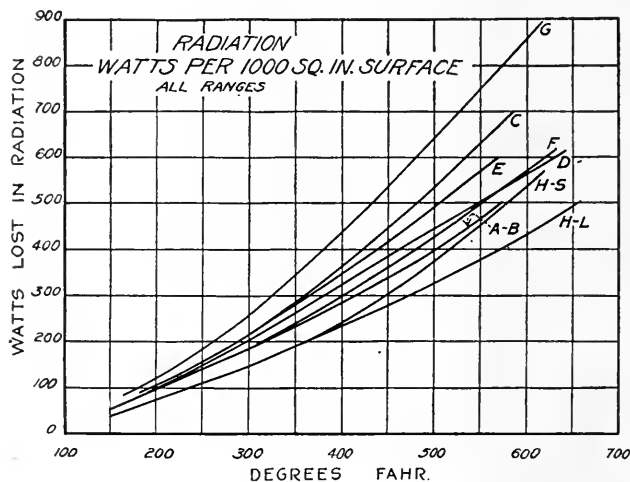
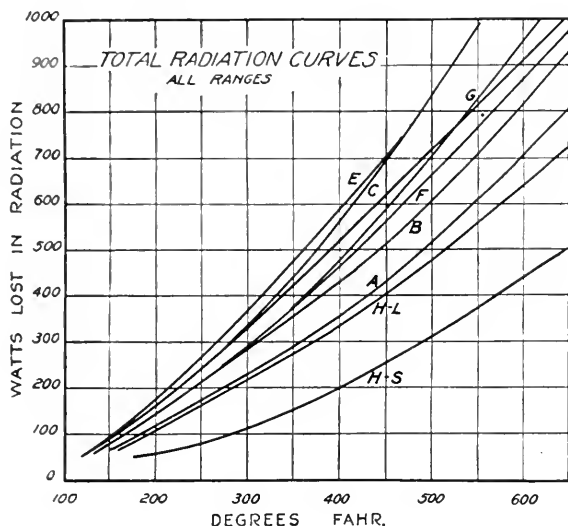
The first installment of this article, printed in the Feb. 16 issue, dealt with the surface-heating units of the electric range. The study of the subject is concluded this week with a consideration of electric ovens.

SINCE the heat insulation of the oven is important, it is desirable to learn the amount of radiation from the oven. To do this a fixed input was given the oven until its internal temperature became constant. This test was made for inputs of 50, 150, 250, 500, 750 and 1000 watts, with current supplied by a storage battery and measured by a wattmeter. The temperature was measured by a carefully calibrated resistance thermometer near the center of the oven.

When the oven temperature became constant at 1000

Before comparing the radiation losses of the different ovens it should be carefully borne in mind that these tests were made on ovens of a large variety of sizes, which would affect their total radiation losses materially. Therefore, to make a more just comparison, the radiation of each oven has been reduced to watts per 1000 sq. in. (6450 sq. cm.) inside surface and watts per cubic foot contents, as plotted on the curves of Fig. 5. Table IV gives the exact measured inside dimensions of the ovens and the calculated inner surface area and cubical contents.

In the upper part of Fig. 4 the total radiation curves for all the ovens are plotted. These show, for instance, that at 450 deg. Fahr. (232.2 deg. C.)—a high baking



FIGS. 4 AND 5—RADIATION AND COOLING CURVES FOR ELECTRIC OVENS

watts input the circuit was opened, and the temperature was then read at time intervals, giving points for the cooling curve. The time and number of kilowatt-hours required to bring each oven successively to temperatures of 250, 300, 400, 450 and 500 deg. Fahr. (121.1, 148.9, 204.4, 232.2 and 260 deg. C.) was also measured, these being characteristic baking temperatures.

temperature—the radiation varies from 709 watts for large oven E to 258 watts for small oven H-S, while in Fig. 5 it will be observed that the difference in radiation for the same ovens is comparatively small when reduced to unit surface area. Fig. 5 (upper part) likewise shows that the radiation at 450 deg. Fahr. varies from 540 watts on small oven G to 280 watts on large oven H-L when reduced to watts per 1000 sq. in. (6450

*Copyright, 1918, by R. G. Kloeffler.

sq. cm.), whereas the total radiation of the same ovens shown in Fig. 4 does not differ widely. The ovens A, B, F and H-S and H-L all have radiation losses below 360 watts per 1000 sq. in., or 0.36 watt per square inch. These same four are the lower ones in previous Fig. 4, but the difference there is much greater since the size of oven was not taken into account.

In the lower part of Fig. 5 the radiation has been reduced to watts per cubic foot. Some have contended that this should be the proper basis for comparison, but this is not the opinion of the writer. As a proof of this contention it is pointed out that both H-S and H-L are in same range, are constructed similarly, and should have the same radiation per unit. The comparison by watts per 1000 sq. in. (6450 sq. cm.) shows this to be true, while the comparison per cubic foot places the radiation on H-S near the top and H-L at the bottom, which is not consistent. Both sets of curves agree that the radiation loss on oven G is very high.

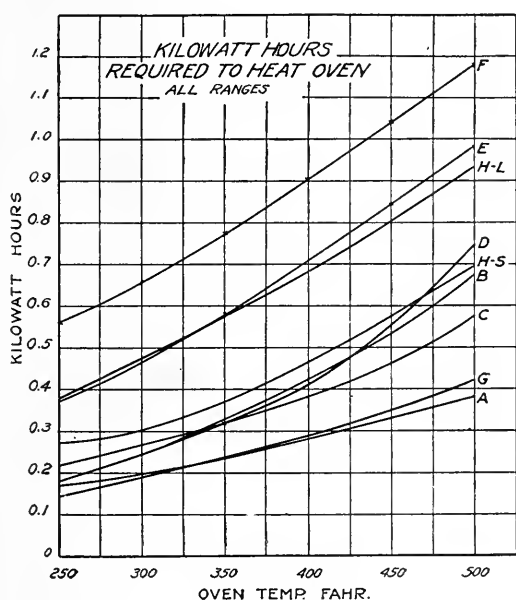


FIG. 6—RATIO OF ENERGY CONSUMED TO OVEN TEMPERATURE

This oven has glass panels in the door, which permits a large heat radiation.

A comparison of the cooling curves is given in the lower part of Fig. 4. Here it might be expected that these curves would fall off in proportion to the amount of radiation as shown in curves of Fig. 5. This would follow if the ovens were of the same size, and does so approximately since ovens C and G, with largest radiation, fall off most rapidly and F, B, H-S and H-L, with smaller radiation, cool much more slowly.

From the analyses made above, it is evident that there is a large difference in the heat-retaining efficiency of the ovens. But judgment should not be based on this alone, since an oven which retains its heat longest may require more energy to heat it than another not so well insulated. This is brought out clearly in the curves of Fig. 6, which show the kilowatt-hours required to bring the various ovens to temperatures from 250 deg. to 500 deg. Fahr. A range of from 1035 kw.-hr. for large oven E to 330 kw.-hr. for small oven A was required to bring them to 450 deg.

It should be observed that the four ovens requiring the most energy to heat are the ones which retain their heat the best or really store it up. Hence for an opera-

tion which requires a short time, like baking biscuits, the oven which requires the fewest kilowatt-hours for preheating is obviously the best. Again, for the longer operations, such as baking bread or roasting, the heat-

TABLE IV—INSIDE DIMENSIONS AND CUBICAL CONTENTS OF OVENS

Range	Oven	Inside Area*	Cubical Contents†
A	18 in.x12½ in.x12½ in. (45.7 cm.x30.8 cm.x31.7 cm.)	1,250 8,060	1.71 44.7
B	17¾ in.x17½ in.x12¾ in. (45 cm.x44.4 cm.x32.4 cm.)	1,520 9,801	2.29 64.8
C	18½ in.x16 in.x14½ in. (46.3 cm.x40.6 cm.x36.8 cm.)	1,577 10,175	2.45 69.3
D	18½ in.x18 in.x14 in. (46.3 cm.x45.7 cm.x35.5 cm.)	1,612 10,400	2.66 75.3
E	18 in.x18½ in.x14½ in. (45.7 cm.x47 cm.x36.8 cm.)	1,724 11,120	2.80 79.2
F	18 in.x18½ in.x12 in. (45.7 cm.x47 cm.x30.5 cm.)	1,542 9,950	2.32 65.5
G	19 in.x12 in.x10½ in. (48.2 cm.x30.5 cm.x26.6 cm.)	1,118 7,218	1.39 39.1
H-L	18½ in.x15½ in.x13½ in. (47 cm.x39.4 cm.x33.6 cm.)	1,474 9,508	2.20 62.2
H-S	10½ in.x11½ in.x13½ in. (26.3 cm.x29.2 cm.x33.6 cm.)	818 5,380	9.15 25.9

*In square inches and square centimeters.

†In cubic feet and cubic decimeters.

retaining oven with lower radiation losses may require less energy and give a more uniform temperature.

To get at this more concretely, a table has been prepared showing calculated kilowatt-hours required to keep the oven within the required range of temperature for a short operation (baking biscuits) requiring a hot oven, a one-hour operation (baking bread) and a two-hour operation (meat roast). Only the energy required to maintain the temperature is given, it being assumed that the heat would be the same in each case.

This table (V) has been prepared from the curves in Fig. 6 with the following assumptions as a basis. About 450 deg. Fahr. is required for baking biscuits and any oven will retain its heat a sufficient time for this operation after reaching 450 deg. Hence the number of kilowatt-hours required to heat it to 450 deg. is taken

TABLE V—KILOWATTS REQUIRED TO PREHEAT AND KEEP OVENS AT PROPER TEMPERATURE

Range Oven	Biscuits, 450 Deg. Fahr., Kw.-hr.	Bread, 400-300 Deg. Fahr., One Hour, Kw.-hr.	Roast, 400-250 Deg., Two Hours, Kw.-hr.	Cubical Contents in Terms of Oven E, per Cent
A	0.330	0.447	0.624	61
B	0.540	0.490	0.645	82
C	0.460	0.680	0.935	87.5
D	0.556	0.662	0.824	95
E	0.840	0.910	1.200	100
F	1.040	0.905	0.905	22.5
G	0.350	0.540	0.60	49.5
H-S	0.575	0.515	0.85	32.7
H-L	0.810	0.680	0.680	78.5

directly from Fig. 6. Bread will require about one hour to bake, and beginning with 400 deg. Fahr. the temperature may fall to 300 deg. Fig. 6 gives the watt-hours required to raise the temperature of the ovens to 400 deg. Then the cooling curve is consulted, and the

time during which energy must be applied to give an average temperature of 350 deg. is noted. From the radiation curve (Fig. 4) the necessary watts which must be supplied to maintain this temperature can be obtained, and this, multiplied by time and divided by 1000, gives additional kilowatt-hours. This value added to the initial kilowatt-hours gives the total energy required for baking bread. For making a roast a temperature range of from 400 deg. downward to 250 deg. in two hours is assumed, and the same system of computing as for bread is used. Two ovens remained within this temperature range for two hours.

The figures given are not asserted to be exact, but in-

dicative of results achieved under practical conditions.

Table V shows that ovens G and C with large radiation losses are more economical for making biscuits than H with low radiation losses. A and H-S, being small ovens, appear to be most economical for the average of three operations. The large ovens B and H-L show how the low radiation loss makes for economy in the long-period operations.

The advantage of cooking cereals, etc., in ovens as fireless cookers will show most favorably also in the oven having low radiation losses. The last column gives the size of each oven in percentage of the largest oven and will help the reader in making a fair comparison.

A. I. E. E. Convention Papers and Discussions

Abstracts of Principal Papers, Including Rating and Selection of Circuit Breakers, Substitutes for Standard Cells, Demand Meters and Dielectric Losses in Cables

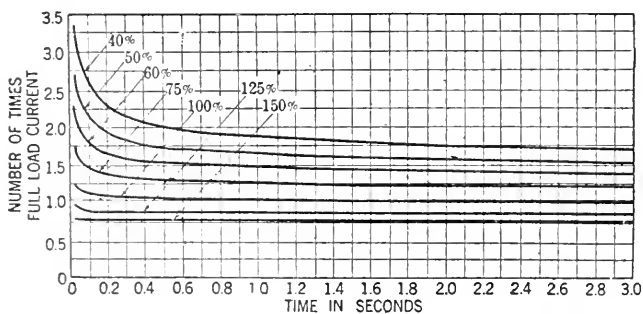
EIGHT papers were presented before the mid-winter convention of the American Institute of Electrical Engineers in New York Feb. 15 and 16 that aroused considerable valuable discussion. They were as follows: "Rating and Selection of Oil Circuit Breakers," by E. M. Hewlett, J. M. Mahoney and G. A. Burnham; "A New Standard for Current and Potential," by C. T. Allcutt; "The Thermoelectric Standard Cell," by C. A. Hoxie; "The Character of the Thermal Storage Demand Meter," by P. M. Lincoln; "Measurement of Power Losses in Dielectrics of Three-Conductor High-Tension Cables," by F. M. Farmer; "Commutation in Alternating-Current Machinery," by Marius A. C. Latour; "The Secomor—A Kinematic Device Which Imitates the Performance of a Series-Wound Polyphase Commutator Motor," by V. Karapetoff, and "The Polyphase Shunt Motor," by C. K. Altes.

factors which are involved in the selection of circuit breakers for various systems.

While the r.m.s. current at any point of a system under short-circuit conditions is affected by numerous factors, practical approximate selection of circuit breakers, sufficiently accurate for many cases, can be made by using only reactance and an accepted group of time-current decrement curves, such as presented here. The curves are based on the following assumptions: Transient characteristics for alternators of normal design are determined from oscillograph tests; effect of capacitance and resistance is neglected; the contact resistance at short circuit is zero; the alternator is carrying full load 80 per cent power factor; the short circuit was established at the point of pressure wave corresponding to maximum possible instantaneous current, and no automatic voltage regulators are used. The curves are applicable for selecting circuit breakers for systems consisting of single or multiple machines with or without external reactance.

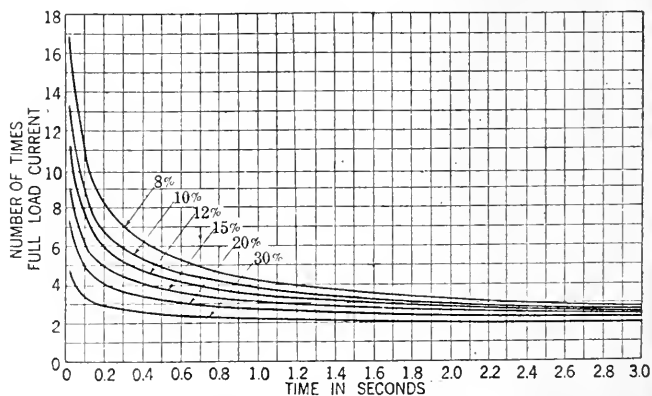
Rating and Selection of Oil Circuit Breakers

"On account of the variable conditions in systems on which circuit breakers are used, it is impossible to give a simple rule which will cover the selection of circuit



CURRENT DECREMENT CURVES FOR AVERAGE SYSTEMS

Ratio of system short-circuit current (r.m.s. amp.) to full load generator current at different intervals after circuit has been



opened. The reactance indicated on each curve is based on the total kva. rating of the generators.

breakers for all cases," say E. M. Hewlett, J. M. Mahoney and G. A. Burnham, joint authors of a paper on the above subject. The authors discuss the interpretations of the A. I. E. E. Standardization Rules covering rating of oil circuit breakers and consider the variable

To make use of the curves it is only necessary to determine the total reactance between the generators and the point of short circuit, remembering to convert the percentage of reactance in each case to a value corresponding to the total generator rating feeding into

the short circuit. After the total reactance and the time in seconds required for the circuit-breaker contacts to open are known it is possible to read the ratio of the r.m.s. short-circuit current to the full-load current directly from the accompanying curves. Several examples showing the applications of the curves are given in the original paper.

Unless the external reactance is very high, the use of automatic voltage regulators will increase the excitation after a short circuit so much that while the voltage may not be raised even to normal value, the sustained short-circuit current will be increased about 50 per cent. The authors conclude by expressing the belief that manufacturers of oil circuit breakers should publish information similar to that outlined in this paper not only to serve as a guide in the application of electrical protective devices but also to assist in bringing about a more uniform selection and a better understanding of the various expressions and methods used in connection with the rating of this class of equipment.

Discussion

The subject of selection and rating of oil circuit breakers aroused lively discussion, in which the following speakers took part: C. M. Hewlett, J. M. Mahoney, R. Summerhayes, W. W. Willard, Bassett Jones, C. C. Hanker, Philip Torchio, P. M. Lincoln, R. F. Doherty, F. L. Hunt, H. H. Dewey, H. D. James, M. L. Pollard, M. J. Neall, E. G. Merrick, C. H. Adams, H. C. Rushing, Jr., and G. A. Burnham.

Mr. Hewlett pointed out that the current-decrement curves shown in the paper were obtained from medium-size and small machines through the co-operation of manufacturers. Later tests will be made to check the accuracy of the curves for machines of higher ratings. He urged standardization of tests on circuit breakers.

Mr. Mahoney, commenting on the suitability of duty as a basis for comparing oil circuit breakers, expressed the belief that the A. I. E. E. specifications for duty are sufficient, as the duty imposed under actual operating conditions is usually less severe than that assumed in connection with the specifications.

Mr. Summerhayes elaborated on the effect of power factor on the rupturing capacity of oil circuit breakers. For instance, at 100 per cent power factor the current and voltage waves pass through zero at the same time, and it is easier for the oil circuit breaker to rupture the circuit than at lower power factors when the current and voltage are never zero at a time. With considerable reactance in the circuits oscillations may be set up which cause transient conditions that are difficult to determine. When resistance predominates switch duty is less severe.

Mr. Willard pointed out that the curves presented in the paper by Hewlett, Mahoney and Burnham cover cases in which all legs of a polyphase circuit are involved, as well as the grounding of one phase. It is possible, he added, that the curves will also cover cases where one leg is grounded, provided only one of the generators in multiple is grounded. Attention is also called to the necessity of considering cases where the grounds occur on the generator side of the transformers as exceptional and not covered by the curves.

Mr. Jones emphasized the need of information which would facilitate the selecting of oil circuit breakers from a variety of different makes. There is no necessity, he pointed out, of having a different type of circuit

breaker for every condition, if reinforcing parts are available which can be applied to a few standard makes of oil circuit breakers. By thus making a few types suitable for all conditions, manufacturers would be able to simplify their stock by carrying fewer types of oil circuit breakers, and the users of switches could modify circuit breakers as operating conditions changed by reinforcing the parts.

Mr. Torchio said that no circuit breakers have been found capable of opening short circuits in the proximity of New York generating stations without reactors. He trusted that developments will bring out such a switch. One of the greatest difficulties in selecting oil circuit breakers, he pointed out, is in judging future requirements. Systems change so rapidly that unless a large enough circuit breaker is installed in the beginning substitution of larger units may have to be made too often or reactors will have to be provided to supplement the switch which met former operating requirements but is too small, alone, for present conditions. Large circuit breakers are usually more economical than small units used in conjunction with reactors, but on industrial circuits where proper attention cannot be given to the switches it may be better to use simple switches with reactors.

Mr. Lincoln pointed out the necessity of expressing reactance ratings in terms of current as well as voltage, since a reactor which will have a certain effect with one current will have a different effect with another current. The difficulty which manufacturers have in rating circuit breakers is due to the inability to test them under the user's conditions. Therefore close co-operation between manufacturer and user is necessary if the proper development in circuit-breaker information and construction is to be expected.

Mr. Doherty pointed out that in old machines—that is, those designed several years ago—the sustained short-circuit current is larger than in recently designed machines; therefore the curves given in the paper should be modified accordingly.

Mr. Hunt, in calling attention to the necessity of a more definite method of rating of circuit breakers to permit comparison, suggested that manufacturers give curves showing the effect of different factors on the performance.

Mr. Dewey said that so far circuit breakers have been made which are capable of rupturing 500,000 kva. The development of larger circuit breakers is not so important, the speaker believed, since it is doubtful whether circuit-breaker rating will limit the size of electric systems. It is more likely that damage to buses, etc., on peak values of the short-circuit current will be the limit.

Mr. James called attention to the fact that the impedance of transformers will limit the short-circuit current drawn by motors. Selective operation of oil switches—that is, automatically opening branch-circuit, feeder and generator switches in the order named—will help considerably in solving the oil circuit breaker problem.

Mr. Pollard contended that while the information presented in the paper may help in certain cases in deciding the maximum r.m.s. current which may exist, it does not help in the selection of circuit breakers of different makes. Since further investigation along this line would be of interest to operating engineers, he

suggested the formation of a committee composed of operating engineers and manufacturers to specify standards of comparison. This need was emphasized by Mr. Adams. Mr. Pollard also urged marking current and voltage on all circuit-breaker name plates.

Mr. Neall said that in drafting specifications distinction should be made between the duty which will demolish a circuit breaker and that which will only unfit it mechanically for continued operation. He expressed the belief that the A. I. E. E. should specify what percentage of maximum rating should be allowed in circuit breakers.

Mr. Merrick said that the momentary short-circuit currents for single-phase and three-phase shorts do not differ considerably, but that the sustained single-phase short-circuit current may be 30 to 50 per cent greater than a three-phase short-circuit value, depending on whether a definite-pole machine is used or not. With a definite-pole machine the single-phase short-circuit value obtained with a leg-to-leg short circuit may be 75 per cent greater than with a three-phase short circuit.

There are three duties for an oil circuit breaker to perform, said Mr. Cushing. They are to disconnect a circuit, to carry current and open under abnormal conditions. Therefore, in stating the performance of circuit breakers, it should be pointed out what they can do besides opening under abnormal conditions.

Mr. Mahoney pointed out that it is the expulsion of oil that really limits the duty of an oil circuit breaker, as after a certain number of operations enough oil may be expelled to make extinction of the arc difficult. Furthermore, arcing tips may be consumed, hence it is not desirable to operate without inspection after a certain number of operations.

In closing the discussion on the paper, Mr. Burnham said that standardization of oil circuit-breaker ratings would be very welcome to manufacturers, but at the present time there is no apparatus, to his knowledge, which can be used to determine the effect of factors affecting the short-circuit current on the rupturing capacity of oil circuit breakers. While old catalogs issued by manufacturers of oil circuit breakers may not have been of much assistance to users in selecting the type of equipment used, he expressed the belief that most new catalogs will be serviceable, as they will list the operating and tripping time of the mechanism used with the circuit breakers. Special emphasis was laid upon the necessity of close co-operation between users and manufacturers.

Substitutes Suggested for Standard Cells

Chester T. Allcutt described a new secondary standard which is proposed as a substitute for the standard cell in certain classes of direct-current measurements. The device consists of a Wheatstone bridge which will balance for but one value of current. Various factors affecting the accuracy and permanence of the devices are discussed, and a number of curves are given showing the characteristics which have been obtained. The work done in connection with the development of this new standard has demonstrated that it can be relied upon to maintain an accuracy of 0.1 per cent.

A means of obtaining a secondary standard of emf. by utilizing the emf. of a thermocouple was described

by C. A. Hoxie in a paper following Mr. Allcutt's. The method consists in balancing the potential across a resistance against the thermoelectric emf. of the thermocouple. This requires a definite value of current through a filament which is used as a source of heat for the thermocouple. The construction of the cell is discussed in detail, particularly the use of gas in the bulb. The results of permanency tests on a number of cells are shown.

Discussion

In the discussion of the preceding subjects it was brought out by several speakers that while the war has made it exceedingly difficult to secure standard cells there is no necessity of using high-precision cells for some kinds of potentiometry. Among those taking part in the discussion were Dr. C. H. Sharp, F. C. Stockwell, Dr. E. E. F. Creighton, Dr. P. G. Agnew and the authors of the two papers.

Dr. Sharp described an inexpensive, easily made and convenient standard cell which is being used in the Electrical Testing Laboratories on work not requiring high precision. To secure standard alternating-current or direct-current voltages it is convenient to use a bridge made up entirely of incandescent lamps which will balance on only one voltage.

Mr. Stockwell expressed the belief that the two methods described in the preceding papers fall short of replacing the primary standard cells in simplicity, convenience, accuracy and permanency. He also questioned the value of substituting primary cells, as modified cadmium cells can be made very cheaply—for about \$3 apiece—and will last about three years. When aged they have almost the accuracy of the primary standard cell.

Dr. Creighton expressed the belief that the value of two substitutes for primary standard cells described in the preceding papers is in connection with alternating current. These cells have been used with frequencies of 100,000 cycles per second.

Dr. Agnew pointed out that the accuracy of the unsaturated type of Weston cell can be made very high by preparing the mercurous sulphate with alternating current. In this connection, he pointed out, the emf. depends upon the frequency used in the preparation of the compound.

Demand Meter That Operates on Thermal-Storage Principle

After giving a detailed description of the principle and construction of the thermal-storage demand meter, P. M. Lincoln showed why it will always indicate what may be called the logarithmic average rather than the arithmetic average of power consumption heretofore indicated by practically all demand meters. The inherent faults of the arithmetic-average or block-interval meter are described and examples given demonstrating that the thermal-storage meter alone recognizes the true heating effect that fixes size of equipment and, therefore, the cost that should be assessed against the customer. The thermal storage-demand meter gives a much higher indication for a very short-time peak-load application than does the block-interval demand meter, thereby making unnecessary the adoption of short demand periods designed to penalize such high peak loads.

Discussion

The suitability of the readings given by thermal-storage demand meters in determining the primary charge assessable to consumers constituted the chief subject of discussion in connection with the preceding paper. Among the speakers taking part in the discussion were the following: C. R. Hall, G. W. Magalhaes, G. L. Hoxie, M. G. Lloyd, A. S. Albright, H. D. James, H. L. Wallau and the author of the paper.

Mr. Hall compared the indications of the Wright, the thermal-storage wattmeter and the thermal-storage ammeter types of demand meters, expressing the belief that the readings given by the latter type more nearly represent the heating effect on the equipment serving a consumer.

Mr. Magalhaes did not favor the standardization of the maximum-demand period, saying that local conditions should fix this value.

Mr. Hoxie expressed the belief that the consumer's maximum demand, which is coincident with the station peak, is the value which should be taken into account in fixing the primary charge, as it is this value which determines the amount of generating equipment which must be kept in reserve to serve a consumer.

Dr. Lloyd agreed that the readings given by a thermal-storage demand meter closely approximate the heating effect produced in a generator supplying a load, when only one consumer is being served, but that under actual operating conditions, where the loads of several consumers are superposed, the diversity causes the maximum system demand to be less than the sum of the maximum demands of the individual consumers. Hence the consumer's maximum demand is not an indication of the amount of the equipment which must be kept in reserve to serve him.

Mr. James pointed out that the chief value of the thermal-storage principle is in indicating the heating effect on individual pieces of apparatus such as motors. Thermal-storage ammeters are particularly valuable in indicating when an intermittent load is overheating a motor.

In closing the discussion Mr. Lincoln contended that heating of electrical apparatus is due to voltage as well as current, therefore a thermal-storage wattmeter type of demand meter should more closely represent heating of the apparatus serving a consumer than an ammeter type of demand meter. Referring to Mr. Hoxie's remark, he said that the distribution expense is relatively larger than the generation expense per consumer, so maximum demand as indicated by the consumer's meter does represent the portion of the total overhead charge which should be assessed against the consumer in the form of a primary charge.

Measuring Dielectric Loss in Three-Conductor Cables

In a paper entitled "Measurement of Power Loss in Dielectrics of Three-Conductor High-Tension Cables" F. M. Farmer described a method used at the Electrical Testing Laboratories for measuring the dielectric power losses in 10-ft. (3.04-m.) samples of three-conductor cables with three-phase potential applied to the cable. Methods of overcoming the difficulties encountered are discussed in considerable detail.

Among the conclusions drawn are the following: The power loss in the dielectric in a three-conductor cable can be readily measured under actual three-phase conditions in the laboratory with specimens 10 ft. (3.04 m.) long; no special apparatus is necessary other than a reflecting high-sensitivity wattmeter; apparently the power loss in the dielectric cannot in all cases be accurately calculated from data obtained in single-phase tests, although it is highly probable that for all practical purposes the discrepancy would not be serious.

Discussion

Reference to dielectric loss tests abroad and in this country, different methods of making the tests, cause of difference between losses as obtained by single-phase and three-phase tests, standardization of tests, limitation of dielectric losses by specifications, precautions necessary in tests, and advisability of testing dielectric losses after cable has been in service were the chief subjects discussed in connection with this paper. Among those taking part were H. W. Fisher, R. W. Atkinson, C. W. Davis, Mr. De Bois, John L. Harper, W. H. Cole, L. L. Elden, Philip Torchio, L. T. Robinson, F. W. Peek, Jr.; Dr. M. G. Lloyd, J. R. Craighead and Prof. C. A. Adams.

Mr. Davis referred to the electrometer, electrody-nometer and bridge methods of testing dielectric losses, saying that each had been used by his company.

In trying to account for the difference between loss readings obtained by making single-phase and three-phase tests, Mr. De Bois referred to the shifting of the neutral plane due to phase rotation as possibly affecting the losses. Naturally the center of the cable is hottest, but not necessarily owing to greater stresses. The reason why cables break down in the center more than elsewhere is because the dielectric losses are cumulatively increased by the high temperature existing.

Mr. Cole pointed to the possibility of carrying capacity of cables being limited by part of the dielectric changing in such a manner that other parts are overstressed.

Mr. Torchio showed curves indicating the effect of wave form on the dielectric losses, and urged reducing losses to capacitance and resistivity per unit of volume.

Mr. Robinson pointed out that correction for the phase-angle distortion of a potential transformer can be eliminated by applying a compensating load which can be measured.

Mr. Peek called attention to the advisability of measuring dielectric losses in cables after they have been in service, as the insulating compound may migrate.

In offering a clue to the difference in losses as obtained by single-phase and three-phase tests, Dr. Lloyd pointed out that the dielectric may be stressed differently in the two cases, that the insulation is not homogeneous, that the loss due to an alternating field may be different from that due to a rotating field, etc. Along this same line Professor Adams emphasized the non-homogeneity of cable insulation, and the different effects of single-phase and three-phase currents on the temperature, the losses per unit volume, the specific resistivity and on the flux distribution.

OTHER PAPERS AND DISCUSSIONS

Abstracts of the three remaining papers will be found under "Technical Theory and Practice," on page 420 of this issue of the ELECTRICAL WORLD.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

FIREPROOF COMPARTMENTS FOR TRANSFORMER UNITS

Each Cell Opens Directly Out of Doors—Steel Curtains Provide for Removal or Protection Against Weather as Required

The accompanying illustration shows the provision of fireproof compartments for transformer units which is one of the particular features of a new substation of the Edison Electric Illuminating Company of Brockton, Mass., marking an advance over practice in many older



THIS TYPE OF CONSTRUCTION FOR HOUSING TRANSFORMER UNITS REDUCES FIRE HAZARD MATERIALLY

installations. A separate cell is built for each of the main transformers, each cell opening directly out of doors. Metal roller curtains provide for protection against weather or removal, as the occasion requires. Each transformer is mounted on a reinforced-concrete track, the outer ends of the rails or beams terminating in a concrete sill in which a rectangular slot is left for oil drainage. Adjacent transformers are separated by fire walls through which the necessary connecting leads pass.

ADVANTAGES AND METHOD OF INTERLOCKING MOTORS

Motors Should Be Interlocked When Driving Cutting Machinery Where the Rate of Material Feed Varies

BY DAVID R. SHEARER

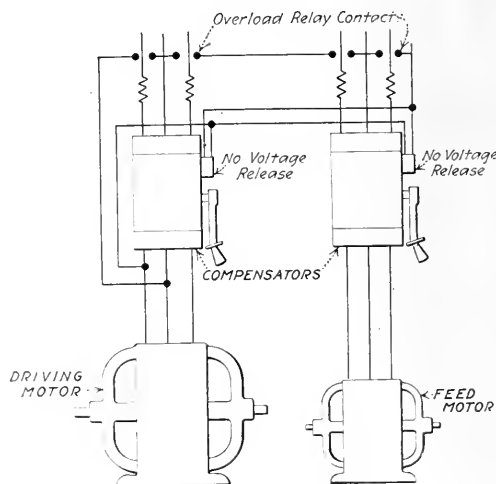
In a great many manufacturing operations it is frequently found advisable to drive a given machine by more than one motor. That is, the machine may require more than one motor in order that the different operations of the machine may be changed with respect to other operations of the same mechanism. This is true particularly with cutting machinery, where the rate of material feed should be adjustable in order to handle various sizes of stock. As examples of machinery in which this characteristic is necessary, planers, wood saws, diamond marble saws, sizers and other

tools in which the cutting is practically constant but the feed variable may be mentioned.

As long as the cutting motor and the motor operating the variable feed are both running, the entire machine operates satisfactorily, but should the cutting motor blow a fuse, trip its relay or be stopped by the operator and the feeding motor continue to run, serious trouble is liable to follow. The feed will force material against the powerless cutters and either bend or break parts of the equipment. Most feeds operate rather slowly by being geared down many times from the motor shaft, so that the feed motor, though very small, may have enormous power on the slow-moving rolls or carriage handling the material.

Trouble can be obviated easily on any machine operating under power from two or more motors by interlocking the no-voltage-release coils on the starters or compensators. The accompanying illustration indicates a driving and a feed motor operating in an interlocking manner on three-phase alternating current. It will be noticed that current is taken from the driving motor leads through both release coils and both relay trips on the two compensators. Thus, if the cutting or drive motor is stopped or fails, the current is broken in the release coil of the other machine and it stops also. Moreover, if either motor becomes overloaded sufficiently to trip the relays the entire set is at once brought to a stop.

By the addition of a double-throw switch the coil-operating current may be taken from the leads of either



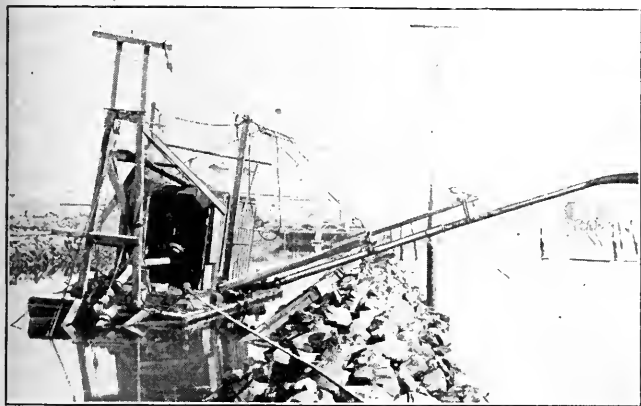
DRIVING AND FEED MOTOR OF CUTTING MACHINERY INTERLOCKED TO INSURE SIMULTANEOUS OPERATION

motor as desired. This is sometimes advisable when it is necessary to operate one of the motors singly for some specific purpose. This method of interlocking may be extended to cover several motors operating interdependent mechanism, and the actual arrangement of connections may be subject to many changes; but the principle remains the same.

ELECTRIC SUCTION DREDGE FOR CONDENSER INTAKE

Rock-Filled Jetties Built to Help Clear Canal of Silt—Details and Cost of Electrically Driven Dredge

The San Diego Consolidated Gas & Electric Company has used with success for a number of years an electrically driven suction dredge for keeping clear the channel in the bay from the condenser intake to deep water. The main intake of the company's steam plant consists of a double concrete tunnel 800 ft. (243.8 m.) long. The lower or intake tunnel is 6 ft. by 3 ft. 9 in. (1.8 m. by 1.1 m.) at the intake chamber and 6 ft. by 4 ft. 9 in. (1.8 m. by 1.4 m.) at the power house. The discharge tunnel is 6 ft. by 6 ft. (1.8 m. by 1.8 m.). The intake chamber is 23 ft. by 20 ft. (7 m. by 6.1 m.). The intake chamber is situated on San Diego Bay near the foot of Ninth Street. From the intake chamber a canal was dredged, perpendicular to the shore line at this point, in a southwesterly direction. This dredged canal is about 800 ft. (243.8 m.) long and reaches to a deeper part of the bay. Owing to the silting up of the canal



ENERGY FOR DRIVING MOTOR SERVED THROUGH CABLE CONNECTED TO NEAREST POLE

with mud and débris it was necessary to dredge frequently in order to obtain sufficient circulating water at extreme low tide. For this purpose an electric suction dredge was constructed and was used with good effect several times a year. More recently the company has lined the sides of the canal with a pair of rock-filled jetties which carry the intake out to the United States government bulkhead line. The center lines of the jetties are 54.2 ft. (16.5 m.) apart.

WHAT EXPERIENCE WITH THE DREDGE HAS SHOWN

Since the jetties were installed the canal silts up far less rapidly than before, little silt being carried in from the sides; for although the tops of the jetties are below extreme high tide, it was only at low tide that much silt and débris was formerly carried sideways into the canal. Not only has the installation of jetties reduced the frequency and cost of dredging, but as the discharge water cannot flow back into the intake canal at low tide, lower temperatures of circulating water are obtained and plant efficiency is consequently improved. Likewise the water is cleaner, thus reducing the expense of cleaning intake screens and condenser tubes. The jetties are now used as a dumping ground for waste brick and similar scrap from about the plant and are in consequence gradually being increased in height.

At present it is necessary to dredge the canal annually. This is usually done just before the extreme low tides of the fall. The barge used for the dredge is a 15-ton lighter, 10 ft. (3 m.) wide by 31 ft. (9.4 m.) long. The pump is a United Iron Works 6-in. (15.2-cm.) centrifugal sand and gravel pump with renewable brass wearing rings in the hubs and with shaft covered with brass tubing. The pump is direct-connected to a 35-hp., 220-volt, three-phase, 60-cycle, 600-r.p.m. induction motor. The dredge is equipped with a house to cover motor and pump and with booms for handling suction and discharge lines. The mooring lines are handled by means of midget windlasses. The suction pipe is 6-in. (15.2-cm.) wrought iron; the discharge pipe a piece of 7-in. (17.7-cm.) pipe, 24 ft. (7.3 m.) long, made of No. 16 galvanized iron, light weight being desirable at this point. No cutter is used. The suction pipe is lowered until it rests on the bottom, and as the dredge is warped lengthwise along the canal a good cut is made in the soft mud and gravel.

The dredge is served by means of a line of 40-ft. (12.2-m.) poles bolted to piles driven just outside of one of the jetties. A three-wire cable carries 220-volt, three-phase energy from the nearest pole to the dredge. The poles also serve to carry lamps for the illumination of the jetties and the protection of small boats in the bay.

The cost of the dredge was as follows:

Lighter	\$150
Pump	390
Motor	440
Booms, piping and housing.....	120
Tools and equipment.....	155
Wiring	35
Labor	160
Total.....	\$1,450

At present prices the cost of a similar dredge would of course be considerably greater.

UNINTERRUPTED PRODUCTION VERSUS CIRCUIT PROTECTION

Circuit Breaker Is Adjusted Near to the Current Capacity of Circuit and Fuse of Much Greater Capacity Used for Short-Circuit Dangers

BY E. C. PARHAM

When a fuse of low enough capacity to protect apparatus from the effects of ordinary overloads is used, frequently recurring violent fluctuations of current will blow the fuse so often as to interfere seriously with the production of the motor that the fuse is used for protecting. If a larger fuse is used the circuit may be damaged. With a circuit breaker it is much more practicable to adjust to the safe continuous-current capacity of the circuit because the very short time required for resetting a breaker does not seriously affect production. Owing to the general neglect of circuit breakers, however, and to the common but reprehensible practice of abusing their adjustment, it is a wise precaution to include in the circuit a fuse that can be depended on to act under short-circuit conditions should the circuit breaker fail to do so. That circuit breakers can be criminally abused is illustrated by the following experience:

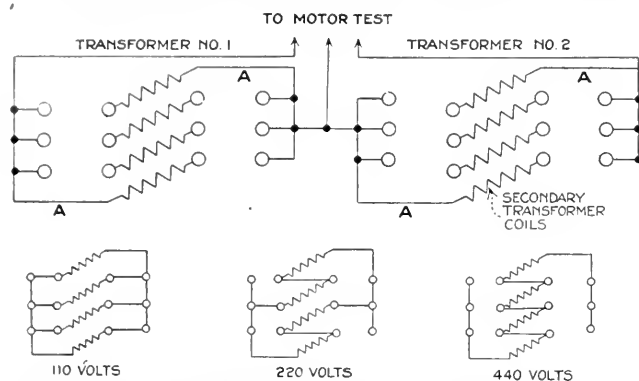
The output of a certain station generator was passed through a double-pole circuit breaker that was con-

needed in series with fuses. As the demand on the station increased another generator was installed, and further increase of load made it necessary to screw up the circuit-breaker adjustment because frequent blowing of the breaker was interfering with the service. Then the fuses began to blow and heavier fuses were installed. Meanwhile the breaker parts were turning blue from heating. To relieve this condition the operator connected a switch in parallel with the breaker and the switch parts immediately began to discolor. Finally the breaker exploded.

SWITCHING ARRANGEMENT FOR TESTING MOTORS

Installation Includes a Pair of Transformers Having 110-220-440 Volt Secondaries and Single-Throw, Single-Pole Switches

The arrangement of switches shown in the accompanying figure will be found useful in motor repair shops for testing purposes. By means of this arrangement single or three-phase 110, 220 or 440-volt energy



A SWITCH ARRANGEMENT THAT WILL BE FOUND USEFUL FOR TESTING MOTORS IN REPAIR SHOPS

may be tapped from a pair of transformers connected in open delta, merely by switch operation, thus saving considerable time in changing connections to suit the various motors under test.

The installation requires a pair of transformers having 110-220-440-volt secondaries. Such transformers are sometimes constructed with eight secondary leads, sometimes with only four. In the latter case four special leads must be brought out, as it is necessary to have access to both terminals of each of the four secondary coils. The extra leads can be readily brought through porcelain bushings placed in holes drilled in the transformer covers.

It will be noted that the full capacities of the transformers are utilized at the standard voltages. In addition, a variety of single-phase voltages are obtainable across the outside leads for special testing by connecting the two transformers for different voltages.

This switching combination is not foolproof. Either transformer may be short-circuited by incorrect connections, but the arrangement is so simple that any tester soon becomes accustomed to it.

Standard single-pole, single-throw knife switches are installed, but half of the switches are used double-throw. If the handles of the switches which are used double-throw strike the bases of the others, the handles may be offset to clear laterally. The installation may

be somewhat improved by the insertion of additional single-pole switches at points A, although these are not absolutely essential.

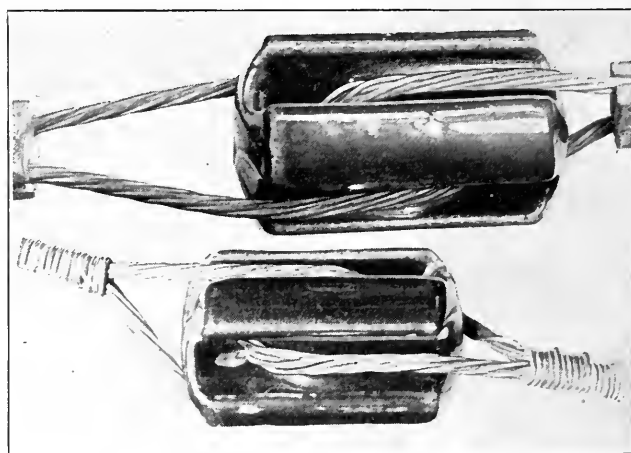
THE PROPER INSTALLATION OF STRAIN INSULATORS IN GUYS

Results of and Conclusions Drawn from Tests Made on the Proper Placing of Clamps Adjacent to Insulators

In making up strain insulators in guys, particularly where large insulators and three bolt guy clamps are used, care must be taken to place the clamps close to the insulators if the full strength of the guy cable is to be developed. A number of samples were recently made by a Western company and tested for tensile strength. The edges of the clamps were set about 3 in. (7.6 cm.) from the end of the insulator, as appeared to be customary with the linemen making up the samples. It was found that in every case slippage occurred at from one-half to three-quarters of the full strength of the guy, first one clamp and then the other slipping down to within 1 in. to $\frac{3}{4}$ in. (2.54 cm. to 1.9 cm.) of the face of the insulator, after which each would hold and the sample would develop the full strength of the guy cable.

In the accompanying illustration (upper) a sample is shown under test after one clamp has slipped but before the other had let go. In this particular sample slipping began at 3300 lb. (1496 kg.), and the strand—5/16-in. (8-mm.) seven-strand standard steel—finally broke, after the second clamp had slipped up, at 4400 lb. (1996 kg.). The same results were indicated with lighter guys and insulators made by wrapping without the use of clamps. A good specification covering this point is to make sure that the space between the insulator and the clamp (or wrapped splice if used) does not exceed 1 in. (2.54 cm.).

With respect to the relative values of three-bolt



CLAMP ON RIGHT HAS SLIPPED; SPLICED-IN INSULATOR AFTER BOTH SPLICES HAD SLIPPED

clamps as compared with wrapped splices, the tests indicated that the use of clamps increased the ultimate strength from 15 to 20 per cent, although in all cases the samples, whether made up with or without clamps, exceeded the rating of the steel cables. The lower illustration shows a spliced-in insulator after both splices had slipped.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

CENTRAL STATIONS FIND WAYS TO SELL THRIFT STAMPS

Efforts Are Made Successfully to Interest Customers
and Employees in Small Savings for
the Government Use

Interesting details are coming in of the success which central stations throughout the entire country are having in the sale of war saving stamps. Public utilities have been particularly invited by the government to become authorized agents for the sale of these thrift stamps and war saving stamps and have responded with enthusiasm. Most of the large holding companies have sent out a call to all their properties to line up in the movement and, with the independent companies, have been enrolled direct from Washington. Many ingenious methods are being employed in promoting the sales. For instance:

WHAT THE CASHIER CAN DO TO HELP

In the office of the Colorado Springs Light, Heat & Power Company—and this idea is now being generally employed—whenever a customer pays a bill at the cashier's window and the change he is to receive is 25 cents or more the cashier suggests that he receive a thrift stamp in place of the 25-cent piece. War saving stamp posters are conspicuous in the office, and the cashier on the floor endeavors to interest every customer who comes in in the purchase of war saving stamps as well as appliances.

The Massillon (Ohio) Electric & Gas Company has made a feature of a large "W. S. S." banner which has been hung in front of the office window. In the early days of the campaign there were a great many inquiries as to the meaning of the initials, and members of the new-business department saw to it that this reacted in the purchase of thrift or war saving stamps. The Massillon company gave each of its employees a partly filled thrift-stamp book as a Christmas gift, and this has been done by many other companies at Christmas time.

The Danbury & Bethel Gas & Electric Light Company contributes a Christmas bonus each year to its employees and last Christmas paid the money in thrift stamps.

The Salina (Kan.) Light, Power & Gas Company has made a practice of presenting some small heating appliance to its employees as a Christmas gift. This year it was a war saving stamp or thrift stamps instead.

In Bloomington, Ill., the Union Gas & Electric Company acted so promptly that it was the first authorized agent for the sale of war saving stamps in the community except, of course, the post office. This was commented on extensively by the local newspapers and produced considerable local publicity not only for the company but for the war saving stamps.

The New Orleans Railway & Light Company organized a special campaign for the sale of war saving

stamps for its employees. They designed an elaborate window display as a central feature, and prizes were given to the employees selling the most stamps.

The Montgomery (Ala.) Light & Water Power Company has featured a special advertising campaign to push the sale of war stamps in the name of the company and has developed a large sale for these stamps. It has made the slogan of its campaign, "Ask for your change in thrift stamps. A quarter to Uncle Sam means no quarter to the Kaiser."

The Toledo (Ohio) Railway & Light Company, in addition to carrying "W. S. S." posters both inside and outside the street cars and placing them on sale in the office, carhouses, shops and power houses, has stocked each representative of the new-business department with war saving stamps to be sold to present and prospective customers on whom he calls.

The Empire District Electric Company of Joplin has introduced another innovation by offering a thrift card with \$1 worth of stamps as a premium to any one who purchases an electric washing machine, a vacuum cleaner or a sewing-machine motor.

One of the most interesting ideas for selling the stamps has been originated by the Manhattan & Queens Traction Company, which operates in New York City, and it will be of interest to central stations operating railway lines. This company has placed thrift stamps on sale in every one of its street cars. Posters are displayed inside the car, and passengers are requested to take their change in stamps wherever the amount is large enough. This has produced a surprising number of sales.

MAKING IT EASY TO POCKET THE STAMPS

In the New York office of the Henry L. Doherty Company impetus has been given to the purchase of war saving stamps by employees by discontinuing the distribution of salary checks and having every employee call at a special window for his check. Here an attractive young woman undertakes to induce every employee to buy at least one thrift stamp, and her efforts meet with much success. At the war saving stamp window in the Doherty office it has been found of great assistance in the sale of stamps to have on hand small square sheets of oiled paper for wrapping up the stamps and little envelopes in which to inclose them. Many a man will hesitate to buy one stamp because he has no place to put it. His thrift card may be at home, and if he puts a loose stamp in his pocket it is liable to be damaged.

The spirit in which the central-station industry is supporting the government in this campaign is undoubtedly developing a large additional market for war saving stamps, and with every member of the organization from the office boy up enlisted in the work it will render increasing service in the effort to raise two billion dollars for the war in this way.

ANOTHER COMPANY STOPS FREE DELIVERY OF LAMPS

Outlying Lamp Service Stations Are Installed and
35-Cent Delivery Charge Is Established
in Chicago

The Commonwealth Edison Company of Chicago, which includes free lamp renewal as a part of its service, stopped gratuitous distribution of the lamps on Jan. 15. At the customers' requests lamps were formerly delivered free of charge anywhere in the city. Under the present arrangement when a customer calls at the lamp service bureau the clerk states that the company has, for the convenience of its customers, established lamp service stations in various parts of the city and gives the person who calls the address of the nearest station. The customer is also told that there is a complete stock of lamps at this station and that an attendant there will help him select the proper sizes of lamps. For those who do not wish to call at the stations for lamps the company still maintains a delivery service, for which it charges 35 cents per call.

The lamp renewal stations, of which the company now has twelve, usually occupy space in stores that are already established. This number of stations will probably need to be increased. In selecting these stores it was suggested that real-estate agencies might be desirable concerns to carry the lamps, since they have to maintain stores and have nothing in the way of stock to occupy their windows. On reconsideration, however, it was decided that the most desirable locations for the lamp renewal stores were places of business which had something to gain by having electric service customers call for lamps. The twelve agencies are located as follows: One printer's store, one electric fixture store, one building formerly vacant, three hardware stores, two drug stores and four buildings already partly occupied by the company. This arrangement gives one store to each zone of 2½ miles to 3 miles (4 km. to 4.8 km.) in the city.

An analysis of 1000 calls for lamps made just after the new system was installed showed that about 10 per cent of the customers would rather pay the 35 cents charge than call for lamps in person. This ratio is expected to decrease, however, as familiarity with the system increases.

PATRIOTIC ACTIVITIES OF CENTRAL STATIONS

Carrying Out a Vigorous Policy in Patriotic, Civic
and Other Public Enterprises Is Con-
sidered Important

H. H. Harrison, president of the Merchants' Heat & Light Company, Indianapolis, Ind., is firmly of the belief that "the public utility which serves its public serves itself." This motto, it is thought, applies in time of war as well as peace. In consequence the Merchants' company has been particularly active since war was declared in conducting such patriotic and civic activities as deserved support under the circumstances. Its efforts in soliciting Christmas presents for the French children in co-operation with the French Relief resulted in 18,000 presents being sent to France. Of late the company has been engaged in promoting food conservation and in fostering a movement for sending comic valentines to

American soldiers in France. The latter endeavor had a twofold purpose. The valentines were from the works of Indiana's best caricaturists and authors and will certainly bring smiles to the faces of Hoosier soldiers who receive them. Then, too, the proceeds of



FIG. 1—WINDOWS CONTRASTING AMERICAN AND FRENCH CHILDREN'S CHRISTMAS TO AID RELIEF WORK

the sale of valentines go to the French Relief. The show windows of the Merchants' company office and store, being on the most prominent corner in Indianapolis, have formed a valuable asset in advertising these



FIG. 2—CENTRAL-STATION WINDOW THAT SELLS VALENTINES TO ENTERTAIN SOLDIERS AND PROVIDE RELIEF

campaigns. Some of them are shown herewith. The company's motograph sign on top of the building was considered so valuable in advertising this sort of work that it was especially exempted from all lightless night orders by the local fuel administrator.

KEEPING IN TOUCH WITH OPINION OF CUSTOMERS

Method Designed by Syndicate to Prevent Unfavorable Public Impression from Gaining Headway in Communities Served

One of the big problems of companies serving a number of communities is that of knowing definitely the opinion of the communities toward the company. The general headquarters containing the office are as a rule not in the small towns, but rather in some large

YOUR SUGGESTION BOX

BUSINESS resolves itself into a matter of dealing with friends.

"A FRIEND," says Emerson, "is a person with whom I may be SINCERE."

WE WANT YOU to be perfectly sincere with us, just as we aim to be perfectly sincere with you. To keep pace with the growing needs of this community, we must come into close relations with you—we must know *your* requirements, *your* opinions, *your* wants.

WE THEREFORE INVITE your frank recommendations and criticism.

IF YOU HAVE any suggestions for the further upbuilding of our service, or if you have any report to make whatsoever—whether in the way of claim, complaint or commendation you will be *doing us a favor* if you will pass it on in writing over your signature.

TO MAKE THIS EASY as well as confidential for you, we are posting a Suggestion Box in the local office. We ask you to make frequent use of this "Special Delivery" service, and to accept in advance our assurance of careful and courteous attention to your communications.

ONLY THE OFFICERS of the Company will have access to this box, which is to be opened by them periodically, on the occasion of their visits to this station.

LET US HAVE YOUR CO-OPERATION in making this new plan bear good fruit for you and us alike.



INDIANA
POWER & WATER CO.



SUGGESTIONS DIRECTLY FROM CUSTOMERS TO OFFICERS ARE SOLICITED

city in the same general section of the country. In each of the communities served the company is represented by a local manager or a lesser employee, with whom the local public may or may not be in accord. Owing to the comparatively small amount of time the major officials of the company can devote to any one town, a long period may elapse before any public antagonism toward the company will be found out, unless it is reported by the local representative himself. In most cases the representative probably does make such reports promptly. It is the instance in which no such report is made that causes trouble, for once unfavorable public sentiment is established it is an expensive procedure to change it.

Realizing the facts in this situation and wishing to keep in close touch with the opinions of its customers, the Utilities Development Corporation of Chicago has established a system of keeping its officers and its customers in more frequent direct communication. At each city served by the company suggestion boxes have been installed. While the suggestion box idea in itself is not new, this company's method of adapting the idea to its needs is something unique. The printed form

reproduced herewith is used in connection with each box. As will be observed the spirit of the announcement is one of absolute fair-dealing. To eliminate the hesitancy any customer might feel about making a suggestion that would be counter to the known ideas of the local representative, the statement is made that "only the officers of the company will have access to this box." This statement is made in such a manner, however, as not to reflect lack of confidence on the part of the company in its local employees. Therein, it is thought, is the strong feature of this printed announcement. It invites the direct dealing of customers with the company's officers without reflecting discredit on the company's employees.

BUYING ENERGY A BENEFIT TO A MUNICIPAL PLANT

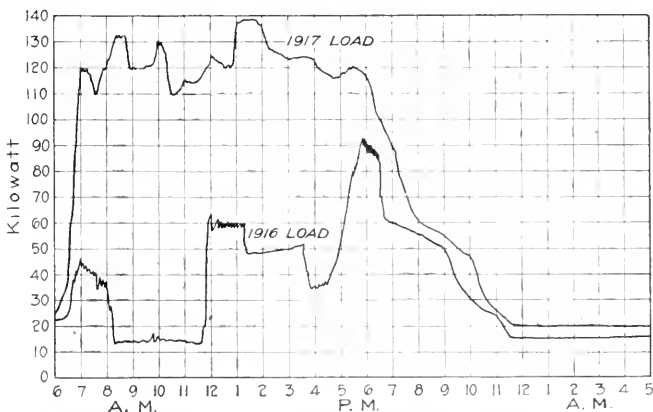
Difficulty in Handling Peak Diminished and Load Factor Greatly Increased by Purchase from Power Company

BY J. E. MELLETT

Georgia Railway & Power Company, Atlanta

An example of the benefits derived by a municipal plant through the purchase of energy from the power company will be noted by referring to the accompanying load curves for this class of business. Before this municipality contracted for energy its plant was inadequate for the city's needs, and more or less difficulty was experienced in handling the regular evening peak which is characteristic of all small municipal plants. All new business was discouraged, electrical stagnation existed, and the load factor was approximately 24 per cent.

After connecting to the Georgia Railway & Power Company's high-tension system there were no limiting features, and the load curve taken in 1916 showed that the load factor was increased to 29.6 per cent. The jagged appearance of this curve in the morning, at noon and early evening was caused by a three-phase



HOW THE PURCHASE OF ELECTRICAL ENERGY IMPROVED THE LOAD CURVE OF A MUNICIPAL PLANT

elevator motor in the only up-to-date office building in the city. A load curve taken early in 1917 indicated that the load factor was increased to 40.5 per cent. Recent maximum-demand indications taken on this plant, together with data on energy consumption, show that a load factor of 46.5 per cent was attained for 1917.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Getting Good Commutation with Alternating-Current Machinery.—In discussing commutation in alternating-current machinery, M. C. A. Latour says perfect commutation in a continuous current motor depends substantially on the production of a mean resultant neutral field in the region where commutation is taking place. He then goes on to show that the production of a perfect revolving field in a polyphase commutator motor assists in insuring perfect commutation at exact synchronism. In a single-phase commutator motor a polyphase revolving field can be produced at synchronism by utilizing supplementary brushes, short-circuited upon themselves, displaced by 90 electrical space degrees from the main single-phase brushes on the commutator. As in the case of polyphase motors, the problem of securing perfect commutation at synchronism becomes that of producing a perfect rotating field. The use of fractional-pitch windings on the rotor and a sinusoidal distribution of conductors on the stator is of much assistance in this connection. In a motor built in accordance with the principles set forth the commutator difficulties are not serious, the overload range is in excess of that of an induction motor, and the machine can act as a condenser on the system, when operated above synchronous speed. When alternating-current polyphase commutator machines are working above or below synchronism it is necessary in judging the commutation to take into consideration the emf. produced by the resultant field of the stator and rotor in the short-circuited winding sections. If a machine is intended to have the greatest possible range of speed, then it is essential to arrange things so that synchronism corresponds to a speed of perfect operation so far as commutation is concerned.—*A. I. E. E. Proceedings*, February, 1918.

Analysis of Adjustable-Speed Alternating-Current Motors.—Discussing the polyphase shunt motor, W. C. Korthals Altes points out that there exists a demand for a reliable adjustable-speed alternating current motor and then goes on to analyze the advantages and disadvantages of different types now available. For instance, the neutralized motor with shunt-field control is not practicable for commercial frequencies on account of the expensive control equipment required. The induction motor with a commutator on the secondary side is suitable for large outputs, but the control is still too complicated to make this motor suitable for the smaller machine-tool drives. The induction motor with commutator on the primary side offers the best solution for machine-tool motors. The theory of its operation is discussed in detail, and a complete description is given of the mechanism required to shift the brushes and of the new type of armature winding used.—*A. I. E. E. Proceedings*, February, 1918.

Kinematic Device for Imitating Performance of Alternating-Current Machines.—A device consisting of

four movable bars of adjustable length which is used for the purpose of imitating the performance of a series-wound polyphase commutator motor is described by Prof. V. Karapetoff in a paper entitled "Secomor." The bars can be set in a combination to represent the vector diagram of voltages in a motor with any desired constants. By moving the bars to vary the load complete performance characteristics of the motor can be obtained, including speed, torque, power factor, etc. An additional mechanism permits taking into account the impedance drop in the machine. An adjustable saturation curve made of soft wire is used in conjunction with the device to enable one to investigate the effect of saturation. Preceding the description of the "secomor" is a discussion covering the fundamental theory of operation of series-wound polyphase commutator motors.—*A. I. E. E. Proceedings*, February, 1918.

Traction

Use of Iron Transmission Wires for Alternating-Current Railroads.—W. KUMMER.—Because of the shortage of copper, Swiss engineers have studied carefully the practicability of using iron cable in place of copper for the overhead contact wires on railroad systems. Dr. W. Kummer, a Zürich engineer, calls attention to the fact that the successful use of iron for third-rails has caused engineers to underestimate the difficulty of using iron for the overhead contact lines. The

TABLE I—VOLTAGE DROP IN RAILS AND COPPER WIRES FOR ALTERNATING CURRENT PER KM. PER AMP.

Cycles per Second	WIRE OF 50 SQ. MM.			WIRE OF 100 SQ. MM.			WIRE OF 150 SQ. MM.		
	ϵp	$\epsilon \sigma$	ϵ Total	ϵp	$\epsilon \sigma$	ϵ Total	ϵp	$\epsilon \sigma$	ϵ Total
0	0.35	0.00	0.35	0.19	0.00	0.19	0.13	0.00	0.13
15	0.38	0.21	0.45	0.22	0.22	0.31	0.16	0.22	0.28
25	0.40	0.34	0.54	0.24	0.36	0.43	0.19	0.36	0.40
50	0.46	0.62	0.78	0.34	0.65	0.71	0.24	0.66	0.70

large cross-section of the rail offers far less resistance to the returning current than the smaller aerial wire, the proportion being about one to twenty. Furthermore, old tests and calculations regarding iron wires were based on direct current and not on alternating. Voltage losses with the latter are far greater, as will be seen from an examination of Fig. 1. Taking the maxima of the various curves in Fig. 1, and plotting a new curve with them, the diagram in Fig. 2 is obtained. At the end of a series of equations and formulas, covering large-dimension rails and small-diameter wires, the author finally leads up to a table in which are shown the differences between copper and iron wires as regards voltage losses per kilometer on overhead transmission lines of 50, 100 and 150 sq. mm. cross-section. The rails used were the regular standard Swiss SBB

I-type, weighing 45.93 kg. per meter. The value E_p represents the voltage drop in the overhead wire, E_σ represents the drop in the rails, and E total =

Generation, Transmission and Distribution

Subdivision of Waterfalls in Hydroelectric Practice.—F. PAGLIARO.—There are cases, the author holds, where instead of carrying water power through one conduit to a central point of operation it is more economical to subdivide the total fall into a series of smaller falls, with a corresponding series of operating stations. Stating the various factors of cost that enter into such a calculation, he cites a case where the flow is 15 cu. m. a second and the drop (300 m.) uniform for a distance of 3 km. For a development with one central station these figures of cost are arrived at by the author:

	Francs
Conduit	3,870,000
Central-station building	50,000
Equipment	100,000
Total	4,020,000

With the fall divided into two the figures are thus given:

	Francs
Conduit	2,210,000
Two central-station buildings	100,000
Equipment of first station, including transformer.....	250,000
Equipment of second station.....	100,000
Transmission line between stations.....	30,000
Total	2,690,000

With the fall twice divided at equal distances the cost is found to be slightly more than in the case that has just been considered. The figures are:

	Francs
Conduit	2,010,000
Three central-station buildings.....	150,000
Equipment of first two stations.....	400,000
Equipment of third station.....	100,000
Transmission lines	40,000
Total	2,700,000

Here the second plan, with two falls and stations, is the most economical. However, the author does not forget that a saving in the initial cost of installation may be more than counterbalanced by greater cost of operation and by loss of energy in transmission.—*Revue Générale de l'Electricité*, Jan. 5, 1918 (abstracted from *L'Ettrotecnica*, July 25, 1917).

Telegraphy, Telephony and Signals

Comparative Experiments on the Audion.—G. VALLAURI.—The author gives an account of experiments made with five samples of the audion, with the object of determining their relative behavior as amplifier, generator and detector for the purposes of radiotelegraphy.—*London Electrician*, Feb. 1, 1918.

Miscellaneous

Gas-Engine Troubles and Remedies.—A. L. BRENNAN, JR.—Although during the last few years internal-combustion engines have reached a high degree of perfection, they are still subject to many of their former troubles. How these troubles may be quickly and intelligently diagnosed is told in this article.—*Power*, Jan. 29, 1918.

Buying an Ash-Handling System.—HERBERT E. BIRCH.—How to purchase intelligently an ash-handling system to remove ashes from boiler ash pits is a question that is confronting many engineers and is discussed in this article. It is a timely subject, and the author brings out many ways of solving this apparently simple problem.—*Power*, Feb. 5, 1918.

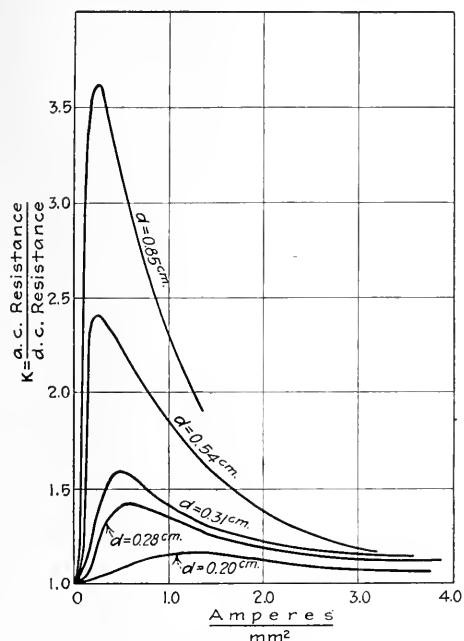


FIG. 1—RATIO OF A.-C. TO D.-C. RESISTANCE FOR DIFFERENT-SIZE IRON WIRES AND CURRENT DENSITIES

$\sqrt{E_p^2 + E_\sigma^2}$. As a result of these studies, Dr. Kummer looks with interest but with great apprehension upon the attempt to use iron wires for overhead contact lines. The only suggestion which he makes is to subdivide the

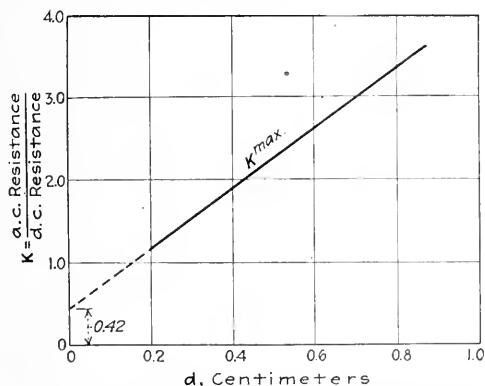


FIG. 2—MAXIMUM RATIO OF A.-C. TO D.-C. RESISTANCE FOR DIFFERENT-DIAMETER IRON WIRES

overhead wire, similarly to the wires in a wire rope, and then to design some new type of contactor which would be effective on such lines. A number of small-diameter

TABLE II—VOLTAGE DROP IN RAILS AND IRON WIRES FOR ALTERNATING CURRENT PER KM. PER AMP.

Cycles per Second	WIRE OF 50 SQ. MM.			WIRE OF 100 SQ. MM.			WIRE OF 150 SQ. MM.		
	ϵ_p	ϵ_σ	ϵ Total	ϵ_p	ϵ_σ	ϵ Total	ϵ_p	ϵ_σ	ϵ Total
0	2.62	0.00	2.62	1.32	0.00	1.32	0.88	0.00	0.88
15	6.52	1.03	6.60	4.40	1.03	4.51	3.50	1.04	3.65
25	7.49	1.54	7.64	5.02	1.55	5.25	4.06	1.55	4.23
50	9.14	2.22	9.40	6.20	2.23	6.60	4.94	2.25	5.42

wires would reduce the values E_σ and E total considerably below those given in Table II.—*Schweizerische Bauzeitung*, Dec. 22, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

NOTE ISSUES APPROVED FOR ELECTRIC UTILITIES

Capital Issues Committee of Federal Reserve Board Acts for Philadelphia Electric Company and in Another Case

The capital issues committee of the Federal Reserve Board has acted favorably upon proposed security issues of electric utilities, holding that the improvements are essential to the conduct of the war.

One issue is that of \$7,500,000 Philadelphia Electric Company two-year 6 per cent gold notes, dated Feb. 1. These will be secured upon the property of the subsidiary Delaware County Electric Company, including its large new Chester power station. They were offered for public subscription at 97 $\frac{3}{4}$ and interest, yielding about 7 $\frac{1}{4}$ per cent, by Harris, Forbes & Company, Drexel & Company and Brown Brothers & Company.

The letter approving this issue, dated Feb. 12 and signed by Paul M. Warburg, chairman capital issues committee, is addressed to the Philadelphia Electric Company and reads:

Referring to the proposed issue of \$7,500,000 two-year 6 per cent gold notes of the Philadelphia Electric Company: After inquiring into the purpose of the issue above described we are of opinion that the sale of said notes is not incompatible with the interest of the United States.

This finding constitutes no approval of such issue as regards its merits, security or legality in any respect.

In any public offer or advertisement of the said issue this letter must be incorporated in full.

Similar approval was given in a letter to Charles A. Hinsch, president Fifth-Third National Bank, Cincinnati, regarding an issue of \$1,560,900 of two-year 6 per cent first-mortgage lien gold notes of the Union Light, Heat & Power Company, Covington, Ky. These notes were offered at 96 $\frac{3}{4}$ and interest, yielding 7 $\frac{3}{4}$ per cent, by A. B. Leach & Company, the Fifth-Third National Bank of Cincinnati and Field, Richards & Company.

A statement issued by the capital issues committee says:

The chairman of the capital issues committee, when seen to-day and asked to make some statement concerning the activities of this committee, said that the support which the committee had received from all parts of the country was most encouraging. He cited as an illustration a resolution voluntarily adopted by the governing committee of the New York Stock Exchange, reading as follows:

"Whereas, the Federal Reserve Board has, upon the request of W. G. McAdoo, Secretary of the Treasury, appointed a committee of its members to act as a capital issues committee authorized to pass upon such proposals as may be submitted to them in respect to capital expenditures or issues of new securities,

"Resolved, that the committee on stock list will require, as a condition to the listing of such new capital issues, the presentation of the approval of such committee of the Federal Reserve Board."

Co-operative resolutions have also been passed on the part of municipalities. A case in point is the League of

Kansas Municipalities, which, among other recommendations, resolved that:

"It is recommended that during the period of the war each and every city government in this State shall undertake only such paving and other improvement work as may be actually necessary to be undertaken at this time, thereby releasing men and money for the service of the national government."

Another illustration of this spirit of co-operation was cited by him in the resolution adopted by the Richmond Real Estate Exchange, Richmond, Va., as follows:

"Resolved by the Richmond (Va.) Real Estate Exchange that the President of the United States and the Secretary of the Treasury be, and they are hereby, requested to issue an appeal promptly to all governors, and through them to state legislatures, mayors and legislative bodies of municipalities, requesting them to exercise the most careful scrutiny over all appropriations, and to exclude from their respective budgets every item that does not represent an actual necessity for the proper conduct of the government, to the end that the states and municipalities may set an example in patriotism and sacrifice for the institutions and individuals within their respective jurisdictions, and that material and labor may be conserved for the needs of the national government."

In dealing with applications so far submitted, the committee has adopted the policy that whenever the application involves the renewal of maturing obligations such renewal should be favorably considered unless there are particular reasons to the contrary. A similar policy is being adopted by the committee in dealing with the funding of banking debt incurred prior to Feb. 1, 1918.

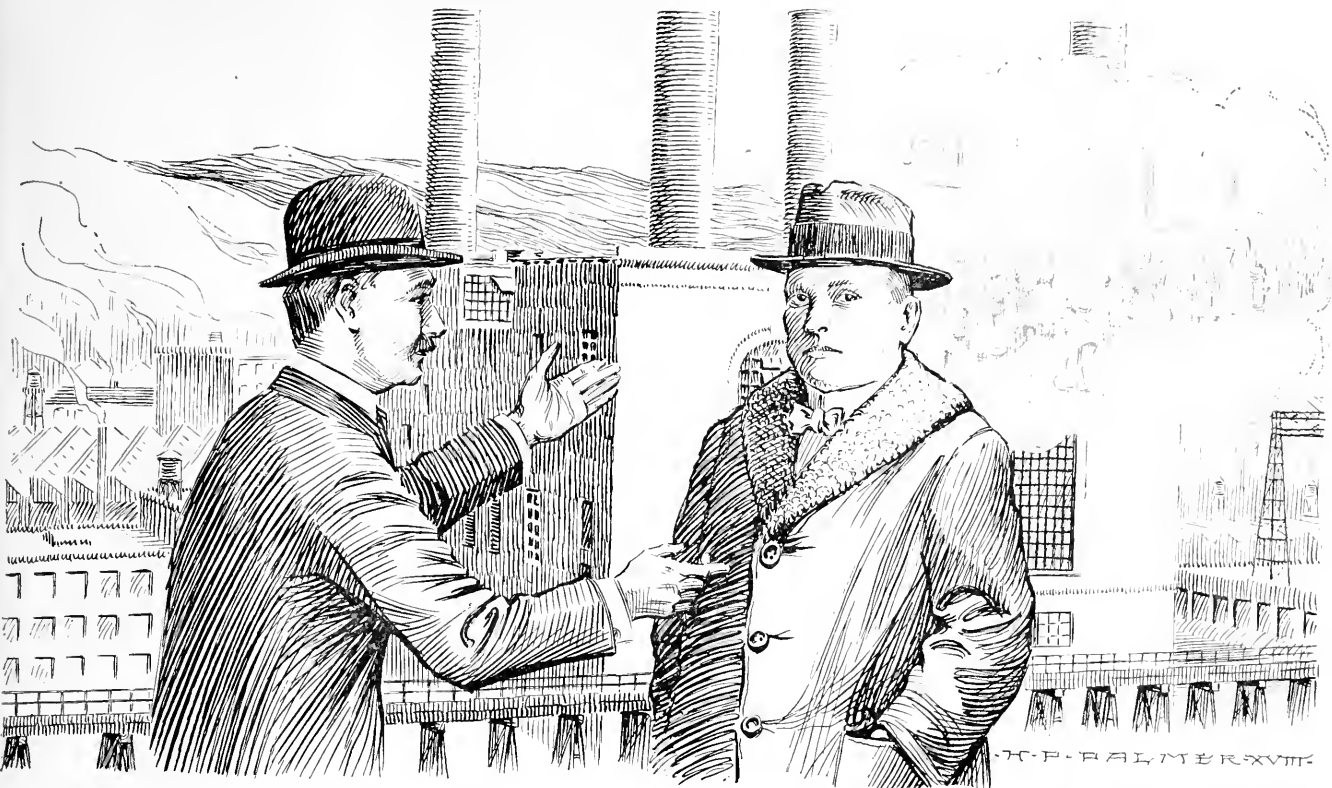
In dealing with bonds to be issued for the purpose of new road construction, the committee has been moved primarily by the consideration of whether or not these roads are of importance either from a military or economic point of view and whether or not results, through the new construction, may be expected to be obtained approximately within the present year.

In passing favorably upon certain projects involving the production of electric power, the committee was guided by the fact that the amount involved was small as compared with the funds already hazarded in such undertakings and by the fact that the power to be produced was required primarily for purposes connected directly with the successful prosecution of the war.

In dealing with municipal and state issues the decisive factor in the deliberations of the committee has been whether or not the expenditure is absolutely necessary for the health and welfare of the community. The committee urges that public authorities, both state and municipal, approve appropriations only where urgently required by the health and welfare of the people.

The advisory committee of the capital issues committee has been in close touch with all local committees established by the twelve Federal Reserve banks, and all personal presentations of applications are being made to them.

On Feb. 8 it held a public hearing at which there appeared representatives of the national organizations of the public utility companies of the country. These representatives discussed with the committee some of the problems and difficulties, both as to operation and finance, under which they were operating due to war conditions. They all pledged their hearty support and co-operation to the purposes to be accomplished by the capital issues committee and assured the committee that during the period of the war capital expenditures would be limited strictly to the most imperative needs. The committee is consulting freely with representatives of the various departments and boards and its work has been facilitated by their advice.



"PLEASE FORGET ABOUT WORKLESS DAYS, DR. GARFIELD. GIVE YOUR UNDIVIDED ATTENTION TO COAL PRODUCTION AND TRANSPORTATION. THAT WILL SOLVE YOUR PROBLEM AND OURS."

TRADE TOPICS DISCUSSED BY CENTRAL DIVISION JOBBERS

War Conservation, Freight Embargoes, Returned Goods, Universal Catalog and Heating Appliance Situation on Chicago Program

At the central division meeting of the Electrical Supply Jobbers' Association in Chicago on Feb. 13 the program consisted mainly of discussion on trade topics and the election of officers.

W. S. Bissell of Toledo, A. C. Downing of Des Moines, Iowa, and James Richardson of Minneapolis each presented a short paper on war conservation and freight embargoes. These papers evoked considerable discussion which brought out the point that jobbers are endeavoring to get along with fewer men. When men are lost from their organizations they advance men already at hand and fill in with men lower in the ranks.

The difficulty experienced in getting shipments due to rail embargoes has been general.

The returned goods evil was discussed informally, and it seemed to be the impression that this troublesome feature of the jobbing business is increasing in extent. Some companies are making a 10 per cent service charge on returned goods, but even this is not an entirely successful expedient since the charge does not nearly cover the entire expense.

As a result of the discussion of a universal electric supply catalog it was decided that Chairman Bernardin should appoint a committee to take up this matter.

The problem of the salesman and his automobile also came up for discussion, and there seemed to be dissent from the opinion that a salesman with an automobile could call upon more customers and solicit business from smaller trade than a man trying to make a territory on foot. There was considerable discussion and

difference of opinion as to the way of arriving at the proper method of compensating the salesman for the use of a car in the company's business.

George E. Hughes, president of the Edison Electric Appliance Company, addressed the jobbers on the heating appliance situation. He also spoke at some length on the policy which the Edison Electric Appliance Company will probably pursue in connection with the jobbing trade.

F. M. Bernardin of the B.-R. Electric Company, Kansas City, was re-elected chairman of the division.

ILLINOIS COMMISSION HAS 500 RATE INCREASE CASES

Approximately That Number Filed in January—
Questions Developed Concerning Property Value
to Expedite Handling Without Serious Delay

Approximately 500 rate cases, in most of which increases are sought, were filed before the Illinois Public Utilities Commission in January.

This large influx of cases, with its demand upon the commission's time, has led to the development of a method of handling rate increase cases which it is believed will facilitate action on many. The commission engineering department has worked up questions dealing with plant property which cover about thirty-five typewritten pages. These can be answered by any practical utility man and do not necessitate detailed valuation.

From the questions it is possible for the commission engineering staff to get a good rough idea of value in much less time than through the older methods. Companies applying for these questions have been supplied by the commission.

War Lessons Shown in A. I. E. E. Sessions

President Rice, at Midwinter Convention in New York, Draws Attention
to the Part of the Electrical Engineer in Carrying the
War Through to Victory

MORE than the usual amount of interest displayed in connection with convention papers was shown at the midwinter convention of the American Institute of Electrical Engineers, held in New York Feb. 15 and 16, as evidenced by the attendance of more than 400 and the lively discussions provoked. In favorable contrast with some meetings where most of the time is devoted to presentation of papers and little or no time left for discussions, at this convention there was time for these. Furthermore, each speaker was limited to about five minutes' talk, so many suggestive ideas were presented. On account of war conditions, the convention was made a purely business affair, sessions being held on Friday morning, afternoon and evening and Saturday morning.

SUMMARY OF THE PROCEEDINGS

The first session was opened by a presidential address by E. W. Rice, Jr., who discussed the great importance of water-power development and railroad electrification as fuel conservation measures. Following this, a paper was presented upon the selection and rating of oil circuit breakers. Substitutes for primary standard cells, the suitability of the thermal-storage type of demand meters for determining consumers' primary charge and the measurement of dielectric losses in three-conductor cables were the general subjects discussed at the afternoon session, each interesting its own particular field considerably.

Between the afternoon and evening sessions a strictly informal dinner was served at the Café Boulevard, at which Mr. Rice spoke on the necessity for co-operation to win the war. About 225 persons attended. Following the dinner a semi-popular lecture was presented by Dr. A. C. Crehore on "Some Applications of Electromagnetic Theory to Matter."

The Saturday morning session was devoted to discussion regarding alternating-current commutator motors. This subject drifted into that of electrification of railroads, some interesting views being presented on the adaptability of different types of alternating-current motors to this service. Considerable interest was shown in a kinematic device developed by Prof. V. Karapetoff for predetermining the performance of series-wound polyphase motors.

Abstracts of most of the papers and discussions are given in this issue on pages 410 to 413, inclusive.

In his address at the opening of the first session E. W. Rice, Jr., president of the Institute and president General Electric Company, followed the lines of his remarks on the same subjects before the Lynn Section on Feb. 2, which were reported in the *ELECTRICAL WORLD* of Feb. 9, 1918, page 322.

"Members of the electrical profession and industry have reason to be pleased with the contributions which they have made for the benefit of the world," said Mr. Rice in introducing his subject. "While we are glad to think that our science and our industry are fundamentally devoted to the products and conditions of peace,

we realize that in the electric light, searchlights, the X-ray, telephones, telegraph, wireless apparatus, electric motors, etc., electricity plays an important part in the grim business of war."

Mr. Rice showed the importance of electricity in coal mining and the effect of railroad electrification in increasing the capacity of trackage and speeding train schedules. He added:

It is estimated that something like 150,000,000 tons of coal was consumed by the railroads in the year 1917. Now we know from the results obtained from such electrical operation of railroads as we already have in this country that it would be possible to save at least two-thirds of this coal if electric locomotives were substituted for the present steam locomotives. On this basis there would be a saving of over 100,000,000 tons of coal in one year.

This is an amount three times as large as the total coal exported from the United States during 1917.

The carrying capacity of our steam roads is also seriously restricted by the movement of coal required for haulage of the trains themselves. It is estimated that fully 10 per cent of the total ton mileage movement behind the engine drawbar is made up of company coal and coal cars, including in this connection the steam-engine tender and its contents. In other words, the useful or revenue-carrying capacity of our steam roads could be increased about 10 per cent with existing track facilities by eliminating the entire company coal movement.

I have not mentioned the consumption of oil by the railroads, which we are told amounted in 1915 to something like 40,000,000 barrels, nearly 15 per cent of the total oil produced. This fuel is entirely too valuable to be used in a wasteful manner. It is important for many reasons that such a wonderful fuel as oil should be most economically used, if for no other reason than that it will be needed for the ships of our forthcoming merchant marine, for the tractors that till our fields and the motor trucks that serve as feeders to our railways.

It should give us courage and optimism for the future of our profession to contemplate the service which we may render in this direction and which it seems to me is immediately at hand. It should arouse in all of us, and particularly in the younger engineers, an enthusiastic confidence in the present and future stability and value of our profession and of the electrical industry. It should satisfy the young engineer that the opportunity for him to render important service is as real and great to-day as it has been in the past for those of us who have seen and participated in the marvelous growth of the industry up to the present.

PRESIDENT RICE'S ADDRESS AT INFORMAL DINNER

At the informal dinner at the Café Boulevard, Broadway and Forty-first Street, on the evening of Feb. 15, Mr. Rice spoke on war conditions and the need for the largest measure of generous co-operation to win the war. His call for "war to victory" met hearty applause.

"There was never a time in the history of the world when work was more needed and when talking is only justified which may help forward the great work which is at hand," were his first words. "We all know what that great job is—the winning of the war. Everything else must wait and take a back seat until that job is done."

Mr. Rice added that we are fortunate in having in our President a spokesman who is able to state the ideals of

the American people and their purpose in this great war in a manner so clear and so impressive as to perfectly satisfy and thrill every loyal American, and he has so appealed to our Allies that he is now accepted as the leading spokesman for all on our side of the war. It is fortunate for the world's future that his messages contain no indication that we will be satisfied with an inconclusive peace, and no matter how much we may hope that his messages may eventually break down the resistance of our enemy, through an appeal to reason, we are warned, said Mr. Rice, that it is vitally necessary to throw our full strength into winning the war, through the exertion of superior military and naval and industrial power. He continued:

The average citizen is mystified and wonders just what is the matter. He was told that the greatest possible production, especially of war material, was vital to our success, and this appealed to his common sense; but just as our manufacturers were getting up speed and working at high pressure they have been ordered to stop and to reduce pressure, as production is said to be ahead of the distributive facilities of the country. He has been told that the army organization has completely broken down. He has seen reports that the submarine menace has been mastered, only to note that the sinkings continue at an alarming rate. He was told that millions of tons of shipping were needed, and an organization was started to build these ships. He saw months of time wasted in talk at a time when every day lost meant the loss of millions of dollars and of thousands of lives. After months of weary waiting the deadlock was broken and we got fairly launched upon a shipping program. We thought that we were running along fairly well when suddenly the entire country was stunned by the recent drastic order of the Fuel Administrator, closing many industries and stopping much of business life.

WHERE PATRIOTISM HAS SCORED

The speaker reviewed the patriotic support of the administration by Congress in the early months of the war, without distinction of party; the Liberty Loans and the patriotic part of "wicked Wall Street"; the drastic scheme of taxation, which will be loyally supported even by those most heavily hit; the magnificent acceptance of the draft system and the Red Cross and kindred activities.

"In view of this record of accomplishment and our truly splendid start in the war," asked Mr. Rice, "why has this feeling of nervousness come over the country? Why has Congress suddenly changed its attitude of unquestioning support to one of investigation and criticism? What does it all mean? Is it true that we are making a failure of the job?" He continued:

It seems clear to me that we have not made a failure, and that everything is moving along as well as we had a right to expect under all the circumstances. When we consider that less than a year ago our nation of a hundred million of people, entirely unprepared for war, with institutions and traditions only adapted to the conditions of profound peace, was thrust into this greatest of enterprises, I think we have already accomplished wonders and that we should not be discouraged. Business men, and especially engineers and manufacturers who understand the nature of the equipment required for this conflict, however, must appreciate that our fundamental, and let us hope not fatal, mistake is that we waited until the war was thrust upon us before we started to get ready.

I think that a little reflection will make it clear that the mistakes that we have made since we started in the war, however numerous or avoidable, are in the aggregate negligible compared with the overwhelming mistake of failure to prepare for the war during 1915 and 1916; that precious time has been lost forever and no effort or time, criticism or talk can cancel that mistake and give us back the lost

time. We must expend untold billions and we must make superhuman efforts, but we must be patient and realize that inconsiderate haste is likely to result in added friction, lost motion, false starts and a general retardation of our program.

FROM THE BUSINESS MAN AND ENGINEER'S VIEWPOINT

Hesitating to make any suggestions, Mr. Rice said, however, as a business man and engineer, that certain matters seem worthy of consideration. He added:

To be successful the people must believe in the war and must work for the war. It would seem, therefore, that, this fact being recognized, we should not attempt to handle the job on the basis that it is to be run exclusively by the party in power. In such an emergency it does not seem probable that we can get best results by our customary majority or party government. All the people must be represented.

The country is greatly encouraged at the large number of able men, prominent in business and other walks of life, who have volunteered for service in various departments of the government and who have been accepted and set to work. This policy should be encouraged, as the more it is followed the better the country will be satisfied and the sooner we will win the war.

It is essential that the men who are charged with enormous responsibilities in our governmental enterprises have the confidence of the country, as their orders, no matter how drastic or arbitrary or apparently unnecessary, should be followed with confidence. At the present time orders are patriotically obeyed, but with some misgiving, due not so much to the hardships inflicted as to the feeling that our leaders do not fully realize what they are doing. There is no lack of confidence in their good intentions and character, but there is some questioning of their wisdom and practical experience.

I like the President's expression, "spirit of accommodation," for that is an essential element of co-operation.

We must have co-operation between the government and industries, and to be effective this means that both must be parties to the co-operation. It cannot be a "lion and lamb" sort of affair. If the governmental heads use their vast power arbitrarily and unwisely, they can easily cripple the industries of the country and thus delay victory for years.

Take, for example, the matter of priority. This is merely one of the factors of production. All large industrial establishments handle such matters through a production department with a production manager at its head. Such a man is settling questions of priority every day. If he settles them wisely, the industrial organization is successful; if he makes many mistakes, the organization will function badly and probably fail. If an inexperienced man were put in charge of the production of any establishment, he could, and probably would, with the best of intentions, reduce the productive efficiency of such an establishment by 50 per cent within a few weeks.

I believe that the problems facing us will be successfully solved in time, but we need more co-operation, more of the spirit of accommodation, all our patience and wisdom, and above all, a willingness to work to the limit.

We must discipline ourselves until a shirker in any field of useful effort will be regarded with the same contempt as a shirker in the military service of the country.

PHILADELPHIA ELECTRIC RATE INCREASE APPROVED

Advance of 10 per Cent in Power Schedule Authorized by Pennsylvania Public Service Commission Because of Higher Costs

An increase of 10 per cent in rates of power consumers of the Philadelphia Electric Company has been authorized by the Pennsylvania Public Service Commission. The advance in rates was approved by the commission on account of the higher expense of operation.

MUCH DISCUSSION ON THE CURTAILMENT OF LIGHTING

Many Viewpoints Developed Before Illuminating Engineering Society After Presentation of Preston S. Millar's Paper

A greatly interested audience gathered at the special meeting of the Illuminating Engineering Society in the Engineering Societies Building, New York, on the evening of Feb. 14, at which a paper on "Lighting Curtailment" was presented by Preston S. Millar, general manager Electrical Testing Laboratories, New York. Extracts from this paper were published in the *ELECTRICAL WORLD* of Feb. 16, 1918, page 370.

President G. H. Stickney in opening the meeting said that there are a great many things in the pursuit of happiness that were commendable a year ago which to-day must either be restricted or eliminated in order that we may carry this war through to victory. Waste of lighting must be prevented. On the other hand, light is a very important adjunct in the war from the battle line back through the lines of transportation, through manufacture, through all the activities of life, and there are some places where lighting may need to be increased. The society has been very fortunate in having opportunities to serve the country in the emergency, said Mr. Stickney.

MR. LIEB ON PRESENT-DAY PROBLEMS

Following Mr. Millar's presentation of his paper, the discussion was opened by J. W. Lieb, chairman National Committee on Gas and Electric Service. Mr. Lieb expressed the appreciation of the National Committee for the effective co-operation rendered by the Illuminating Engineering Society and the readiness and enthusiasm with which the members of its war service committee had responded to the repeated calls made by various government departments through the national committee and passed on to the society. He described the attitude which the national committee, acting on behalf of the gas and electric utilities, has taken in co-operating with the authorities in restricting unnecessary use of energy.

Mr. Lieb added that he would not endeavor to discuss the wisdom or the expediency of avoiding, as has been done, the classification of industries into essential and non-essential or dispensable and indispensable. He declared, however, that if any one wished to obtain for himself some idea of the difficulties involved in such a preparation of order of priority, say, of industries, he might make out what he would think was a proper order of priority or of dispensability of industries, classify it either by classes of business or industries, and he would find out very soon the enormous difficulties which such a classification presents. The fundamental touchstone is, "Is this or that industry immediately contributory to the conduct of the war?" Following that must of necessity be the consideration, "Is this or that industry indispensable to the public health and public welfare?" From these two fundamentals one would branch out and go down the list through industries of varying importance. The difficulties in making such a differentiation are enormous and they really do not impress themselves until one undertakes to make for himself such a differentiation, Mr. Lieb said.

In giving estimates as to the effect of lighting cur-

tailment Mr. Lieb said that exterior illumination was estimated at one-half of 1 to 1 per cent of the total output. It is not easy to find a difference in coal consumption of one-half of 1 to 1 per cent, but when it is coupled with the proposition that selected coal is impossible to obtain and when there is a variation in coal consumption from day to day of 10 or 15 per cent, the problem has added difficulties.

The experience of most of the prominent lighting companies in the five day suspension period was that roughly the output of power houses was curtailed on the average about 25 per cent, said Mr. Lieb. On the closed Mondays there was a reduction of approximately 35 per cent.

Dr. Coleman W. Cutler, chairman illumination committee, National Committee for the Prevention of Blindness, said that the saving of light may be of value in the saving of energy. The most of what the increased flood of lighting has given to the world is very beneficial, but some people cannot keep up with the demands of highly stimulated conditions. Children and working classes suffer most from insufficient lighting, and curtailment of their supply would be little short of criminal.

Dr. M. G. Lloyd, Bureau of Standards, expressed thorough sympathy with the general attitude of the author of the paper. He said that he would like to see the Fuel Administration conduct a campaign along the lines of the Food Administration, bringing home to every power plant operator and to every residence dweller who operates a furnace the necessity for making the best use of fuel. Dr. Lloyd referred to the estimate in the recent paper of Lynn S. Goodman and William B. Jackson before the American Institute of Electrical Engineers [see *ELECTRICAL WORLD*, Jan. 19, 1918.—Eds.] that the increased coal consumption due to poor quality is 10 per cent. If that could be eliminated there would be, on the figures given in the paper, a saving of 64,000,000 tons, which would more than cover the estimated shortage, and then the little saving effected by cutting down on lighting would be unnecessary.

Frank W. Smith, chairman lamp committee, National Electric Light Association, and vice-president United Electric Light & Power Company, New York, spoke of the action of New York electric and gas companies in circulating 1,800,000 fuel conservation cards among their consumers. He said that of the 145,000,000 lamps sold in the United States in 1916 more than 16 per cent were of the carbon and gem types. A very material saving in fuel would result from substitution of more efficient lamps.

DR. BELL ON THE FUEL ADMINISTRATION

Dr. Louis Bell, Boston, said that central stations would do their part manfully and would see that the use of light is economized so far as the saving does not interfere with the country's efficiency. He urged, however, that the Fuel Administration cut out unnecessary industries with a ruthless hand. The Fuel Administration could drive hard at the wastes which are unnecessary and inexcusable in business that has nothing to do with the great end of the war. The Fuel Administration before turning to central stations to curtail output or simultaneously with that demand (for these properties are willing to take their medicine with the rest) should suppress unnecessary industries.

Bassett Jones, New York, brought out the importance of a campaign to economize fuel in the home, similar to the Food Administration campaign.

W. A. Durgin, Commonwealth Edison Company, Chicago, discussed the necessity for developing efficiency in household fuel consumption and also the importance of saving eyesight as factors that should have careful consideration.

W. D'A. Ryan, General Electric Company, said that lighting is not anywhere near as large in volume as it should be. In place of an increase of 73 per cent there should be from 100 per cent to 200 per cent increase.

After the successful conclusion of the war, street lighting and industrial lighting should be increased an average of 150 per cent. In his work of illumination in Western cities Mr. Ryan is increasing the light, not 100 or 200 per cent, but from 500 to 1000 per cent. Recently the white way lighting in an Eastern city has turned out. This is protective lighting, and after three nights, on account of the increase of crime and nuisances, it was found necessary to restore the illumination.

Norman Macbeth, New York, said that newspapers had made a tremendous fuss about electric advertising. This is a form of advertising that has justified itself; it reduces sales cost.

MR. DOANE ON GROWTH OF LIGHTING BUSINESS

S. E. Doane, National Lamp Works of General Electric Company, said that the lighting business of the country has increased more rapidly than ever before. In spite of the effort to economize in lighting, the building of shipyards, operation of factories at night, construction of cantonments and many other things have tended to increase the use. Mr. Doane said he did not see how the industries could be served better than by making the fact clear that the solution of the problem does not lie in conserving lighting. We can look forward to no saving of coal, but on the contrary to a greater use of coal for lighting than ever before. Emphasizing the need of economy in lighting and in fuel in the home, Mr. Doane urged that the services of patriotic women should be enlisted.

W. J. Serrill, Philadelphia, thought that the chances were that the transportation system would be improved so much next winter that such a crisis would not occur again and that there ought not to be any reduction in lighting. Mr. Serrill expressed the opinion that a great deal of the present white way lighting is an extreme vulgarity and an advertising defacement of the cities. Considering what the illuminating engineer has done in flood lighting, what beautiful effects can be shown on the handsome facades of buildings, Mr. Serrill thinks that it is a pity to push too far the present type of moving sign lighting.

Mr. Jones spoke of the question of painting for light. He will report at a later meeting of the society the case of a factory in which the painting for light was so worked out that repeated tests showed utilization of over 100 per cent; in other words, that more light was being received than the lamps furnished. It is remarkable what can be done by treatment of the wall surfaces. Prism glass was also used in the windows of the factory.

R. E. Simpson, engineer Travelers' Insurance Company, Hartford, Conn., said that a director of a com-

pany operating twenty or more mills ordered that all unnecessary lighting should be cut down. One foreman cut out the lighting of stairways and other unfrequented places. The result was unprecedented increase in the accident rate, particularly at the points where lights were taken away. This was brought to a climax when one man was caught by a shaft near the ground and killed.

Among others who contributed to the discussion were A. L. Powell, Frank E. Wallis, W. H. Rolinson and W. J. Hammer. Mr. Millar also spoke in closing the discussion.

WITH EXCESS POWER SUPPLY, LOUISVILLE SEEKS INDUSTRIES

Margin in Capacity Above Current Demands of Customers Used to Boost Campaign for New Industrial Establishments

Donald McDonald, vice-president and general manager of the Louisville Gas & Electric Company, has been named vice-president of the Louisville Industrial Foundation, the million-dollar industrial department of the Louisville Board of Trade, which public subscription

10,000 K.W. Surplus Electric Power In Louisville, Ky., for Manufacturing

The Louisville Central Power Station has at this time more than 10,000 K. W. surplus electric power for industrial purposes, immediately available.

Louisville can supply a considerable area of floor space for manufacturing purposes.

Modern dwellings for workmen are available in Louisville at moderate rentals.

Louisville is one of the few cities of the United States favored with surplus electric power for industries in excess of present demands.

The Central Power Station owns its coal mine and operates its own coal cars, assuring a plentiful supply of fuel and continuity of surplus electric power.

Surplus electric power, together with industrial floor space and comfortable homes for workmen, affords manufacturers a remarkable opportunity for additional industrial operations at this time.

For detailed information and power rates, write or wire

TAMPTON AUBUCHON, General Manager

Louisville Industrial Foundation

Incorporated

CAPITAL \$1,100,000.00

910 Columbia Building

Louisville, Kentucky

HOW THE LOUISVILLE BOARD OF TRADE IS ADVERTISING THE OPPORTUNITIES OFFERED INDUSTRIAL ENTERPRISES BY THE KENTUCKY CITY

has supported for the purpose of attracting new industries to the city. This department has already been of considerable benefit to the Louisville Gas & Electric Company, as the foundation, offering financial aid in some cases, has been instrumental in getting a number of small industries using central-station service to locate in Louisville.

The accompanying advertisement from the New York Times shows what Louisville is doing.

WAR SERVICE WORK OF THE UTILITIES COMMITTEE

Returns to Fuel Administrator on Five Workless Days and Three Mondays Show Perhaps 30 per Cent Saving in Fuel

A report of recent activities of the National Committee on Gas and Electric Service, of which J. W. Lieb is chairman, has been received by the ELECTRICAL WORLD. It says that with improvement in weather conditions the reports received from public utilities give reason to believe that transportation facilities have ameliorated considerably and that both coal and oil shipments are moving with more freedom. At the request of the Fuel Administration the public utilities secured information as to the relative saving in output and coal supply for the five-day period and three Mondays following. The returns showed about 21 per cent reduction in output and a coal saving of perhaps 30 per cent.

The report of the committee says in part:

The Fuel Administration through M. L. Requa, Oil Administrator, has issued an order of preference for oil shipments. Public utilities are placed in the fifth class, thus insuring them a continuous supply of fuel and gas oil. The preferential order is divided into twelve groups, and it is estimated that the first ten groups will use but 60 per cent of the oil produced. From this it is quite evident that there will be an ample supply to care for the wants of the public utilities.

The Director General of Railroads has also issued instructions that both coal and oil are exempted from all embargo restrictions, thus giving free movement forward of these commodities which are an essential part of the supply of every public utility.

The priorities committee of the Council of National Defense has recently issued a new form of application for priority, to which is attached a form for the applicant making an affidavit that the conditions are as represented in the application. These forms of priority are used particularly for the procuring of material which is very essential to plants that are furnishing electrical energy to munitions manufacturers in general.

Surveys are still being conducted throughout the country in order to obtain accurate information as to the conditions of electric power supply for manufacturing purposes. It has also become necessary to make an investigation of the gas companies on which demands are being made for the industrial use of gas, which much exceeds the capacity of some of the gas companies. It is very much to be desired that public utilities notify this committee of any excess available power that may exist in their communities which would attract war material manufacturers to their vicinity.

The committee has been requested by the Quartermaster's Department to find in the public utility field, if possible, 200 or 250 competent auditors. It is extremely difficult to get information on this class of work, and the public utilities are probably in the same position as other industries in having very few such men available.

"Terminal pools" have been formed in about half a dozen large centers in the Middle West, and these pools are working quite satisfactorily in improving the delivery of coal to public utilities.

A zoning system of coal production areas which will supply coal to zones of consumption in order to avoid cross haulage is being considered and worked out by the Fuel Administration, but no orders on this have yet been issued. It has, however, been definitely decided to make no effort for the present toward arranging for zones of gas coal.

Senator Ramsdell of Louisiana headed a delegation which called on the committee in Washington with reference to procuring assistance in the developing of natural gas wells in Louisiana for the purpose of furnishing service to war industry plants, such as the proposed chemical plants which are being constructed by the government. Arrangements

were made to bring his proposition before the proper authorities.

The commission on car service has recently issued Circular No. 84 containing instructions to all the carriers that in confiscating coal no coal must be taken that is consigned to public utilities. The gas and electric companies will feel considerably relieved when these instructions are carried out, as the taking of coal by the railroads has seriously interfered with the operations of public utilities.

The committee is also working with the conservation department of the Fuel Administration Bureau on several plans to conserve the consumption of coal, and will shortly seek information from the various public utilities in order to arrive at conclusions as to the best way to proceed.

Information is being received by the committee from the various public utilities requested to furnish information to be presented to Dr. Garfield showing the percentage of output of either electric energy or gas to be used by manufacturers turning out war materials. Some of these reports indicate an amazingly high percentage of output furnished for this purpose.

The War Department has recently asked the committee to obtain information as to the possibility of taking over 200,000 kw. in turbine units which have been ordered by central stations from the large electrical manufacturing companies. This does not necessarily mean that the turbines will be commandeered, but a survey of these conditions has been thought necessary by the department, and the committee is being used as the avenue for procuring this information.

The committee has been called upon to furnish the names of several young men who have had experience along operating lines with central stations and power plants to enter the government service with commissions. It is the intention to place these men in the service of the War Department and assign them to make a survey of electrical conditions throughout the country and expedite matters in connection with power service to war industry manufacturers.

INDUSTRIAL PEACE

CONFEREES NAMED

Secretary of Labor Wilson Announces Personnel of Joint Conference of Employers and Union Labor Leaders

Secretary of Labor Wilson has announced the personnel of the joint conference of employers and union labor leaders who will lay down a basis of relations between capital and labor during the war. Five members, as follows, were chosen to represent each side by the National Industrial Conference Board and American Federation of Labor and they will select two additional representatives of the public.

Representatives of employers: Loyal A. Osborne, New York, vice-president Westinghouse Electric & Manufacturing Company and chairman executive committee National Industrial Conference Board; Charles F. Brooker, Ansonia, Conn., president American Brass Company; W. J. Vandervoort, East Moline, Ill., president Root & Vandervoort Engineering Company; L. F. Loree, New York, president Delaware & Hudson Company; C. Edwin Michael, Roanoke, Va., president Virginia Bridge & Iron Company.

Representatives of workers: Frank J. Hayes, president United Mine Workers of America, Indianapolis; William L. Hutcheson, president United Brotherhood of Carpenters and Joiners of America, Indianapolis; J. A. Franklin, president Brotherhood of Boilermakers, and Iron Shipbuilders of America, Kansas City, Kan.; Victor Olander, representative International Seamen's Union of America, Chicago; T. A. Rickert, president United Garment Workers of America, Chicago.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Philadelphia Section, I. E. S.—Pres. S. Millar addressed the Philadelphia Section of the Illuminating Engineering Society on Feb. 15 on the subject of "Lighting Curtailment."

Chicago Section, A. I. E. E.—Thaddeus Bailly and John A. Seede will address the Chicago Section of the American Institute of Electrical Engineers on Feb. 25 on "Electric Furnaces."

Schenectady Section, A. I. E. E.—P. W. Wilson, special correspondent for the *London Daily News*, addressed a meeting of the Schenectady Section of the American Institute of Electrical Engineers on Feb. 20 on the subject of "Britain at War."

Engineers' Society of Milwaukee.—E. S. H. Baars of the Vilter Manufacturing Company gave an illustrated talk on "Coal Accumulators and Their Application to the Refrigerating Industry" at a meeting of the Engineers' Society of Milwaukee on Feb. 13. Alexander H. Luedicke and Fred Goes of the same company gave an illustrated talk on army refrigerating equipments.

Association of Iron and Steel Electrical Engineers.—The next regular meeting of the Philadelphia Section will be held on March 1. John S. Rowan of the Rowan Controller Company of Baltimore will present a paper on "Standardized Mill Table Controllers." B. W. Gilson of the Carnegie Steel Company, Youngstown, Ohio, will deliver a paper on "Generation, Distribution and Consumption of Power" at the regular meeting of the Cleveland District Section to be held Feb. 23. A joint technical session of the A. I. E. E. and the Cleveland District Section of the A. I. E. E. will be held March 18. The Pittsburgh Section will meet March 16.

Prominent Engineers Attend Dedication of Dayton Engineers' Club.—The following attended the ceremonies in connection with dedication of the new Engineers' Club at Dayton, Ohio: Dr. W. O. Thompson, Gordon Rentschler of Hamilton, Elmer A. Sperry, Sr.; Elmer Sperry, Jr., and F. M. Tait of New York, Lieut. F. Vezzani, Col. J. J. Carty, Gov. James M. Cox, Major J. G. Vincent, H. M. Allen of Troy, Dr. L. H. Baekeland, Dr. Clark W. Chamberlain, Major C. M. Hall, W. B. Mayo and F. P. Book of Detroit, Commander McCormick, U. S. N.; J. H. Libberton of Chicago; C. E. Drayer, Cleveland Engineers' Club; A. M. Wilson, Cincinnati Engineers' Club; F. W. Weissmann, American Chemical Society, Cincinnati; Walter S. Wing, Society of Engineers of Western Pennsylvania; Col. E. A. Deeds, C. F. Kettering and Major Orville Wright.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Accounting in Illinois.—The accounting department of the Illinois Public Utilities Commission has prepared standard accounts for gas, electric, water and heating companies, effective on Jan. 1, 1918.

Surcharge Authorized in Noblesville, Ind.—The Indiana Public Service Commission has entered an order authorizing the Noblesville Heat, Light & Power Company to add a surcharge, as a wartime emergency measure, of $\frac{1}{2}$ cent for each kilowatt of energy furnished. The order extends to Feb. 1, 1919. The commission estimates that a surcharge will bring the company about \$2,500 additional revenue during the coming year. Increased cost of operation, including the tremendous increase in price of coal, made addition to the revenues necessary.

Overtaxation.—A decision of the New York Public Service Commission, First District, written by Commissioner Travis H. Whitney, places responsibility for the poor condition of many surface railroads upon the burden of overtaxation placed on them by city and State. Denying the application of the North Shore Traction Company for authority to increase the fare from 5 to 7 cents, the decision says: "The responsibility of the city and State authorities for inadequacies of the corporate income of companies such as this petitioner is thus strikingly manifested. If the city and State wish to require passengers to pay high enough fares to enable the street-railroad companies to pay into the public treasury not only real estate, local and school taxes but also franchise taxes, percentages on gross earnings and the like, and in addition wish the passengers within a comparatively short period to buy for the city and pay for property which the city says must pass soon to city ownership without further payment therefor, the bearings of such a policy should be frankly recognized. What goes into the public treasury must under such circumstances come out of the fare payer or must in some other form come out of the taxpayer. It cannot, over any long period of time, come out of the investors. Efforts to leave the investors to bear the burden can only mean deterioration of service, failure to make needed extensions and eventual receivership. Ought the city to require passengers to pay the cost of early city ownership of all the company's property situated in the city streets and nevertheless leave the company's property unable to do more than furnish to those passengers grossly inferior service?"

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Exercise of Care in Stringing Power Wires Across Telephone Wires.—It is the duty of an electric company in the construction and maintenance of its wires carrying heavy currents of electricity across the space where telephone or other such wires are strung to make approved and effective provision against the communication of its current to such telephone or other wires, it was held by the Supreme Court of Appeals of West Virginia (94 S. E. 372).

Duty to Repair Wires.—While a telephone company is bound to exercise ordinary care to keep its poles, wires and appurtenances in such condition as will make their presence along a highway reasonably safe for persons traveling thereon, it is not liable for injuries occasioned by a break because of an unknown defect occurring after nightfall, which was repaired the following morning as soon as discovered, the Court of Appeals of Kentucky held (198 S. W. 721).

No Liability When Adequately Forewarned.—Where an employee of the city water commissioners who was killed while patching gutters on a pumping station by contact with wires supplying the electric power to the station was warned not to get near the wires and told after finishing one gutter to move his ladder around to another and thus avoid the wires, and where if he had heeded such instructions he would not have been injured, there could be no recovery for his death from the employer or the power company, the Supreme Court of North Carolina held (94 S. E. 299).

Negligence in Case of Broken Wire.—Unexplained, the fact that the feed cable of an electric street railroad had broken away from its fastening to an iron pole at the street side and at intervals came in contact with the pole, as a consequence of which a boy received a shock, created a presumption of negligence, under the doctrine of *res ipsa loquitur* (the thing speaks for itself), the Supreme Court of New York, Appellate Division, held (167 N. Y. S. 690). The presumption of negligence from the fact of a feed cable of a street railroad having broken loose from its fastening to an iron pole at the side of the street, and so having come in contact with it occasionally, thus shocking a boy, is not overcome by showing that this was caused by lightning in the forenoon, eight hours before, in the absence of convincing evidence that the company exercised all reasonable care to discover and remove the menace.

Employment of Girls as Meter Readers.—The Binghamton (N. Y.) Light, Heat & Power Company has begun to employ girls to read meters and deliver bills. It has been found advisable to do this on account of the general labor conditions, and it is in line with the policy adopted about six months ago of employing girls in all branches of the work where it is feasible to do so, thereby releasing many men for federal service.

Saving Power in Canada.—The Hydro-Electric Commission of Niagara Falls, Ont., at its annual meeting elected Mayor H. P. Stephens chairman. A communication was read from Sir Henry Drayton, Dominion Power Controller, and the Ontario Hydro-Electric Power Commission asking the city to reduce street lighting. A municipal campaign will be waged urging householders to reduce electric lighting in homes so as to release additional power for Canadian war industries.

Speeding Instruction at Cornell.—Because of the exceptional demand for trained engineers for government war needs, the faculty of Sibley College of Mechanical Engineering, Cornell University, has signified its willingness to carry regular work for the present sophomore and junior classes through the summer as a first term of the junior and senior years respectively, and to continue sixteen-week terms, practically without interruption, until these classes are graduated. This will furnish graduates for government service considerably earlier than would be possible otherwise. This is regarded as a war measure only and will not remain in force at the close of the war.

Terre Haute, Indianapolis & Eastern to Buy Plant.—The Terre Haute, Indianapolis & Eastern Traction Company has petitioned the Indiana Public Service Commission for authority to purchase the common and preferred stock of the West Indiana Utilities Company, which operates lighting plants at West Terre Haute and Brazil, Ind., for \$121,000 cash, and for authority thus to eliminate competitive conditions at Brazil. The traction company has sold electricity to the West Indiana Utilities Company plant there and also furnished similar service itself. The common stock of the West Indiana company totals \$50,000 and preferred stock \$150,000, representing all the capital.

Common Stock Dividend Passed.—Commonwealth Power, Railway & Light Company directors have passed the common stock dividend. A dividend of 1½ per cent was declared on the preferred, payable in scrip due on or before Feb 1, 1924, with 6 per cent interest payable semi-annually. President Anton G. Hodenpyl said: "While the earnings are sufficient to pay the usual dividends, nevertheless because of the present abnormally high cost of operation and the inadvisability if not impossibility of marketing long-time securities, your directors have felt that the company's net earnings should for the present be conserved and used in place of the moneys usually derived from the sale of securities."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Stops Payments to Soldiers and Dependents.—In general it has been decided by the board of directors of the Commonwealth Edison Company that the practice of the company in making payments to the dependents of employees who have entered the military service of the United States should be suspended as of Jan. 1, 1918. It was found that the government plan of allotments, etc., was in effect the same as the company's plan, except that in some cases the amount to be paid by the government was less. It was decided that in certain cases the company might continue to do something for dependents of employees in military service.

Power Development Commission Completes Work.—The Power Development Commission of New York, headed by Senator George F. Thompson of Niagara, has completed its seven years' labors in the investigation of the possibilities of water-power development. The outstanding feature of its report to the Legislature is that it places on record the meaning of the waste of force at Niagara Falls. The commission states that half the flow of Niagara River, if diverted to the purpose, would light and heat all the homes of the State and turn all the wheels of industry, with a saving of the 40,000,000 tons of coal burned last year. Washington officials are to be urged to seek the concurrence of Canada in such changes in the treaty as would permit the use of waters above the Falls for the development of hydroelectric power of ten times the present limit of 400,000 hp.

Inmates of Institution Help to Save Valuable Metals.—The House of Correction, Chicago, under the direction of John L. Whitman, is effecting considerable saving in handling junk material discarded by municipal departments or institutions. Pieces of copper wire discarded by the electrical department are collected and the rubber and lead insulation is removed by hand. Under the commercial system of reduction the rubber would be lost. By employing unskilled labor the superintendent was able to conserve over \$11,000 worth of rubber. One inmate was employed in cutting small particles of platinum in electric light bulbs discarded by various public buildings. Working with an old washboard and a druggist's mortar, he conserved over \$9,000 worth in less than a year. The lamps were of the older type, since platinum has not been used in constructing the leading-in wires of incandescent lamps for three years. Some lamps dating back more than twenty years contain 10 cents' worth of platinum at present prices.

Sanitary District Raises Salaries.—The Sanitary District of Chicago has raised the salaries of all employees who did not receive salary increases last year. The total raise distributed among 525 employees amounts to \$60,000 per year, bringing the total salary payroll of the Sanitary District up to \$1,062,000 per annum. A large percentage of the men in the engineering department of the district are affected by this order.

Civilian Workers Needed for Army Ordnance Department.—The Ordnance Department of the army urgently needs several thousand civilian workers. The United States Civil Service Commission is conducting an extensive campaign to obtain this needed help. Workers are desired for different classes of positions, including clerical, testing, mechanical trades, drafting and inspection. They are vitally necessary in the prosecution of the war. They will form part of the forces behind the front without which the actual fighters would be powerless. For further information apply to the representative of the United States Civil Service Commission at the post office or custom house in any city, or to the Civil Service Commission, Washington, D. C. Except for the positions of stenographer and typewriter, typewriter operator, multigraph operator and general clerk, applicants are not assembled for a written examination, but are rated principally upon their education, training and experience, as shown by their applications and corroborative evidence.

Men Wanted for Navy Aviation Service.—The Navy Department announces that men will be selected soon for aviation service. Men of suitable qualifications who report now to the navy recruiting offices are eligible for examination for commissions and ratings. Rates of pay and duties assigned will make this opportunity highly attractive to mechanical engineers and to draftsmen, mechanics and others experienced in gasoline engine design or operation. Men are to be selected to equip for special work in connection with aviation as follows: Experienced engineers for engineer officers at the various naval air stations; experienced gasoline engine men for further instruction at Columbia University and special instruction at Packard Motor Company on Liberty engines; graduate mechanical engineers and men of experience along engineering lines for special duty in Bureau of Steam Engineering and in connection with work of this bureau at various places; aeronautical and other gasoline-engine draftsmen for work in the Bureau of Steam Engineering; men who have had experience in compressed gases, especially hydrogen; mechanical engineers for special work under the Bureau of Construction and Repair; mechanical draftsmen for duty in Bureau of Construction and Repair on aviation work; suitable men for training for quartermasters' (aviation) and carpenters' mates. Full information may be obtained at any navy recruiting office.



J. B. OLSON

James B. Olson, who has resigned from the Habirshaw Electric Cable Company, Inc., of which he was assistant secretary and general sales manager, as noted in last week's *ELECTRICAL WORLD*, is one of the best-known wire men in the country. Mr. Olson entered the wire industry in 1888 with the New York Insulated Wire Company. In 1892 he went to Chicago, where for two years he was Western sales manager for that company. On Jan. 1, 1894, he resigned to go with the India Rubber & Gutta Percha Insulation Company, afterward changed to Habirshaw Wire Company, of which he was made general sales manager and afterward secretary. On the consolidation of this company with the Electric Cable Company and the Waterbury Company, two years ago, Mr. Olson became general sales manager of the new company, the present Habirshaw Electric Cable Company. Later he was made an officer of the company under the title of assistant secretary.

Frank E. Watts, New York district manager of the Hart Manufacturing Company, past-Jupiter of the Jovian Order and former Eastern manager of the *ELECTRICAL WORLD*, is suffering from a broken leg received as the result of a fall on an icy pavement on Wednesday of last week. His right leg is broken about four inches above the ankle.

Prof. D. M. Folsom, head of the School of Mines at Stanford University, California, on Feb. 6 was made petroleum administrator for the Western States by Mark L. Requa, National Oil Administrator. Mr. Folsom has been serving as chairman of the petroleum committee of the State Fuel Administrator in California and is one of the leading oil experts of the West. In his new capacity he will have supervision over the production and distribution of petroleum in the States of California, Washington, Oregon, Idaho, Utah, Nevada and Arizona and the Territories of Alaska and Hawaii. This appointment is taken to mean the abolition of the petroleum committee, which consisted of Professor Folsom and two members of the Railroad Commission of California.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

H. G. Bonner, formerly new-business manager of the Alliance (Ohio) Gas & Power Company, has been made manager, succeeding F. C. Pratt. Mr. Bonner entered the Doherty organization five years ago as new-business manager at Elyria, Ohio, having been prior to that manager of the Louisville (Ky.) branch of the Westinghouse Electric & Manufacturing Company.

Samuel Scovil, president of the Cleveland Electric Illuminating Company, has resigned, and is now in the employ of the government as representative of the Cleveland district of the Federal Ordnance Department. Mr. Scovil has been president of the Cleveland company for the past four years, having been vice-president prior to that. Mr. Scovil, who is well known throughout the electrical industry, was elected third vice-president of the National Electric Light Association at its annual meeting last summer.

Frederick W. Prince, superintendent of the lighting department of the Hartford (Conn.) Electric Light Company, has resigned to join the staff of the Franklin Electric Manufacturing Company of Hartford. Mr. Prince is well known in central-station circles, having taken an active part in the work of the New England Section of the N. E. L. A. and been employed by the Hartford company for about eighteen years. He was educated at Trinity College, Hartford, graduating in electrical engineering under Prof. W. L. Robb, for many years consulting engineer of the Hartford company. In his new work, which is scheduled to begin April 1, Mr. Prince will hold the title of quality expert, co-ordinating the work of the engineering, production and sales departments, with headquarters in Hartford.

Charles Reginald Underhill, who has recently been appointed captain in the aviation section of the Signal Reserve Corps, as announced in the Jan. 12 issue of the *ELECTRICAL WORLD*, was chief electrical engineer of the Acme Wire Company, New Haven, Conn. Mr. Underhill was born in 1874 and received his primary education in the district schools near Buffalo. After a brief career as telegraph operator, he entered the employ of the Western Electric Company, New York City, in the inspection department. During the latter term of this employment, having charge of the inspection department as assistant chief inspector, he became interested in the design of electromagnets and resigned to become chief electrical engineer of the Varley Duplex Magnet Company, and in the next four years, while connected with this company, he made numerous experiments with elec-



C. R. UNDERHILL

tromagnets, particularly the solenoid type, the results of which were published in a series of articles in the *ELECTRICAL WORLD*. In the same period he wrote his book "The Electromagnet." About this time wireless telegraphy was being rapidly developed, and Mr. Underhill invented and demonstrated a wireless printing telegraph system. From 1904 to 1909 he was consulting electrical engineer in New York City, specializing in signal systems and electromagnet devices. At this time he wrote his book "Solenoids, Electromagnets and Electromagnetic Windings," and in collaboration with W. W. Massie wrote "Wireless Telegraphy and Telephony." For a brief period Mr. Underhill was employed as editor and technical writer for the Westinghouse Electric & Manufacturing Company, from which position he resigned in 1910 to become chief engineer of the American Electric Fuse Company. Since 1911 he has been employed by the Acme Wire Company as chief electrical engineer, during which period he has made extensive researches into the operation of electromagnets. For several years past he has lectured at the leading engineering colleges on the subject of electromagnets and their application. Mr. Underhill is the author of "Electromagnets, Induction Coils and Condensers," Section 5 of the "Standard Handbook for Electrical Engineers." He is a member of a number of national engineering societies, in addition to being a fellow of the American Institute of Electrical Engineers.

Obituary

Prof. Joseph Frederick Klein, dean of the faculty and head of the mechanical engineering department of Lehigh University, died suddenly on Feb. 11. Prof. Klein was born in Paris in 1849 and came to this country when four years old. He attended the Sheffield Scientific School of Yale University, from which he received the degree of Ph.B. in 1871 and the degree of D.E. in 1873. He had been professor of mechanical engineering at Lehigh since 1881.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

CHANGING CONDITIONS IN VACUUM-CLEANER MARKET

Manufacturers Considering More Closely Problems of Distribution in Order to Eliminate Certain Abuses Arising from Ignorant Competition

The general condition in the vacuum-cleaner field is unsatisfactory. This is true not on account of the volume of sales, for manufacturers are at present finding it easy to sell all the machines they can make from the material they can get. It is true, however, on account of the relations obtaining between the manufacturers and the various distributing agencies. On account of the fact that in the past manufacturers have mainly sold vacuum cleaners by going out to agents with a special proposition entailing extensive advertising, campaigns and free services of salesmen, the business has got into a state where the profit to the manufacturer is generally unsatisfactory.

Owing to the present steady demand and the limited supply, the time seems propitious to manufacturers for changing their policies and putting the sweeper on a commodity basis. One large manufacturer is making a serious effort to overcome past mistakes made in direct selling and is organizing to sell through the electrical trade. Another who had become dissatisfied with the electrical trade and who branched out into the hardware and department store field to obtain his agencies is considering coming back into the electrical trade. Efforts are being made to bring more manufacturers to a realization of the conditions which have been making the business unprofitable with a view to correcting the abuses.

It is necessary that in this movement the trade should realize its own responsibility. The movement to be a success requires the co-operation of the trade through the extension of its loyalty to the manufacturers who operate on a sound business basis instead of bestowing patronage first upon one manufacturer and then upon another because of some extra inducement which is offered temporarily. As a plain case of sound economics, it is pointed out by those interested, the trade should realize that it will be best served by the manufacturer who is making a fair profit and who is operating on an even turn-over basis.

JOBBER'S LAMP STOCKS MORE CAREFULLY ASSORTED

Manufacturers Are Aiming to Accomplish a Better Distribution on an Even Basis—Readjustment of Requirements Under Way

Jobbers in the East have stated that the situation on incandescent lamps has greatly improved since the middle of January. They also said that hereafter conditions would continue to become better and that shortages and stringency had ceased. In fact, by a reassortment of stocks a saving of at least 30 per cent, it is averred, has been effected in the quantity and sizes heretofore carried. Lamp voltages have also been rearranged on standard sizes to the advantage of jobber and dealer, a fact which the user or consumer will appreciate.

When a leading manufacturer was consulted in reference to the foregoing statement he said stocks in the hands of distributors and jobbers had been reassorted. A few sizes rather out of the ordinary in wattage had been eliminated from the regular sizes, but were still carried in factory stock on call. Jobbers and distributors, according to the ELECTRICAL WORLD informant, were required, under their

contracts, to submit a quarterly inventory of their lamp sales and merchandise on hand. This practice, it was learned, is the general rule in the trade. The inventories for the quarter ended Dec. 31, 1917, were more carefully scrutinized in view of the many reports that shortages existed in certain sections on particular types and sizes.

It was ascertained that the statement was well founded, but the fault was not factory underproduction but that the manner of distribution was at fault. The manufacturers, it is stated, were therefore satisfied that it was necessary to put into circulation some types and sizes that had been in jobbers' stocks for quite a while without moving. Items that were in this class, while not in great demand in one section, were strong sellers elsewhere where shortages existed. A close study of the situation by expert sales and factory stock managers led to the practical conclusion that a more satisfactory distribution could and should be devised to relieve the pressure and meet the demand on a more equitable basis. This is now under way, and an improvement in the lamp situation is acknowledged by the trade.

Combing over the jobbers' inventories revealed the weakness and error of previous methods of distribution. None of the standard sizes was eliminated, but the requirements of the jobber and distributor were differently assorted. A more even distribution was accomplished. The total production of lamps is held to be ample, and if the new arrangement is followed out to its logical conclusion, it is said, there is no reason for either a pinch or a stringency at any time anywhere. To be sure, there may be a temporary shortage due to extraordinary conditions, as during the past year. This was occasioned by the extraordinary call for the lamp equipment of cantonments, naval bases, aviation fields, shipyards and other large industrial enterprises developed by the war situation. Then local stocks were rapidly absorbed and in a few instances completely exhausted. Manufacturers have been working along these lines, it is stated, for some time; and, aiming at a more even distribution as a basis, the problem is in a fair way of being rapidly solved.

BOILER MARKET BEST IN THE EASTERN STATES

Business Has Slacked Off in Middle West but Is Expected to Revive Soon—Deliveries Six to Eight Months Without Priority Order

The business in boilers of central-station sizes can at present be divided into three general classifications for analysis. They are, first, commercial business in the district between Pittsburgh and New York; second, commercial business west of Pittsburgh, and, third, marine business. East of Pittsburgh inquiries and orders are being handled in volumes above normal. This is due largely to the great amount of strictly war work in that territory, creating extraordinary demands for power that must be supplied. In the Middle West, where there is less war work, the boiler business, while still good, has fallen off somewhat. The staple buyers of boilers—the central stations—are not in the market for any more equipment than they must of necessity purchase. A better market for boilers in the Middle West is expected to prevail in the coming months regardless of whether the war continues or ends quickly. If the war continues, it seems inevitable that the war business will spread over a wider territory than it now takes in. There are several good fuel fields west of Pittsburgh, and it is believed that the logic of distributing government business more widely, from a geographical standpoint, will become recognized.

This naturally is expected to help boiler business in the Middle West. On the other hand, if the war suddenly stops public-service business is expected to again flourish, since the lack of capital is all that is preventing extensions of plant. The business in marine boilers is so heavy that some of the prominent factories are looking for ways to let the business divided between their competitors rather than trying to do all of the work themselves. On the whole, the boiler manufacturing industry is far behind with its orders. Deliveries on marine boilers are twenty-four months and up; deliveries on commercial boilers are from six to nine months without a priority order. With an -1 priority order a commercial customer might get a delivery in from two to three months.

Some of the boiler manufacturers are taking advantage of the "sellers' market" that conditions have created to put into effect selling policies that they believe are for the ultimate good of customers but which there was no way of enforcing under ordinary conditions. Manufacturers claim that central stations and some industrial plants are not to make the mistake of wanting to install boilers that are too large. No boiler in a plant, say these manufacturers, should be so large that its loss in times of peak load will affect the operation of the plant if it is a station that stands alone, or will affect the operation of the system if it is an interconnected plant. In the past all argument on this effect has had little effect on customers. They thought they knew what they wanted and ought to have. In some cases boilers too large for the plant have been sold with a written protest from the manufacturers as a part of the contract. Nevertheless, this has not prevented the customer from coming back on the manufacturer if the boiler went wrong as was predicted. Nothing seems able to prevent that. So at least one company now is making it an absolute rule not to sell boilers that it knows are too large for the plant in which they are to operate. If it cannot convince a customer that he should buy boilers of sensible sizes, it is willing that some other manufacturer should get the business and stand the future grief.

METAL MARKET SITUATION

Consumption of Copper Falls Off a Trifle—Wire Prices Fixed at Base Figures

During the suspension of business on the fuelless Mondays, now happily abrogated, with the exception of New England, the consumption of copper for civilian purposes has suffered a reduction—just how much is now being figured out. At any rate, the call for the metal, which appears to be in good supply, has shaded off, and industrial consumers are supplying their requirements—in less than for lots—at 24.67½ cents per pound, the government price, perhaps even better. Wire base is unchanged; rubber-covered, cable and weatherproof remain stationary, with probably some slight reduction in the nature of extra discounts under certain favoring conditions.

Straits tin is not to be had—none offering, but Banca, from China, is in fair supply. Prices are very irregular. Lead has moved up a few points; sheet zinc has dropped sharply. The other metals are unchanged.

NEW YORK METAL MARKET PRICES

	Feb. 11			Feb. 18		
	f	s	d	f	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	27.00			27.00		
Lead, trust price.....	6.75			7.00		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter.....	19.00			15.00		
Aluminum, spot	7.92½			7.92½		
Aluminum, Straits	*85.00			*85.00		
Aluminum, 98 to 99 per cent..	34.00 to 36.00			34.00 to 36.00		

OLD METALS

Waste copper and wire.....	21.50 to 22.00	21.50 to 22.00
Waste, heavy	14.00 to 15.25	14.00 to 15.25
Waste, light	10.00 to 10.50	10.00 to 10.50
Waste, heavy	6.00 to 6.25	6.25 to 6.50
Waste, old scrap	5.50 to 5.75	5.50 to 5.75

*Nominal.

THE WEEK IN TRADE

WITH the appearance of more favorable weather a more wholesome condition is reported in the electrical trade throughout the country. Freight congestions have by no means been relieved—far from it. The Eastern seaboard and North Atlantic coast cities are still suffering from lack of even reasonable deliveries. The abrogation of the fuel order, with the exception of New England, where the shortage is felt severely, has stimulated trade measurably. The transportation of needful raw material along freer lines has helped factory production.

Nevertheless, electrical goods are moving more easily, and the spirit of optimism is loudly expressed. Concretely, fan order contracts are being signed up on a more liberal basis than last year, lamp cord is in strong demand, porcelain insulators are in better supply. Conduit, while below the normal stock level, is on heavy call, as well as electric tools, floodlamps, wire and second-hand motor installations. A scarcity of large motors is predicted, on account of the extended time delivery. Building operations for January show a falling off of fully 50 per cent as against the same month in 1917.

Collections vary from slow to excellent, according as reports concern different branches of the trade. Credits are being held up firmly.

NEW YORK

So important have become deliveries that the careful buyer is not so much concerned by the price of merchandise as by when he will receive it. Delivery is demanded before quotations are asked, and if there is any uncertainty on this score, the order is withheld for further consideration and for other quotations before it is placed. This situation is said to be affecting the sale of all electrical goods. In addition, both jobbers and dealers are continuing to buy cautiously and not far ahead. Locally jobbers, and in some instances manufacturers, are endeavoring to persuade dealers to handle specific lines exclusively. The proposition is not meeting with much favor, it is intimated, as the retailer contends he should sell what is called for irrespective of the make or brand, unless it is universally recognized as standard by the trade and public. Dealers are quoted as being opposed to doing missionary work in the furtherance of any special electrical merchandise. This, they contend, is a function of the manufacturer or exclusive distributor.

LAMPS.—The situation in lamps is said to be improved by the recent action of the manufacturers in the more even distribution of stocks. A saving of 30 per cent is claimed by some jobbers with the new arrangement.

WIRING DEVICES.—Staple goods in this varied line are reported as being in strong supply by jobbers who specialize on isolated plants and like supplies.

POLES.—While prices remain stationary, the difficulty in obtaining supplies grows steadily worse, particularly for chestnut poles of the 35-ft. size, the popular pole, for which an enormous demand is reported. Stocks are low, but a large quantity is on order. Thirty-foot and 40-ft. poles are being substituted, when accepted, as well as white and Northern cedar. This pertains to the Eastern territory only, against which freights are a drawback. An order for 2200 chestnut poles, shipped out of Chicago stock, may be turned into cedar. The embargoes are working a great hardship.

CONDUIT.—Stocks are low owing to traffic conditions. Prices on conduit are not likely to change, and the situation will doubtless improve with the arrival of more propitious weather and the clearing up of freight congestions.

COLLECTIONS AND CREDITS.—No complaint is heard of slow collections, several jobbers asserting that they

would be too good to believe if the actual settlements had not been really checked up. Little credit is being sought and trade acceptances are slowly but surely working their way into trade favor.

VACUUM CLEANERS.—The Hotpoint division of the Edison Electric Appliance Company, Inc., on Feb. 8 issued the following notice: "Because of continued rising cost of material and labor, it is necessary for us to increase the list price on our model L vacuum cleaner and attachments, also on model M attachments. Beginning March 1 to all classes of trade and consumers our new list will be as follows: Model L vacuum cleaners, \$30; model L attachments, \$8.50; model M attachments, \$8.50. Until March 1 orders will be accepted for the above articles at present lists for shipment as may be specified prior to April 1."

LINE HARDWARE.—Following the making of extremely large purchases of line hardware by the government, distributors are of the opinion there will be a tendency to reduce production for commercial consumption. Pittsburgh mills, which have a large quantity of hardware on order, cannot get goods in this market unless subject to long delays. Primary distributors are therefore buying cautiously from Connecticut producers, and not farther ahead than for a month's anticipated requirements.

CONDULETS.—Reports are that condulets are hard to stock and difficult to obtain, excepting in small quantities, in common with everything in the electrical staple line made of steel. Prices are, however, unchanged.

CHICAGO

"What you can get you can't sell, and what you can sell you can't get." Those words from a prominent manufacturers' agent in the Chicago territory sum up rather exaggeratedly, but to some extent accurately, the general state of the trade. Nevertheless, business continues to be done. It is heard everywhere that if prices were at the same level as they were a year ago the volume would be considerably off. As it is the volume of merchandise moving is less than it was at this time last year, but the value appears to be about equal to what it was a year ago. The meeting of the central division of the Electric Supply Jobbers' Association, with its discussions of war conservations and claims and its election of officers, was the feature of the week.

For the week ending Feb. 13 429 electrical permits, aggregating 5293 incandescent lamps and 576 hp., were applied for at Chicago. For the same week last year 803 permits were used. Building permits for the week ending Feb. 13 totaled twelve and amounted to \$308,600, as against sixty permits amounting to \$831,600 for the same week last year.

MOTORS.—Factories have been notifying certain Chicago agents that motors of 50 hp. and larger will be quoted at 10 months and upward. This indicates a greater scarcity of goods of this kind. War business does not make unusual demands for smaller motors. Immediate deliveries can therefore be made on many sizes and types up to and including 15 hp.

LINE MATERIAL.—The business in pole-line material which is usually anticipated at this time of year, as the result of storms, has in part materialized. Not all of the large stocks laid in to take care of it have been used, however, in spite of the severe weather. This is not regarded as unusual, since the most destructive storms are the sleet storms that usually come later in the year.

PORCELAIN INSULATORS.—The high-tension demand is holding up well, but the electric railway demand is off. Repairs, replacements and a few short extensions are creating the high-tension demand. Some instances in which the need for increased line capacity made it advisable to increase the operating voltages have also resulted in orders. Deliveries are 50 per cent better than last year at this time. Thirty to sixty days are quoted.

DOMESTIC APPLIANCES.—The only complaint concerning business in this field comes from manufacturers whose customers are overstocked. It appears that during the later months of 1917 some dealers were induced to put in very heavy stocks of high-priced goods. In some cases dealers were oversold by manufacturers' representatives

seeking records. High-priced material has not moved as rapidly as cheaper goods.

LAMP-DIMMING DEVICES.—There is an active demand for goods of this class. The business has no abnormal war features, but is of the steady, staple variety.

PORTABLE ELECTRIC TOOLS.—The demand for portable electric tools is brisk, but the production was seriously handicapped by the Fuel Administration's order. One concern which ordinarily produces 5500 tools, of both electric and pneumatic types, a month produced last month only about 3200 tools. This large reduction was caused not only by the fact that the production of this particular plant was affected, but also by the further fact that it was impossible to secure the necessary castings because of delays the foundries suffered in getting raw materials, held up by the fuel order. It is said that this condition prevails in spite of the fact that a very large percentage of the tools on order are to be used in shipbuilding and in all sorts of shipyard construction. This concern is about 10,000 tools behind on its orders.

BOSTON

Continued vigorous activity characterizes the trade, with government work the basis of major undertakings. Retailers report a rather quiet week, but plenty of optimism is in evidence as the winter draws toward its close. Labor-saving equipment seems certain to be in increasing demand, and even the small dealers are featuring washing machines and vacuum cleaners with excellent results. Building operations are very quiet and labor for electrical contractors' employ is rather more plentiful. Prices hold firm, with few changes. Deliveries of electrical equipment and supplies are still very unsatisfactory, but continued open weather is alleviating railroad congestion, and the outlook for improved service this spring is encouraging. Jobbers are well stocked, generally speaking. Collections do not show much change, being slow in the case of the smaller contractors, reasonably satisfactory in central-station circles and excellent in the mills.

The coal shortage remains threatening; New England is suffering severely from shutdowns in industrial war production forced by coal scarcity, and there is much unrest among wage earners thrown temporarily out of work. An eight-million-dollar war-storage terminal, including a dock and warehouse with more than 2,000,000 sq. ft. of floor space, is planned for Boston by the War Department, it is announced.

LAMPS.—Carbon lamps are still short, but central-station men do not appear to be much exercised. Some localities report ample supplies of tungsten lamps, judged by reasonable requirements. The outlook is good for increased production and larger factory stocks this spring. One jobber expects to increase his lamp sales by 100,000 this year, due to consignment contracts and list price sales by local central stations.

MOTORS.—Revamping of motor installations is a developing branch of electrical practice. New munitions contracts almost always force machinery rearrangements, and while the demand is great the supply of motors of smaller sizes is improving in extent and variety. Second-hand motor dealers are working under heavy pressure.

TESTING EQUIPMENT.—Plants making testing specialties for laboratories and meter departments are passing through a season of curtailment in new orders, due partly to shortage of testers. Protracted hostilities will probably lead to the increased employment of women in the testing field. Some foreign business is being handled, notably in South America and New Zealand. A representative specialist producer of artificial loads reports ample stocks of magnet wire and copper, with good labor conditions.

CONDUIT.—Scarcity of larger sizes is a widespread plaint, and shipments are slow and uncertain. Forehanded jobbers' orders are gradually coming in, but the situation cannot be called at all satisfactory.

REFRIGERATING EQUIPMENT.—Prospects are good, inquiries in fair volume, prices steady, labor fairly plentiful and deliveries of eight to twelve weeks possible on important work.

ATLANTA

The recent statement by the Fuel Administration that fuelless Mondays would be abandoned, at least for the present, was cheerfully received in this section. While the Southern States were exempted one week earlier than the Northern States, it was anticipated that a rescinding order would follow to cover any territory affected in the original order. The recent mild weather has greatly relieved the fuel situation and surface conditions appear normal.

The trade in general reports that electrical goods from manufacturers' and jobbers' local stocks to interstate destinations in the Southeast are moving more easily. A marked improvement is also noted in deliveries of goods from a few of the Northern and Eastern points. Large quantities of material had been delayed owing to Eastern embargoes. There is no evidence at this time to indicate that business is slowing up; in fact, all manufacturers and jobbers interviewed are very enthusiastic as to the business for 1918. The increased quotas for early delivery of fans reflects material evidence of actual conditions in this line alone.

Industrial activity continues along shipbuilding, essential and quasi-essential lines. The new government dock yard at Fort Wentworth, Ga., will cost approximately \$5,000,000. The National Ship Building & Dry Dock Company, Savannah, Ga., has secured a three-million-dollar contract for wooden hulls. The Dayton Company, Dayton, Tenn., capitalized at \$4,000,000, will develop iron and coal properties in Tennessee and Georgia. The Cumnock Coal Mining Company, Cumnock, N. C., capitalized at \$1,000,000, will develop coal land. Fabricated steel ships will be constructed by the Pensacola Shipbuilding Company, Pensacola, Fla., plant investment approximately \$700,000.

LAMP CORD.—The demand for all sizes continues strong. Local stocks seem to be holding up well, and a plentiful supply of the standard size is on hand. Factory deliveries are very slow. Special sizes are very hard to obtain.

SWITCHBOARD INSTRUMENTS.—On the whole the demand has been steady, with the exception of spotty large orders placed with equipment. No change in price has been noted for some time. Shipment promises are very good and vary from four to six weeks.

SOCKETS.—The volume of business in this line is large and the demand shows some increase. Stocks are in pretty fair shape.

TRANSIL OIL.—Manufacturers report great difficulty in securing proper quantities to fulfill transformer orders. This situation is mostly due to rail embargoes.

SEATTLE

From present indications February's trade volumes will be much heavier than last month's, which were surprisingly large. Sewing-machine sales featured the week's business, as has been the case for several weeks. Sales of other labor-saving devices are steady but not startling. The volume of sales of electrical equipment and machinery to shipyards and industrials shows a slight increase over the past week. The buying of electrical machinery and equipment for Alaska canneries is at peak and is expected to subside shortly. It has been heavy. Government buying for navy yard and army cantonments has dragged perceptibly. Stocks, with the exception of conduit, rubber-covered wire, lamps and both large and small motors, are in good shape. The freight situation is no better; shipments are dribbling in very slowly. Shipments which heretofore took eighteen days now take five and six weeks. Car shortage is much in evidence, especially in the Puget Sound district. Portland jobbers report a heavy volume of sales the past week, to wooden shipyards particularly. Steel shipyards are buying steadily.

Convinced that further delay in providing housing for shipyard and like war industry workers will cause slowing down of war essential work, the Seattle Chamber of Commerce will ask the government for \$3,000,000 to assist in a home-building campaign. A report to the government states no houses are for rent, a large number being erected for sale only. The residence building boom in Seattle continues, and Tacoma's record for the first eight days of the

month was 35 per cent greater than the entire month last year. One Tacoma capitalist plans to erect 500 homes immediately to handle the influx of workers.

The Seattle headquarters of the Emergency Fleet Corporation has received an order for 15,000,000 ft. of fir to supplement a former order of 50,000,000 ft., to be substituted for Southern pine. The railroads have promised co-operation in making shipments promptly.

The boom in grain elevator construction in eastern Washington and Oregon continues. Orders and inquiries for electrical equipment from this source are increasing daily. Several large orders for motors and lighting equipment were placed the past week. The Alaska Engineering Commission of Seattle has awarded contracts for motors, wire and lamps for government railroads. Additional contracts for like equipment will be let shortly.

Conduit is in slightly increased demand from shipyards; government buying receded slightly. Shipments are highly unsatisfactory, on account of the manufacturers' inability to secure closed cars. Stocks low; prices steady. Several large orders for floodlamps for lighting shipyards in the two shipbuilding cities completely shot stocks to pieces, forcing jobbers to wire Eastern factories for additional supply. Additional orders are at hand. Motor generators are moving as fast as jobbers can get them. Shortage has prevailed for several months.

SAN FRANCISCO

Continued rains have greatly improved prospects in California, and the recent strain on business conditions has eased correspondingly. Hydroelectric companies, however, cannot now expect relief, as it is too late to pack and freeze the snow, the melting of which supplies the later summer flow. Thus facing the necessity for returning early to the use of fuel in standbys, and with oil now at \$1.50 per barrel and likely to go higher, the central stations are applying for authority to increase rates. A strike of electrical workers in Los Angeles and neighboring cities has been averted by arbitration at the last moment. The labor situation, however, is in a somewhat unsettled state.

Within the last few weeks plans for considerable construction activity have been announced. The one-million-dollar contract for the government camp at Riverside has been let on a percentage basis. Engineers are now at work laying out another government camp, including an aviation base, 12 miles from Sacramento, which will have about fifty-two buildings and will cost about \$1,250,000. Work to the value of about \$1,000,000 is under way or will soon be started at San Francisco by the State Harbor Commission.

Freight shipments from the East are now coming through in about twenty-eight days. The Southern Pacific Railroad reports that a system of embargoes has resulted in entirely clearing up the congestion of eastbound freight from San Francisco and Los Angeles.

MOTORS.—One large firm reports a readiness to ship from stock in San Francisco all sizes up to 30 hp. Stocks on hand at the factory in these sizes are considered ample, and the small-motor situation is considered to be excellent, in fact better than has been the case previously for more than eighteen months. Deliveries on sizes from 30 hp. to 50 hp. are slow and above 50 hp. are rather indefinite.

LAMPS.—The general situation has not changed materially. No effect of the heatless Mondays in the East has yet been felt on the coast, but in a few weeks, when there has been time for coast lamp orders to come through, there may be greater difficulty in filling orders. A new lamp factory on the coast is to be in service in a few months, after which the situation is expected to be very greatly relieved.

WIRE.—The demand for both rubber-covered and weatherproof wire is reported as below normal. Prices have not changed. For the most part stocks are in bad shape. The completion of factory extensions and a falling off in this business is given as a reason for the decreased demand. However, considerable government business is in prospect. One firm reports a considerable sale of weatherproof to steam railroads.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List per 1000 Ft.
B. & S. Size	No. 14 solid	\$61.00
No. 12 solid		71.00
No. 10 solid		90.00
No. 8 solid		106.00
No. 6 solid		145.00
No. 10 stranded		95.00
No. 8 stranded		115.00
No. 6 stranded		160.00
No. 4 stranded		205.00
No. 2 stranded		266.00
No. 1 stranded		315.00

Twin-Conductor		List per 1000 Ft.
No. 14 solid		104.00
No. 12 solid		135.00
No. 10 solid		185.00
No. 8 stranded		235.00
No. 6 stranded		370.00
No. 4 stranded		575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor		No. 14 Solid
Less than coil	List to \$61.00	
Coil to 1000 ft.	10% to 59.17	
		No. 12 Solid
Less than coil	List to \$71.00	
Coil to 1000 ft.	10% to 68.87	

Twin-Conductor		No. 14 Solid
Less than coil	List to \$105.00	
Coil to 1000 ft.	\$70.00 to 10%	
		No. 12 Solid
Less than coil	List to \$135	
Coil to 1000 ft.	10% to \$130.95	

DISCOUNT—CHICAGO

Single-Conductor		No. 14 Solid
Less than coil	List to + 10%	
Coil to 1000 ft.	List to 10%	
		No. 12 Solid
Less than coil	List to + 10%	
Coil to 1000 ft.	—10% to 5%	

Twin-Conductor		No. 14 Solid
Less than coil	+ 10% to \$115	
Coil to 1000 ft.	—10% to \$80	
		No. 12 Solid
Less than coil	List to + 20%	
Coil to 1000 ft.	—10% to 5%	

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to \$24.00
1/5 to std. pkg.	20% to 19.80
Std. pkg.	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	20% to 12%
Std. pkg.	34% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.285	.295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil		Coil to 1000 Ft.
3/8-in. s. stp.	Net to \$75.00 —15% to \$69.75	
3/8-in. d. stp.	+10% to 75.00 List to 72.00	
1/2-in. s. stp.	List to 100.00 —15% to 93.00	
1/2-in. d. stp.	+10% to 100.00 List to 96.00	

NET PER 1000 FT.—CHICAGO

Less Than Coil		Coil to 1000 Ft.
3/8-in. single strip	\$75.00	\$63.75
3/8-in. double strip	78.75	71.25-71.75
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Foot	Size, In.	List Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$25.00-\$55.00	\$20.00-\$21.50
1/4-in.	\$28.00-\$60.00	\$22.50-\$27.00
		\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$36.00-\$55.00	\$25.00-\$37.50
1/4-in.	\$40.00-\$60.00	\$27.00-\$30.00
		\$25.00-\$27.00

CONDUIT, COUPLINGS AND ELBOWS.

RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

Couplings, List		Elbows, List
1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	1/4 in. to 1/2 in.	3/4 in. to 3 in.
2500 to 5000 lb.	4% to 6%	7% to 9%
	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.	1/4 in. to 1/2 in.	3/4 in. to 3 in.
2500-5000 lb.	3.3% to 6.7%	6.3% to 9.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	\$5.00 to \$6.00
Discount	30%

CHICAGO

List	\$5.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.	100	\$0.30
60-watt—B.	100	.35
100-watt—B.	24	.70
75-watt—C.	50	.70
100-watt—C.	24	1.10
200-watt—C.	24	2.20
300-watt—C.	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4 1/4 in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$24.90 to \$31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$29.00 to \$35.60
Coil to 1000 ft.	21.50 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$24.00 to \$25.75
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OUTLET BOXES

	List, per 100
No. 1—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
No. 2—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.	30.00
No. 3—C.A., 9, 4R, B 1 1/2.	25.00
No. 6—F.A., 7, C.S., 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%-37%	20%-32%
10.00 to \$50.00 list.	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N. C.			

	Std. Pkg.	List
Less than 1/5 std. pkg.		
1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N. C.			

	Std. Pkg.	List
Less than 1/5 std. pkg.		
1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10 to \$11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push		
1/4-in. cap key and push sockets.	500	\$0.33
1/4-in. cap keyless socket.	500	.30
1/4-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	14% to \$25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

	High Grade:
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00

	Low Grade:
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.	List to +5%
\$10 to \$25 list.	11%
\$25 to \$50 net.	14% to 15%

	Low Grade
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.	+5%
\$10 to \$25 list.	11%
\$25 to \$50 list.	14%

	Low Grade
Less than \$10 list.	5%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp. 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to -15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	Union and Similar—	List, Each
No. 155		\$0.34
No. 160		.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.		Net
\$2.00 to \$10.00 list.	10% to 20%	5%
\$10.00 to \$50.00 list.	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25%	20%
\$2.00 to \$10.00 list.	25%	20%
\$10.00 to \$50.00 list.	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/4
No. 18, full spools.	0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.64
No. 18, full spools.	0.50 to 0.54

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net
	Less than 500 Ft. 500 to 1000 Ft. 1000 to 5000 Ft.
No. 11.	\$15.00-\$18.00 \$13.00 \$10.25-\$11.50
12.	23.25-25.41 21.30-21.78 15.97-19.35
10.	32.40-35.31 29.70-30.18 22.13-27.00
8.	45.70-49.12 41.90-42.12 30.88-38.00
6.	72.40-77.84 66.35-66.72 48.93-60.30

CHICAGO

	Price per 1000 Ft. Net
	Less than 500 Ft. 500 to 2500 Ft. 2500 to 5000 Ft.
No. 14.	\$18.00 \$13.00-\$13.50 \$11.50-\$12.00
12.	25.33-\$26.28 22.48-25.33 20.40-20.93
10.	35.04-36.54 30.03-31.26 28.23-29.23
8.	48.97-51.57 41.98-44.13 39.42-41.36
6.	66.46-88.38 66.43-75.61 56.39-70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 4 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 31.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$35.50 to \$40.35
25 to 50 lb.	31.50 to 39.35
50 to 100 lb.	33.50 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements
in Manufacturers' Products Used in
the Electrical Field

Master Switch

The master switch shown herewith has a lever which controls the starting and a press button in the front for stopping. In the running position the starting lever is held by an electromagnet which is in series with the field



WITH LEVER FOR STARTING AND BUTTON
FOR STOPPING

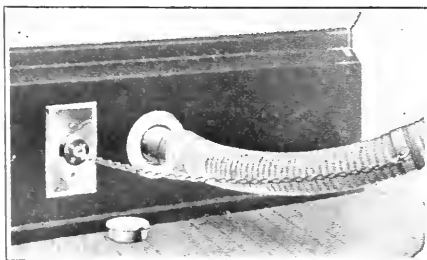
winding of the motor, so that in case of a failure of voltage or a rupture of the field circuit the starting lever automatically flies to the "off" position.

This switch is made by the Igranic Electric Company, Ltd., London, Eng.

Automatic Control for Stationary Vacuum Cleaner

Stationary vacuum cleaners when installed in large apartment buildings, hotels, club houses and halls have hose connections in many locations and switches on each floor to start and stop the cleaner. With such a system an employer or tenant using a cleaner connection on one floor and knowing that others are being used elsewhere in the system depends on the others to close down, with the usual result that the plant continues to run unnecessarily.

The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has designed a vacuum-cleaner receptacle the



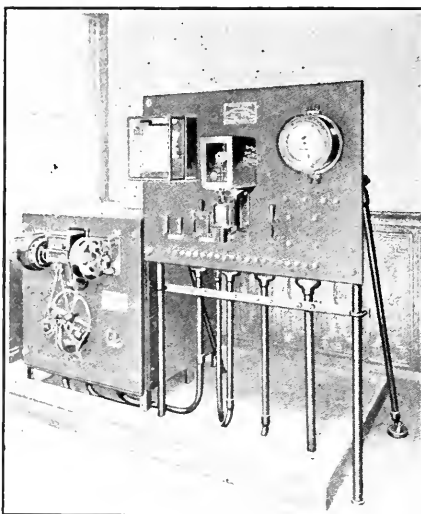
VACUUM CLEANER RECEPTACLE AND
CONTROL

cap of which is attached to the hose, as shown in the accompanying illustration. Inserting the cap in the receptacle closes an auxiliary circuit to the starting equipment. In the case of small stationary outfits in private homes the

cap can be used to close the motor circuit direct. This automatic control insures against waste of electricity and unnecessary operation of the cleaner. These receptacles are wired in parallel so that the insertion of one or more caps will operate the plant. Being chained to the hose, the cap will always be there when the use of the hose is required. The receptacle and cap furnished are of a special design which permits the cap to be readily detached at any angle. No other cap is interchangeable with it, and consequently the receptacle cannot be used for other purposes. The complete device includes receptacle, cap and 14 in. (35.6 cm.) of chain but not the hose clamp.

Meter for Measuring Coke Oven Gas

Increasing quantities of surplus gas from by-products coke-oven plants are being consumed in various processes in steel mills, and it is desirable to have



RECORDING PANEL INSTALLED IN OFFICE

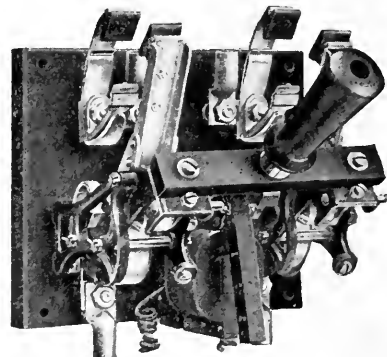
an accurate and reliable measurement of this gas. For this purpose the Thomas meter has been applied, which measures the quantity of gas in standard units, such as cubic feet at 30-60, without any calculations or corrections for pressure and temperature, although these may vary through wide ranges. The total quantities (in cubic feet) are shown on an integrating meter, and the rate of flow is shown graphically on a curve-drawing instrument. The graphic chart obtained from this instrument is very useful to the superintendent of a coke-oven plant, showing him at a glance the amount of gas being used for fuel in the coke ovens over

any period, with variations in quantities clearly indicated.

The meter is installed in a housing which replaces a portion of the gas-pipe line. The principle of the Thomas meter is that it measures the heat capacity of a gas electrically. The amount of electric heat necessary to raise a standard unit 2 deg. is used as a measure of the gas flowing through the meter. The electricity for heating the gas can be conducted on comparatively small wires, consequently the meters showing the amount of gas used can be placed in the superintendent's office or other desired location, which may be several hundred feet from the meter proper. The recording panel is shown herewith as installed in the office of the rolling-mill superintendent of the Brier Hill Steel Company at Youngstown, Ohio. The graphic chart shows at a glance just how much gas is being used at any time in the steel mill. The complete Thomas meter and recording panels are made and installed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis.

Circuit Breakers

The Roller-Smith Company of 233 Broadway, New York City, has brought out an inclosed-type plain no-voltage circuit breaker. It is pointed out that these breakers are now mounted in inclosing cases. The outfit complete comprises the circuit breaker, the inclosing case, which is provided with wiring inlets at the top and bottom, a convenient handle with which the breaker may be opened by a slight upward pressure or closed with a slight downward pressure, and a target on the left side of the case showing

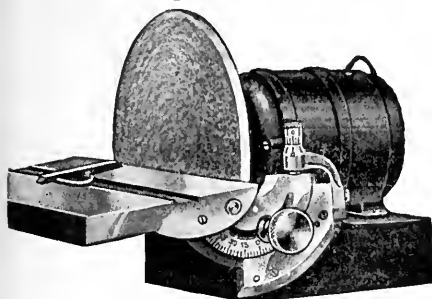


NO-VOLTAGE INDUSTRIAL-TYPE CIRCUIT
BREAKER WITHOUT INCLOSING CASE

whether the breaker is open or closed. The equipment is offered for 45-amp. and 100-amp. loads and voltages of 110, 220, 312 and 440. Each breaker has one no-voltage coil, which is wound for the voltage specified.

Motor-Driven Sanders

The Electric Specialty Company of Stamford, Conn., has developed the speed sander shown here, which is driven by an alternating-current or direct-current motor. The motors used are said to be dust-proof, with shafts over-

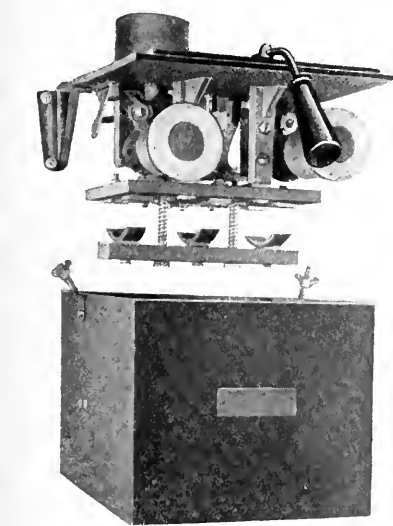


EQUIPPED WITH A MICROMETER ADJUSTMENT

size, running in ball bearings. The steel disks are turned and ground accurately on all surfaces, insuring perfect balance. This machine is equipped with a micrometer adjustment which when turned one space tips the table 0.001 in. on 1-in. (0.0025 cm. on 2.54-cm.) thickness. This is a great convenience in duplicating one bevel against another, it is said. The micrometer also acts as a positive right-angle stop, so that the table can be kept perfectly square with the disk.

Motor-Starting Switches

Motor-starting switches designed for low-voltage and over-load protection are made by the Wells-Morris Manufacturing Company, 90 Second Street, San Francisco, Cal. These switches, equipped with protective plugs (inverse-time-limit design) of proper size, give both inverse-time-limit overhead protection and low-voltage protection.



DESIGNED FOR LOW-VOLTAGE AND OVER-LOAD PROTECTION

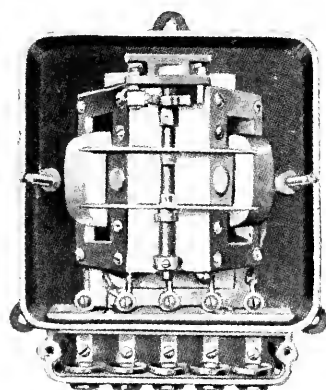
They also protect polyphase motors from operating single-phase. The switches are furnished with left-hand threaded receptacles to receive the protective plugs.

These switches are quick-break, opening by gravity, spring-assisted. Each pole has two breaks in series and wiping contacts with a special member to take the arc. The contacts will not freeze closed, it is claimed. They open automatically when the power is interrupted or if a protective plug blows, giving absolute protection against overload and single phasing. The low-voltage release coil uses only a small amount of energy and is positive in its method of operation.

Reverse Phase Relay

Reverse phase relays for the protection of elevators, cranes, conveyors, textile machinery, etc., are sold by the Philadelphia Electric Company Supply Department of Philadelphia, Pa. The complete equipment consists of the relay and a double-pole circuit breaker equipped with a shunt trip coil only. The relay is a potentially operated device, consuming but a negligible amount of energy.

The electrical elements consist of two laminated iron electromagnets, the coils of which are connected to opposite phases of the supply circuit. A vertical shaft supported by bearing pivots carries two aluminum sectors,



RELAY WITH CASING REMOVED

which are partly inclosed by air gaps in the magnetic circuit. The magnets are so placed that when energized from a polyphase circuit a rotating field is produced. This field, acting upon the sectors, causes the latter to rotate in a direction dependent upon the phase rotation of the supply circuit. A contact attached to the shaft and receiving the current through a flexible connection completes the trip-coil circuit of the accompanying circuit breaker when the direction of phase rotation is of such a kind as to cause the relay to operate.

The relay may be supplied to either close or open a circuit, such as that supplying the no-voltage release coil of an oil switch or circuit breaker. The device is mounted in a substantial dust-proof iron case, with sealable wing nuts, and terminal chamber having binding posts for the connection leads.

This relay is designed for use on two-phase or three-phase, three-wire or four-wire, 25-cycle or 60-cycle circuits,

and will be furnished for 110, 220, 330, 440, 550 and 600 volts service.

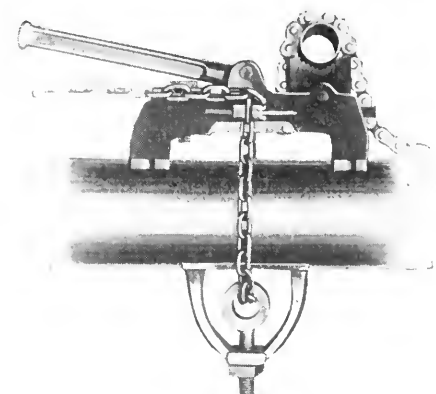
The circuit breakers furnished with these relays are of special design either of a totally inclosed oil type or of a plunger type with iron inclosing box with relay mounted thereon. The capacity of the breakers has been standardized at 100 amp. and 220-600 volts, which at the 220-volt rating will take care of motors up to and including those of 30-hp. capacity. Larger capacity circuit breakers can, however, be furnished.

Pipe Vise

The pipe vise shown herewith is a simple, portable vise which can be moved from one location and mounted at another in a moment's time. It fastens to any kind of a horizontal or vertical support, whether round, square or flat, without the use of bolts. It locks any size of pipe or conduit within its limits by the slight push of a lever. No previous adjustment is necessary.

The base support is squared out in the form of an inverted V, at the sides of which are bolt lug feet, to be used only in case the vise is to be permanently bolted in one position. Hence it will conform to a round, square or flat surface. A clamp support on the opposite side of the column is a part of the equipment. It is a bell-section shape, having a boss at the top, through which a threaded supporting eye-bolt passes free. A heavy nut resting on the top of the boss and engaging the threaded eye-bolt adjusts the tension of the chain passing through the eye of the eye-bolt. The base of the clamp support is squared out in a manner similar to the vise base in such a way that it fits the same shaped surfaces.

A heavy wrought-iron chain is riveted on one side of the vise base. It passes around the supporting column, through the eye of the eye-bolt in the clamp support, and thence to the other side of the vise base, a link being held securely in position in a socket. Tightening of the eye-bolt nut tightens the



VISE IS PORTABLE

supporting chain and holds the vise rigidly in position.

The Gerolo Manufacturing Company, Old Colony Building, Chicago, is the manufacturer.

Trade Notes

L. L. FLEIG & COMPANY, INC., of Chicago announces that it has raised its capital stock from \$30,000 to \$50,000. The company handles electrical insulating materials.

M. V. STAIG, formerly with the Fort Wayne & Northern Indiana Traction Company, is now manager of the appliance sales department for the F. Bissell Company, Toledo, Ohio.

THE WAGNER ELECTRIC MANUFACTURING COMPANY of St. Louis, Mo., has insured its 3,000 employees, up to \$1,000 each, for 1918. The company pays the premium on the entire amount of insurance.

J. KING WALLACE, formerly with the Continental Fibre Company, is now district manager for the Consumers' Rubber Company, Cleveland, Ohio, covering the States of New York, Pennsylvania and Maryland.

HOWARD DINGLE and W. W. Clark, formerly manager and assistant manager of the Crocker-Wheeler Company, Amper, N. J., have formed the Dingle-Clark Company, contracting engineers, with headquarters at 536 Engineers' Building, Cleveland, Ohio.

S. M. MOORE, for six years in the New Haven (Conn.) office of the General Electric Company, has joined the staff of the New England Engineering Company of Waterbury, Conn. He has been placed in charge of office work in connection with motor and apparatus sales.

THE GENERAL ELECTRIC COMPANY of Lynn, Mass., on Feb. 5 distributed bonuses to about 13,000 employees who have worked continuously for it for five years. Five per cent of the total earnings of the past six months was paid, and the total amount disbursed was about \$100,000.

SCHWEITZER & CONRAD, INC., of Chicago, has recently appointed the Franklin Sales Company, Denver, Col., district representative for Wyoming, Colorado, New Mexico, Arizona, Utah, the western portion of Nebraska and the eastern portion of Montana and Idaho. The Franklin company will sell the entire line of S. & C. protecting and switching devices.

THE NATIONAL X-RAY REFLECTOR COMPANY of Chicago has appointed G. F. Evans supervising engineer in the territory comprising the State of Ohio (except Toledo and Cincinnati), West Virginia and Western Pennsylvania. Mr. Evans is established at 825-826 Columbus Savings & Trust Building, Columbus, Ohio. He was formerly connected with the W. C. Moore Company of Columbus.

CHARLES H. KEELING, after years of experience in the electrical field, has joined the selling forces of the Square D Company of Detroit, Mich., and will travel in the Canadian territory, with headquarters at Toronto. He was formerly connected with the Renfrew Electric Manufacturing Company, Ltd., Renfrew, Canada, being its first sales representative. In 1916 Mr. Keeling was appointed sales and advertising manager of that company.

THE DE LA VERGNE MACHINE COMPANY of New York City, since its control by the William Cramp & Sons Ship & Engine Building Company, because of the large amount of turbine work, will somewhat curtail its oil-engine and ice-machine business. The company states that for ice machines there is little or no outlook for the next year or more, as the government is conserving the ammonia supply to the extent of not permitting its use in new plants.

HICKEY & SCHNEIDER, INC., New York City, manufacturer of transmission-line equipment, heretofore a partnership, is now to be continued as a corporation, capitalized at \$100,000, according to a statement made by Mr. Schneider, president of the concern. P. Kovac, formerly with the New York Edison Company, is sales engineer in charge of the company's sales and service departments. P. S. Houton, an engineer of broad experience, is to handle the design work.

EARL E. EBY, manager of the industrial bearings division, Pittsburgh office of the Hyatt Roller Bearing Company of Newark, N. J., for the past two years, has been appointed assistant sales manager, with offices in the Metropolitan Tower, New York City. Mr. Eby is a graduate engineer from the Ohio State University and previous to his connection with the Hyatt company spent four years in the engineering department of the Westinghouse Electric & Manufacturing Company.

THE NATIONAL X-RAY REFLECTOR COMPANY as the result of a suit brought in the United States District Court, southern district of New York, against the Stronksy Manufacturing Company, for infringement of the "X-ray" trade mark by putting out a lighting fixture called the "X-Ray Lite," has received a decree holding the X-ray trade-mark good and valid and granting a perpetual injunction restraining the defendant from infringing it.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., will remove its automobile equipment department manufacturing operations to the company's Newark (N. J.) works. At these works the Westinghouse company has for many years been manufacturing small motors and instruments of accuracy and precision. Its facilities and staff assure a continuation of the present high quality of the automotive equipments. At the same time the general sales offices of this department will be moved to 110 West Forty-second Street, New York City, where the Eastern district sales office will also be. S. D. Levings has resigned as Eastern representative of the automobile equipment department.

THE SQUARE D COMPANY of Detroit, Mich., held its first annual sales convention at the Hotel Statler Jan. 10, 11 and 12. It was attended by the company representatives from coast to coast and members of the advertising and home sales force. Bryson D. Horton, president of the company, made the opening address; A. MacLachlan, sales manager, gave a talk on "The Industrial Plant"; L. D. Calhoun, advertising manager, and G. H. Eddy, with the ELECTRICAL WORLD, also spoke on timely topics. A dinner tendered by President Horton was given the guests on the evening of the 11th at the Detroit Athletic Club. A trip of inspection through the plant was made the following day.

Trade Publications

FANS.—The Carleton Company, 170 Summer Street, Boston, Mass., is distributing a leaflet descriptive of its fans for the 1918 season.

FANS.—The Hamilton-Beach Manufacturing Company of Racine, Wis., has prepared a leaflet descriptive of its Cyclone universal fan.

FANS.—The Pittsburgh Electric Specialties Company, 396 Broadway, New York City, has prepared a leaflet descriptive of fans for 1918.

CIRCUIT BREAKERS.—The Cutter Company of Philadelphia is distributing a calendar. Various interesting information and data regarding this company's line of circuit breakers are included in this calendar.

FANS.—The Robbins & Myers Company of Springfield, Ohio, has prepared its catalog No. 1117, descriptive of its electric fans for alternating-current and direct-current circuits, including non-oscillating, oscillating, ceiling and ventilating fans and hat cleaning motors.

ILLUMINATING GLASSWARE.—The Phoenix Glass Company, 230 Fifth Avenue, New York City, is bringing out a monthly publication to be known as the *Illuminator*, which will deal mostly with matters pertaining to illuminating glassware. All new designs will be shown on perforated and punched pages which can be easily removed and filed away in a loose-leaf data book. This will permit all the new designs to be kept together and will not require the going over of the files of the *Illuminator* each time reference is to be made. All changes in discounts, package charges, etc., will be noted. Articles by fixture manufacturers and illuminating engineers on various problems that they have actually met and solved will be featured. In this first issue an article on a new cost system installed by Cassidy & Son Manufacturing Company contains much information that is valuable to the fixture manufacturer. Articles will be published by the leading designers in the country on various subjects dealing with the artistic features of glassware and fixtures.

STEAM TURBINES.—Interesting applications of steam turbines in naval public utility and industrial service are illustrated in bulletin 242, just issued by the Terry Steam Turbine Company of Hartford, Conn. In this twenty-eight-page publication the advantages of turbine drive for auxiliaries are featured, followed by a clear-cut description of the Terry wheel and principle of operation, with diagrammatic explanation of the action of steam, reasons for selecting this product and a condensed engineering discussion of eleven cardinal points

in design. A full-page illustration of labeled turbine parts is included, and an interesting diagram is added showing the relative water rates with and without the use of partial nozzle control. The principal engineering features bearing upon turbine selection are set forth in simple terms easily understood by the industrial executive and sufficiently complete in detail to interest the technical reader. Shaft whipping, maintained alignment, handling fractional loads efficiently, low upkeep cost and reliability are a few of the points discussed. Applications of the vertical type of unit used for the past decade on United States destroyers, late advances in turbines giving various classes of pumping service handled by this equipment, generating units, duplex exciters and fans of the turbine-driven type are featured in the bulletin.

New Incorporations

THE GENERAL UTILITY COMPANY of Dunn, N. C., has been chartered with a capital stock of \$100,000 by B. O. Townsend, Marvin L. Wade and G. M. Tilghman.

THE DOMESTIC ELECTRIC APPLIANCE COMPANY of Peoria, Ill., has been chartered with a capital stock of \$25,000 by R. B. Cherry, V. E. Hopkins and E. G. Kuecks.

THE COMMONWEALTH WATER & ELECTRIC COMPANY of San Benito, Tex., has been incorporated with a capital stock of \$30,000 by John T. Lomax, W. D. Carpenter and S. Spears.

THE GOWER-MASON ELECTRIC COMPANY of Greenville, S. C., has been incorporated with a capital stock of \$35,000. The officers are: DuPont Guerry, Jr., president, and R. S. Huntington, secretary and treasurer.

THE LANDIS ELECTRIC COMPANY of San Diego, Cal., has been incorporated by H. G. Landis, Edward Jewell and Arthur J. Simpson. The company is capitalized at \$25,000 and proposes to manufacture electrical specialties.

THE HYLE ELECTRIC SERVICE, Inc., of Buffalo, N. Y., has been incorporated with a capital stock of \$3,000 by Howard D. Hyle, Irving R. Templeton and J. Francis Carter. The company proposes to manufacture storage batteries.

HUNTING & GUERRY of Greenville, S. C., has been chartered with a capital stock of \$50,000 to do an electrical contracting business. The officers are: R. S. Huntington, president, and DuPont Guerry, Jr., secretary and treasurer.

THE MONTEREY (IND.) LIGHT & POWER COMPANY has been incorporated by Charles M. Stern, William H. Vandenberg and V. H. Surghnor. The company is capitalized at \$60,000 and proposes to distribute electricity for lamps and motors.

THE BENSON ELECTRIC COMPANY of New York, N. Y., has been chartered with a capital stock of \$250,000 by H. S. Leman, R. Goldman and A. H. Bloch, 507 Westminster Square, Brooklyn, N. Y. The company proposes to manufacture specialties.

THE HOME ELECTRIC COMPANY of Hendersonville, N. C., has been incorporated with a capital stock of \$500,000 to construct and operate interurban railways. The incorporators are: William H. Oates, Claudia H. Oates and Anne Oates, all of Hendersonville.

HESS & HICKS, Inc., of New York, N. Y., have filed articles of incorporation with a capital stock of \$5,000 for the purpose of doing a general electrical and mechanical engineering business. The incorporators are: Julia F. Hess, Frank F. Hess and Gary Hicks.

THE F. D. SCHUSSLER MANUFACTURING COMPANY of New York, N. Y., has been incorporated by F. D. Schussler, T. C. Miller and T. Moran, 259 Eighty-first Street, Brooklyn, N. Y. The company is capitalized at \$100,000 and proposes to manufacture tools, electrical goods, etc.

THE REMINGTON ELECTRIC WELDER COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$300,000 to manufacture electric welders. The incorporators are: Martin E. Smith, Artemus Smith, M. E. Doto, all of Wilmington, Del.

THE WELLES-KINTO CLOCK COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of \$100,000 by F. R. Hansell, Land Title Building, Philadelphia, and S. C. Seymour of Camden, N. J. The company proposes to manufacture motor-driven clocks and other automatic equipment.

New England States

PITTSFIELD, MASS.—Arrangements are being made by John F. Cooney, owner of the Union Square Theater, for the installation of an electric-light and power plant. Contract has been placed for a 200-amp. Westinghouse electric generating unit.

SPRINGFIELD, MASS.—The question of petitioning the State Legislature for authority to develop the water power of Little River to supply electricity for municipal purposes is under consideration by the City Council.

NEW LONDON, CONN.—The Standard Brass & Copper Tube Company, Woodbridge Street, is installing a new power plant in connection with an addition to its rolling mill.

Middle Atlantic States

ALBANY, N. Y.—Plans are being considered by the Esco Electric Company for rebuilding the portion of its plant at 368 Broadway, recently destroyed by fire, causing a loss of about \$75,000. The new building will cost about \$50,000.

AUBURN, N. Y.—Plans have been prepared by the New York Telephone Company, 15 Dey Street, New York, N. Y., for the construction of a new telephone exchange building on South Street.

BROOKLYN, N. Y.—Charles Pfizer & Company of Brooklyn are planning to erect a one-story boiler house, to cost about \$15,000, at their works at 11 Bartlett Street.

BROOKLYN, N. Y.—Application has been made by the Kings County Electric Light & Power Company to the Public Service Commission for permission to issue \$1,000,000 in bonds, to provide for extensions, improvements, etc.

BROOKLYN, N. Y.—The Krantz Manufacturing Company, Seventh Street, near Second Avenue, manufacturer of electrical supplies, has filed plans and awarded contract to the Werner-Huberty Company, 50 Court Street, Brooklyn, for erection of an addition to its plant to cost about \$35,000.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25, under specifications (No. 2826) for installing an electric elevator and dumbwaiter at the naval hospital at the Brooklyn Navy Yard. The cost is estimated at \$6,500. Bids will also be received at the same time under specifications (No. 2825) for a diet kitchen and refrigerating equipment at the naval hospital, Brooklyn.

BROOKLYN, N. Y.—The United States government has leased property, consisting of a tract bounded by Second and Third Avenues, Twenty-ninth and Thirty-second Streets, South Brooklyn, from the Bush Terminal Company and the city of Brooklyn, on which it will erect several large factories for the manufacture of products for army service. Plans, it is said, are being prepared for the construction of two initial buildings, each eight stories, U-shaped, about 200 ft. by 75 ft., with 75-ft. wings. Warehouses will also be built for shipping service.

GREENWICH, N. Y.—Application has been filed with the Public Service Commission by the Consolidated Electric Company of Greenwich for permission to construct and operate an electric-light plant in Northumberland. The company proposes to construct an electric transmission line, 3 miles long, from the Northumberland Bridge through Bacon Hill and along the highway leading from Bacon Hill to Grangetown. The necessary local franchises have been obtained by the company.

LONG ISLAND CITY, N. Y.—Plans have been filed by the Astoria Light, Heat & Power Company for the erection of a new plant, 44 ft. by 175 ft., on Winthrop Avenue, to cost about \$20,000.

NEW YORK, N. Y.—Ernest & Herman Levy, Fourth Avenue and Nineteenth Street, it is reported, are planning to erect a new power plant in connection with their proposed new silk mill, to be located at Purdy and O'Dell Streets. The cost of the entire project is estimated at \$75,000.

NEW YORK, N. Y.—Preparations are being made by the West Virginia Pulp & Paper Company for extensions to its different plants, involving an expenditure of about \$1,000,000. Contract has been awarded by the company for the construction of eight new buildings at Tyrone, Pa., to form a new unit for the present works there. At Piedmont, Va., a similar plant will be erected by the company, at a cost of about \$300,000 and four new buildings will be built at its Mechanicsville, N. Y., plant.

ROCHESTER, N. Y.—The Wheeler-Green Electric Company has filed notice

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

with the Public Service Commission of an increase in capital stock from \$100,000 to \$500,000, to provide for extensions, etc.

ROCHESTER, N. Y.—Preliminary plans are being prepared by F. L. Raschig of Cincinnati, Ohio, for the city of Rochester for the construction of an electric railway (8 miles long) through the old bed of the Erie Canal, to cost about \$8,000,000.

WATERVILLE, N. Y.—The Village Trustees have awarded the Waterville Gas & Electric Company a contract for lighting the streets of the village for a period of two years and 11 months. Under the terms of the new contract the company is to install 40 Mazda lamps, 20 of 100 cp. and 20 of 250 cp.

CAMDEN, N. J.—The construction of a municipal electric-light plant is being considered by the city officials.

CLOSTER, N. J.—The Rockland Electric Company of New Jersey has been granted permission by the Board of Public Utility Commissioners to issue \$80,000 improvement gold notes.

DOVER, N. J.—The New Jersey Power Company has secured a contract to supply energy to operate the plant of the Somerset Stone Crushing Company (replacing steam power) at Bernardsville. About 60 hp. in motors will be required.

NEWARK, N. J.—Plans have been filed by the General Lead Batteries Company, 4 Lister Avenue, for the construction of an addition, 50 ft. by 80 ft., at its plant.

NEWARK, N. J.—A permit has been taken out by the Butterworth-Judson Corporation, Avenue R, for the construction of a one-story boiler plant addition, 55 ft. by 110 ft., to cost about \$25,000, at its chemical works.

NEWTON, N. J.—The Town Committee is considering making improvements to the fire-alarm system.

POMPTON LAKES, N. J.—Plans are being considered by the Board of Education for the immediate installation of new electric-lighting systems throughout the school buildings.

TRENTON, N. J.—Plans are being considered for the installation of a new refrigerating plant at the New Jersey State Hospital at Morris Plains, for which bids will be received until Feb. 26. Francis H. Bent is state architect.

TRENTON, N. J.—Plans are being prepared for the installation of a new power plant to cost about \$15,000, in connection with the construction of the first unit of the proposed new general hospital. William A. Kleman is city architect.

WEST NEW YORK, N. J.—The Town Council is considering a bond issue of 150,000 for the installation of a municipal electric-light plant.

BIRDSBORO, PA.—The Birdsboro Electric Company is erecting a high-tension transmission line to the mines of the Brooke Iron Company at French Creek to supply energy to operate machinery in the mines there.

CARLISLE, PA.—Plans are being considered by the City Council for improvements to the fire-alarm system.

CLINTON HEIGHTS, PA.—Plans have been prepared by the Kent Manufacturing Company for the construction of a steam-driven electric power plant, one story, 40 ft. by 68 ft., to cost about \$50,000.

DERRY, PA.—The plant of the Pittsburgh High Voltage Insulator Company was badly damaged by fire recently. The company manufactures high-tension insulators, etc.

ERIE, PA.—An ordinance providing \$22,500 for completing the conduit system and the new lighting system along State Street has been submitted to the City Council. The conduits will be placed on State Street with extensions out Twelfth Street to Walnut and Front Streets to connect with the new plant of the Erie Light Company.

GROVE CITY, PA.—Plans have been filed by the Grove City Creamery Company for the construction of a new plant and power house, to cost about \$35,000. Contract has been awarded to Rose & Fisher, 1719 Pennsylvania Avenue, Pittsburgh.

HARRISBURG, PA.—Notice has been filed with the Public Service Commission by the Juniata Public Service Company of an issue of \$300,000 in bonds. This com-

pany recently acquired a number of electric companies operating in the Susquehanna and Juniata Valleys.

HARRISBURG, PA.—The Harrisburg Railways Company is planning to place its new substation in operation soon to provide power for its Second, Third and Fourth Street traction lines. Three new large transformers will be installed immediately to utilize energy from its York Haven plant.

PHILADELPHIA, PA.—Contract has been awarded by the Bell Telephone Company for proposed alterations and improvements in its building at Eleventh and Filbert Streets to Albert Zellfelder of Philadelphia.

PHILADELPHIA, PA.—Contract has been awarded to F. B. Davis of Philadelphia by Shane Brothers & Wilson Company, Sixty-third and Market Streets, for the construction of a new power house, 35 ft. by 45 ft., at its plant.

PHILADELPHIA, PA.—Plans are being prepared by Andrew J. Sauer & Company of Philadelphia for the construction of a power house to be erected by I. S. Leberman at his plant in the Kensington district, to cost about \$10,000.

READING, PA.—The Metropolitan Electric Light Company is extending its electric transmission lines from the Birdsboro Stone Company at Six Penny to the French Creek Mines.

TRAPPE, PA.—The Borough Council has awarded the Counties Gas & Electric Company of Norristown a contract to supply an electric street-lighting service in the borough of Trappe.

WILLIAMSTOWN, PA.—Notice has been filed with the Public Service Commission by the Lykens Valley Light & Power Company of an issue of \$15,000 in bonds, the proceeds to be used for improvements.

DOVER, DEL.—Plans have been prepared for alterations and extensions to the local plant of the Diamond State Telephone Company.

MONKTON, MD.—The construction of a hydroelectric power plant on Gunpowder River, to cost about \$25,000, to furnish power to operate the proposed flour mill to be erected for the Monkton Roller Mills, is under consideration. The plans provide for the construction of a dam and power house to develop about 100 hp. Otis E. McCoy of Mount Washington is president.

CHARLESTON, W. VA.—Plans for the reconstruction of the boiler house at the State University at Charleston, which was recently destroyed by fire, are under consideration by the trustees of the university.

WHEELING, W. VA.—The car barns and rolling stock of the Wheeling Traction Company were destroyed by fire recently, causing a loss of about \$200,000.

WARRENTON, VA.—The Warrenton Electric Light & Ice Company is changing its plant from direct to alternating current. Two small direct-current generators have been taken out and two alternating-current generators having a total capacity of 90 kw. have been installed. M. J. O'Connell is manager.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25, under specifications (No. 2822) for electric-light and power system at Anacostia, D. C., to cost about \$16,000.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 1, for furnishing and installing lighting fixtures in the United States post offices at Aledo, Ill.; Altus, Okla.; Berwick, Pa.; Butler, Mo.; Cambridge, Md.; Cherryvale, Kan.; Durant, Okla.; Fitzgerald, Ga.; Gallatin, Tenn.; Glenwood, Iowa; Hoopesville, Ill.; Indiana, Pa.; Marion, Ill.; Monessen, Pa.; Olney, Ill.; Sanford, Fla.; Vernon, Tex.; Waynesboro, Va.; Willow, Cal., and the United States post office and court house extension at Oklahoma City. Specifications may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 1685—12,000 ft. lead and armored, interior communication cable, 90,000 ft. lead and armored single-conductor wire. Puget Sound, Wash., Schedule 1684—50 portable ventilating sets; Schedule 1682—50,000 ft. lighting and power wire; Schedule 1685—5000 ft. lead and armored two-conductor lighting and power wire. Various, Schedule 1688—Miscellaneous hard spring brass wire, miscellaneous soft copper wire, miscellaneous phosphor-bronze wire. Applications for proposal blanks should designate the schedule desired by number.

North Central States

BUENOS, OHIO.—A committee has been appointed by the Chamber of Commerce to look into the matter of establishing another power plant in Bucyrus.

ST. PARIS, OHIO.—An election will soon be called to submit to the voters the proposed to issue \$5,500 in bonds for improvements to the electric-light plant.

SPRINGFIELD, OHIO.—Work, it is reported, will begin on the construction of a large power plant and storage house at the plant of the Robbins & Myers Company, to cost about \$100,000. It will be located on Nelson Street about 750 ft. from the main factory.

WILLARD, OHIO.—Contract has been awarded for a 150-kva., 60-cycle alternator, directly connected to a Chuse non-releasing Corliss engine for the municipal electric-light plant. R. D. Smith is superintendent and electrician.

WINCHESTER, KY.—The city of Winchester is contemplating equipping its proposed new water-works system with electrically operated machinery, for which plans are now being prepared. A committee will soon be sent to Washington to negotiate with the United States government for a permit to install water turbines at Lock No. 10 on the Kentucky River, to develop power to operate the pumps and machinery in the plant.

JEFFERSONVILLE, IND.—Plans are under consideration for rebuilding the State Reformatory at Jeffersonville, of which a large part was destroyed by fire on Feb. 6, causing a loss of between \$500,000 and \$750,000, including trade shops, raw and finished materials, machinery, etc., refrigerating plant, shoe shops, and several other departments. The work will be held up until money can be appropriated.

WASHINGTON, IND.—Plans are being considered for changing the system of the Electric Works to single-phase, 60 cycles. W. J. Perrine is superintendent.

LINCOLN, ILL.—A generator to furnish electricity for the Lincoln municipal railway. It is reported, is to be installed in the plant of the Lincoln Water & Light Company.

SYCAMORE, ILL.—The Geneva Lake, Sycamore & Southern Railway Company, which proposes to build an electric railway from the south shore of Geneva Lake, through McHenry, DeKalb, Kendall and La Salle Counties, has been granted a license to incorporate. The company is capitalized at \$150,000 and has its main office at Sycamore. For further information address A. E. Hammersmith.

BLOOMER, WIS.—At an election held recently the proposal to purchase the electric plant of the Bloomer Electric Light & Power Company, to be owned and operated by the municipality, was carried.

OMRO, WIS.—The Wisconsin Power, Light & Heat Company of Milwaukee has purchased the property of the Omro Electric Light Company and contemplates extending the Kilbourn and Prairie du Sac transmission lines from Markesan to Berlin and thence to Omro this summer. E. B. Heimbach is division superintendent.

ORFORDVILLE, WIS.—The Orfordville Light & Power Company is considering the erection of an electric transmission line (4½ miles long) to a nearby town. The proposed line will be three phase, 60 cycles, 6600 volts, and will have a carrying capacity of 60 kw. A. E. Tomlin is secretary and manager.

POYNETTE, WIS.—The local electric-light plant, owned by Perry Speed, it is reported, has been purchased by L. M. Libby of Glenwood, Wis.

BOONE, IOWA.—The contract for electric wiring the County Home at Boone has been awarded to the Beck Electric Construction Company of Minneapolis, Minn., at \$1,923.

DAVENPORT, IOWA.—The contract for electric wiring the intermediate school at Davenport has been awarded to the Standard Electric Company of Clinton, Iowa. The cost of the building is estimated at \$176,000.

ELKADER, IOWA.—Improvements are being made to the system of the Standard Telephone Company, including the installation of underground cables and an aerial cable, to cost about \$13,000. About 20,000 ft. of wire will be required.

LORIMER, IOWA.—The Board of Railroad Commissioners has granted the Lorimer Light & Power Company a 25-year franchise to erect and operate an electric transmission line upon certain roads and highways in Union County for the distribution of electricity for lamps and motors.

WATERLOO, IOWA.—The Citizens' Gas & Electric Company of Waterloo has been granted a franchise by the Board of Rail-

road Commissioners to erect and operate an electric transmission line for the distribution of electricity for lamps and motors over certain roads and highways in Black Hawk County for a period of 25 years.

KANSAS CITY, MO.—The Interurban Central Station Company is contemplating the construction of a new interurban station on McGee Street, between Ninth and Tenth Streets.

KANSAS CITY, MO.—In a report submitted by Burns & McDonnell, consulting engineers, the proposal to install electric generating equipment at the Turkey Creek pumping station was declared feasible and economical. The cost of the proposed electric-lighting plant is estimated at approximately \$750,000, and it would serve, it is stated, adequately the territory between Twelfth and Thirty-first Streets and Main Street to the State line.

OSARK, MO.—The Finley Light Company, recently incorporated, has taken over the plant of the Water Power Light Company and is changing the system from 60 cycles to 25 cycles and will connect with the transmission system of the Ozark Power & Water Company, which passes the plant. When connections are made a 24-hour service will be established. George T. Breazeale is secretary and manager.

ST. LOUIS, MO.—The Harry Benjamin Equipment Company, Central National Bank Building, it is reported, is in the market for a 250 to 300-kva., three-phase, 25-cycle, alternating-current transformer.

ST. LOUIS, MO.—Plans have been prepared for the erection of a new telephone exchange building for the Southwestern Telephone Company at Delmar and Lake Avenues, to cost about \$85,000. L. R. Timlin is architect.

MADDOCK, N. D.—Plans are being prepared by W. E. Skinner, engineer, Minneapolis, Minn., for the installation of an electric-lighting system, to cost about \$7,000.

NOME, N. D.—The installation of an electric-lighting system in Nome is under consideration by the City Council.

SHARON, N. D.—The local electric-light plant has been taken over by the village of Sharon, to be owned and operated by the municipality.

ARMOUR, S. D.—The South Dakota Light & Power Company is completing an addition to its power house, 45 ft. by 60 ft., and is installing a 300-hp. Smith gas producer. The company has purchased a 300-hp. Rathburn-Jones gas engine together with an additional Smith gas producer of 300 hp. The delivery of the new equipment is expected about May 1. A 90-hp. Munzell engine, formerly used at the Platte station, is now being installed. J. F. Cameron is vice-president and manager.

BRANDON, S. D.—The plant of the Brandon Electric Light Company has not been operated since last September. The question of securing power from the plant at Sioux Falls is under consideration. L. D. Kepple is treasurer of the Brandon Electric Light Company.

CENTERVILLE, S. D.—The Centerville Milling Company has completed the construction of a new dam and wheel pits. Later the company will install a new water wheel. A. J. Struble is manager.

MITCHELL, S. D.—Plans, it is reported, have been prepared by Burns & McDonnell, consulting engineers, Kansas City, Mo., for improving the lighting and water systems. R. E. Davis is city auditor.

STEVENS, S. D.—Contract has been awarded by the Alfalfa Products Company to the Younglove Construction Company, United Bank Building, Sioux City, Iowa, for the construction of an alfalfa products plant at Stevens, to cost about \$100,000. The proposed plant will be equipped for electric-motor drive. Dale C. Koon, 4201 Garretson Avenue, Sioux City, Iowa, is president. Stevens has not a post office.

ALLEN, NEB.—Bids will be received by the Board of Education, District No. 70, Dixon County, Allen, Neb., until Feb. 27 for construction of high school building. Separate bids to be submitted for electric wiring, heating and plumbing and ventilating. Plans and specifications are on file in the office of the secretary of the Board of Education, Allen, and at the office of R. A. Bradley & Company, architects, Exchange National Bank Building, Hastings, Neb.

DALTON, NEB.—Bids will be received by the city of Dalton until Feb. 26 for one 75-hp. and one 30-hp. special oil engine, complete with compressor tank, and one 50-kva. and one 30-kva. generator.

FALLS CITY, NEB.—Bids will be received by the city clerk, Falls City, until March 4 for equipment for the electric-light plant and water-works system as fol-

lows: One 12-in. by 24-in. by 36-in. cross compound Corliss engine; one 16-in. by 32-in. by 36-in. cross compound Corliss engine; one 225-kva., three-phase, 60-cycle, 2300-volt generator; two surface condensers with auxiliaries, one eight-panel switchboard, two 16-kw., 6.6-amp. constant-current transformers and one 750-gal.-per-minute pump with motor. Specifications are on file in the office of the city clerk, Falls City, and may be obtained at the office of the engineers, E. M. Stevens & Company, 708 Ridge Arcade, Kansas City, Mo.

FIRTH, NEB.—Arrangements are being made for improvements to the electric-light plant, including the installation of a 25-hp. gasoline engine, one 16-hp. oil engine and a 15-kw. direct-current generator. Bids, it is understood, have been received for the proposed equipment.

GRANT, NEB.—Bids will be received by the Commissioners of Perkins County, Grant, until March 4 for construction of a high school building. Separate bids to be submitted on plumbing, heating and ventilation and electric wiring. Plans and specifications are on file in the office of H. E. Pankonin, chairman, Grant, and at the office of R. A. Bradley & Company, architects, Hastings, Neb.

BEAVER CROSSING, NEB.—Bonds to the amount of \$9,000 for the installation of an electric-lighting system have been sold.

DOWNER, KAN.—The United Telephone Company is contemplating the erection of a telephone exchange building, to cost about \$15,000. C. S. Brown of Abilene, Kan., is general manager.

EUREKA, KAN.—Bids will be received by J. W. Kenner, city clerk, Eureka, until Feb. 27 for improvements to water-works system, including construction of water-filtration plant, water-works improvements and two 400-gal.-per-minute vertical centrifugal pumps and motors. Plans and specifications are on file in the office of the city clerk, Eureka, and at the office of Black & Veatch, engineers, Inter-State Building, Kansas City, Mo.

MULVANE, KAN.—The boiler room and refrigerating plant of the Helvetia Milk Condensing Company's plant was recently destroyed by fire, causing a loss of about \$20,000.

PITTSBURG, KAN.—Work will begin at once on the construction of the addition to the Normal School at Pittsburg, to cost approximately \$200,000. Bids, it is reported, will soon be asked on heating, electric wiring, plumbing, etc. J. M. Leeper of Topeka has the general contract for the work. R. L. Gamble, Topeka, is state architect.

WICHITA, KAN.—Bids will be received at the office of the secretary of the Board of Education, Wichita, until March 11 for the erection of two school buildings, one to be the South Side Intermediate, located on Zimmerly Street, between Market and Lawrence Streets, and the other, the Skinner School, to be located at the corner of Twenty-first and Hydraulic Streets. Separate bids for heating and ventilating system and electric wiring will be received at the same time. Plans and specifications are on file in the office of Lorentz Schmidt, architect, Wichita.

Southern States

RALEIGH, N. C.—The Empire Steel Company is contemplating the construction of a hydroelectric plant to develop about 10,000 hp. to supply energy for its proposed steel plant, which will be equipped with electrically operated machinery. Joel F. Armistead, representative, Raleigh, may give further information.

AMERICUS, GA.—Owing to the great increase in cost of operating its plant the Americus Lighting Company has offered to sell its system to local interests at cost. A committee, consisting of Stephen Pace, Lee Allen and others, has been appointed to consider the advisability of accepting the offer. The company recently asked an increase in rates for electricity and gas, which was opposed by the citizens.

ATLANTA, GA.—The proposal to install an electric generating plant at the city crematory has been approved by the City Council and a committee has been appointed to raise the necessary money. The cost of installing the plant is estimated at about \$75,000. Energy generated at the plant will be sold to the Georgia Railway & Power Company.

BRUNSWICK, GA.—The City & Suburban Railway Company is reported to be considering the construction of an extension of its street car line to several industrial plants.

MONTEZUMA, GA.—Plans are being considered by James Harrison and E. M. McKenzie for the installation of a hydroelectric plant on Whitewater Creek, 4 miles from Montezuma. Electricity generated at the plant will be transmitted to Montezuma and Oglethorpe.

POWDER SPRINGS, GA.—The Domestic Electric Company, recently incorporated with a capital stock of \$2,500, is contemplating the construction of an electric-light plant. J. D. Middlebrooks is interested in the company.

TY, TY, GA.—At an election to be held on March 8 the proposal to issue \$7,000 in bonds for the construction of a municipal electric-light plant will be submitted to the voters.

VALDOSTA, GA.—The construction of a hydroelectric power plant on the Withlacoochee River, it is reported, is under consideration by A. F. Langford, general contractor.

FAYETTEVILLE, TENN.—The stockholders of the Fayetteville Electric Light & Power Company have decided to develop a water power on Elk River at a cost of about \$25,000. Machinery, it is understood, will be purchased at once.

HADLEY'S BEND, TENN.—Contract has been awarded by the War Department, Washington, D. C., to the Thompson-Starrett Company, 51 Wall Street, New York, N. Y., for the construction of explosive manufacturing plant, to cost \$60,000,000. The site contains nearly 5000 acres, of which buildings will cover 2000 acres. The warehouses and power houses will be of brick construction, other buildings will be of corrugated iron on wooden frames. The government will build several thousand dwellings for employees.

NASHVILLE, TENN.—Preliminary surveys will be made by the Nashville-Gallatin Interurban Railway Company for the proposed extension from Madison to Neelley's Bend Ferry to serve to government powder plant.

DOTHAN, ALA.—The Columbia Power Company is building a hydroelectric power development at Kelso, consisting of two reinforced concrete power dams, timber storage dam, 26 miles of 44,000-volt transmission lines. All equipment has been purchased. It is estimated that 1500 hp. will be developed at a cost of about \$250,000. Electricity generated at the plant will be transmitted to Dothan, Columbia and Headland. Tucker & Laxton of Charlotte, N. C., are engineers. Dermott Shemwell of Lexington, N. C., is president.

FLORENCE, ALA.—Frank L. Davies of Danville, Ill., it is reported, is interested in a project to construct an electric railway from Huntsville to Florence, a distance of about 64 miles.

LITTLE ROCK, ARK.—Contract has been awarded by the Little Rock Railway & Electric Company for the installation of a turbine to cost about \$200,000.

BRISTOW, OKLA.—The City Council has voted to issue \$36,000 in bonds to take over the local electric-light plant, to be owned and operated by the municipality.

KINGSTON, OKLA.—The Kingston Ice & Light Company is planning to rebuild its plant, recently destroyed by an explosion, causing a loss of about \$25,000.

OKEMAH, OKLA.—The City Council is considering calling an election to vote on the proposal to issue bonds for improvements to the municipal electric-light plant, water-works and sewer system.

STILLWATER, OKLA.—An election will soon be called to vote on the proposal to issue \$175,000 in bonds for improvements to water works, municipal electric-light plant and sewer system.

BOWIE, TEX.—The Texas Light & Power Company is planning to rebuild its electric-light and power plant, recently destroyed by fire, causing a loss of about \$3,000.

CANYON, TEX.—The Canyon Power Company, it is reported, will rebuild its electric plant recently destroyed by fire.

HARLINGEN, TEX.—The municipal electric-light and water plant has been leased to A. Goldammer for a period of five years. Mr. Goldammer, it is understood, will extend the service and build an ice factory.

HOUSTON, TEX.—The City Council is reported to be considering the construction of a municipal belt line in Houston, for which plans have been prepared. E. E. Sands is city engineer.

LA PORTE, TEX.—The La Porte Water, Light & Ice Company is considering the installation of a new generator, ice machine, engine, and making line extensions. Nothing definite as yet has been decided upon. Philip J. Pfeiffer is owner and manager.

Pacific and Mountain States

CHELAN FALLS, WASH.—Contracts have been closed by the Wenatchee (Wash.) Valley Gas & Electric Company for the construction of a 1000-hp. power plant at Chelan Falls. Orders have been placed for machinery and materials and it is hoped to have the plant in operation by July 1, 1918.

COLVILLE, WASH.—A contract has been closed between the Washington Water Power Company of Spokane and the Stevens County Light & Power Company of Colville, whereby an electric transmission line, 40 miles long, will be erected to furnish electricity in the southern part of Stevens County.

EPHRATA, WASH.—The Intermountain Power Company has petitioned the Commissioners of Grant County for a franchise to construct and operate an electric transmission line over certain highways in Grant County.

EVERETT, WASH.—The Norway-Pacific Construction & Drydock Company of Everett, recently organized, has purchased a site in Everett on which it will build a shipbuilding plant to cost about \$1,000,000. Plans have been prepared for a large number of buildings, including ways for five steel ships, two wooden ships, wharves and a 10,000-ton capacity floating sectional dry dock; a pattern shop and foundry, a machine and engine shop, and annealing, forge and boiler works, a power house, and steel fabricating shop, 30 ft. by 240 ft. M. G. Thomle is president.

LA GRANDE, WASH.—Preparations are being made by the American Nitrogen Products Company for the installation of three electric ovens at its plant.

SEATTLE, WASH.—Contract has been awarded by the Board of Public Works to the Pacific Lamp & Supply Company of Seattle for furnishing 500,000 incandescent electric lamps for the municipal lighting department, to cost about \$100,000.

SEATTLE, WASH.—Bids will soon be called for by the Board of Public Works for the construction of the new Ballard substation, to be erected at Fourteenth Avenue N. E. and West Forty-ninth Street, for the municipal lighting department. Plans now being made ready by Daniel Huntington, city architect, call for a two-story and basement reinforced structure, 55 ft. by 55 ft., providing space for two motor-generator sets. Provision will be made for further extensions.

SEATTLE, WASH.—Final action has been taken by the City Council on the passage of an ordinance providing for advertising for bids for a municipal electric-light plant. The ordinance is designed to supplement the previous action in advertising for bids for the construction of a hydro-electric plant on the public domain, so as to enable any one who has a power site to offer it to the city fully developed if he cares to do so. Bids under this ordinance as well as the former will be received until March 1. No bid will be considered if the amount of energy to be developed is less than 10,000 kw. The bids submitted must include a plant fully completed, including necessary dams, wires, diversion works, storage basin, pipe lines, tunnels, conduits, etc. The cost of the proposed system is estimated at about \$5,000,000. C. B. Bagley is secretary of board of public works.

SPOKANE, WASH.—Plans have been completed by City Engineer Butler for the installation of a new ornamental lighting system on Post Street from the new Post Street Bridge to Third Avenue. The cost is estimated at \$37,740.

STEILACOOM, WASH.—The installation of a municipal water-works system is under consideration in connection with lighting plant. A 12½-hp. electrically-operated pump has been purchased for same. R. F. Gleason is electrician.

TACOMA, WASH.—An ordinance is being prepared under the direction of H. F. Gronen, commissioner of the light and water department, which will be submitted to the voters at the election to be held on April 2, asking their opinion on the purchase of a \$5,000,000 power plant for the city of Tacoma.

MARSHFIELD, ORE.—Arrangements are being made by the C. A. Smith Lumber Company to install additional electric equipment to double the output of its mill. Machinery, costing about \$80,000, for the second unit, it is reported, has been ordered.

AZUSA, CAL.—Preparations are being made to increase the output of the substation of the municipal electric-lighting system to 600 kva., at a cost of about \$4,000. Norman E. Humphrey is superintendent.

CHICO, CAL.—The contract for furnishing electricity for maintaining the electrolier lighting system has been awarded to the Northern California Power Company.

PITTSBURG, CAL.—The Pacific Gas & Electric Company has submitted a proposal to the City Trustees for installing an electric service for the southwest addition. The cost is estimated at about \$2,000.

SAN DIEGO, CAL.—The Railroad Commission has granted the San Diego Consolidated Gas & Electric Company permission to distribute and sell electricity under a franchise granted by San Diego County, provided it does not operate in the territory now served by the Del Mar Light & Power Company or the Escondido Mutual Water Company.

MONTICELLO, UTAH.—The capital stock of the Blue Mountain Irrigation Company has been increased from \$15,000 to \$60,000. Amendments have been filed to the charter of the company giving permission to generate and distribute electricity. F. I. Jones is president.

OGDEN, UTAH.—Bids will be received at the office of the chief clerk, Department of Agriculture, Washington, D. C., until March 6 for furnishing office supplies, instruments, field equipment, furniture and telephone and fencing materials to the Forest Service Supply Department Depot at Ogden, Utah, during the fiscal year beginning July 1, 1918. Proposal blanks and further information may be obtained on application to the above office or to the purchasing agent, Forest Service, Ogden, Utah.

PROVO, UTAH.—Application has been filed with George F. McGonagle, State Engineer, by Scott P. Stewart of Provo for permission to take from the north and south branches of North Fork Creek 10 second-feet of water. The plans provide for the construction of a cement dam and a 21-in. iron or wood stave pipe to carry the water to a point where power will be generated by a Pelton water wheel, operated under a 1400-ft. head of water. Electricity generated at the proposed plant will be distributed in Utah and Wasatch Counties.

SWEETGRASS, MONT.—The Toole County Telephone Company, recently organized, is planning to erect about 200 miles of telephone line.

WORLAND, WYO.—The Worland Light & Power Company expects to install a 125-hp. boiler and also to purchase various instruments for switchboard. J. M. Atkinson is manager.

DENVER, COL.—The Queen City Foundry Company of Denver has placed an order for a one-ton Booth-Hall electric steel furnace to replace the converter equipment now in use. The furnace has a holding capacity of three-quarters to one ton, and is rated at 300 kva. Energy will be delivered to the furnace by the Denver Gas & Electric Company.

Canada

BRANDON, MAN.—The installation of an electric generating plant to furnish electricity for municipal purposes, including the street railway system, is under consideration by the City Council.

WOODSTOCK, N. B.—A committee has been appointed by the Woodstock Board of Trade to confer with the federal and provincial governments on the advisability of utilizing the water powers of Grand Falls, Tobique and Meductic in New Brunswick for power and fuel purposes.

CHATHAM, ONT.—The Chatham, Wallaceburg & Lake Erie Railway Company, it is reported, is contemplating utilizing hydroelectric power on the Chatham-Wallaceburg section of its system. Owing to coal shortage the company has not been able to generate sufficient power to keep the line in operation.

TORONTO, ONT.—The plant of the Toronto Laundry Machinery Company, Sorauer Avenue and Dundas Street, was recently destroyed by fire causing a loss of about \$200,000. It had been utilized for the manufacture of shells and will be rebuilt at once.

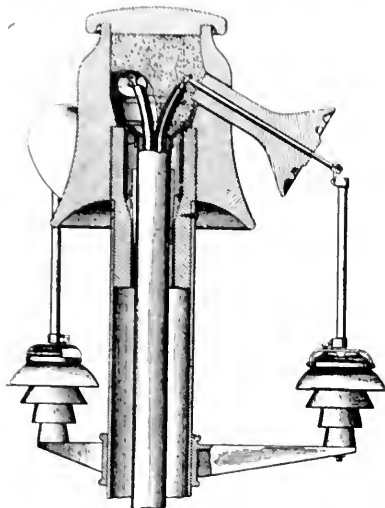
TORONTO, ONT.—A portion of the plant of the Metropolitan division of the Toronto & York Railway Company, including repair shop, was recently destroyed by fire, causing a loss of about \$100,000. Considerable machinery, it is understood, will have to be replaced.

Miscellaneous

PETERSBURG, ALASKA.—The Council is considering the installation of a turbine at or near the water-works dam with a view of developing power for operating the electric-lighting plant.

(Issued Jan. 22, 1918.)

- 1,254,162. TELEGRAPHIC-RECEIVING INSTRUMENT; Charles Adams Randall, Boston, Mass. App. filed Nov. 28, 1918. Provides a means for augmenting the received signals and rendering them more clear than has been heretofore possible.
- 1,254,171. SIGNALING CIRCUIT; George A. Campbell, Montclair, N. J. App. filed Sept. 9, 1916. Improvements.
- 1,254,172. SIGNALING CIRCUIT; George A. Campbell, Montclair, N. J. App. filed Sept. 9, 1916. Provides a substation consisting of transmitter, receiver, auxiliary resistance and a transformer having a



1,254,938—Cable Terminal Pole

- plurality of windings in combination with a telephone line.
- 1,254,473. SIGNALING CIRCUIT; George A. Campbell, Montclair, N. J. App. filed Sept. 9, 1916. Object is to provide signaling means characterized by the maximum possible ratio of received and transmitted energy and further characterized by the absence of side tone.
- 1,254,476. SIGNALING CIRCUIT; George A. Campbell, Montclair, N. J. App. filed May 18, 1917. Improvements.
- 1,254,477. CIRCUIT-BREAKING DEVICE; Walter W. Carpenter, Lansdowne, Pa. App. filed Oct. 10, 1916. For use in connection with voltage regulators for electric generators.
- 1,254,490. MULTIPLE - FUSE CARTRIDGE; Frederick A. Feldkamp, Newark, N. J. App. filed Nov. 6, 1916. Improved construction.
- 1,254,528. MOLDING ADAPTER; Henry T. Paiste, Philadelphia, Pa. App. filed Dec. 11, 1913. May be detachably connected to a metallic or other molding containing electric conductors.
- 1,254,531. METHOD OR PROCESS OF SMELTING ZINC; Isak Partanen, Telluride, Col. App. filed Feb. 2, 1916. Improvements.
- 1,254,584. IGNITION DEVICE; Arthur Dickerson, Salt Lake City, Utah. App. filed Sept. 17, 1917. For internal-combustion engines.
- 1,254,620. METHOD OF AND MEANS FOR MEASURING VOLTAGES; Max G. Newman, Lanesboro, Mass. App. filed March 1, 1917. For measuring the maximum voltage in a circuit supplied by a variable source of potential, such, for example, as an alternating-current generator.
- 1,254,633. JUNCTION-BOX COUPLING FOR ELECTRIC CONDUITS; John N. Seism, Brooklyn, N. Y. App. filed Dec. 21, 1911. Improvements.
- 1,254,641. FLOOR BOX; Frederick B. Adam, St. Louis, Mo. App. filed April 10, 1916. Comprises a reversible member which forms a flat cover plate for the box when arranged in one position, and when reversed or turned upside down forms a cover provided with a nozzle or raised support for an insulator bushing adapted to receive a cord or electrical conductor leading out of the box.
- (Issued Jan. 29, 1918.)
- 1,254,642. AUTOMATIC CIRCUIT - CHANGING SWITCH; Arthur H. Adams, Sparkill, N. Y. App. filed Aug. 4, 1916. Improvements.
- 1,254,657. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed March 13, 1915. Relates to telephone exchange systems of the cen-

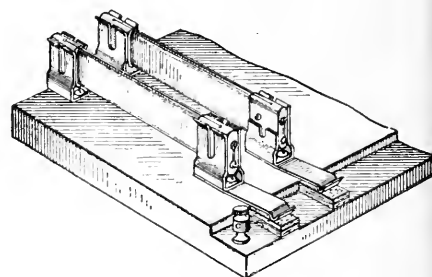
Record of Electrical Patents

Notes on United States Patents

tral energy type and has for its object the production of improved signaling means for such systems.

- 1,254,658. IMPULSE-TRANSMITTING DEVICE OR SENDER; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 26, 1916. Relates to senders for controlling selectively operable switching devices employed in automatic and semi-automatic telephone systems.
- 1,254,661. COUNTING APPARATUS; Amos F. Dixon, Newark, N. J. App. filed May 24, 1915. Improvements.
- 1,254,663. METHOD OF TREATING METAL PARTS TO PREVENT SOLDER ADHERING THERETO; Louis W. Downes, Providence, R. I. App. filed July 10, 1917. Improvements.
- 1,254,679. AUTOMATIC TELEPHONE - EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed July 23, 1915. Improvements.
- 1,254,680. AUTOMATIC TELEPHONE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Jan. 3, 1916. Means for eliminating as far as possible the impulse or stepping relays.
- 1,254,681. NON-NUMERICAL SWITCH; Charles L. Goodrum, Brooklyn, N. Y. App. filed Sept. 11, 1916. Type employed in completing connections between calling and trunk lines.
- 1,254,682. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Feb. 10, 1917. Relates to machine-switching telephone-exchange systems with subscribers' control and has for its object the provision for partial supervision in systems of this character.
- 1,254,691. TELEPHONE SYSTEM; Edward E. Hinrichsen, New York, N. Y. App. filed April 24, 1917. To reduce the amount of apparatus required in central energy systems.
- 1,254,697. ADJUSTABLE SUPPORT FOR ELECTRIC LAMPS; Johan P. Johansson, Fauna, Enkoping, Sweden. App. filed Jan. 2, 1917. Comprising a flexible electric conductor from which the lamp is suspended and a jointed support for said conductor, the arrangement being such that the support may be swung through any desired angle and the conductor drawn to the desired extent through its support without liability to damage or unduly wear the conductor.
- 1,254,700. ANTI-CATHODE; Edwin W. Kelly, Philadelphia, Pa. App. filed Sept. 30, 1916. For electric vacuum tubes, and particularly anti-cathodes employed in X-ray tubes.
- 1,254,702. EXCAVATING MACHINE; Charles B. King and Frank Rensberger, Marion, Ohio. App. filed June 16, 1917. Applies particularly to a machine for excavating and loading coal.
- 1,254,703. STRAIN RELIEF FOR PENDENT ELECTRICAL DEVICES; Charles J. Klein, Milwaukee, Wis. App. filed June 6, 1914. The grip on the conductor is effected between the socket base and a loose member retained by a part of the casing.
- 1,254,707. METER CUT-OUT AND TESTING DEVICE; Earle A. Le Fever, Buffalo, N. Y. App. filed July 25, 1913. Improvements.
- 1,254,710. SELECTOR - SWITCH MOVEMENT - CONTROLLING CIRCUIT; Alben E. Lundell, New York, N. Y. App. filed Jan. 29, 1916. For use in automatic telephony.
- 1,254,711. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed June 13, 1916. Applies particularly to line testing and guarding arrangements for automatic or semi-automatic telephone exchanges.
- 1,254,712. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed June 17, 1916. In which the establishment of connections is controlled from an operator's position.
- 1,254,713. AUTOMATIC SWITCH; Frank A. Lundquist, New York, N. Y. App. filed Nov. 20, 1916. For interconnecting telephone lines.

- 1,254,736. MAGNETIC CHECK; Frank L. Simmons, Milbury, Mass. App. filed Nov. 5, 1911. Improvements.
- 1,254,758. MECHANICAL RECTIFIER; Arthur W. Winterborne, San Antonio, Tex. App. filed June 24, 1916. Adapted especially for use upon Ford automobiles.
- 1,254,769. ALARM; Clarence A. Braconier, Wayne, Mich. App. filed June 9, 1917. Combined thermal and electric alarm that may be advantageously used as an automatic fire alarm and a heat alarm for brooders and indicators at places where it is desirable that a predetermined temperature shall cause the operation of audible signal.
- 1,254,787. ADVERTISING DEVICE; Alphonse Fernandez, Washington, D. C. App. filed Jan. 10, 1917. Provides means whereby a great number of advertising signs or cards may be displayed in a relatively small space.
- 1,254,812. ELECTRIC - SWITCH CASING; Charles L. Klein, Milwaukee, Wis. App. filed Dec. 8, 1913. Improved means for securing covers to surface switch bases.
- 1,254,814. THERMOSTAT; Edwin B. Lane, West Hoboken, N. J. App. filed Nov. 4, 1916. Proof against vibration.
- 1,254,830. MEANS FOR COMPENSATING FOR DISTURBANCES OF EARTH POTENTIAL; Joseph W. Milnor, New York, N. Y. App. filed March 10, 1917. At the two ends of a system of communication and to avoid any periodic oscillation of potential due to the action of the compensating means itself.
- 1,254,831. METHOD OF AND MEANS FOR CORRECTING FOR ALTERNATING-CURRENT ELECTROMAGNET INDUCTION AND FOR ALTERNATING-CURRENT EARTH POTENTIAL; Joseph W. Milnor, New York, N. Y. App. filed March 10, 1917. Comprises means, including alternating-current generators and automatic regulating devices therefor, for applying to the communication circuit or circuits a correcting potential of proper voltage phase and frequency.
- 1,254,849. BURGLAR ALARM; Willis C. Reed, Cambridge, Ill. App. filed Aug. 10, 1915. Improvements.
- 1,254,851. ENGINE STARTER; Julius H. Richards, Newark, N. J. App. filed Dec. 14, 1914. The feature is the mounting of the gear which engages the engine on a shaft which passes through the armature of the electric motor yet is separate therefrom, thus allowing the armature to remain in a permanent position within its field, by which means it is always in a position to exert its greatest torque.
- 1,254,864. ELECTRIC ALARM; Everett S. Taber, Canton, Mass. App. filed March 30, 1915. Comprising a bell or gong, a hammer and electromechanical means for causing the hammer to strike the bell.
- 1,254,880. ELECTRIC VIBRATOR; William C. Brinton, Jr., Kennett Square, Pa. App. filed Oct. 24, 1916. Improvement.
- 1,254,886. CUT-OUT FOR ELECTRIC CIRCUITS; Nicholas J. Conrad, Chicago, Ill. App. filed June 4, 1917. Inserts a resistance in series with the circuit to be disconnected before actually breaking the circuit.
- 1,254,902. ADJUSTABLE-SPEED MOTOR; Willis W. Hale, Cleveland, Ohio. App. filed Nov. 20, 1915. Operates without serious or detrimental sparking, by rotating brushes engaging a commutator which is connected to the primary or inducing windings.



1,255,080—Fuse

- 1,254,910. MEANS FOR COMPENSATING FOR DISTURBANCES OF EARTH POTENTIAL; Paul J. Howe, Ridgewood, N. J. App. filed March 10, 1917. For compensating for differences of potential between the ground connections at the two ends of a system of electrical communication.
- 1,254,938. CABLE-TERMINAL POLE; Edmund O. Schweitzer, Chicago, Ill. App. filed Sept. 21, 1914. Improvements.
- 1,255,080. FUSE; Wallace L. Cook, Chicago, Ill. App. filed Feb. 9, 1917. Fuse wire is carried in a strip of insulating material, preferably wood.

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Number 9

Planning for Future Coal Supply

MILDER weather and freer freight movement should not blind public utility companies to the continued seriousness of the fuel situation. Experience is a stern teacher and a sure guide. The co-operation of state fuel administrators should therefore be sought at once in planning for the coal supply of the future. Storage in quantities should be resorted to whenever feasible, but it ought to be and is possible so to co-ordinate production and distribution that a constant and regular supply of fuel will be assured to public utilities. If the various state electric associations will make a serious survey of the situation and with the assistance of railroad operators and the state fuel administrators evolve a practical plan of operation, serious shortage next winter will be avoided. The time to take action on such a plan, however, is now.

Brighter Prospect for Western Water Powers

WITHIN the last few weeks there has been notable improvement in the prospect for hydroelectric power development on the Pacific Coast. Drastic action by the fuel administrators—and finally urgent recommendation from these sources for the utilization of hydroelectric power to the maximum—put the water-power question in a new light. Just such a radical turn of affairs has been needed for some time if water-power projects are to be brought back into popular favor, but it remains to be seen whether the improvement in the situation has been great enough to insure that funds for development will be forthcoming. Certain it is, however, that fuel shortage has greatly improved the status of the undeveloped water-power project, and if rate increases comparable with the increased cost of production are allowed by public utility commissions there is a prospect for considerable activity in hydroelectric development. A significant point is that under the new conditions encouragement is given to municipal projects in the same degree as to private ventures, so that several dormant municipal ownership schemes have been brought forward and now give every promise of becoming live issues.

In most of the Pacific Coast centers practically all available power has been absorbed or spoken for, and as new developments have not been numerous of late considerable additions to the total power available are not in prospect, as is usually the case. In the city of Los Angeles it is being urged that funds be made available for the development of additional aqueduct power;

the city of Seattle is going ahead on an ambitious scheme of development on the Skagit River which will doubtless appear in a very favorable light under present conditions, and power companies all along the coast have been taking account of stock and making estimates as to what additional power can be most quickly made available and what it will cost to add it to the system. In the San Francisco district, where the power companies are now combined under one administrative head, each company has submitted to the Railroad Commission a memorandum of additional power possibilities, and these will doubtless be considered collectively with the good of the combined systems in mind. For some time water-power development has been discouraged by the government regulations and restrictions which hedged it about, has been looked upon with disfavor by capitalists, and under adverse rate conditions even developed powers have been unable to offer attractive profits to stockholders. Now conditions are changing. It is to be earnestly hoped that a new order of things will be established judiciously and on a basis such that the much-needed water-power development will be encouraged and aided.

Broader Aspects of Research Work

THE annual report of the president of the Carnegie Foundation, Dr. Robert S. Woodward, contains much of interest to those concerned with the broader aspects of scientific research. The report shows clearly the part which an endowed altruistic organization may play in guiding and promoting investigations of value. Dr. Woodward deprecates the division of research into scientific and industrial and of the sciences into pure and applied. In his opinion both phrases have been turned to account in setting up invidious distinctions inimical to the progress of all concerned. The principal harm probably lies in causing mutual misunderstanding and even alienation between the pure scientist and the applied technologist. The engineer begrudges the physicist and the mathematician their hair-splitting involved writings in which he cannot find a simple relationship needed for the practical problem on hand; while they look askance at and deplore his inaccurate short-cut methods and empirical recipes.

Invidious distinctions of this kind ought not, however, to be longer countenanced. Students should early be taught that the whole store of human knowledge is their property, and that any of it or any of its exponents and specialists may be called upon to assist in the solution of a particular practical problem. With the words "pure" and "applied" dropped, the interests

of both science and industry will materially gain. An optimist who is looking for beneficial results of the great war may point with satisfaction to an active participation of pure scientists in the most important practical problems of the day. Proposed investigations should be characterized as something more definite than "industrial" or "scientific." There should be an infinite number of gradations, rather than two opposite classes.

President Woodward touches a sore spot when in speaking of fallacies he says: "The worst of all these fallacies is found in the not unpopular notion that if experts could be set at work under the direction of inexperts great progress could be achieved. This is the fallacy so often used to justify placing technical work under the administration of politicians and promoters rather than under the charge of competent men." The difficulty, however, lies in the definition of "competent" men under whom research men can thrive and achieve their best. The man who is too much of a researcher himself in some one line may not be competent or sympathetic enough to judge about other lines, and he probably loves his own problem too well to spend much time in supervision and administrative work. On the other hand, a foreman with a stop-watch, an administrator with "vim and vigor," is sure to alienate his scientists and to discourage them. At least some of them will degenerate into "getting results," turning out papers and reports in quantity without much regard to permanent value and quality. And yet, while it is difficult to describe an ideal type of administrator, we have splendid examples like Dr. Whitney of the General Electric Company or Dr. Stratton of the Bureau of Standards. A two-faced Janus, a double personality, is needed, one who is an investigator and an organizer at the same time, saturated with judgment and sympathy and boiled in tact.

Speaking of normal investigators as distinct from pseudo-scientists who apparently bother the Carnegie Foundation sorely, Dr. Woodward strikingly characterizes the latter in one short sentence: "The pseudo-scientist is in general excessively egoistic, secretive, averse to criticism and almost always unaware of the work of his predecessors and contemporaries in the same field." While this may be true of pseudo-scientists, the opposite statement does not always hold true. Not every one who exhibits some of the above-mentioned sins is necessarily an impostor or a low-grade worker. Secretiveness is often imposed by commercial considerations, by modesty, cautiousness, or by the lack of literary ability. A lack of sympathy or interest in advanced investigations on the part of the reading public sometimes accounts for the seeming secretiveness. Again, one sometimes finds a surprising ignorance of the literature of the subject on the part of a high-grade original worker and an extensive knowledge of bibliography among mere compilers, imitators and hack writers. The two probable reasons are a woeful lack of reading knowledge of foreign languages and an absorbing interest in a problem that makes the researcher too stingy of his time to read what others have done. A brilliant research worker often needs a business manager to guide him, to force him to read about other people's work, and to advertise him and his writings. Such a business manager might well underscore in blue pencil some parts of Dr. Woodward's report and lay it on his ward's desk.

Skill Is Needed in Employment Methods

THE demand for skilled employment managers is far greater than the supply. With an apparent labor shortage the wisdom of putting each man in his best place, of giving him the highest type of work he is capable of doing, of encouraging him to improve himself, has been apparent. Intelligent employment methods must become universal. They are necessary for the development of the highest efficiency of the individual as an individual and as a member of an industrial organization. Moreover, they bring employee and employer into close, sympathetic touch. Each will profit from the experience of the other. Such contact, too, is a necessary preparation for the inevitable—co-operative management. Any scheme that is not based on confidence and sympathy will fail.

Uses of the Graphic Meter

A PAPER on the applications of the graphic meter to motor practice by Professor Clewell points a moral, to wit, that it is always wise before undertaking a motor-drive equipment to find out what the real conditions are rather than to rely upon assumptions. In the early days of motor applications the besetting sin of everyday practice was installation of motors considerably too large for the job. This fault was generally an unhappy inheritance from steam-engine practice, in which it was a custom to install an engine as large as would probably be needed and then a couple of sizes larger still for good measure. The result was an uneconomical load all the time, of which the user of the engine was seldom cognizant. Indicators were looked upon as scientific playthings by most manufacturers, and all that anybody knew definitely about the amount of power used was the rating of the engine. When the electric motor came along there was a very strong tendency on the one hand to order, and on the other to sell, a machine of about the same rated output as the previous engine without further investigation. The penalty paid for this indiscretion was high first cost, low efficiency, and in the case of alternating-current motors abominably low power factors. Later people began to make experimental tests of the power actually required, and then reform began. Professor Clewell's paper brings out very forcibly the importance of the graphic meter in finding out exactly not only the output which may be required but also the distribution of that output through the day's work, often economically more important than the actual work required. In these days, when charges for electrical energy are commonly based on demand as well as energy required, the nature of that demand is of large economic importance, and this is precisely what the graphic meter provides ready to hand. It shows not only how much energy is required but hour by hour the probable range of variations. Indeed, it goes further and gives an exceedingly good line on the general activities of the shop, sometimes with results important to the cost of production.

There are two general varieties of graphic meters, each of them important in its own sphere and considerably used. The familiar dial instruments are extremely convenient for rough determinations of demand in terms of time, and from their simplicity they can be

very handily used in keeping records over a considerable period. While not attempting accurately to register the quick variations which sometimes appear, for many uses they are quite sufficient. The curve-drawing instruments working on a continuous roll capable of a variety of speeds and giving results in rectangular coordinates which can readily be graphically integrated meet another class of requirements—those which require a close measurement of power involving quick variations. Cases of this sort arise in connection with some machine tools having a cycle of operations in which the input is necessarily very variable from time to time. Such graphical instruments often give extremely valuable hints for improvements in design and management. Their place is to fill the gaps necessarily left by the simpler and rougher recorders whenever close analysis becomes necessary. Both classes of recorders have their necessary uses, and both should be employed much more frequently than they are, even at the present time when their value has already become well established. Examples given by Professor Clewell as to the kind of information obtainable from these graphical records make their importance clear.

The Columbus Generating Station

THOSE of our readers who are interested in the organization and performance of stations of medium size will read with appreciation the details of the new Columbus (Ohio) plant. Perhaps its most striking feature is its location about 10 miles (16 km.) from the center of the city, where coal and water are readily available. The old-time central station, planted of necessity near the center of load, is gradually passing away; but it is still a little unusual to find a plant for city service deliberately put out where it belongs, and located primarily for good generating conditions, in full realization of the fact that power transmission makes such a location in every way available. Incidentally, the new plant does a considerable transmission business at distances further than Columbus itself. The equipment is a typical one—modern turbo-generators and water-tube boilers—and one of the incidental advantages of an out-of-town location shows in the ground plan layout, all on one floor, which considerably simplifies the care of apparatus.

A sign of the times which should be well heeded is the preparation which has been made for fuel supply. Two 400-ton steel bunkers are being constructed just outside the boiler room, filled by conveyors through a coal crusher and then by tilting with bucket elevators.

An electric traveling larry takes charge of the coal at the bunkers for distribution to the stokers along the firing aisle. These bunkers are merely for temporary supply, and further continuity of action is guaranteed by the storage yard outside, capable of keeping in stock three or four months' supply. This is crossed by an elevated railway from which the coal can be dumped into storage and there distributed or reloaded by a locomotive crane with a grab bucket. The water supply is also well cared for, the source being the river, and it is worth noting that a water-purifying system with two 20,000-gal. tanks is in use to insure the quality of the feed water. The electrical part of the system is along familiar lines, except that the primary voltage is 4150 on a four-wire distribution system, a step upward which could advantageously be taken more often than it is.

Adapting Induction Meters to Different Frequencies

WHEN an alternating-current distributing system changes the frequency impressed by the generators between the limits of 25 and 60 cycles the incandescent lamps and the heaters connected to the system remain unchanged. It is true that the incandescent lamps may give evidence of a flicker at low frequencies, but ordinarily this is not serious. The motors connected to the system, however, require to be changed. The integrating energy meters or watt-hour meters, being motor devices, are also thrown out of calibration by a large change of system frequency, unless they happen to be commutator-motor meters capable of being operated either on continuous or on alternating-current circuits. The ordinary alternating-current induction meter, which is not serviceable on continuous-current circuits, is thrown out of calibration by a marked change of frequency.

The experience of one utility company in regard to the recalibration of its induction meters, when changing its frequency first from 60 cycles to 25 cycles and then, after two years, back again from 25 cycles to 60 cycles, is described in this issue by E. L. Fischer. It is shown that whereas a meter can be adapted to such an increase of frequency by adjustment and recalibration, it can ordinarily only be adapted to such a decrease of frequency by changing the shunt coils as well. In other words, induction meters will suffer a large rise in frequency without change of parts, but not a large fall in frequency. As the meter question is only one of the difficulties that accompany a change in central-station impressed frequency, the manager who undertakes such a change deserves sympathy and condolence.

METHODS of improving economy of operation and construction and of utilizing labor and materials efficiently are uppermost in the minds of utility managers to-day. Two articles dealing with such matters will be published shortly. One will show how to utilize second-hand line material and the other will treat of heat insulation as a solution of the fuel problem. Another very timely article will dwell on the selection, lay-out, application and tests of motor and control apparatus in the plate shop of a recently equipped shipbuilding company. The principles involved will, of course, be equally applicable

The Coming Issues

to many other machine shops. Since the effects of temperature and aging have a bearing on the behavior and performance of all electrical apparatus, the application of a series-inductance bridge for measuring insulation capacity and dielectric energy loss at low frequencies and high-potential gradients, which will also be described in an early issue, will be of interest to electrical engineers. An analysis of the building-heating problem in large cities, made with reference to the distribution of power from central stations, is also to be published soon, and in view of recent experiences should prove of peculiar interest.

Interconnection of Plants in Massachusetts

Spreading Rapidly Through the State, Especially in the Eastern and Central Areas, the Interconnection of Generating Systems Is Recognized as an Economic Movement of Great Importance

This description of progress in the interconnection of generating systems in Massachusetts is another indication of a policy which is receiving increasing attention as a means of conserving fuel and power. The possibilities of interconnection in California and New York were described in the *ELECTRICAL WORLD* of Jan. 5, 1918, page 12.

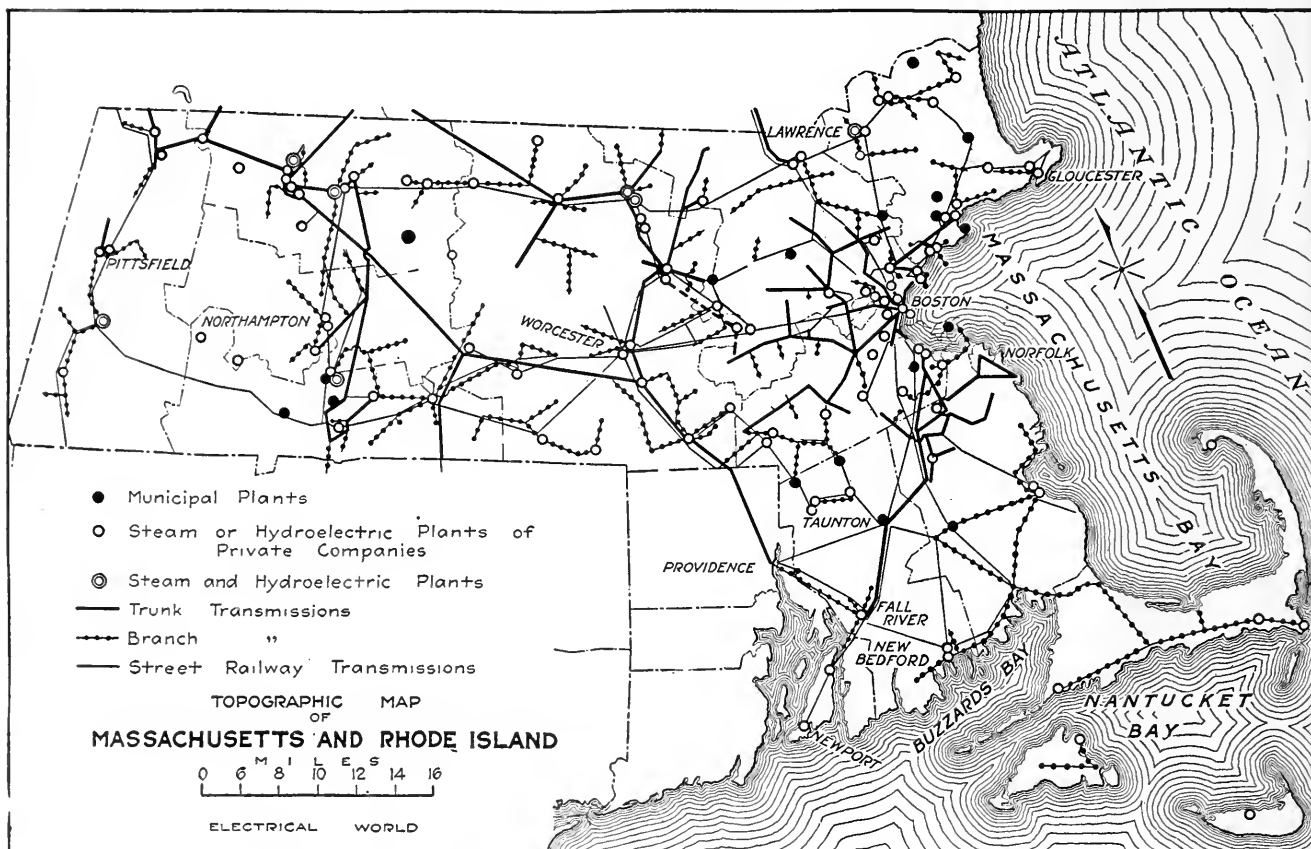
THROUGH the courtesy of the New England Fuel Administration, the accompanying map is presented of all the electric system interconnections in Massachusetts up to date, including hydroelectric transmission lines, central stations, municipal electric plants and street railways.

The map is arranged to show these lines schematically only; it was not designed to exhibit their correct geographical location. Taken by and large, however, it shows that interconnection is now spreading rapidly through Massachusetts, especially in its eastern and central areas. The State is about 200 miles (321.8

miles), the chief of which are the New England Power Company and the Turners Falls Power & Electric Company. Seventeen municipal plants are shown on the map.

The largest central station in the State is that of the Edison Electric Illuminating Company of Boston, and the transmission network radiating from this plant, at L Street, South Boston, serves almost half a hundred municipalities. This system will be connected shortly through the dotted transmission line shown in the east central part of the State with the Metropolitan Water Board's hydroelectric plant at Clinton and thus with the lines of the New England Power Company. This does not mean the entrance of hydroelectric energy into Boston on any considerable scale for the present, but if economic considerations justify it, there appears no serious engineering difficulty.

A recently planned connection is one between the



(Prepared by F. E. Frothingham for the Public Utilities Committee of the New England Fuel Administration)

km.) long on its east and west axis, with an average width of about 60 miles (96.5 km.).

The street railway transmission lines are in general a little less conspicuous on the map than the lines of the interconnected electric supply utilities, and many of the former are operated at 25 cycles. Sixty cycles is the standard frequency of virtually all the Massachusetts central stations and also of the large transmission

Boston Edison system and that of the Tenney syndicate of central stations north of Boston, embracing Malden, Revere and Salem. Running from northwest to southeast is the transmission system of the New England Power Company, forming trunk lines connected with many local central stations, electric railways and also interconnected with the Turners Falls system at Leverett, in the Connecticut Valley. These lines extend

from the Deerfield Valley diagonally across Hampshire and Worcester Counties to the Rhode Island line, where the transmission is extended through the Pawtucket-Woonsocket district to the system of the Narragansett Electric Lighting Company, in Providence, the largest steam relay on the New England Power Company's lines.

From the upper border of Massachusetts a trunk line of this system extends from the Vernon hydroelectric plant through northern and central Worcester County to the operating center at Millbury, outside Worcester, the two trunk line systems being joined here and also looped through Vernon to the Deerfield Valley district. Branch transmission lines extend from the trunks at various points to the Berkshire district in the western part of the State to Camp Devens (the Ayer cantonment), to central stations operated by C. D. Parker & Company of Boston, in central and southeastern Massachusetts, and with connections to the central-station companies at Fitchburg, Worcester, Clinton, Marlboro, Southbridge and other places.

The Turners Falls system is confined chiefly to the Connecticut Valley, in the Springfield-Greenfield district, including both hydroelectric plants and steam relays. Through the interconnection switching station at Leverett a factor of safety of great value has been introduced with respect to wholesale energy supply, as well as an economic opportunity for the best utilization of diversity factors.

Electrical continuity is now a fact from Williamstown (the seat of the college headed by Fuel Administrator Garfield), in the extreme northwestern corner of the State, to Narragansett Bay, Rhode Island, and this will be true soon of the reach from Williamstown to tide-water at Boston.

The map shows that much remains to be done in the way of interconnecting local central stations and municipal plant systems with one another, and that the Gas and Electric Light Commission will find itself provided with no small task if its request to the Legislature goes through for power to order interconnections and the curtailment or shutdown of inefficient stations.

TYPICAL BENEFITS FROM PLANT INTERCONNECTION

**How a 6000-Kw. Station in Massachusetts Gets
Energy at 25 Per Cent Less than It Could
Produce It—Other Advantages**

A transmission line will be completed in the near future between the turbine station of the Narragansett Electric Lighting Company at Providence, R. I., and the plant of the Attleboro Steam & Electric Company at Attleboro, Mass., which will illustrate in a marked degree the advantages of central-station interconnection where one of the plants is relatively small. Before the line could be built it was necessary to obtain the approval of the Massachusetts Gas and Electric Light Commission. In sanctioning the work the commission said in part:

"The present industrial activity and the difficulties in securing coal have emphasized the desirability and even necessity of so co-ordinating the developed sources of power, both steam and hydroelectric, throughout the State by connecting lines as to utilize existing plants

and introduce substantial economies in their operation and future investment. The undertaking in question is a step in this direction, and the board has no hesitation in authorizing the construction of the line."

Despite the war, the business of the Attleboro company in supplying power to jewelry-manufacturing plants and other customers within its territory has increased during the past year. The generating capacity of the Attleboro company's station is 3000 kw., one 1500-kw. and two 750-kw. turbines being in service. The peak load is about 1900 kw., and the load is increasing rapidly for the size of the station. A study of the growth of load indicates that the Attleboro company would be obliged to expend \$630,000 within the next twenty years to meet its increasing business if this were done by progressively enlarging its own station.

The company's total output last year was about 4,000,000 kw.-hr., and the rate of annual increase in business during the past decade has been about 8.5 per cent in station output. The present cost of production is about 1.13 cents per kilowatt-hour.

Negotiations with the Narragansett company, one of the largest central-station organizations in New England, led to an agreement for the purchase of energy from the Providence tidewater station and for the construction of a 35,000-volt transmission line between the systems of the two companies. The capacity of the line is to be 20,000 kw. at 35,000 volts, but for the present it will be operated at 22,000 volts, and not more than 5000 kw. will be required.

The general plan, starting from the Narragansett company's plant, is to furnish energy through underground cables to its East Providence substation, thence carrying the line overhead along the right-of-way of a branch of the New Haven Railroad and northerly across country to the steam plant of the Attleboro company. The total length of line is about 12 miles (19.3 km.) from the East Providence substation to Attleboro, where an outdoor substation is provided in the plan for receiving energy from the line at an estimated investment cost of about \$35,000. The estimated cost per mile, including material and labor but exclusive of right-of-way of the two-circuit, overhead 22,000-volt line is \$6,396.12.

At the outdoor substation in Attleboro about 5000 kw. in transformer capacity is to furnish the initial installation, with switchboard equipment to handle 10,000 kw. It is expected that this installation will not have to be enlarged for over a decade. For all energy supplied the Attleboro company is to pay the Narragansett company at the rate of 8.57 mills per kilowatt-hour, measured on the secondary side of the transformers in the Attleboro plant, with an adjustment for coal price variation and for any energy produced by other means than coal. The base price per kilowatt-hour is to be increased or decreased 0.085 mill for every 10 cents' variation from the base price of \$3.50 a ton for coal. The agreement, which has a life of twenty years from May, 1917, provides for the retention and maintenance of the turbine-driven units of the Attleboro company in the station of the latter, so that energy may be supplied reciprocally to the Narragansett company whenever necessary or desirable. Attleboro is not on tidewater, and by purchasing energy the company saves a 60-cent-per-ton freight rate on coal from Providence.

Columbus Company's Idea of a Modern Station

Plant Established Outside City—Relatively Large Generators—Unit Arrangement in Boiler Room—Almost Exclusive Use of Motor-Driven Auxiliaries—Considerable Electric Equipment Outdoors

UNTIL recently Columbus, Ohio, and many cities like it have been served by generating stations situated very close to or somewhere near the load center of the district served. Owing to the effect which lack of coal storage space and scarcity of a supply of good boiler-feed water will have on the reliability of service and performance of the plant, however, it is usually better to locate the power station outside of the district served and where railroad facilities, plenty of room for coal storage and ample supply of water are available. Because of the developments in transmission equipment which make it unnecessary to locate a generating station at or near the center of distribution, the Columbus Railway, Power & Light Company was able to forget the old requirements influencing the location of generating stations and has recently put in operation its first generating station to be placed

supplies considerable energy for Camp Sherman at Chillicothe and to the cities of Chillicothe and Circleville, 50 miles (80 km.) south of Columbus.

Among the features of the station are the following: The generating units are rather large (18,750 kva.) for the community served. The steaming equipment is arranged in units of two boilers and one economizer each, the economizer having approximately 71 per cent of the heating surface of the two boilers. With the underfeed stokers provided a maximum output of 340 per cent normal rating is effected. The economizer arrangement is such that access is obtained from outside of the building. The brick wall of the building is omitted opposite each economizer, and asbestos sectional covers are used instead. This arrangement economizes floor space and makes the economizers easily accessible for inspection or repair. All steam piping is provided with

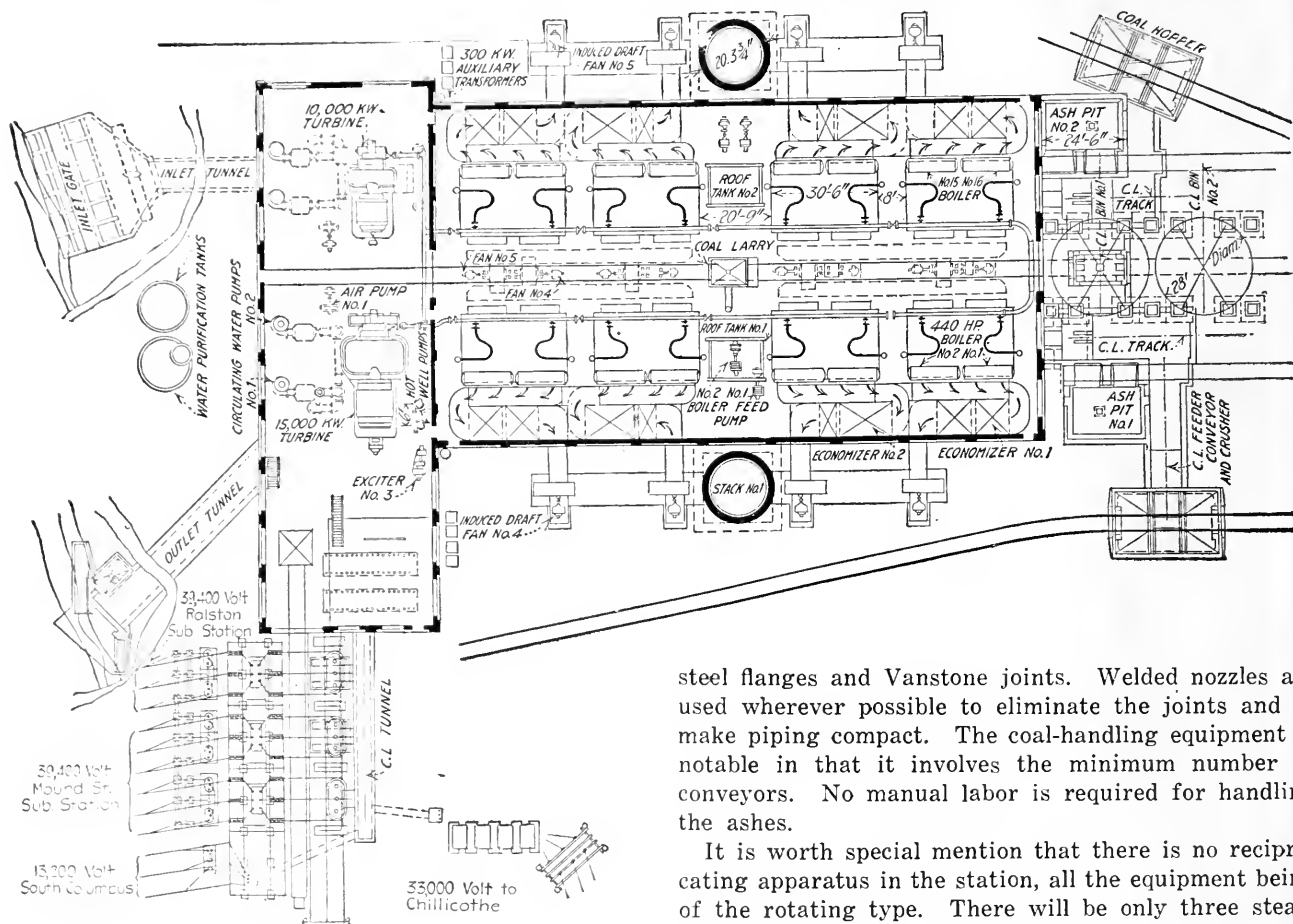


FIG. 1—LAYOUT OF STATION EQUIPMENT AND OUTDOOR ELECTRICAL APPARATUS

outside the city limits, where both coal and water are available. The plant is situated 10 miles (16 km.) southeast of the center of the city. In addition to furnishing energy for the light, power and railway requirements of the city and in a number of towns within a radius of 15 miles (24 km.) of Columbus, the plant also

steel flanges and Vanstone joints. Welded nozzles are used wherever possible to eliminate the joints and to make piping compact. The coal-handling equipment is notable in that it involves the minimum number of conveyors. No manual labor is required for handling the ashes.

It is worth special mention that there is no reciprocating apparatus in the station, all the equipment being of the rotating type. There will be only three steam auxiliaries, including one steam turbine-driven feed pump and two steam-driven dry-vacuum pumps. All other auxiliary equipment is driven by induction motors, the majority of which are of the adjustable-speed type. Every motor and turbine, including the generating units, has flexible couplings.

Very little space is required within the station for electrical equipment, only the generator-voltage switches being installed indoors. All transformers, high-voltage

structures, main-line switches and lightning arresters are situated outdoors, but any of this equipment can be cut out of service and transported into the station for inspection and repair, thus securing all the advantages of the outdoor type of electrical equipment with minimum disadvantages.

Since the station is situated so far from the center distribution, energy will be carried into the city over

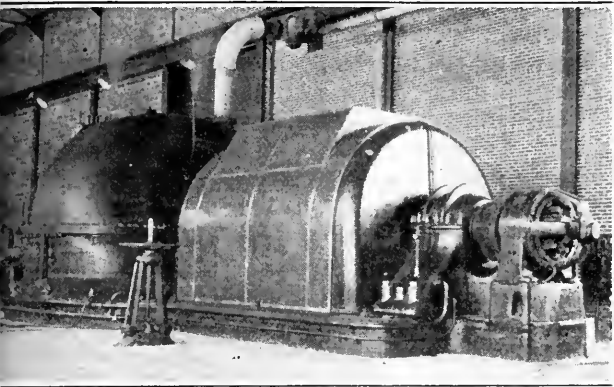


FIG. 2—EMERGENCY EXCITATION FOR THIS GENERATOR CAN BE FURNISHED BY TURBO-EXCITER

three transmission-line circuits at 39,400 volts and over one circuit at 13,200 volts (the latter being generator voltage), which will feed an industrial section at the extreme south end of the city relatively near the station. That part of the station which is in operation consists principally of one 18,750-kva. turbine and eight 40-hp. boilers. Two 13,200/39,400-volt, 15,000-kva., three-phase, water-cooled outdoor transformers will be installed for the present, a 12,500-kva. turbine and eight additional boilers will be installed early this year, and a third transformer will be installed at a later date.

In general the plant is laid out with the idea of having all equipment that requires constant attention on the main floor level. This applies to switchboards, turbines, motors for driving circulating-water pumps and hot-well pumps, controllers for all fan and stoker drives, battery-charging sets, etc. Therefore there will be little occasion for the operators to leave the main floor.

COAL AND ASH HANDLING ARRANGEMENT

When the station is completed two 400-ton cylindrical steel coal bunkers will be provided just outside of the boiler room at the end of the station. Coal will be supplied to these bunkers from track hoppers, the coal passing by means of a flight conveyor through a coal crusher, thence by bucket elevators to the top of the coal bunkers. From the bunkers the coal will be carried into the boiler room by means of a $4\frac{1}{2}$ -ton electric traveling larry, which runs along the middle of the firing aisle so that it can be used to supply stokers on both sides when additional boilers are installed. Track scales (Fairbanks-Morse) are provided immediately under one of the coal bunkers so that the fuel can be accurately weighed as it is being carried into the station. The larry has a revolving bin, which works like a turret, and is provided with a screw conveyor which supplies the coal to the stokers. The coal bunkers, crusher and larry are of the Jeffrey type.

While the bunkers will have sufficient capacity to keep the station operating one to two days, irregularities of shipments are guarded against by providing space for

three or four months' supply of coal outside the plant. An elevated track supported on reinforced-concrete piers extends over this storage space so that very little labor will be required in unloading the coal cars, as most of the fuel is received in hopper-bottom cars. The coal will be distributed over the ground and reloaded in the cars for moving into the station by means of a 15-ton Brown steam-driven locomotive crane provided with a 2-yd. (1.5 cu. m.) grab bucket.

STEAMING EQUIPMENT

The boiler plant will consist of sixteen Babcock & Wilcox boilers having 4440 sq. ft. (408 sq. m.) of heating surface apiece. Single-loop superheaters which will give about 150 deg. superheat under average conditions are also provided. Boilers are designed for 250-lb. (17.8-kg.) steam pressure and are provided with Diamond mechanical soot blowers, Copes feed-water regulators, Balanced Draft regulators for opening the outlet dampers and Bailey furnace meters which record the steam flow, air flow to the boilers, the temperature of the exhaust gases and also the draft under the boilers. Each boiler has one eight-retort Sanford-Riley under-feed stoker, with which it is expected to obtain 340 per cent normal rating of the boilers.

The gases from each battery of boilers pass through one Green fuel economizer, being conveyed thereto by means of 5/16-in. (4.93-mm.) steel-plate flues covered with 1.5-in. (38.1-mm.) heat insulation. From the economizers the gases are conveyed to the smokestacks through uncovered steel breechings, the draft being assisted by Green induced-draft fans placed outside the building and driven by adjustable-speed Lincoln motors. Two concrete chimneys will be provided, each chimney accommodating eight boilers or four batteries of boilers. The forced-draft fans for each battery boiler (part Green and part Sturtevant with General Electric

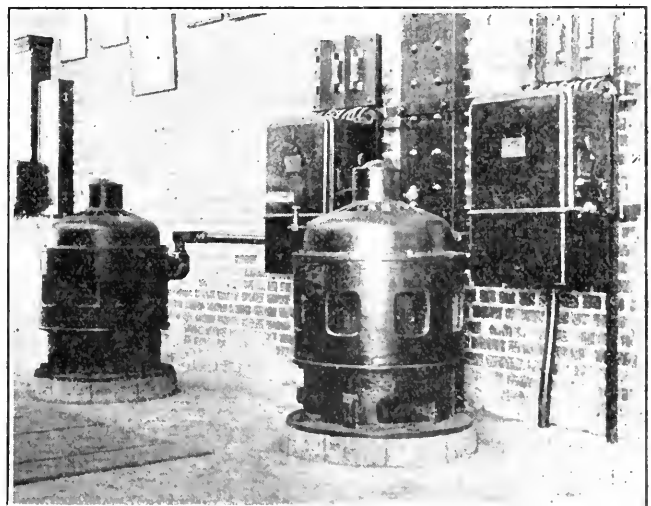


FIG. 3—DUPLICATE VERTICAL-SHAFT MOTORS DRIVING CIRCULATING PUMPS

motors) are installed inside the station below the firing aisle.

It is expected to operate each battery of boilers with its corresponding fans and economizers continuously. When necessary to make extensive repairs the entire unit will shut down, although, of course, either one of the boilers may be shut down for cleaning without dis-

turbing the operation of the other. The controllers for all of the stokers and fans, which are motor-driven, are situated conveniently to the boilers, where they will be under the control of the boiler-room operators. Large steps in the adjustment of drafts will be obtained

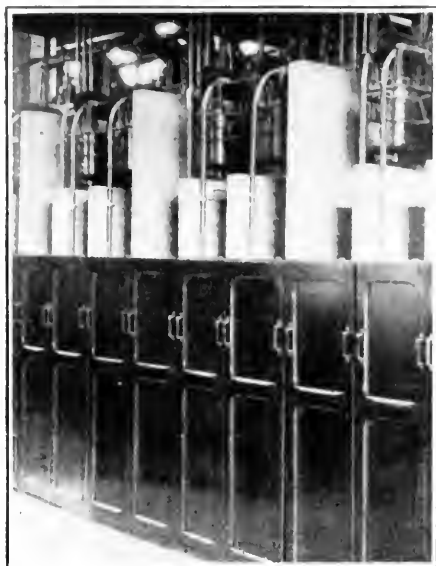


FIG. 4—POTENTIAL-TRANSFORMER SIDE OF BUS STRUCTURE

by changing the speed of the fan motors and by the movement of the dampers in the air ducts.

Steam from the boilers will be carried through 6-in. (15-cm.) steam lines to the main 12-in. (30-cm.) steam header. Each row of eight boilers will be provided with a 12-in. (30-cm.) steam header, the two headers being connected together at each end of the station so as to form a complete ring. The feed water will be supplied to the boilers from water heaters arranged in a similar manner.

The economizers, which have no by-passes, are operated in parallel and feed directly into the feed-water header. To avoid unequal feeding from the economizers, Monel metal orifices are provided in the feed-water header between the connections to the economizer. To insure fine adjustment of the feed to the economizers it is the intention to regulate the opening of the valves in the connections between the economizers and the header, determining the adjustment of these valves by the temperature of the feed water leaving the economizers as shown by Bristol recording thermometers. In addition to the Bailey recording furnace meters, there are Bristol recording thermometers for the gases leaving the economizers and for the water entering and leaving the economizers, also for the water entering the feed-water heater.

The foundations for the boilers, which are of concrete, form the ash pits. Two drag-chain conveyors pass under each row of eight boilers, conveying the ashes out to the end of the station and discharging them into a clinker crusher, which in turn discharges into the boot of a bucket elevator. This equipment is also of the Jeffrey type. The elevator may discharge either into a concrete ash pit or railroad car or wagon. For some time it will be possible to dispose of the ashes around the property, as considerable grading can be done. While each drag-chain has sufficient capacity for carrying out the ashes produced, duplicate conveyors

are furnished so as to allow repairs and changes to be made without interrupting operation.

THE WATER SYSTEM

The circulating water for the Alberger surface condenser under each turbine will be supplied by duplicate vertical-shaft, adjustable-speed, motor-driven Wood circulating-water pumps. These pumps receive water from a gravity tunnel which runs under the entire length of the turbine room. After passing through the condensers, the circulating water discharges into another gravity tunnel which also runs the full length of the turbine room and carries the water out into the river at a point about 160 ft. (48.7 m.) below the intake. Each condenser is provided with duplicate motor-driven single-stage centrifugal Alberger condensate pumps. The concrete tunnels under the turbine room eliminate the usual large amount of piping required for circulating water and also supply the water at convenient points with minimum waste of power. The discharge water lines from the condensers are sealed in the discharge tunnels so that advantage is taken of the siphon action.

The intake end of the tunnel is enlarged and provided with large racks. Six large removable wire baskets are also provided to catch leaves, twigs, etc., which may come down-stream during high water. Each basket is in a separate compartment provided with a gate for shutting off the flow of water when the basket is raised for cleaning. A traveling hoist is provided for operating the gates and baskets. Particles that pass through the baskets and racks can be removed before reaching the condenser by means of Elliott twin strainers, which are installed between the circulating-water pumps and the condensers. The circulating-water pumps are installed immediately on top of the intake tunnels, with their shafts vertical, so that a minimum suction lift of about 11 ft. (3.3 m.) is secured.

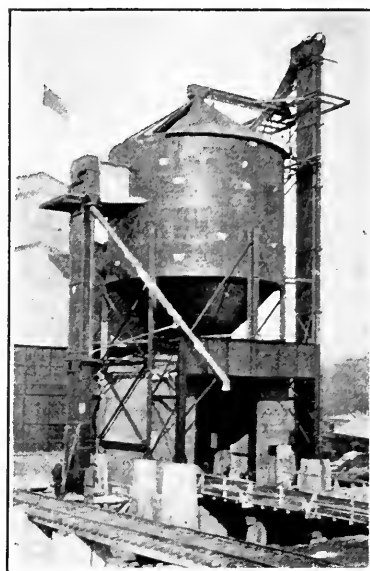


FIG. 5—HOPPER OUTSIDE STATION WHICH RECEIVES COAL FROM CARS DUMPED BENEATH

The condenser of the 18,750-kva. unit, now installed, is bolted directly to the exhaust flange of the turbine and supported on car springs so as to avoid the use of expansion joints. These springs will allow the condenser to expand when it becomes heated.

The condensate from the condenser is forced by centrifugal pumps, also driven by a vertical-shaft motor on the main floor, to the top of the boiler room, where the water will flow through Alberger-Hammond water meters into an open storage tank. This tank is divided

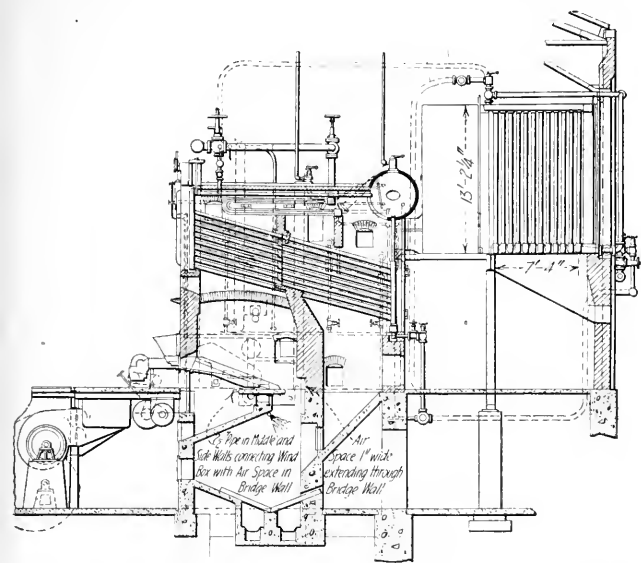


FIG. 6—ECONOMIZERS ARRANGED TO BE ACCESSIBLE FROM OUTDOORS

into two compartments, one with a capacity of 6000 gal. (22,711 l.) for condensate and the other with a capacity of 3000 gal. (11,356 l.) for make-up water. The water from this storage tank will flow through a Hoppes open feed-water heater having two parts. The condensate passes over one-third of the heating surface and the make-up water over the remaining heating surface. From the heater the water will pass through a battery of four 400-gal. (1514-l.) per minute four-stage Cameron centrifugal boiler-feed pumps. Three of these pumps are motor-driven and one is steam-driven. The pumps will discharge into headers supplying the economizers, the economizers carrying full boiler pressure

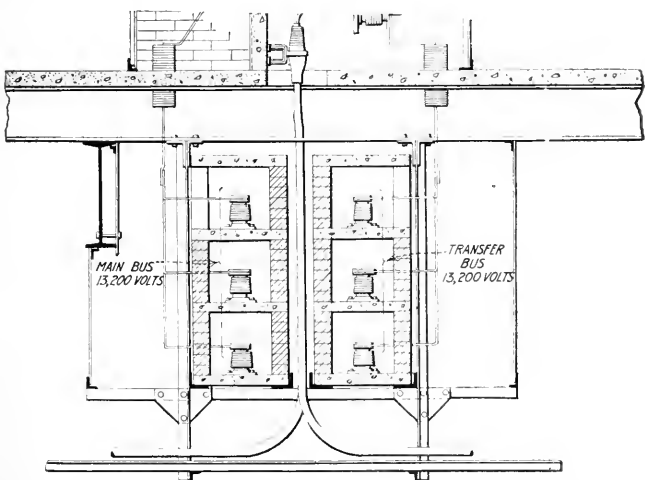


FIG. 7—BUS STRUCTURE SUSPENDED FROM CEILING GIRDER TO ECONOMIZE IN CONNECTIONS WITH EQUIPMENT ABOVE

plus the additional pressure required for forcing the water through the economizer to the boilers.

For purifying the make-up water for the boilers a lime and soda-ash plant is installed which consists principally of two 20,000-gal. (75,706-l.) wood-stave tanks with stirring mechanism and an elevated dosing

tank. The river water is of fairly good quality except during high water. A battery of four 200-gal. (757-l.) per minute motor-driven centrifugal pumps is installed in the basement of the turbine room for furnishing water to the feed-water purification plant and for cooling the 15,000-kva. transformers in the yard.

THE ELECTRICAL SYSTEM

The main generators are connected to a 13,200-volt bus through General Electric Type H-3 oil switches. A transfer bus and a transfer switch are provided so that any 13,200-volt switch with its instrument transformers may be cut out of service and worked on when necessary without interrupting service. All feeders and other circuits are provided with the same type of oil switch, and all of them are remote-controlled from the switchboard.

The arrangement of the greater part of the electrical apparatus, which is placed outdoors, is shown on the plan of the station reproduced herewith. The outdoor oil switches for the 39,400-volt circuits are the General Electric KO-36 type, rated at 50,000 volts. They are mounted on pipe framework with the solenoid-operating mechanism and are equipped with three bushing-type transformers and inverse-time-limit overload relays.

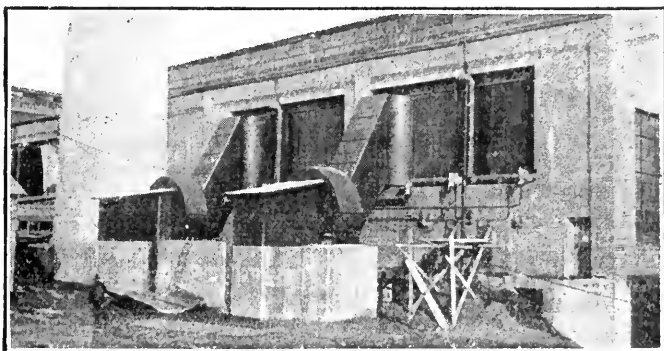


FIG. 8—INDUCED-DRAFT FANS OUTSIDE STATION

The bushings are interchangeable with those on the transformers and lightning arresters.

Two-tank aluminum lightning arresters are provided on 39,400-volt circuits and are equipped with sphere gaps, horn gaps and the other usual auxiliaries.

Energy for motor-driven auxiliaries will be supplied by two duplicate banks of three 300-kva., single-phase, 13,200/220 outdoor-type self-cooled Wagner transformers. The total load from motor-driven auxiliaries in the station will amount to 2533 hp.

The main turbo-generator, power transformers, turbo-exciter, the auxiliary motor drives aside from those mentioned, the control-battery charging set and oil drying and testing outfit were other pieces of equipment of General Electric make. The control battery is of the Exide (Electric Storage Battery) type.

In Columbus electrical energy will be received at 39,400 volts at one point for the present. Later the second and third receiving points will be provided. Energy will be distributed in the city between substations at 13,200 volts. The primary voltage for all light and power consumers is 4150 volts on a four-wire distribution system. The tie lines between the principal substations will operate at 13,200 volts and will consist of triple conductor lead-in-cased cables laid in vitrified clay-dust subways.

Selection of Motors Aided by Graphic Meters

These Instruments Also Facilitate Analysis of Machine-Tool Operations—
Advantages and Disadvantages of Different Types—
Value to Industrial Plants

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

The advantages of the graphic meter as an aid to the analysis of machine-tool operations is illustrated by a discussion of difficulties which have tended to retard the placing of motor application work on a scientific basis. Some of the possibilities in this direction through the use of graphic measuring instruments are outlined. Reference is made to various types of graphic meters, methods for making graphic records, and to certain results which may be looked for from their study.

THE selection of the proper size and type of motor for a given machine tool is often made difficult by the lack of information concerning the character of the load and the effective horsepower which corresponds to the successively changing horsepower requirements for the various parts of the duty cycle. An evidence of the many mistakes which have been made in the past in the selection of the motor is the extent of over-motored machines. By using motors which are higher-powered than necessary for driving machinery the initial investment for motors as well as the operating expense is unduly increased.

There are a number of items¹ involved in the application of motors which are of interest especially from the viewpoint of the central station. They include starting current and starting conditions of the motors, the power factor of the load, fluctuations of load, size of units, starting devices, type and voltage of motor and the hours of service. A very interesting case is cited by Wilson where motors used for the operation of refrigerating machines caused serious disturbances on the lighting system. Later the disturbances were found to be intensified on a certain step of the motor controller, so that ultimately special arrangements had to be made in the motor operation. This case is mentioned to show that the study of individual cases of motor-driven machines may be of added importance at times when the same feeder circuit which supplies the motors also supplies other central-station service such as lighting.

For a number of reasons, therefore, the analysis of factory operations becomes an item of considerable importance, and a graphic meter may be used to advantage for analyzing (a) the time required for various machinery operations, (b) the total or effective power required for the operation of given machine tools as well as the maximum peaks at certain points of the duty cycle, and (c) for obtaining such other information as may be desirable from the standpoint of central-station service.² The graphic meter lends itself particularly to the detection of time losses due to delays in chucking the work or to delays caused by neglect of work and to other causes, since by this instrument a

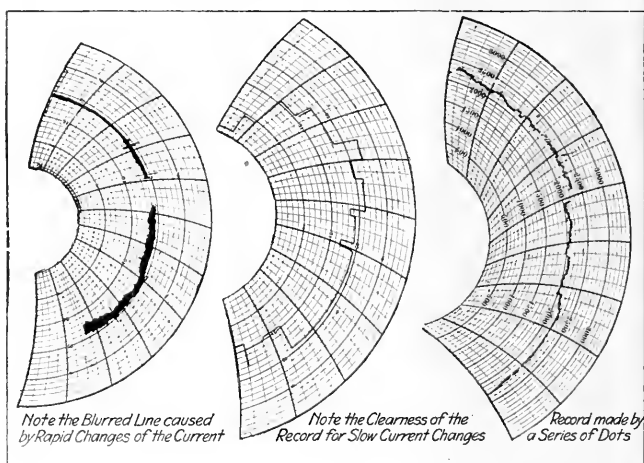
detailed and permanent record is made in terms of time.

SOME AVAILABLE TYPES

The well-known circular-chart type of recording instrument furnishes a convenient basis for graphic records where the changes in the current or power to be measured are not so rapid that they make a blur in the record; in other words, where the changes are such that the recording needle can trace them clearly enough to permit analysis of conditions when desirable.

Owing to the relatively slow passage of the paper under the pen with the circular chart rapid changes in current, like those which made the record in Fig. 1, merely tend to produce a blurred band of ink which indicates little more than the extremes. This indication may often constitute all that is required, however, for such service as the charging of storage batteries. If the changes do not take place too rapidly, as in Fig. 2 for example, the circular chart is entirely suitable.

In the charts just referred to the record is produced by a continuous contact of the pen on the paper, which



FIGS. 1, 2 AND 3—CIRCULAR-CHART RECORDS SHOWING EFFECT OF RAPID CHANGES IN CURRENT, THEIR SUITABILITY FOR INDICATING SLOW CHANGES, AND A CURVE IN WHICH PEN FRICTION IS REDUCED

results in friction that hinders the operation of the recording needle. To eliminate this factor the same general type of instrument has been designed, so that the pen is in contact with the paper only for an instant at a time, producing a dotted rather than a continuous line. A chart of this kind is shown in Fig. 3. In effect, the resulting record is a continuous line except where sudden changes occur. It is fairly obvious that these charts would have limitations in those cases where the performance of the machine tool under investigation placed demands on its motor which were of a rapidly changing character and in the analysis of which

¹Based on a discussion by R. M. Wilson, *Transactions A. I. E. E.*, Vol. 34, p. 774.

²See section on "Measuring Instruments," "Handbook of Machine Shop Electricity," by C. E. Clewell, pp. 278 and 285. An additional reference is made to this source in the explanation of types.

the exact points of these changes and their duration become of the utmost importance.

For this class of analysis the continuous-roll graphic meter is well adapted because the speed of the paper can be made fast enough to record rapid fluctuations. Such a record is shown in Fig. 4.

Graphic meters are classified³ under two heads, (a) those in which the chart or record is made directly by

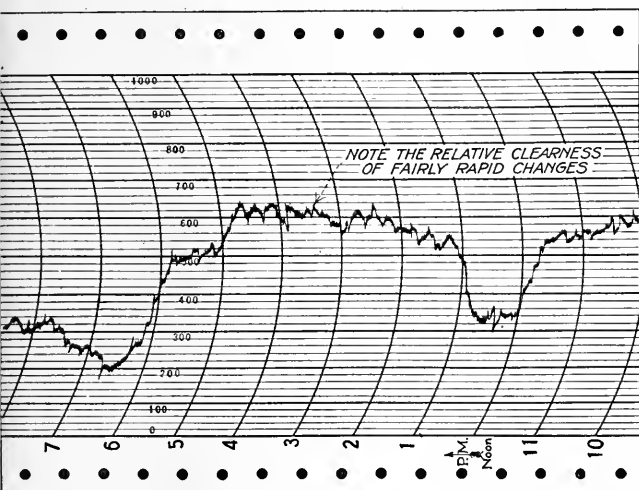


FIG. 4—CONTINUOUS-ROLL RECORD ADAPTED TO INDICATING RAPID FLUCTUATIONS

the moving element of the instrument, and (b) those where some separate form of mechanism is used for making the record. Class (a) includes graphic meters of such types as those of the Bristol, Esterline and General Electric companies, while the Westinghouse type is an example of class (b).

While graphic ammeters are adapted to direct-current circuits, the graphic wattmeter is to be preferred for measurements on alternating-current circuits. Little or no use is made of the graphic voltmeter for machine-tool analysis. It is desirable for graphic meters to have a fairly high paper speed for this service so that the changes in current or power may be recorded with a fair degree of clearness. In fact, it is considered desirable for graphic meters of this class to have several different paper speeds to take care of more or less rapid variations of the load to be measured. Moreover, a fairly high degree of accuracy of the instrument is recommended, since the record derived from it forms the basis of important conclusions. Finally, the paper on which the record is drawn should have a sufficiently wide scale for showing the extreme variations of the quantities under test.

Class (a) graphic meters (see classification referred to) of the direct-current types for current and voltage readings make use of a stationary-coil solenoid together with a movable element of soft iron in the form of an armature which acts against springs. The alternating-current meters operate on the electro-dynamometer principle; that is, with one coil stationary and one movable. The sensitivity of the instrument in this class is affected to a considerable extent by the friction of the pen on the paper.

Where high sensitivity is important several schemes are employed, one being the use of an intermittent-

contact pen, mentioned before, and another the use of a pointer which traces a record on a smoked chart that is semi-transparent and which is "fixed" in a solution after the record is taken from the instrument, thus making a permanent record.

One type of graphic meter uses a separate relay device for the operation of the pen and its mechanism, which is thus entirely independent of the meter element. In this way the sensitivity of the meter is unaffected by the pen mechanism. The paper for this type is furnished with a scale $5\frac{1}{4}$ in. (13.3 cm.) wide, the co-ordinates being rectangular to facilitate analysis. Rolls 248 ft. (75.6 m.) long may be used, which, at a chart speed of 2 in. (5.1 cm.) per hour, permits two months' steady service.

In this particular meter the paper speed can be set at 2, 4 and 8 in. (5.1, 10.2 and 15.2 cm.) per hour, although speeds up to 4 in. (10.2 cm.) per minute are obtainable. The clock mechanism is self-winding in the standard form, although for low speeds a handwound type may be used. For high-speed paper operation the roll may be operated directly by the small motor which winds the clock.

PRACTICAL RESULTS OF LOAD ANALYSIS

The use of graphic meters of the types just described under actual operating conditions serves to show, (a) the way in which the motor-driven machine tool is being operated, (b) the presence of abnormal conditions in the machinery itself, (c) whether shafting losses are excessive, and (d), by a comparison with other charts from the same machines taken previously they show

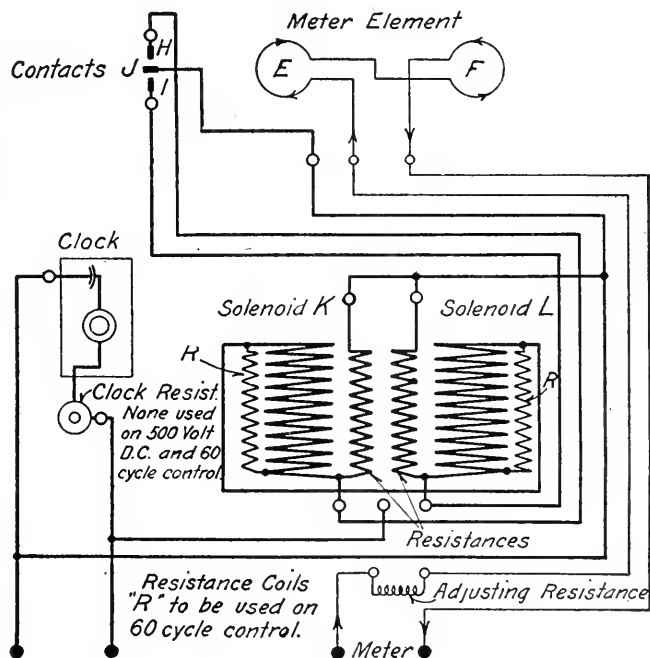


FIG. 5—INTERNAL CONNECTIONS OF ONE TYPE OF DIRECT-CURRENT GRAPHIC METER

whether production is being maintained at a proper rate.

In addition to these indications one of the principal uses in the standardization of machine-tool motor applications is the determination of actual rather than assumed horse-power requirements. This may be accomplished, of course, very readily in the case of machines which are already motor-driven but in the operation

³This classification is based on the "Standard Handbook for Electrical Engineers," fourth edition, p. 171, to which several references are made in this article.

of which there is some doubt as to the correctness of the motor size and type. In the case of line-shaft driven tools for which motor drive is considered a motor may be temporarily connected to the given machine and a graphic record made of its input for establishing the power requirements of the machine tool. In effect, this scheme makes use of the preliminary motor

ing the root-mean-square horsepower of the motor required for the work, as explained in a previous article.

In one case graphic meter records in a shop indicated an idle period for one or two hours each morning for most of the employees. As a result of these records, a study of the situation showed that the inability of the machine-tool operators to get the help of a crane for lifting the material into the machines was the cause of the delay. Additional helpers and better crane service removed the difficulty. Here the important point to note is that a major defect in the shop management was brought to light by the graphic records taken on the electric power circuits.

In another case where steel mill operations were involved the application of a curve drawing instrument, together with the knowledge on the part of the operatives that such an instrument was in use, improved production by nearly 20 per cent. The fact that a record is being made of the work, with a corresponding sense that good work will be noted as well as neglect, seems to stimulate the workmen to improved effort.

OTHER DEVICES

To emphasize the importance of the field of usefulness of the graphic meter for industrial operations, attention is directed to a paper⁵ which discusses the extreme value of the multi-recording instrument⁶ in various branches of electrical work. This instrument differs from the ordinary curve-drawing meter in that the continuous recording paper or tape moves only when a record is made, and a number of different quantities are charted on a single record.

This instrument has been proposed as of value in the recording automatically of the times and extent of the various steps in industrial processes, possibly by the

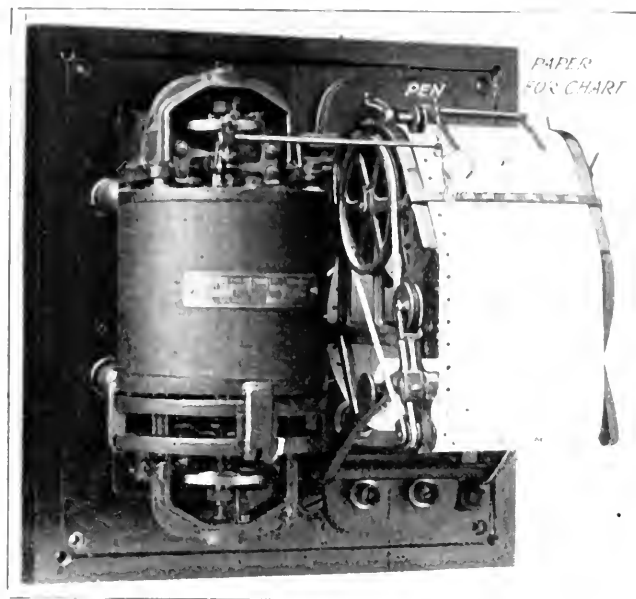


FIG. 6—POLYPHASE CURVE-DRAWING WATTMETER WITH REROLL ATTACHMENT

as a dynamometer, and the simplicity of this power analysis, in comparison with efforts to make a similar analysis by purely mechanical means, is apparent.

The idea of making fairly complete industrial "electrical surveys" with portable graphic instruments is not new, although its adoption is limited perhaps by a lack of a general appreciation of the advantages of such a course in present-day factories. Such surveys refer to more or less systematic tests of motor-driven machinery for the purpose of making regular checks of the load on given motors in terms of their capacity and for finding abnormal conditions which should receive the attention of the maintenance department.

The convenience and relatively high accuracy of the portable line of graphic meters are certainly important features in the modern types and in themselves commend a wider use of such instruments to the attention of industrial managers. Another advantage of portable meters is their reliability. Chart speeds are easily obtainable for a range from 0.75 in. (1.91 cm.) per hour to 6 in. (15.2 cm.) per minute, with nine values.

Although the actual uses of the graphic meter are very numerous, several applications and practical results will illustrate the field. Thus, in the determination of the power required for elevator operation⁷ a graphic wattmeter may be used to secure a record of watts and time. The resulting curve possesses an area which may be reduced quickly to kilowatt-hours. This value of kilowatt-hours, when taken in conjunction with the distance traversed, gives a basis for finding the kilowatt-hours per car mile.

A graphic meter applied to the motor of a motor-driven lathe gives a chart which may be used for find-

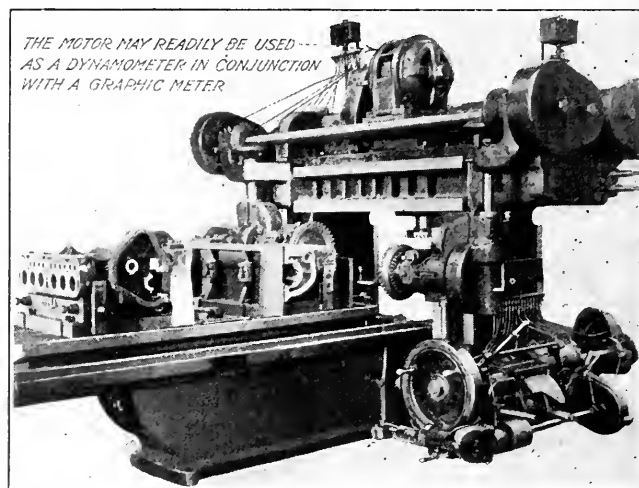


FIG. 7—THE MOTOR DRIVING THIS MACHINE MAY BE USED AS A DYNAMOMETER WITH A GRAPHIC METER

mere electrical contact made at the start and stop of an operation and transcribed on such a chart at some central location.

BIBLIOGRAPHY.—*American Machinist*, Vol. 41, No. 20, p. 855; *Electric Journal*, Vol. 14, No. 2, p. 59; bulletins of the Esterline and Bristol companies, together with the various references made in the footnotes throughout the text.

⁵By Charles P. Steinmetz, *Transactions A. I. E. E.*, Vol. 33, p. 283, and discussed by C. L. Clarke in the same volume.

⁶Described by E. E. F. Creighton, *Transactions A. I. E. E.*, Vol. 31, p. 825.

⁷See "Standard Handbook for Electrical Engineers" fourth edition, p. 1226.

Adapting Induction Meters to New Frequency

How a Company Changed Its Sixty-Cycle Watt-Hour Metering Equipment So as to Operate on Twenty-five-Cycle Energy and Later Changed Back to Sixty-Cycle at Minimum Expense

BY E. L. FISCHER

SOME time ago an electric utility with which the writer was connected found it expedient to change the frequency of its electric-service supply from 60 cycles to 25 cycles. Two years later it became necessary to revert to former conditions. Among other problems, the question arose of what to do with the meters. At first it was thought necessary to dispose of the 60-cycle meters and purchase 25-cycle instruments. By co-operating with the instrument manufacturers and conducting some investigations, however, a scheme was worked out whereby the old meters could be used under the changed conditions without sacrificing meter accuracy or efficiency.

THEORETICAL ANALYSIS OF CONDITIONS

Owing to limited space, it is necessary to assume that the reader is familiar with the operating principles of induction watt-hour meters. To understand the principles on which the changes were made, assume a meter with a shunt coil of zero resistance; that is, one whose impedance is composed entirely of inductive reactance. In such a meter it is at once clear that the current taken by the shunt coil would be 90 deg. behind the impressed voltage, and consequently no "lag" would be required. Now consider that this meter is designed for a frequency f and that it is in a circuit on a system with a frequency n times that for which the meter was designed, or nf .

The torque produced on the disk by the windings of a meter is determined by (1) magnitude of the series and shunt coil flux, (2) phase relation of series and shunt coil flux, (3) frequency of the flux, and (4) resistance of current paths in the rotor or disk. The torque is directly proportional to the first, third and fourth and varies as the sine of the angle between the shunt and series coil flux. The fourth is, of course, unaffected by frequency variation and so will be considered no further.

In placing the meter on a frequency nf the first effect will be, of course, a change in frequency of flux, and from this cause the torque (all other conditions remaining the same) will be n times its former value. The magnitude and phase of the series-coil flux which is caused by the load current would not be affected by a change in frequency. Since reactance varies directly with the frequency, its value under the new condition will be n times the original value; hence the current through the shunt coil will be $1/n$ original value, and so will the shunt-coil flux. The phase relation of the flux to the impressed voltage is unchanged; therefore the torque would be $1/n$ former value, all other things remaining the same. Owing to the difference in frequency, however, it is n times its former value; consequently the resulting torque for a given load and power factor remains unchanged regardless of frequency variation and the meter would be correct on all loads and frequencies.

To an actual meter the above discussion applies so far as flux frequency and series-coil flux magnitude and phase relation are concerned; but, since the shunt coil has resistance as well as reactance, the assumption that the shunt coil is purely reactive with resulting conclusions does not apply. The impedance of the shunt coil varies with the frequency by an amount depending upon the ratio of inductance to resistance. The reactance varies directly with the frequency; the resistance remains unchanged. If this ratio of inductance to resistance be large, the change in impedance will be correspondingly large, and vice versa. It is not possible, unless some specific case be taken up with known or assumed values of resistance and inductance, to determine the exact effect frequency variation has upon the accuracy of induction meters. However, there are certain results which can be foreseen.

It is plain that, since the ratio of resistance to reactance varies, the phase relation between impressed voltage and shunt-coil flux will be greatly affected, and to get anything like successful operation from the meter at the new frequency it will have to be "re-lagged." Also, it is plain that the shunt-coil current will be considerably altered since the impedance is affected. If the frequency be lowered to any great extent, the current will become excessive and heat the coil dangerously, while if the frequency be raised the current is decreased and consequently the shunt coil losses will be decreased.

It is reasonable, therefore, to expect that a meter may be operated successfully on any frequency, within reason, greater than rated frequency by simply recalibrating. It is equally clear that a meter cannot be operated on frequencies much lower than rated because of the excessive current taken by the shunt coil and by the difficulty of getting sufficient lag adjustment. There is every reason to expect then that a meter designed for 25-cycle circuits could be made to operate successfully on 40 cycles or 60 cycles, or even 133 cycles, but a 60-cycle meter could hardly be expected to operate satisfactorily at rated voltage on 25 cycles. The registration of a meter which has a shunt coil in which the ratio of inductance to resistance is very large will be practically unaffected by frequency variations.

RESULTS OF ACTUAL EXPERIENCE

The results of the author's experience in actual work during the changes previously referred to have substantiated the foregoing conclusions to a marked degree. In changing from 60-cycle to 25-cycle circuits we did not find it possible to operate our 60-cycle meters on 25-cycle lines without changes in the meter coils; but in the second change we found, as expected, that we could operate the 25-cycle meters very satisfactorily on 60 cycles by only recalibrating.

Following is a detailed list of just what was done

with each type of meter in the company's service:

General Electric, type I, 25-cycle meter, to operate on rated voltage and loads 60-cycle: Remove the copper bands from the shunt pole, change the heavy-light load adjustment plate for that of a regular 60-cycle meter and recalibrate on 60 cycles, using 25-cycle meter constant. (Note—The speed of a 25-cycle type-I meter is just half that of the 60-cycle meter of same capacity.)

General Electric, type I, 60-cycle meter, to operate on rated voltage and loads 25-cycle: Exchange the 60-cycle shunt and lag coils for regular 25-cycle coils, using the same series coils and laminated sheet-steel structure (if preferred, the entire laminated structure with all coils attached may be exchanged, but this is not necessary); also exchange the register for the register of a regular 25-cycle meter of the correct capacity (this is necessary on account of the change in speeds as noted above) and calibrate on 25-cycle, using standard 25-cycle meter constant.

General Electric, type I-10, 25-cycle on 60-cycle circuit rated voltage and loads: Exchange the heavy copper lag plate and the heavy-light load adjustment plates for the regular 60-cycle plates and recalibrate meter on 60 cycles, using 25-cycle constant.

General Electric, type I-10, 60-cycle on 25-cycle circuit rated voltage and loads: Exchange the entire laminated structure with all coils for the regular 25-cycle structure and coils. Exchange 60-cycle lag and light-load adjustment plates for regular 25-cycle plates. Exchange 60-cycle permanent magnet for 25-cycle magnet; also exchange register as the speed is different. Calibrate on 25 cycles, using constant of regular 25-cycle meter.

General Electric, type I-14, 25-cycle on 60-cycle circuit rated voltage and loads: Remove heavy copper plate attached to laminated structure surrounding shunt pole and calibrate on 60 cycles.

General Electric, type I-14, 60-cycle on 25-cycle circuit rated voltage and loads: Exchange entire laminated structure and coils for regular 25-cycle structure and coils. Also exchange permanent magnet and calibrate for 25 cycles.

Westinghouse, type OA, 25-cycle on 60-cycle rated voltage and loads: Remove the copper bands surrounding the shunt pole and calibrate on 60 cycles.

Westinghouse, type OA, 60-cycle on 25-cycle circuit. This meter cannot be supplied with 25-cycle coils on account of difference in size. It is necessary to supply cases for these, and we found it to our advantage to sell these meters at second-hand values and replace them with regular 25-cycle meters.

Westinghouse, type C, 25-cycle on 60-cycle circuit rated voltage and loads: Remove the copper bands from the shunt pole and calibrate on 60-cycle.

Westinghouse, type C, 60-cycle on 25-cycle circuit rated voltage and loads: Exchange the entire laminated structure with all coils for regular 25-cycle structure and coils; also exchange permanent magnet and calibrate on 25-cycle.

Sangamo, type H, 25-cycle on 60-cycle circuit rated voltage and loads: Break the brass band surrounding the shunt pole and calibrate on 60-cycle, using 25-cycle constant.

Sangamo, type H, 60-cycle on 25-cycle circuit rated voltage and loads: Exchange the shunt and lag coils with their laminated structure for regular 25-cycle coils and structure; also exchange permanent magnet and register gear train attachment and calibrate on 25-cycle, using regular 25-cycle constant. (In the later type H meters it will be found that the laminated structure is of the same dimensions in both 25-cycle and 60-cycle meters, so that the series structure of the 60-cycle meter will fit on the shunt structure of the 25-cycle meter, making it unnecessary to exchange the series-coil structure. In the meters of older type, however, this is not true, and the entire laminated structure would have to be exchanged; also new holes would have to be drilled and tapped in the case, as the supporting lugs of the 25-cycle structure would not fit the holes in the regular 60-cycle case.)

In all of the foregoing changes it should be considered that the word "calibrate" includes the proper lagging of the meter as well as the correct adjustment at full and light loads and unity power factor.

In making the change from 60 cycles to 25 cycles the cost varied somewhat in different types of meters, owing to different costs of coils, etc. The average cost for materials was roughly \$1.75 per meter, and the labor cost, including installation and removal, cartage to and from the shop, and actual labor in the shop, was 60 cents, thus making the total cost per meter \$2.35. This cost is net after deducting for the salvage value of coils, etc.

The second change was not nearly so expensive, practically the entire cost being labor. This item, including installation, etc., as above, was roughly 55 cents per meter.

After making the changes both ways on all meters, it was found that the 60-cycle meters changed to 25-cycle meters are in every case practically identical in operation with meters of the same type designed for 25-cycle service; that the 25-cycle meters operated on 60-cycle are not identical with meters designed for 60-cycle service, as there is in all makes of meters a considerable difference in torque between 25-cycle and 60-cycle meters. It was found, however, that the 25-cycle meters operated on 60-cycle circuits (after the changes listed above) had practically the same torque, maintained accuracy, etc., as they formerly had on 25-cycle circuits, and that the losses were in the neighborhood of 40 per cent of their original value. The company is well satisfied with the results of the change and believes its meters will give entire satisfaction throughout their life.

Electrical Restrictions at Rome

New regulations controlling the use of electricity for lighting and heating have been issued by Rome municipal authorities. Exits of theaters, concert halls, etc., will be allowed only one lamp, not exceeding 60 watts. Present lighting of shop windows and showcases is to be reduced 50 per cent, by discontinuing half of the lamps in use and keeping the candlepower of the remaining half at present value. No further extensions will be permitted, either by changing the candlepower of the lamps or otherwise, in heating and lighting installations of shops, offices, public buildings, etc. Use of energy for heating is forbidden between 4 p. m. and 10 p. m.

Cinders for Fuel in Germany

According to the *Frankfurter Zeitung*, the new power house of the Frankfort State railway station at Frankfort-on-the-Main is utilizing for the first time in the history of German railroading cinders collected by locomotives in special "cinder catchers." When locomotives are cleaned at the end of a trip the cinders are piled on a large heap, from which an electric cable car runs directly to the boiler room. Cinders are fed to grates by automatic underfeed stokers, and the combustion is so complete that less than 0.5 per cent of combustible material is found in the ashes. Three boilers of 250 sq. m. heating surface each supply steam to two turbines of 2000 hp. each, while a third turbine of like rating is to be installed later on foundations already prepared. Energy is generated at 6600 volts, in sufficient quantity to supply light and power demands. This economy is a result of the coal situation.

Initial Current Obtained in Incandescent Lamps

Results of Investigations to Determine the Amount of "Overshooting" of the Current When Metal-Filament Lamps Are Thrown in Circuit— The Three Main Factors

BY C. J. BERRY

Engineering Department National Lamp Works of General Electric Company

The initial current does not rise to a value greater than normal strength in the proportion of the hot to the cold tungsten lamp resistance. Line resistance and reactance drops, and also the behavior of the electrical apparatus supplying the energy, are factors which decrease the effective voltage at the lamp, thereby keeping the current from rising to a high degree. The higher-wattage lamps do not "overshoot" to so high a percentage above normal value as the lower-wattage lamps. The total time required for the current to rise initially and then to settle at approximately a constant value is from 0.1 second to 0.2 second, depending upon the size of the lamp.

There is a marked initial distortion of the current wave form on alternating current that is due to the alternate cooling and heating of the filament. The initial current rises to different percentages, depending upon the point of the voltage wave at which the lamp is thrown in circuit and also upon the condition of the magnetism of the transformer before the switch is closed.

The "overshooting" occurring with vacuum-type lamps is slightly less than that taking place with gas-filled lamps, since the filament temperature of the gas-filled lamp is higher than the operating filament temperature of vacuum lamps.

There is no excuse for fuses blowing or circuit breakers opening when gas-filled lamps are thrown on circuit, provided that the protective apparatus is of proper rating and set correctly, and has a small time-factor element.

WHEN tungsten-filament lamps are first thrown in circuit there is an initial rush or "overshooting" of current caused by the filament resistance of the cold lamp being low as compared to the resistance it has when the lamp is lighted. It is the purpose of this article to show how much this initial current is with different lamps and how long this current exists at the high value. The determination of the initial rise of current or "overshooting," and also the action of the voltage at the lamp at the same time, involves some knowledge of the effect of the line constants. With a rapidly changing current like the initial current of the metal-filament lamps inductance effects have to be taken into account. The main factors influencing the initial phenomena are lamp-filament resistance, line resistance and reactance, and the regulation of the source of supply. These factors will be considered separately in the following paragraphs.

LAMP-FILAMENT RESISTANCE

The resistance of the filament of a tungsten lamp is many times greater when the lamp is lighted than when the lamp is not connected in the circuit; that is, the temperature coefficient of the filament is positive. With the old type of untreated carbon-filament lamps the resistance of the filament decreases as the filament temperature increases.

The lamps used in this work were the gas-filled tungsten lamps, vacuum tungsten lamps and untreated carbon-filament lamps. The lamps were of the 105-125 volt class. All of the differently sized gas-filled lamps between 75-watt and 1000-watt rating were included.

Different sources of energy were used for supplying the energy to the lamps; namely, a 7.5-kw., 120-volt direct-current generator, an 80-amp.-hr., 120-volt storage battery, and a 115-volt, 60-cycle lighting circuit. These different sources of supply were used in order to note any difference in the initial behavior of the current.

Neglecting reactance effects and assuming the voltage across the lamp terminals to remain the same, the current which would flow when the lamp was first put on the circuit would vary inversely as the filament resistance. The initial current theoretically then would be the normal current value times the ratio of the hot resistance to the cold resistance of the filament.

LINE RESISTANCE AND REACTANCE

The initial current under constant voltage conditions at the lamp would be as many times greater than the normal current as the ratio of hot to cold resistance. However, the voltage does not remain constant, because there are self-induction effects occurring on the line and there is an increased resistance drop taking place in the line. Also the regulation of the electrical apparatus furnishing the energy must be considered. Some of the instantaneous effects occurring in the lamp during this initial phenomenon are inductance, skin effect and the cooling of the filament by the gas and leading-in wires, but these effects are probably of very small account. The line from the generator to the lamp was approximately 150 ft. (45.7 m.) long and the wire was No. 8 B. & S. gage copper wire, making the total line resistance approximately 0.2 ohm.

The voltage across the lamp is less than normal line voltage by an amount equal to the sum of the increased resistance drops and reactance drops in the circuit. As the current increases, however, the slope of the current curve becomes less steep, making the successive inductive drops smaller and thereby affording the line voltage a chance to recover. On the other hand, as the current rises the resistance drops in the circuit increase, but this is not large enough to keep the voltage across the lamp from rising to its normal operating potential. The current keeps on rising for only a small interval of time, however, and then it decreases, since the lamp filament is becoming hot very rapidly. As the current increases the lamp-filament resistance increases rapidly until there is finally a point reached beyond which the current does not increase. This maximum point occurs when the lamp resistance begins to increase more rapidly than the voltage across the lamp and is determined by subtracting the resistance and reactance drops in the circuit from the generator emf. This maximum current value is reached in a very short interval of time, varying from 4×10^{-4} to 3×10^{-3} second. The current after reaching its maximum value immediately starts to resume its normal operating value, and this is reached

in about 0.1 second to 0.2 second, as shown by the oscillograms.

VOLTAGE REGULATION AND LINE REACTANCE

The machine used in the tests was a 7.5-kw. direct-current generator. With a machine of this rating it hardly seems probable that the machine regulation would have much effect on any initial voltage regulation. If the generator were small, a poor instantaneous regulation would be expected. Armature reaction and reactance effects as well as armature resistance will produce a voltage change. As soon as the lamp is switched in circuit, the voltage at the generator will drop slightly, since there is this initial "overshoot" of current to the lamp. If a small generator were supplying the energy to the lamps, it could not be expected that the initial rise of current would be so great as if the generator used were sufficiently large to absorb the load without showing a decrease in voltage.

To learn something about the inductive reactance of

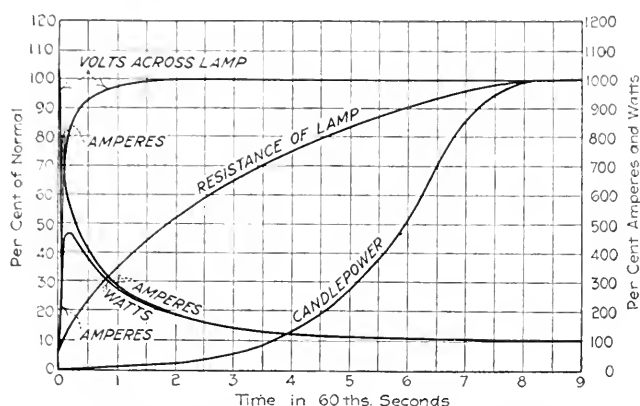


FIG. 1—CURRENT, VOLTAGE, POWER AND CANDLEPOWER CHANGE AFTER LAMP IS CONNECTED WITH CIRCUIT

the particular circuit used in these tests, a non-inductive resistance was connected in the line in place of the lamp and the current switched on. In this test an 11-kw. generator was used, because at that time it was impossible to get the 7.5-kw. exciter. An immediate fall in open-circuit voltage on the line, followed by a gradual rise in voltage and current, was noticed on the oscillogram. In this case the voltage and current came to their normal value in phase with each other and reached maximum values at the same time.

The initial drop in voltage can be accounted for by several different actions; namely, generator resistance, reactance and reaction, and line resistance and reactance. It is safe to assume that the circuit resistance remains constant, and hence, neglecting the circuit reactance, the voltage on open circuit should immediately come to its normal value, and the same is true of the current. There is, however, an inductive reactance effect in the circuit which causes the voltage to fall to a low value, from which it gradually resumes its normal value. This inductive reactance effect can be attributed mostly to the line reactance and not to any generator action.

Since the wires for this line were each about 150 ft. (45.7 m.) in length and were run in conduit, the coefficient of self-induction is comparatively small. However, the rate of change of the current with respect to time is great and produces a large back emf. Most lines in practice have a larger coefficient of self-induction and

TABLE I—RATIO OF HOT TO COLD FILAMENT RESISTANCE OF INCANDESCENT LAMPS

Lamp	Ratio of Hot to Cold Resistance (Approximate Only)
Carbon, untreated	0.5 to 1
Metalized filament	1.5 to 1
Tantalum	6.5 to 1
Vacuum-type tungsten filament	11.5 to 1
Gas-filled tungsten filament (75-1000 watts)	14.6 to 1*

*The resistances on which the ratio is based include the resistance of the leading-in wires as well as that of the tungsten filament, but the resistance of the leading-in wires from the lamp base to the filament is only a very small percentage of the total lamp resistance. The increase in the ratio of hot to cold filament resistance of the gas-filled lamps over that for the vacuum lamps is due to the higher operating filament temperature of the gas-filled lamps.

TABLE II—RATIO OF INITIAL MAXIMUM CURRENT TO NORMAL CURRENT

Lamp Wattage	Ratio of Initial Maximum Current to Normal Current	Ratio of Initial Effective to Normal Current
75	12	....
100	11	1.5
200	10	....
300	10	....
400	10	....
500	9	1.9
750	8	....
1000	7	2.5

TABLE III—TIME FOR CURRENT TO REACH MAXIMUM AND CONSTANT VALUES†

Lamp Wattage	Time to Reach Maximum Values, Sec.	Time for Approximate Normal Current, Sec.	Time When Double Normal Current Is Reached. (Descending Side of Current Curve), Sec.
75	0.0004	0.07	0.01
100	0.0007	0.10	0.02
200	0.0008	0.10	0.03
300	0.0011	0.13	0.03
400	0.0012	0.13	0.03
500	0.0014	0.15	0.03
750	0.0021	0.17	0.04
1000	0.0031	0.23	0.07

†If the lamp filament happens to be warm, the current does not rise to such a high maximum value.

TABLE IV—DECREASE IN OPEN-CIRCUIT VOLTAGE INITIALLY WHEN LAMP IS THROWN IN CIRCUIT

Gas-Filled Tungsten Lamp (Watts)	Maximum Current (Amp.)	Line-Resistance Drop with Maximum Current (Calculated), Volts	Decrease in Open Circuit Voltage Initially (from Oscillograms), Volts
75	7.2	1.4	29.9
100	9.0	1.8	35.1
200	17.2	3.4	42.5
300	26.2	5.2	61.4
400	36.6	7.3	61.7
500	45.7	9.1	71.6
750	51.7	10.3	86.0
1000	65.2	13.0	92.6

tend to prevent the current from rising very high initially.

Although the ratio of the hot to cold resistance for gas-filled lamps is 14.6, it may be noted that on none of the oscillograms did the initial current rise to 14.6 times the normal current value. The nearest approach to this was twelve times and occurred with the 75-watt lamps. There is a decrease in the ratio of initial maximum to normal current as the size of the lamps increases. With the low initial resistance of the lamp filament, the current builds up at a very rapid rate, and this produces a reactance drop in the line which,

delivers is approximately 65 amp. it does not seem probable that the generator would show a very marked decrease in terminal voltage, or, in other words, a bad instantaneous regulation.

The initial drop in voltage when a lamp is put on circuit was noticed also when the storage battery supplied the energy instead of the direct-current generator. In fact, the voltage recovery was less rapid in the case of the storage battery. This was evidently due to the change in internal resistance of the battery and perhaps to a time lag of action of the battery.

The current rises to a maximum value in a very short interval of time, approximately from 0.0004 second to 0.003 second, and hence there is a large change in the linkages between the flux and the circuit. This initial back electromotive force of self-induction must be the main cause of the excessive initial voltage drop across the lamp.

Complicated relations take place during this initial phenomenon, and if any mathematical demonstration were applied it would necessitate a knowledge of the constants of the entire circuit and it would also have to take into account the variable voltage at the lamp due to the line reactance, the generator regulation, the variable circuit resistance drop and the change in resistance of the filament with a rapid change in current which would require some knowledge of the thermal capacity or the lag of temperature with instantaneous current. Also with the rapid change in current skin effect in the filament of the lamp would probably have to be taken into account, as well as the heat conduction and convection by the gases in the lamp bulb from the tungsten filament and also the cooling effect of the leading-in wires.

In this article it will be sufficient to state, however, that the current does not "overshoot" in the ratio of the hot to cold resistance. The larger

the lamp, the less will the current "overshoot" when expressed in percentage terms. The current with the 75-watt lamp went to 1200 per cent of normal current, while with the 1000-watt lamp it rose to only 700 per cent of normal current. There is some inherent regulation in all circuits which prevents the current from rising to the theoretical 1460 per cent of the normal current value.

ACTION ON ALTERNATING CURRENT

Some oscillograms were taken on throwing a 1000-watt gas-filled tungsten lamp in circuit, using 60-cycle alternating current. Experiments were performed to determine the effect of switching on the lamp at the zero point and also at the peak of the voltage wave. The oscillograms showed that the time needed for the alternating current to assume a normal value was identical with that required for the direct current to reach its normal value. One might expect, however, that with

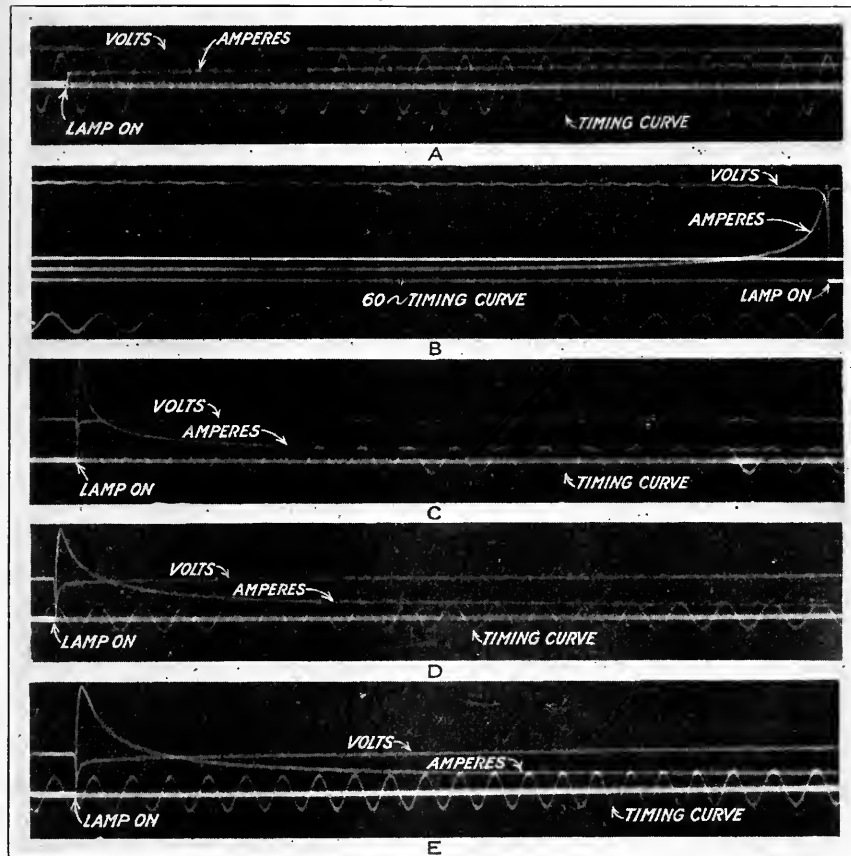


FIG. 2—VARIATIONS IN CURRENT WHEN INCANDESCENT LAMPS ARE ENERGIZED
A—112-volt, 120-watt carbon lamp; B—115-volt, 300-watt gas-filled lamp; C—119-volt, 400-watt gas-filled lamp; D—118-volt, 750-watt gas-filled lamp; E—117-volt, 1000-watt gas-filled lamp. The source of supply was a 7.5-kw. direct-current generator, the timing curve having a frequency of 60 cycles

added to the increased initial resistance drop in the line, brings the effective voltage at the lamp to a low value for some of the higher-wattage lamps.

It may be noted that the decrease in voltage read from the oscillograms is very much greater than the calculated line resistance drop due to the maximum current flowing. Since this large drop in voltage across the lamp cannot be all accounted for by a line resistance drop, it must be caused either by a large inductive reactance voltage drop on the line or the regulative action of the electrical apparatus supplying the energy.

The decreases in voltage from open-circuit values expressed in percentage terms range from 27 per cent to 78 per cent of open-circuit voltage. The decrease in voltage in every case as shown on the oscillograms is many times greater than that which could be accounted for by a line-resistance drop alone. Of course, the machine regulation has some effect on this drop in voltage, but since the full load current that this machine

the alternations in current there would be some cooling action on the filament and that more time would be required for the current to assume a normal operating value. The amount of "overshooting" of the current when the 1000-watt gas-filled lamp was thrown in circuit at the peak of the voltage wave was 600 per cent and when thrown in at the zero part of the wave was only 500 per cent. On direct current with this lamp the initial "overshooting" was found to be about 700 per cent.

The current wave form was not a sine curve like the voltage wave form. Some distorting action seems to have taken place. There was an apparent lead of the peak of the current wave with respect to the peak of the voltage wave. The current wave shape was rather steep at first, rising to a peak and then falling off more gradually. This was caused by the change in resistance of the lamp filament. When the current starts from zero up to its maximum value, the filament is at the cooler state and proceeds to the hotter state, producing an "overshooting" effect. When the voltage decreases the current does not assume so great a value as it had at the same voltage point on the increasing side of the voltage wave. In other words, considering two equal voltage values, one on one side of the voltage wave and one on the other side, there is a greater current at the first voltage point than at the second, because the filament is cooler in the first instance than in the second. The current starts to return to zero before the voltage reaches its maximum point, because the rate of change of the resistance is greater than the change of voltage. Assuming constant voltage points on both sides of the voltage wave, on the upward portion of this wave the filament resistance is low, but on the downward portion it is greater, hence less current will flow in the second case. This causes a distortion of the current wave. Since the current reaches its maximum value before the voltage peak, the maximum overshooting occurs when the lamp is thrown in circuit just before the voltage wave reaches its peak value.

The maximum value of the initial current depends somewhat upon the condition of magnetism of the transformer before the switch is closed, and this magnetic condition depends upon the point in the current cycle at which the transformer was opened when last used.

ACTION WITH VACUUM-TYPE TUNGSTEN FILAMENT

Theoretically the "overshooting" of the initial current when vacuum-type tungsten-filament lamps are thrown in circuit would not be so great as that taking place with gas-filled lamps. The ratio of the hot to cold resistance of the vacuum lamps is not so large as that for the gas-filled lamps, and also the cooling effect of the gas in the gas-filled lamps keeps the filament cold longer, giving the current an opportunity to rise. This difference is small and could hardly be distinguished by oscillograms.

Some tests were made using potentiometers for reading the voltage and current to determine with a higher degree of accuracy how long it took for the current to attain a constant value with gas-filled lamps. The results show that the time required for the current to reach a constant value when gas-filled lamps are switched in circuit varies from one-half minute to two minutes for the 100-watt to 1000-watt lamps, inclusive.

There is absolutely no cause for any blowing of fuses or the opening of circuit breakers when a lamp load is first thrown on the circuit, provided that the fuses are of the correct size for the load and the breakers are set properly. The effective current during the brief period of 0.1 second to 0.2 second is only approximately 100 per cent greater than normal. With this overload the ordinary fuse or circuit breakers will not open the circuit because of the time element involved in their operation.

SWITCHING ON LAMP BANK ON SERVICE LINES

In actual practice more than one lamp is, as a rule, thrown on circuit at the same time. The effect is practically the same as switching on one lamp having a wattage rating equal to the sum of the individual wattages of all the lamps put on circuit. If the lamps were not grouped together or concentrated on the line, there would be perhaps a slight difference in the effect produced by switching on a number of lamps or one lamp of the combined wattage, owing to a difference in the current strength at various parts of the multiple line, since there is more current flowing in the line at the supply end. This produces a variation in the reactance and resistance drops in the line, and the initial rush of current at the supply point would be slightly different in the two cases.

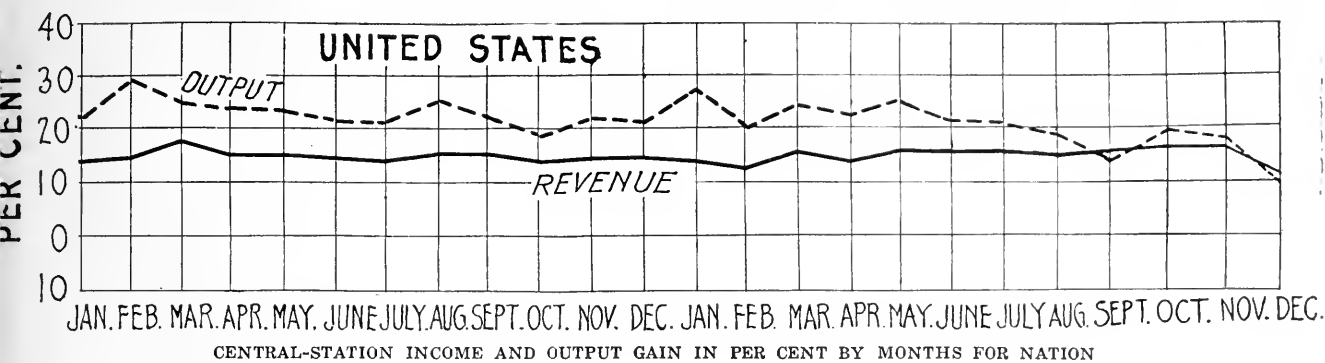
Where an installation of vacuum-type tungsten-filament lamps is replaced by one of gas-filled lamps there will be only a very slight difference in the amount of "overshooting" if the total wattage in each case remains the same, although the current in the gas-filled lamp installation will reach a slightly higher value because of the greater difference existing between the cold and hot resistance.

It must be borne in mind that the results of this test are those obtained when using a certain supply source and electric circuit. Slightly different results might be realized under different circuit conditions. The usual circuit would be found to have a greater line reactance, and this means that the initial rise in current would not be as high as the results of this test show.

German Central-Station Rates

A recent communication from the Electricity Administration of Germany discusses grounds upon which central stations are entitled to increase charges, says the London *Electrical Review*. The price of coal has risen 100 per cent or more, that of other working materials several hundred per cent and wages have risen to an extraordinary level. Voluntary allowances to dependents of workmen represent a further heavy burden. Bulk consumers are therefore urged to pay a higher price in proportion to the increased cost, even where long-term contracts give them a legal right to supply at pre-war prices. Other results are being felt from the introduction of "summer time," restricted use of light and power on grounds of economy or because of small works being closed, and absence on active service of innumerable small consumers. It is pointed out that the effective maintenance (financial and material) of electricity and gas works is a matter of national importance, also that these concerns are at present subject to abnormal depreciation as well as increased working costs.

Central-Station December Operations



THE effect of coal shortage and the readjustment of business on account of the war are beginning to show in the returns made by electric utilities to the ELECTRICAL WORLD. Reports of the central stations for December, 1917, indicate an increase of 11.5 per cent in revenue from the sale of energy and of 9.6 per cent in the kilowatt-hour output as compared with December, 1916.

It was to have been expected that the December statistics would carry some reflection of the slow-down in industry which arose from the abnormal operating conditions. Shortage of coal supply was of course a large contributing factor. Another was the gradual but apparently sure reduction in activity of the less essential and non-essential industries. Still another was the aggravated state of affairs in even the industries vital to the prosecution of the war, where railroad embargoes and the general paralysis of transportation facilities, together with labor uncertainties, combined to reduce output of factories.

Though still making an increase in both gross revenue and kilowatt-hour output, the central stations were so affected by the unprecedented situation that their percentage of gain in both items was smaller than in any other month of the year. The gains, however, were good average increases, and it is only as they are

compared with the stimulated output when there were no special handicaps to production that they look somewhat small. An increase of around 10 per cent covering all parts of the country is progress at a very fair rate.

Based on the returns shown for 55 per cent of the industry, the ELECTRICAL WORLD estimate for the whole industry in December is: Revenue, \$44,450,000; output sold, 2,345,000,000 kw.-hr.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	REVENUE FROM THE SALE OF ENERGY			KW.-HR. OUTPUT		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
Jan.	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March.	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April.	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May.	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June.	63	23,279,000	20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July.	63	22,768,000	19,680,000	15.8	1,397,482,000	1,159,410,000	20.5
August.	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
Oct.	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.0
Nov.	62	26,665,000	23,183,000	17.0	1,455,370,000	1,292,113,000	15.1
Dec.	55	24,455,000	21,977,000	11.5	1,288,085,000	1,176,471,000	9.6

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States		
		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase
January. . .	64	\$3,181,000	\$2,762,000	15.1	66	\$11,400,000	\$9,874,000	15.6	56	\$8,081,000	\$7,013,000	15.2	86	\$1,602,000	\$1,020,000	9.5
February. . .	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
March.	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
April.	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	7.0	86	4,282,000	3,821,000	12.1
May.	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
June.	64	2,641,000	2,290,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
July.	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
August.	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	12.9
September. .	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
October.	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
November. .	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,451,000	7,063,000	19.7	81	4,661,000	4,110,000	5.9
December. .	63	3,425,000	2,953,000	16.1	54	9,805,000	9,103,000	7.7	43	7,409,000	6,211,000	19.3	79	3,816,000	3,710,000	2.9

Month	Percentage of Industry Represented	1917			Percentage of Industry Represented	1916			Percentage of Industry Represented	1917			Percentage of Industry Represented	1916		
		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase
January. . .	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	365,094,000	298,990,000	21.4
February. . .	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
March.	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
April.	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
May.	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
June.	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
July.	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
August.	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
September. .	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
October.	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
November. .	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
December. .	63	133,955,000	109,903,000	21.7	54	477,040,000	432,731,000	10.3	43	360,800,000	319,471,000	13.0	79	316,290,000	314,366,000	0.6

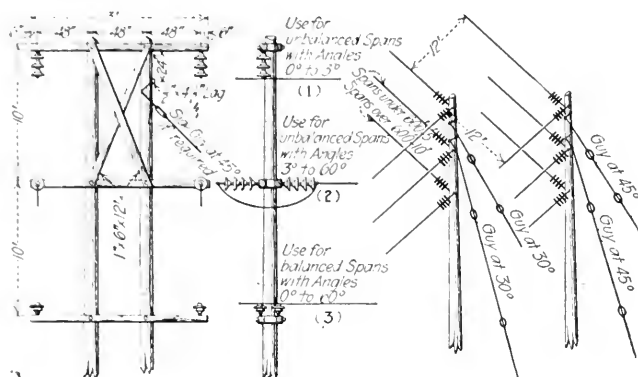
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

TYPICAL LINE CONSTRUCTION OVER ROUGH TERRITORY

California Company Extends Service Into Mining Regions of North Feather River District Over 60-Mile Route

A 44,000-volt transmission line has recently been completed by the Great Western Power Company over a 60-mile (96.6-km.) route which affords a typical example of the requirements and practice in the rough mountainous sections of northern California. In this length of line there are thirteen crossings of the North



FIGS. 1 AND 2—45,000-VOLT SPECIAL TWO-POLE TOWER, AND POLE TOPS FOR ANGLES OVER 60 DEG.

Fork of Feather River, with spans ranging up to 1500 ft. (457.2 m.) in length. Twenty per cent of the poles had to be hauled up to the line with block and tackle. The line was built to supply mining power load and connects the Big Bend generating station with the Veramont substation near the town of Taylorsville.

In considering what type of construction to use the likelihood of a desire to increase the voltage later to 100,000 had to be considered, as well as the need for mechanical strength of the line required in rugged country and the present high cost of materials and labor. The 3000-kva. load for which each of the two circuits on the line was designed could be carried easily at 45,000 volts, and this voltage was selected. The question of insulators received careful attention, and it was found that by using the pin type (O. B. No. 11,623) the cost per pole would be \$4 per three-phase circuit, including pins, as against \$15 for the suspension type, including hardware. The insulators selected are of the new design, two-part type, tested for 145,000 volts.

For the mechanical strength required it was thought best to use three-strand No. 4 hard-drawn copper wire. Wooden poles were used, 35 ft. to 50 ft. (10.7 m. to 15.2 m.) in length, and for ordinary spans the cross-arms were spaced 5 ft. (1.5 m.) apart. Additional clearance was provided by making the center cross-arm 9 ft. (2.7 m.) in length, while the others were 7 ft. (2.1 m.) long. For spans over 600 ft. (182.8 m.) double-pole construction was used, with 13-ft. (3.96-m.)

cross-arms and a cross-arm spacing of 10 ft. (3 m.).

The Veramont substation at the Taylorsville end of the line is equipped with a bank of three 1150-kva. transformers. These were Y-connected as a compensator bank to keep down transformer investment and to reduce likelihood of arcs and grounds. With this arrangement transformers at generating plant and substation are interchangeable. In accordance with the Railroad Commission's orders for power lines paralleling lines of communication, the transformers were equipped with a low-tension delta winding for 22,000 volts. This winding, in addition to satisfying the requirements for a path for the third harmonic residual components of current and voltage, also afforded a source of supply for local service in the town of Taylorsville. The station is arranged to be as nearly automatic as possible, and a bell alarm system, connecting with the patrolman's house near by, gives warning of automatic switch operation. When the patrolman is out on the line his wife answers trouble signals that come in. So, although no operator is stationed at this point, there is virtually constant attendance. The regulation on the line is expected to be within 15 per cent.

From the Veramont station several short lines have been built to mining properties near by. One of these was a 16-mile (25.7-km.) line, recently built to the Walkers Brothers' copper mine over very rough country in record-breaking time. A bridle trail cut along

MATERIALS FOR ONE POLE TOP

Two poles, 45-ft., class B.
Six cross-arms, 5 in. by 6 in. by 13 ft.
Twelve machine bolts, $\frac{5}{8}$ in. by 22 in.
Twenty-four washers, $\frac{5}{8}$ -in. cut.
Six space blocks (field cut).
Two pieces 1-in. by 6-in. by 12-ft. rough pine.

INSULATORS AND HARDWARE

- (1) Eighteen O.B.-11,535 insulators.
Six O.B.-11,545 socket clevises.
Six open eyes, 2-in.
Six machine bolts, $\frac{5}{8}$ in. by 8 in.
Six washers, $\frac{5}{8}$ -in. cut.
- (2) Forty-eight O.B.-11,535 insulators.
Twelve O.B.-11,545 socket clevises.
Twelve open eyes, 2-in.
Twelve machine bolts, $\frac{5}{8}$ in. by 8 in.
Twelve washers, $\frac{5}{8}$ -in. cut.
- (3) Twelve O.B.-11,623 insulators.
Twelve round-pipe pins, $1\frac{1}{4}$ in. by 14 in.
Twelve machine bolts, $\frac{1}{2}$ in. by 6 in.
Twenty-four washers, $\frac{5}{8}$ -in. cut.

the line was the only means of transportation, and all supplies and materials came in on horseback. Fortunately, it was possible to cut nearly half the poles required near the point where they were erected. The cross-arms were cut from local timber by the sawmill in service at the mine to which the line was being built.

One of the important problems on this line was the question of digging the pole holes, which would be for

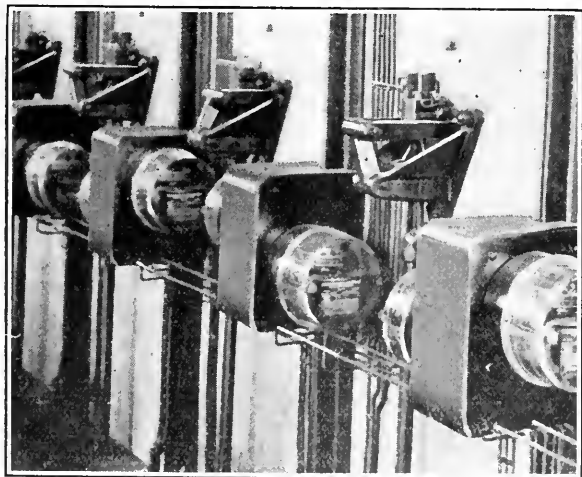
the most part in hard rock. The cost of digging these in this remote region with the ordinary crew would have been very high. This difficulty was surmounted in a very satisfactory way by contracting with a crew of miners from a nearby mine, who agreed to blast out holes at the points designated for a flat rate of \$4 per hole. The depth specified was $5\frac{1}{2}$ ft. (1.65 m.). These men, familiar with local conditions, did the job speedily and profitably. They usually worked from daylight to dark. Their earnings over and above explosives varied widely with the conditions and ranged all the way from \$2 to \$12 per man per day.

This line was for 22,000 volts with a capacity of 1000 kva., the conductors being No. 6 hard-drawn copper, and poles were spaced 20 to 24 per mile (12 to 15 per km.). The line was in service, with a 25-ft. (7.6-m.) right-of-way cleared through heavy growth, forty-five days after work was started.

PANELBOARD SIMPLIFIED BY MOUNTING RELAYS ON BACK

Accidental Operation of the Relays Avoided by
Placing Them Above Mopping and Sweep-
ing Zone

By mounting a group of time-element overload relays on the rear of the switchboard as shown herewith, the United Electric Light Company of Springfield, Mass., greatly simplified the front of the panels and brought the relays well above the "high-water mark" of the mopping zone. The only apparatus on the front of each panel consists of the trip and operating handles for one Condit D-12 oil-switch, a General Electric polyphase watt-hour meter and a Westinghouse alternating-current ammeter. The switch rods con-



TERMINALS ARE PROTECTED BY ASBESTOS-BOARD HOUSING

necting the bell-crank levers are carried under the floor, thus making unnecessary the board walk sometimes seen behind switchboards.

The terminals of the relays are protected, being housed in asbestos board boxes screwed into the angle-irons forming the panel framing. The boxes are 10 in. (25.4 cm.) deep, 8 in. (20.3 cm.) high, and either $3\frac{5}{8}$ in. or 5 in. (9.2 cm. or 12.7 cm.) wide, according to whether one or two sets of relay binding posts are housed in each box. The asbestos sides are $\frac{3}{8}$ in. (0.95 cm.) thick, and the top, front and bottom of each box is

of a single sheet-iron plate which springs readily when it is desirable to remove the cover to examine the terminals.

OUTDOOR DISTRIBUTION RACK USED FOR OVERHEAD SERVICE

New England Company Builds Neat Structure of
This Character for Supporting Wires on
Outside of Station

An interesting distribution rack used in connection with a substation of the Edison Electric Illuminating Company of Brockton, Mass., is shown herewith. From the low-tension transformer coils and switching equipment the various circuits are brought out of the substa-



DISTRIBUTION RACK ON EXTERIOR OF STATION

tion in conduit and are extended upward along the outer wall to potheads that are connected with horizontal conductors supported on a pipe and angle-iron frame. From this structure the overhead circuits proceed to the various pole-line structures. The arrangement is neat, flexible and unusually satisfactory from the standpoint of mechanical strength.

INTERESTING RECORD OF POLES SET PER MAN

One Hundred and Twenty Poles Set in Day by
Fifteen Men—Method of Subdividing Labor
to Keep Each Man Busy All the Time

BY J. F. KEYS

The writer was interested in the article on page 1105 of the Dec. 8 issue of the ELECTRICAL WORLD recording the Georgia Railway & Power Company's record of setting sixty-eight poles in one day with twelve men. The construction gang of the Central Kansas Power Company of Gypsum, Kan., recently, with fifteen men, including a foreman, set and tamped 120 30-ft. and 35-ft. (9.1-m. and 10.6-m.) creosoted yellow-pine poles in one day, thus exceeding this excellent record of poles set per man employed by nearly 40 per cent.

The labor was subdivided as follows: Instead of the erecting gang tamping the poles in as is the usual custom, they did nothing but lift the poles into the holes. Two gangs of tampers of four men each followed. The work was so arranged that each man was kept busy all the time and had exactly the same duties

to perform at each pole, so that every man soon became skilled in his work. The foreman went with the erecting gang, helping at the butt of the pole and also lining the poles for the two tamping gangs, which followed closely. Good-natured rivalry between the tamperers and the erecting gang, together with a slight bonus for the completion of the job by the end of the week, also helped speed up the work.

OPERATING A BROKEN CHAIN GRATE IN EMERGENCY

Holes in Grate Temporarily Covered with Barrel Staves to Hold Coal Until It Had Coked Sufficiently to Support Itself

An emergency arose recently in a small Western plant wherein it was necessary to operate two 400-hp. chain-grate stokers which had been taken out of service owing to holes in the grate as large as a man's hand. To permit operation under these conditions wooden barrel staves were placed over the holes as they appeared in front of the hopper. The staves prevented the coal sifting through the grates until they were nearly burned through, at which time the coal had coked enough to support itself. This scheme permitted operating the grates satisfactorily until the repair parts arrived.

PULL SWITCHES USED ON WHITE-WAY ELECTROLIERS

Ceiling-Type Pull Switch Having a Short Operating Chain Which May Be Pulled by Patrolman Is Used

Multiple electroliers for white way lighting are often switched by patrolmen on bicycles or motorcycles. Sometimes each individual post has its own switch and sometimes groups of posts are switched from one point.



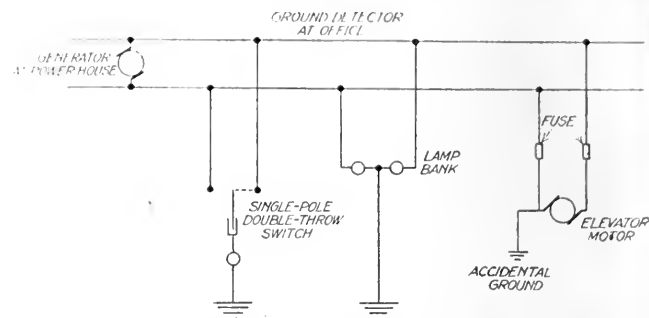
WHITE WAY LAMP EQUIPPED WITH PULL SWITCH

If switches of the knife type are placed in the base of posts, the patrolman must dismount at each switch to operate it. This inconvenience can be avoided by mounting a ceiling type pull switch equipped with a short operating chain having a ring at the end at each switch point. This arrangement is unobtrusive, yet the switch may readily be operated by the patrolman by means of a short hook stick, without the necessity of dismounting.

GROUND DETECTOR FOR ELEVATOR CIRCUITS

Device Installed in Central-Station Office Notifies Company's Employees of Grounds Occurring on Consumers' Premises

A device consisting of a lamp bank and a water rheostat is effectively used by the Memphis (Tenn.) Gas & Electric Company for detecting grounds on consumers' elevator circuits. Pairs of lamps are conveniently placed in various places in the company's of-



WIRING DIAGRAM OF GROUND DETECTOR FOR ELEVATOR CIRCUITS

fice and testing rooms so that a ground can be immediately detected by any one observing their behavior. Two lamps are placed in series across the line with their common point connected to a grounded water pipe. The water rheostat, as shown in the diagram, has one terminal attached to the water pipe and the other arranged so that it may be connected to either side of the line by means of a double-throw, single-pole knife switch.

If a motor circuit becomes grounded, the lamp on the grounded side of the line will be extinguished. The water rheostat is then connected to the opposite side by means of the knife switch and its resistance increased until sufficient current is created to blow the fuse of the offending circuit. If the operator of the motor replaces the fuse, it will immediately be blown again, so that after several trials he will invariably call up the company and report the trouble. A man can then be sent to the premises from which the difficulty is reported, and the exact location of the ground will be discovered in short order.

When the ground is within the motor the lamps will be alternately lighted and extinguished as the elevator goes up and down and reverses the current through the motor. By observing the time interval between reversals the central-station employees can tell approximately what building the ground is in, since in the high buildings the time between reversals is longer than in low buildings.

When this system was first installed it was necessary because of faulty cable to use high-wattage lamps to give a high resistance to ground. Since the cable trouble has been removed the size of these lamps has been reduced to 10 watts. The accuracy of the device is also increased with the decreasing of the resistance to ground.

It has been found that the device always warns the central-station men of grounds and performs a two-fold protective function in eliminating loss of current to ground or possible short circuit from grounds on both sides of the circuit.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

UTILITY AGREES WITH CITY TO THAW FROZEN PIPES

Ohio Company Bills City at \$15 per Service for
Water Pipes Up to 1½ In. Diameter and
Along Established Lines

A contract has just been entered into with the city of Sandusky, Ohio, whereby the Sandusky Gas & Electric Company is paid \$15 per service for thawing out frozen water pipes up to and including 1½ in. (3.81 m.) in diameter. For each ½ in. (1.27 cm.) increase in size of pipe above 1½ in. \$1 additional is charged. This price covers the work along the established lines of the company. Where an extension of more than 200 ft. (60.9 m.) is required \$1 extra is charged for each additional 100 ft. (30.4 m.) of service extension.

In addition, the city furnishes the necessary vehicle to convey the equipment from place to place and an experienced waterworks man to look after the water piping. The city makes all arrangements with the customer and makes collections, and the company bills the city each month for the service rendered. The average time required to thaw out an ordinary service after the current is applied is about eleven minutes.

This does not only mean a substantial profit to the company, but a considerable saving to the city, for were it not for this system being employed, in many instances it would become necessary to take up the pavement in the streets in order to thaw out the frozen pipes by other methods.

The rates in this case are similar in many ways to those used by the Binghamton (N. Y.) Light & Power Company. The latter were described in the ELECTRICAL WORLD for Feb. 16, page 363. Both properties are under the management of the W. S. Barstow Management Association, Inc.

SMALL-COMPANY RATE ADVANCE ANNOUNCEMENT

Interesting Letter That Served to Convince the
Public of the Fairness of a 15 per Cent
Increase in Company's Charges

As a small-company letter which put the need of a 15 per cent rate advance in a few words and served to convince the public of the fairness of the company's position, the following is interesting. The property is situated in Randolph, Mass., a town of fewer than 5000 inhabitants:

The cost of producing and distributing the electricity used by our customers in Randolph and Holbrook has almost doubled during the past year, due to the increased cost of coal, labor, material, etc. We have kept our local expenses at the lowest possible figure consistent with the maintenance of the best service that the company could give to you.

These increased costs, due solely to war conditions, over which we have no control, make it necessary for us to ask

your co-operation by paying for electricity used for lighting, from Feb. 1, 1918, 16 cents per kilowatt-hour, subject to a discount of 1 cent per kilowatt-hour for payment in ten days, making a net rate of 15 cents per kilowatt-hour. This is an increase of but 15 per cent as compared with increases of from 25 per cent to over 100 per cent in the cost of coal, material, supplies and other expenses necessary to supply you with this service. This advance in the price of electricity is necessary to enable this company to continue to pay for energy, labor, taxes, insurance, interest, depreciation, and for the repairs and maintenance required to keep the property of the company in fit condition to serve you.

This increased cost must be regarded as being entirely due to present war conditions, and immediately upon the company receiving any relief from the same a reduction in the price will be made at once in proportion to the relief so secured.

I have the co-operation of E. S. Hamblen, our former superintendent, in solving the problems brought about by these war conditions.

Thanking you for the co-operation you have always given to me and to this company, and trusting you will give me an opportunity to talk with you personally if you feel that this is not a fair rate, I remain yours very truly,

RANDOLPH & HOLBROOK POWER & ELECTRIC COMPANY.

By T. H. DOWD, Superintendent.

A SCHEME FOR ENDING APPLIANCE REPAIR FRAUDS

System of Checks Containing All Repair Data De-
signed to Prevent Customer from Getting
New Devices for Broken Ones

A new repair check system has just been devised by the Harrisburg Light & Power Company of Harrisburg, Pa., for the purpose of putting an end to the petty fraud that creeps into repair department work unless some measure of protection is taken. Not a little trouble has been met in the past owing to the fact that customers would bring in a flatiron or some other heating device to be repaired and on receiving it back would assert that it was not their appliance and that another one had been substituted. Of course, the repair department record would show that an appliance had been received and returned, but it would not prove that it was the identical appliance brought in by this particular customer. The tag, for instance, might have been changed; yet upon investigation of these claims it was found repeatedly that the customer was simply trying in this way to get a new appliance for an old one.

To make this kind of thing impossible the Harrisburg company is now using a simple system of checks numbered in duplicate. The check which is attached to the appliance bears full information as to the number of the appliance, the repair needed, promise of delivery, name of the owner and the charge agreed upon for the work. The stub is given to the owner and must be surrendered and signed in order to secure the appliance. This protects both the customer and the company and does not

put the company in a position where it has to give the customer the benefit of the doubt and present him with a new appliance in order to avoid losing his good will.

COMBINATION GAS AND ELECTRICAL BILLING

Quincy (Ill.) Company Uses Combination Reading Slip, Combination Bill and Combination Ledger—Finds System Highly Satisfactory

A number of combination gas and electric companies have recently found it advisable as a matter of economy to combine gas and electric meter reading and

page—are reproduced herewith. The gas and the electric meter are read at the same time. The company uses the continuous system of meter reading and has a discount day every fifth day. This plan economizes not only the time of the meter reader, who makes but one round to get all readings, but also the time of the customer, who needs to call at the office only once to pay both bills. If the customer pays his bills by check, the combination bill saves him postage and effort. The plan of having a discount day every fifth day is considered a good compromise between the old idea of a discount day once a month and that used by larger companies of having every day a discount day. The combination ledger, which is the loose-leaf type, is a

GAS AND ELECTRICITY																																																											
ACCOUNT No.										LOCATION										GUARANTEED BY										OWNER																													
NAME										EMPLOYED AT										TENANT																																							
FLOOR										ROOM										NATURE OF BUSINESS										DEPOSIT No.										AMOUNT										APPLICATION No.									
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MARCH 1917									
To QUINCY GAS, ELECTRIC & HEATING CO., Dr.									
GAS					ELEC. LIGHT				
Meter Reading, Mar.....1917.....00					Gross, Discount, Net, Balance, Total,				
Meter Reading, Feb.....1917.....00					Gross, Discount, Net, Balance, Total,				
Ca. Feet of Gas Consumed.....00 @ .					Gross, Discount, Net, Balance, Total,				
25c per 1000 cu. ft. added to Net Amt. if not paid by date stamped on margin of bill.					Gross, Discount, Net, Balance, Total,				
ELEC. POWER					ELEC. POWER				
Meter Reading, Mar.....1917.....K. W. H.					Gross, Discount, Net, Balance, Total,				
Meter Reading, Feb.....1917.....K. W. H.					Gross, Discount, Net, Balance, Total,				
Difference,.....K. W. H. @					Gross, Discount, Net, Balance, Total,				
Constant,.....K. W. H. @					Gross, Discount, Net, Balance, Total,				
5 per cent added to Net Amt. if not paid by date stamped on margin of bill.					Gross, Discount, Net, Balance, Total,				
Connected Load in Watts.....					Gross, Discount, Net, Balance, Total,				
Merchandise Account—					Merchandise Account—				
Current Month, Previous Mo., Total,					Current Month, Previous Mo., Total,				
Maintenance of Inverted Gas Area during.....@.....per mo. Balance, Total,					Maintenance of Inverted Gas Area during.....@.....per mo. Balance, Total,				
Sign and Window Lighting Contract, February 1st to March 1st, 1917, Balance, Total,					Sign and Window Lighting Contract, February 1st to March 1st, 1917, Balance, Total,				
TOTAL					TOTAL				

GAS										LIGHT										POWER									
Month and Date Read	Reading	In/Ts	Month and Date Read	Reading	In/Ts	Month and Date Read	Reading	In/Ts	Month and Date Read	Reading	In/Ts	Month and Date Read	Reading	In/Ts	Month and Date Read	Reading	In/Ts												
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Mar.			Mar.			Mar.			Apr.			Apr.			Apr.														
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FORMS USED IN THE HANDLING OF GAS AND ELECTRIC ACCOUNTS IN COMBINATION: (A) COMBINATION LEDGER PAGE FOR LOOSE-LEAF SYSTEM; (B) THE COMBINATION BILL; (C) THE COMBINATION READING SLIP

billing. This is not a new practice, but one that has been growing for some time and has lately received a noticeable increase.

For three years the Quincy (Ill.) Gas, Electric & Heating Company has been using combination meter-reading and billing forms. Three of the printed forms—a reading slip, a combination bill and a ledger

time saver for the office force when used in connection with the combination reading slip.

In speaking of the combination plan of billing, and reading meters, H. O. Channon, manager of the company, said: "The system effects a saving in labor and material and gives good satisfaction to the customer, so it seems that there is little excuse for using any other."

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Notes on the Design of Electromagnetic Machines.—STANLEY PARKER SMITH.—In Part I of the article the author dealt with some of the main principles underlying the design of alternating-current generators. In Part II these principles were applied to the design of a low-speed, three-phase alternator, giving 750 kw. at 2200 volts when running at a speed of 250 r.p.m. In this, the third, part a three phase turbo-alternator is designed to give 2000 kw. at 3000 r.p.m. at a line voltage of 500, and the mechanical stresses in the rotor are discussed.—*London Electrician*, Feb. 1, 1918.

Lamps and Lighting

Economics in the Operation of Large Lighting Installations.—CLARENCE L. LAW and JAMES E. BUCKLEY.—This paper describes the details and routine necessary to the economic operation of lighting installations served by central stations, with particular reference to the systems of the illuminating engineering department of the New York Edison Company. Surveys and subsequent recommendations based thereon cover the preliminary steps and layout of a new installation or in the improvement of an old one. The paper includes sample illumination tests, tabulations and curve sheets showing location of lamps, horizontal intensities, average foot-candles, current consumption and weather charts.—*Transactions of the Illuminating Engineering Society*, Feb. 11, 1918.

Generation, Transmission and Distribution

Electrical Propagation Upon an Open-Circuited Line.—E. BRYLINSKI.—A very elaborate mathematical discussion of this subject by means of methods derived directly from the methods previously employed by Lord Kelvin and Vaschy in the case of a short circuit. It seems evident that the closing of a circuit breaker in an open-circuited line in good condition is not in itself dangerous. Were there condensers, coils or other apparatus in the circuit, it might be otherwise; but this would present a more complicated case demanding new studies.—*Revue Générale de l'Electricité*, Jan. 12, 1918 (reprinted from the *Bulletin de la Société Internationale des Electriciens*).

Water Powers of New England.—HENRY I. HARRIMAN.—After giving an outline of the amount of water power developed in the New England States, the additional amount which can be developed, the amount of coal which would be saved thereby, and the total fall in the principal rivers of New England, the author discusses the relative economy of steam and water-power generating stations. The latter involves a consideration of the ability of each to carry peaks and loads of high load factor, the requirements of the water power for auxiliary electricity during periods of low river flow, and the ability of the steam station to supply this need without added capital expense. Basing his

statements on some reliable figures, the author says that the fixed charges on a steam plant might be almost half of those on the corresponding hydroelectric plant, whereas the operating expense for the hydroelectric plant may be one-eighth to one-twentieth that of a steam plant, this range being due to the difference in sizes of steam plants, their load factors and efficiencies. Whether the statement that one-half of the capacity of central stations is idle 95 per cent of the time be correct or not, it is certainly true that every station must have a very large carrying capacity during the greater portion of the year; but, fortunately for both steam and hydroelectric plants, the period of low water occurs during the summer and early fall, when the central station load is at its minimum. All of these facts lead to the conclusion that the large steam plant and hydroelectric station can be developed economically, depending on the service for which it is best suited and each giving to the other the economy which neither could have alone. In closing, the author says that the water powers of New England are to-day producing more than 2,000,000,000 kw.-hr. of energy. If this energy were produced by coal, it would mean an annual consumption of 3,000,000 tons.—*Journal of the Boston Society of Civil Engineers*, December, 1917.

Forces Which Act Upon a Transmission Line.—CHARLES R. HARTE.—Data are given by means of which the factor of safety of a pole line can be calculated.—*Electric Railway Journal*, Feb. 23, 1918.

Traction

Saving Fuel Through Operating Economies.—A committee of engineers shows how more than 25,000 tons of coal can be saved yearly on Washington electric railways. The report by Messrs. Renshaw, Lamber and Layng estimates that an annual saving in coal of 25,790 tons could be made by the Washington electric railways, as follows:

Source of Saving	Tons per Year
Skip-stop plan	9,400
Double berthing and modifying rapid-transit stops.....	600
Eliminating unnecessary mileage in non-rush hours.....	3,220
Reducing heat 50 per cent.....	2,250
Shutting down small plants to effect the same load reduction as would carrying all Capital Traction Company's load by Potomac Power Company.....	9,700
Staggering office hours of government departments.....	620
Total	25,790

If heat is shut off during peaks instead of being reduced 50 per cent all day, the saving would be 1500 tons instead of 2250 tons and the above total would be correspondingly reduced.—*Electric Railway Journal*, Feb. 9, 1918.

The Coire-Arosa Railway.—An account, taken from the official publication of Brown, Boveri & Company, of the Coire-Arosa electric railway in Switzerland. Energy at 2000 volts direct current is supplied by a trolley line actuated from a power house at Coire, each

car containing four series motors.—*Revue Générale de l'Electricité*, Jan. 12, 1918.

Installations, Systems and Appliances

The Electric Furnace for Melting Ferromanganese.—At a meeting of chemists in Sweden J. Harden stated that the electric furnace was particularly suitable not only for the production of ferromanganese but also for melting it. The ease of control of temperature afforded by the electric furnace and the avoidance of loss of material which it insures render this the best means of melting the alloy. Any type of furnace will serve, but the induction type is the most economical. The cost of operation is about 20 shillings per ton of ferromanganese. In addition to the even temperature maintained, there is a considerable economy of time and material, important items, especially with ferromanganese at its present price of £75 per ton.—*London Electrical Review*, Feb. 1, 1918.

Motor Versus Engine Drive for Pumping Plants.—This article summarizes an investigation of practices and tests of pumping equipment that show advantages of electric drive. Observations from practice, comparisons of electricity and other forms of power for pumping, electric pumping costs, selection of the motor and the economics of operation are taken up.—*Railway Electrical Engineer*, February, 1918.

Wires, Wiring and Conduits

Combined Table of Sizes in the Principal Wire Gages.—This table combines in one series the sizes in the American (B. & S.) steel, Birmingham (Stubs'), British standard and metric wire gages, arranged in order of diameters of wires. It gives the diameters of all the gage numbers in these five systems, in mils, inches and millimeters, also the cross-sections in square mils, circular mils, square inches and square millimeters. The table is specially useful to manufacturers who wish to determine the nearest equivalent in American or British gage sizes of wires specified in millimeters or square millimeters, or vice versa.—*Bureau of Standard Circular* 67.

Electrophysics and Magnetism

A General Method for Studying Periodic Currents.—JOHN MILLS.—The method illustrated may be summarized as follows: (1) The concept of the vector operator i ; (2) the concept of a rotating vector and its expression in an equation; (3) the rate of change of a rotating vector; (4) the concept of a conjugate vector; (5) the representation of a simple harmonic motion, e. g., an alternating current, by the sum of two conjugate vectors; (6) the representation of a damped alternating current by the sum of two conjugate vectors which are similarly reduced exponentially. With the tools thus obtained the transients of spark-set wireless transmitters, the oscillations of tuned and coupled circuits, the currents in unbalanced three-phase circuits, the impedances of transmission lines and other similar magnitudes may be dealt with quantitatively by purely algebraic methods. As a by-product of this method a method is suggested for approaching trigonometry which might be used with some types of students to shorten the time now required for its study.—*Bulletin of the Society of Engineering Education*, January, 1918.

Electrical and Thermal Properties of Iron Oxide.—D. C. BIDWELL.—Data on the electrical resistance and thermo-electric power of specimens of iron oxide, with information on thermal conductivity of Fe_2O_3 . The work is an extension of previous research, having been carried to the melting point of the oxides studied (1520 deg. C.). The electrical resistance in the case of Fe_2O_3 is found to obey the exponential law suggested by Königsberger. When plotted to the corresponding logarithmic equation the two transformations revealed by thermo-electric power lines are strikingly corroborated. Owing to the change in composition of Fe_2O_3 , which occurs on heating, the pure temperature variation is masked, but a wide difference from the behavior at Fe_2O_3 is shown. The change of thermal conductivity of Fe_2O_3 with temperature is found to be a linear one up to 1050 deg. C., the limit of the investigation, although a transformation takes place at 720 deg.—*Physical Review*, December, 1917.

Small Electromagnet for Medical Men.—In order to facilitate the work of the surgeon who wishes to pick out small particles of iron from the human body, Prof. G. Sultan has devised a small handy electromagnet. The magnet is held by a fork which is pivoted on a small stand and can thus be swung around and inclined at will; the magnet can further be shifted in its fork by means of a hand wheel, so that the conical pole piece can be adjusted to any particular spot. The instrument is illustrated in the *Elektrotechnische Zeitschrift* of Oct. 8, 1917.—*London Engineering*, Jan. 25, 1918.

Electrochemistry and Batteries

Storage Batteries on the Italian Railways.—FRANCESCO ROSSI.—An account of the use of storage battery cars on the state railways of Italy and of their costs in comparison with steam traction. The author figures a difference in their favor as regards operating charges of 24.6 per cent and predicts a wide and varied use for the "automotrici" and storage-battery locomotives in Italian industry after the war.—*L'Elettrotecnica*, Jan. 5, 1918.

Telegraphy, Telephony and Signals

Telephony Over Telegraph Lines.—REGNONI.—A description of the Castelli and other apparatus for establishing telephonic communication over a single-wire telegraph line with return through the earth. The problem is, of course, hardest where there is induction to be overcome. V. E. Castelli, chief inspector of the Italian state railroads, has perfected two sets of apparatus—one for short and one for long distances.—*Revue Générale de l'Electricité*, Jan. 12, 1918 (abstracted from the *Rivista Tecnica delle Ferrovie Italiane*, July, 1917).

Loading Coils Versus Repeaters.—W. N. FURTHMANN.—In previous articles on loading coils and repeaters the discussion has shown that the difference of impedance of two telephone circuits or sections it is proposed to join causes reflection losses in telephone transmission. Losses of this kind are present in sections composed either of loaded or non-loaded conductors. The author points out that in loading a telephone circuit it is necessary to consider these losses, as they vitally affect the amount of current that will be received at the end of the line. Since loading coils are fundamentally required to insure a sufficient amount of current at the receiving end of the line, it follows clearly that terminal transformers should be employed in the

common cause. Terminal transformers of high efficiency are certain to contain some transmission loss. The problem involved in their use, therefore, requires careful analysis. They cannot consistently be used where their inherent loss is greater than the good they are to accomplish. The author brings out data in the form of patents which show on their face that terminal losses were not considered in the original invention of a repeater.—*Telephone Engineer*, February, 1918.

Telephone Exchange Transfers and Their Organization.—F. G. C. BALDWIN.—The author points out that transfers may be effected in three ways, as follows: (a) By transferring each line independently; (b) by transferring the subscribers in groups, and (c) by transferring the whole of the lines at one operation. The author points out that method (a) possesses certain commendable features, but traffic considerations unfortunately preclude the adoption of this method. Method (b) has similar, although less, serious objections. Method (c) is the one usually adopted. From a traffic point of view difficulties are reduced to a minimum; the actual operation can be carried out expeditiously—the time being measured in seconds—and a period can be selected for the change when it is known that the traffic will be at a minimum and when least possible interruption to the service will ensue. The author discusses in detail line plant considerations, methods of effecting transfer, preparatory line work, preparatory work at subscribers' stations, preparatory work at old exchange, at new exchange, final preparations, the transfer operation, and traffic and operating considerations.—*London Electrician*, Feb. 1, 1918.

Miscellaneous

Gravitational Repulsion.—FRANCIS E. NIPHER.—In this paper the author describes experiments which, he says, indicate that gravitational attraction between masses of matter depends upon their electrical condition. Not only has gravitational attraction been diminished by electrification of the attracting bodies, says the author, when direct electrical action has been wholly cut off by metal shields, but it has also been made negative or converted into repulsion. This result has been obtained many times. On one occasion the repulsion was made somewhat more than twice the normal attraction. The peculiar feature of the experiments was, however, that passing direct current through the bodies being studied had no apparent effect, the force of gravitation being offset only by using alternating current.—*Transactions of the Academy of Science of St. Louis*, Vol. XXIII, No. 5.

Distillation of Coal.—E. PIERNET.—A plea for distilling all coal that can be so treated for fuel purposes and an account of efforts along this line made in England, Switzerland and Germany. The author says also that by the use of special apparatus tar and pitch may be utilized directly as fuel.—*Revue Générale de l'Electricité*, Jan. 12, 1918.

Masonry in the Central Station.—L. CONGE.—An inquiry into the building and care of furnace walls. The author takes up the quality of the material, considering both ordinary and refractory brick and also the mortar best suited to the work; the care that should be exercised in construction, and the reactions from the temperature or from the composition of the cinders. The effects of calcareous water on masonry are also

mentioned.—*Revue Générale de l'Electricité*, Jan. 12, 1918.

A Substitute for Copper.—German industrial circles are very much interested in the discovery of a new alloy which, it is said, will replace copper for technical purposes. The new metal is said to have a greater density than copper and lower elongation, while being an excellent conductor of electricity. A certain number of tests have already been made on the alloy, and a representative of the A. E. G. is in negotiation with the inventor with a view to acquiring the patent rights. The A. E. G. will probably grant a license to a large foundry at Lausanne to manufacture the substitute. "Lack of detailed information," says the editorial comment, "forbids us to comment with any approach to conviction on the matter, but we may point out that hitherto experience has indicated that any alloy of two metals may be expected to possess a higher resistivity than one of its constituents. Hence, while it would be reckless to deny the possibility of producing an alloy with high conductivity, we are very skeptical as to the reliability of the inventor's claim in this respect."—*London Electrical Review*, Jan. 25, 1918.

Turbo-Rotor Cap Rings.—R. ROBERTS.—The author investigates the calculation of stress in turbo-rotor cap rings and by means of examples shows how these stresses may be calculated for some commonly used designs. In conclusion, the points that may be considered when designing these cap rings are summarized.—*London Electrician*, Jan. 18, 1918.

Electric Ship Propulsion.—A novel method of operating certain classes of overseas traffic is proposed by H. de M. Snell, which consists essentially in using one set of engines for a number of hulls. With the system proposed by Mr. Snell a set of Diesel engines driving electric generators is fitted in a steel caisson, which also contains the engineer's quarters. This caisson is mounted detachably on the stern of any one of perhaps five hulls. These hulls are to be fitted with electric motors driving the screw but with no other propelling machinery. On arrival at port the whole caisson is to be lifted by pontoons from the hull of the incoming vessel and transferred to one about to depart. This operation can, it is claimed, be effected very rapidly by the use of special pontoons. As the machinery caisson is to be mounted on the stern of the hulls, the whole of the propelling machinery is confined to the after end of the boat. It is claimed that with this arrangement more effective subdivision of the vessel is possible, giving greater security against torpedo attack.—*London Engineering*, Jan. 25, 1918.

Luminosity of Rectifier Electrode.—HARVEY B. LEMON.—In setting up as a demonstration experiment the well-known arrangement for rectifying an alternating current, the essential part of which is an aluminum rod and lead plate in 10 per cent sodium-phosphate solution, the following observation was made: When the aluminum rod is positive—that is to say, when the current is in such direction that it will not pass through the rectifier—a very distinct luminosity appears over the surface of the aluminum, and if the applied potential is as high as 250 volts, this luminosity becomes quite brilliant enough to be observed by a spectroscope. The observer asks for explanations of this phenomenon.—*Science*, Feb. 15, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

NEW OFFICERS OF THE ENGINEERING COUNCIL

**J. Parke Channing Elected Chairman and Committees
Appointed—Definition of the Council, Representing Now 33,000 Members**

At the first annual meeting of the Engineering Council, on Feb. 21, J. Parke Channing was elected chairman, Harold W. Buck first vice-chairman, George F. Swain second vice-chairman and Alfred D. Flinn secretary. The following committees were appointed:

Executive committee: The chairman, the two vice-chairmen, and David S. Jacobus, Calvert Townley, George J. Foran.

Finance committee: E. Wilbur Rice, Jr., chairman; Charles F. Loweth, Sidney J. Jennings, David S. Jacobus.

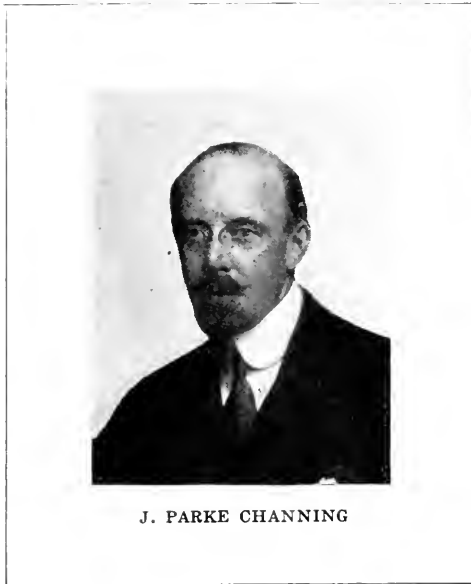
Rules committee: J. Parke Channing, chairman; Clemens Herschel, Nathaniel A. Carle, Irving E. Moulthrop.

Public affairs committee: Charles Whiting Baker, chair-

R. Richards, Charles L. Edgar, Carl Scholz, David Moffat Myers, Edwin Ludlow, Harold W. Buck.

The definition of the Engineering Council that was adopted declared that "The Engineering Council is an organization of national technical societies of America created to provide for consideration of matters of common concern to engineers, as well as those of public welfare in which the profession is interested, in order that united action may be made possible."

The Engineering Council is now composed of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, having a membership of 33,000 and known as "founder societies." The new chairman, J. Parke Channing, is vice-president of the Miami Copper Company and the General Development Company.



J. PARKE CHANNING

man; George F. Swain, Benjamin B. Thayer, E. W. Rice, Jr., Charles E. Skinner.

American engineering service: George J. Foran, chairman; George C. Stone, Alfred D. Flinn, Dr. Addams S. McAllister, Edward B. Sturgis, secretary.

War committee of technical societies: D. W. Bruntno, chairman; Arthur H. Storrs, secretary; James M. Boyle, Nelson P. Lewis (American Society of Civil Engineers), Edmund B. Kirby (American Institute of Mining Engineers), A. A. Greene, Jr., R. N. Inglis (American Society of Mechanical Engineers), Harold W. Buck, Dr. Addams S. McAllister (American Institute of Electrical Engineers), Dana D. Barnum, E. C. Uhlig (American Gas Institute), Joseph Bijur, Dr. Charles A. Doremus (American Electrochemical Society), Louis B. Marks, Preston S. Millar (Illuminating Engineering Society), Christopher R. Corning, George C. Stone (Mining and Metallurgical Society of America), Henry Torrance, F. E. Matthews (American Society of Refrigerating Engineers).

Fuel conservation committee: L. P. Breckenridge, chairman; Ozni P. Hood, secretary; Robert H. Fernald, Charles

Freezing While Nature's Storehouses Are Filled With Heat



—Boston Sunday Advertiser and American.

Presenting the Case for the Utilities

Committee Representing Utility Associations Brings to the Attention of Washington Authorities the Critical Situation Created by the War

A COMMITTEE appointed to represent four national associations of utilities in bringing to the attention of the authorities at Washington the critical situation in the public utility industry as brought about by war conditions has submitted a report. The committee consists of P. H. Gadsden, E. K. Hall and H. H. Crowell. Its report is made to the National Electric Light Association, American Electric Railway Association, American Gas Institute and National Commercial Gas Association.

It is the opinion of the committee that if the credit of the public utilities is to be preserved care must be taken of four phases of the situation:

1. Rates must be increased sufficiently to absorb the increased costs of producing the service.
2. The utilities must be relieved during the period of the war of all non-essential and unproductive requirements, such as paving, undergrounding of wires, duplication and unnecessary extension of service.
3. Some way must be found to enable the utilities to take care of obligations maturing while the war lasts.
4. Assistance must be provided to enable the companies

to finance the unavoidable extensions of service made necessary by the nation's war program.

This analysis of the situation was presented by the committee to John Skelton Williams, Comptroller of the Currency. In his report to Congress, Comptroller Williams called attention to the conditions confronting the utilities, as stated in the ELECTRICAL WORLD of Feb. 9, 1918, page 318.

As a result of this analysis of the situation by the Comptroller, supplemented by additional information and representations to the Treasury Department by the committee, Secretary of the Treasury McAdoo presented the matter to the attention of President Wilson. The letter of Secretary McAdoo and the reply of the President are published below. The report of the committee continues:

The capital issues committee, which will be made a part of the organization of the War Finance Corporation, and before which your committee had a hearing lasting practically an entire day, has already stated that the policy of the national government will be to discourage the sale of

Maintain Utilities at Maximum Efficiency, Says the President

SECRETARY McADOO TO PRESIDENT WILSON

February 15, 1918.

DEAR MR. PRESIDENT:

I beg to hand you herewith several memoranda and letters relating to street railway and other local public utilities furnishing light, heat and power, which I have been asked to bring to your attention by a committee representing public utility interests.

These papers indicate the existence of genuine apprehension regarding the adequacy, under present conditions, of the services and rates of local public utilities. The view is expressed that increased wages and the high cost of essential materials and supplies have affected them as they have affected everybody else, and that united effort will be necessary in order to meet alike the public requirements for service and the corporate financial needs upon which that service depends.

As Secretary of the Treasury I must take official notice of these matters. It is obvious that every part of our industrial and economic life should be maintained at its maximum strength in order that each may contribute in the fullest measure to the vigorous prosecution of the war. Our local public utilities must not be permitted to become weakened. The transportation of workers to and from our vital industries and the health and comfort of our citizens in their homes are dependent upon them, and the necessary power to drive many of our war industries and many other industries essential to the war is produced by them. It may be that here and there, because of the prominence given to less important interests immediately at hand, state and local authorities do not always appreciate the close connection between the soundness and efficiency of these local utilities and the national strength and vigor and do not resort with sufficient promptness to the call for remedial measures. In such cases I am confident that all such state and local authorities will respond promptly to the national needs when the matter is fairly and properly brought before them.

Our public service utilities are closely connected with and are an essential part of our preparations for and successful prosecution of the war, and the unfavorable tendencies which the accompanying papers reveal may most effectively be checked, wherever they may be found to exist, and the needed relief obtained, only by prompt action on the part of the respective local authorities.

I earnestly hope that you may feel justified in expressing the conviction that the vital part which the public utilities companies represent in the life and war-making energy of the nation ought to receive fair and just recognition by state and local authorities. Cordially yours,

W. G. McADOO.

The President, the White House.

THE PRESIDENT'S REPLY

THE WHITE HOUSE, WASHINGTON,

February 19, 1918.

MY DEAR MR. SECRETARY:

I have examined with care the memoranda and letters which you transmitted to me with your letter of the fifteenth. I fully share the views you express regarding the importance of the public service utilities as a part of our national equipment, especially in war time. It is essential that these utilities should be maintained at their maximum efficiency and that everything reasonably possible should be done with that end in view. I hope that state and local authorities, where they have not already done so, will, when the facts are properly laid before them, respond promptly to the necessities of the situation.

I shall be glad to have you communicate with the local authorities whenever the information in your possession suggests that such a course is desirable and in the national interests. Cordially yours,

WOODROW WILSON.

Hon. William G. McAdoo, Secretary of the Treasury.

securities, either public utility, municipal, state or otherwise, for non-essentials. It will be the policy of the government to mobilize all money, labor and materials for the successful prosecution of the war and eliminate for the period of the war non-essential expenditures. When this policy is finally put into effect through the enactment of the war finance bill, it should mean that the companies will be relieved of non-essential expenditures, such as unnecessary paving, undergrounding of wires, etc.

As to the matter of financing maturing obligations and extensions and improvements necessitated by the war program, provision is made for this in the war finance bill, Senate No. 3714, reported on Feb. 21 by the Senate committee on finance. The latter committee gave your committee a hearing and has inserted in the bill a clause designed to cover the needs of public utilities as follows:

"(D) To make advances directly (1) to any corporation owning or controlling (directly or through stock ownership) any railroad or other public utility, and (2) to any firm, corporation or association conducting an established and going business whose operations are necessary or contributory to the prosecution of the war; provided that such advances shall be made only in such cases as the board of directors in its discretion shall determine to be of exceptional importance in the public interest. Such advances may be made for periods not exceeding five years from the passage of this act, upon such terms and upon such security and subject to such rules and regulations as may be prescribed from time to time by the board of directors of the corporation, with the approval of the Secretary of the Treasury. The corporation shall have and retain power to acquire additional security from time to time."

The outlook for the public utilities, decidedly more encouraging than it was two months ago, may be summarized as follows:

1. In the matter of rates the President of the United States, the Secretary of the Treasury and the Comptroller of the Currency have officially recognized that it is in the public interest that public utilities be maintained at their maximum efficiency and their rates be adjusted to meet the increased costs of doing business.

2. The national government, through the capital issues committee, has outlined a national policy seeking to discourage unnecessary employment of money, labor and materials during the period of the war.

3. The war finance bill, now on its passage, makes provision for financing the maturing obligations of public utilities and provides a method for financing necessary extensions and enlargements.

The utility associations are issuing a bulletin containing the letters of the President, the Secretary of the Treasury and the Comptroller of the Currency. In conclusion the committee says in its report:

We recommend that the national associations also take steps to present this general matter to the commissions in the different states as a national question, entirely dissociated from any concrete local question of rate increases for any particular company. Until the general situation has been taken up in this way with the various state commissions, we suggest that you urge your members not to formally submit to the commissions the President's and the other letters, except in instances where they are immediately necessary in pending cases.

We recommend that you arrange to furnish your members with as many copies of the bulletin containing these letters as they may require, and that they be distributed generally among the officers and employees of the various companies.

You will notice that the last sentence in the President's letter to the Secretary reads as follows: "I shall be glad to have you communicate with the local authorities whenever the information in your possession suggests that such a course is desirable and in the national interests."

Your committee calls attention to the fact that the authorities in Washington are already overburdened with tremendous and overwhelming responsibilities, and suggests that under the circumstances members should appeal to Washington only in cases of imperative necessity, and then only after first consulting with their own secretaries.

WASHINGTON TELEPHONE CASE BRINGS UP PUBLIC OWNERSHIP

Postmaster General Burleson Offers to Take Over Control and Operation of the Chesapeake & Potomac Telephone Company During War

Postmaster General Burleson, through Washington city post office officials, has offered to the Public Utilities Commission of the District of Columbia to take over the control and operation of the Chesapeake & Potomac Telephone Company in and around Washington for the period of the war, agreeing, if the offer is accepted, to maintain present standards of pay to telephone employees and guarantee to investors the present rate of return on their holdings.

It is believed in Washington that under present District of Columbia laws creating the Public Utilities Commission and outlining its powers and duties the commission has no power to accept such an offer, although it is well understood that the President of the United States, under the blanket war powers granted him by Congress, could issue an executive order making it possible for the commission to accept such an offer if he deemed it wise to do so. Without such an order it is believed that it is not possible for the commission to accept such an offer except by consent of the telephone company. Officials of the company in Washington decline to discuss the offer.

NECESSARY STEPS TO PUT OUT SECURITIES

Capital Issues Committee of Federal Reserve Board Shows What Should Be Done to Get Its Formal Sanction

As stated in the last issue of the *ELECTRICAL WORLD*, approval has already been given by the capital issues committee of the Federal Reserve Board to the issue of securities by some electric utilities. The capital issues committee has now made public instructions with respect to proposed issues of bonds, notes, shares of stock, etc., in part as follows:

Applications should be addressed to the capital issues committee, 718 Metropolitan Bank Building, Washington.

If the purpose is to refund, fund or pay or extend outstanding bonds, obligations or indebtedness, describe fully the nature and character of bonds, etc., to be refunded and state briefly the time or times and the general purposes for which unsecured indebtedness was incurred.

If the issue is to be made for war purposes or to raise capital in connection with war contracts or war supplies, or to provide equipment, buildings or facilities of any kind for war work, full description thereof and amounts needed therefor should be stated.

If any war purposes are involved, reference should be made to the proper governmental authorities at Washington and elsewhere to enable definite information and corroboration to be obtained directly by the committee.

If the issue is deemed necessary on account of any governmental requirement, national, state or municipal, or of any commission or public authority, describe the same in full.

If the issue is deemed necessary for reasons of public health or welfare or other public economic necessity, describe the same in full.

If the issue is made for private financial requirements and no public interests are involved, a very clear exposition of necessity will be desired.

In all cases full reasons should be given why the proposed issues cannot be postponed until after the war.

MUSCLE SHOALS DAM

TO BE CONSTRUCTED

President Authorizes Huge Hydroelectric Project on Tennessee River as Part of New Government Nitrate Plant

President Wilson signed an order on Feb. 25 authorizing the construction of the largest of the dams on the Tennessee River projected some years ago as the Muscle Shoals hydroelectric development.

The construction is to be carried out with funds derived from the appropriation for a government nitrate plant which was made by Congress in 1916, and the hydroelectric plant when completed will become a part of the two nitrate plants now being built near Muscle Shoals at Sheffield, Ala.

These two plants are (1) a factory for the fixation of nitrogen which will produce approximately 20,000 tons of ammonium nitrate a year and will be owned and operated by the United States and (2) a plant owned by the United States but operated by the Air Nitrates Corporation, which will produce 110,000 tons of ammonium nitrate a year.

Electricity used in the operation of these plants will be generated by steam power and will be brought from distant hydroelectric plants for initial operation, but will eventually be produced at Muscle Shoals.

FIXTURE ASSOCIATION HOLDS SECOND ANNUAL CONVENTION

St. Louis Meeting Discusses Advisability of Joining Contractor-Dealers' Association—C. J. Netting, Detroit, Elected President

The feature of the second annual convention of the Lighting Fixture Dealers' Society of America, at the Statler Hotel, St. Louis, on Feb. 15 and 16, was a discussion on the advisability of affiliation by that organization with the National Association of Electrical Contractors and Dealers.

The discussion brought out that the opinion of the fixture association is divided on this point, one faction feeling that the organization should join with the contractor-dealers, and the other that the fixture business is not really an electrical business, but is more of an art dealers' business. The outcome of the discussion was a decision to appoint a committee to consider whether or not the fixture association should affiliate with the contractor-dealers. This committee is to report not later than the June meeting of the National Association of Electrical Contractors and Dealers. Frank Adam of St. Louis had been authorized by the National Association of Contractors and Dealers to issue an invitation to the lighting fixture society to affiliate with the contractor-dealers.

George H. Barnes, Detroit, presented before the association an able paper containing a considerable amount of tabulated data on the cost of handling glass used in the lighting-fixture business. The association gave the executive committee authority to hire an organizer and secretary. J. Callahan, Detroit, was selected.

The following officers were elected: President, C. J. Netting, C. J. Netting Company, Detroit; vice-president, A. L. Oppenheimer, Enterprise Electric Fixture Company, Cleveland; secretary, J. A. Hamilton, Ham-

ilton-Stotter Company, Cleveland; treasurer, H. E. Pauley, Wallbridge & Co., Buffalo; executive committee: W. L. Burgess, Burgess & Ganden Company, Omaha; E. L. Gress, Gress Chandelier Company, St. Louis; Albert Jacobson, Kansas City (Mo.) Chandelier Company; George H. Barnes, George H. Barnes Company, Detroit.

ASSOCIATED MANUFACTURERS WORK ON INTERNATIONAL TRADE

At New York Meeting Further Progress Is Made in the Consideration of Tariff Matters Affecting the Electrical Manufacturers

A meeting of the international trade committee of the Associated Manufacturers of Electrical Supplies was held at the offices of the association, New York, on Feb. 14. John J. Gibson, the chairman, presided.

Mr. Gibson stated that since the last meeting of the committee the board of governors had taken action to broaden the duties of the committee so that they would include questions in regard to export as well as import and that the name had been changed from tariff committee to international trade committee.

The chairman reported the results of a visit which he had made to the United States Tariff Commission offices in Washington. Commissioner W. S. Culbertson outlined to the chairman the plans of the commission.

Commissioner Culbertson suggested that in the near future a conference might be held between the commission and representative electrical manufacturers.

Mr. Gibson said that he had discussed with Commissioner Culbertson the advisability of employment by the association of a tariff expert. Commissioner Culbertson expressed the belief that such a plan would provide the surest and quickest way of accomplishing the object sought.

Attention was called to section 704 of the act of 1917 creating the Tariff Commission, which reads:

That the commission shall have power to investigate the tariff relations between the United States and foreign countries, commercial treaties, preferential provisions, economic alliances, the effect of export bounties and preferential transportation rates, the volume of importations compared with domestic production and consumption, and conditions, causes and effects relating to competition of foreign industries with those of the United States, including dumping and cost of production.

This section practically covers the newly added duties of this international trade committee. It practically indicates that the work of the committee is parallel, so far as the electrical industry is concerned, with the work of the United States Tariff Commission.

L. Livingston brought up the question of the customs administrative laws and read a digest which he personally had made with respect to certain divisions of the present law and to the suggested revision thereof. A similar digest, made by William C. Burgess, Trenton, N. J. (which was forwarded to the chairman by B. E. Salisbury, of Pass & Seymour, Inc.), was read.

Copies of the digests of the customs administrative laws, prepared by Messrs. Livingston and Burgess, will be sent to members of the board of governors and of the international trade committee and to chairmen and members of the section sub-committees on international trade.

COMMONWEALTH EDISON RESULTS FOR THE YEAR

Operating Revenue for 1917 Reaches \$25,350,000—
Operations Conducted Without Increase in
Rates, Notwithstanding Higher Costs

Operating revenue of the Commonwealth Edison Company for the year ended Dec. 31, 1917, was \$25,351,585, an increase of \$2,488,467, or 10.9 per cent, over the previous fiscal year.

Net operating revenue for 1917 amounted to \$8,723,702, as compared with \$8,133,073 in 1916. The net for the stock was \$4,677,077, or 10.21 per cent on the company's capital stock, as compared with \$4,399,413, or 9.6 per cent on the stock, for the previous year. Earnings and expenses for the year were:

Operating revenue	\$25,351,585.35	
Operating expenses	\$13,791,636.29	
Appropriated for amortization and depreciation reserve	2,836,246.41	16,627,882.70
Net operating revenue	\$8,723,702.65	
Taxes and municipal compensation.....	2,229,906.74	
Operating income	\$6,493,795.91	
Other income	314,831.27	
Total income	\$6,808,627.18	
Less interest on bonds.....	2,131,550.00	
Available for dividends.....	\$4,677,077.18	
Dividends paid	3,667,352.00	
Balance carried to surplus.....	\$1,009,725.18	

President Samuel Insull speaks in the report of the successful operation without increased rates in spite of higher costs. He also discusses the advantage of ownership of coal mines by the company, whose general coal policy enabled it to provide fuel for domestic consumption at critical periods. Mr. Insull's comments follow in part:

There has been charged against taxes and correspondingly credited to taxes accrued an amount deemed sufficient to cover 1917 municipal, state and federal taxes with the exception of war excess profits taxes. This amount will take care of the increase in the income tax, the rate of which has been increased from 2 per cent to 6 per cent on the earnings of the company before payment of dividends.

While the Treasury Department officials have furnished some information and rulings regarding the war excess profits taxes, they have not yet issued the necessary forms on which the taxes are to be calculated and reported to the Treasury Department, and still further rulings are to be expected.

As therefore more or less doubt now exists as to the exact requirements to be followed in making up the report of excess profits, the company considers it inadvisable to attempt any estimate in the matter, but prefers to wait until it is in position to file the official figures and then whatever amount may be found to be payable will be charged against the company's surplus.

In view of the great increases which have taken place during the past year in the cost of labor and materials as a result of the war, without any increase in rates charged, the board feels that the company may justifiably congratulate itself upon the showing it is able to make.

During the past year the company has derived much benefit from its virtual ownership of its own coal mines, both as to cost and as to its ability to secure coal when needed. During the coming year the company expects further to increase its use of coal obtained from its own mines.

It has been the practice of the company during past years to carry a substantial amount of coal in storage to guard against possible fuel shortage from any unforeseen cause. At the beginning of the winter the company had in storage

approximately 425,000 tons, being largely coal produced at its own mines. The policy pursued has enabled the company to carry on uninterrupted operation of its plants during the period of fuel stress with much less demand on general market supplies than usual. In addition it has been enabled during the most acute periods of the coal famine to help the community by placing at the disposal of the local federal Fuel Administrator substantial amounts of coal for general domestic consumption.

As partially set forth in the report for last year, 10 per cent of additional stock was offered to stockholders, for which quarterly payments were required on the first days of February, May, August and November, 1917. Stock certificates were issued on the latter date, thereby bringing up the total capitalization to \$50,422,826. The proceeds from the sale of this stock provided for additional plant capacity to take care of the increasing business. Owing to the high cost of labor and material, and to the patriotic duty which rests upon all corporations and individuals to conserve capital as well as other commodities while the war lasts, it will be the policy of the company during the year 1918 to curtail as far as possible all extensions of its plants and lines, and it therefore does not contemplate during the coming year any further issues of stock or bonds.

During the year 633 employees of the company entered the service of the United States government, being approximately 13½ per cent of the total number of men in the service of the company. The company can be proud of having so large a proportion of its employees in war service.

During the year approximately 31,000 new customers have been added, thus making at present a total of 351,700 customers. This represents an increase of 97,000 kw. in connected load.

The highest maximum load recorded at any one time during the year was 392,330 kw., which is an increase of 6 per cent over the highest load recorded during the previous year.

The company's connected business (exclusive of electrical energy supplied to other public service corporations) amounted to the equivalent of 15,336,791 50-watt lamps on Dec. 31, 1917.

ILLUMINATING ENGINEERING SOCIETY MEETS AT CHICAGO

M. Luckiesh States that Variety in Home Lighting Is
a Necessity and Should Be Thoroughly
Studied

In an address on "The Lighting Art" before the Illuminating Engineering Society, Chicago, on Feb. 21, M. Luckiesh told of the possibilities in home lighting. Fifty per cent of all lighting, he said, is used in the home and the householder does not appreciate that lighting will make the home more beautiful and a better place in which to live. Light is a medium that is real as pigment, continued the speaker. It may be used for decorative purposes by spraying light to get shade effects and is as effective and pleasing to the eye as any so-called decorations.

The subject of home lighting can be divided into two classes, namely, lighting that deals in facts and lighting that deals with fancy.

The following points showing why and how home lighting should be bettered were brought out by the speaker:

A necessity for variety of lighting, because every one demands variety.

Architects can increase use of light by specifying a greater number of outlets.

The electrical contractor can help by not decreasing the number of outlets specified, in order to reduce the cost.

The fixture manufacturers should co-ordinate art and science in design. Mr. Luckiesh stated that only 1 per cent of lighting fixtures now made combine the two ideal

principles. The fixture should be designed first for science and should then be dressed to give a good appearance.

The fixture dealer should arrange his store so that careful inspection can be obtained. The display room is usually a shower of fixtures arranged for economy of space rather than for artistic purposes.

The lamp manufacturers should put on the market lamps of different tints, tints that are light enough to be felt and not seen.

The fixtures should be so arranged that several sets of lights and shades could be obtained to fit in with the mood of a person at different times.

The decorator should make the walls of a neutral color so that the effects of the different tints can be obtained.

A number of slides were shown that gave the effect of tints of lights by shading the slides with different colors. An ideal dining-room fixture was shown which embodied several new features of fixture design.

"ELECTRIC FURNACES"

DISCUSSED AT CHICAGO

Joint Meeting of Chicago Section of American Institute of Electrical Engineers and Western Society of Engineers

"Electric Furnaces" was the topic of discussion at a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Western Society of Engineers at Chicago on Feb. 25. The members of the Heat Treatment Club—a local body of steel engineers—had also been invited as guests of the engineering societies. The papers of the evening were presented by Thaddeus Bailey, president of the Electric Furnace Company of Alliance, Ohio, and John A. Seede, General Electric Company.

Mr. Bailey's paper was a discussion of the development of resistance-type furnaces of large capacity for operation at temperatures between 400 deg. and 1200 deg. Fahr. The paper brought out the tendency in furnaces of this type toward automatic operation and toward the use of the recuperative principle for making use of heat stored in the metal under treatment. Car-type furnaces taking as much as 600 kw. were illustrated and it was stated that a melting type of furnace now in course of construction for a Western zinc-smelting plant will take 1000 kw.

Annealing and heat-treating furnaces of the resistance type, the author stated, had met with favor more on account of the precision with which heat-treating operations can be conducted than on account of saving in cost over fuel-fired furnaces. In some cases a considerable saving has resulted over other methods, especially in the automatic furnaces, where the labor charge was greatly reduced. In other cases effecting a reduction in the number of imperfect pieces of work also made large savings.

In handling brass, however, these furnaces have without exception shown large savings over crucible or open-flame types, no matter how they were fired. The electric furnaces in handling brass will usually show a zinc saving of from 3 to 4 per cent over the open-flame type and a 2 per cent zinc saving over the crucible type. In the latter, however, the crucible costs are so high that an electric furnace will usually pay for itself in from three to four months even with electricity at 2 cents per kilowatt-hour. Moreover, the furnaces are of direct economic value, as they not only save money but also

save metal that would be lost forever if it were allowed to pass off in fumes.

Typical weekly running sheets shown by Mr. Bailey indicated that a 105-kw. tilting-type furnace making brass cartridge-case slabs could be operated on an average of 340 kw.-hr. per ton, including the heating-up losses.

Mr. Seede showed lantern slides following through the history of the development of the several types of arc furnaces. He spoke strongly for automatic control of arc furnaces, arguing the necessity for quicker action than human minds and hands can give. He also mentioned a new arc furnace installation which is to be operated at temperatures as high as 3300 deg.

The two papers were discussed by C. F. Bussy, Hoskins Furnace Company; J. Gardner, Illinois Steel Company; Douglas Walker, Booth-Hall Company; H. M. St. John, Commonwealth Edison Company; Alfred Hertz, Public Service Company of Northern Illinois; G. D. Hart, National Malleable Castings Company, and C. W. Pendll, Public Service Company of Northern Illinois.

Mr. Gardner stated that the two 15-ton and two 30-ton furnaces of the Illinois Steel Company were operating continuously and were giving no trouble. For the larger furnaces automatic control is very desirable, especially in the manufacture of gun steel and other products of superior grade.

OHIO TRANSMISSION AND DISTRIBUTION PEOPLE MEET

Cincinnati Conference Is Attended by Fifty Representatives from Ohio, Kentucky and Indiana Companies and Arouses Great Interest

The conference of the transmission and distribution committee of the Ohio Electric Light Association at the Hotel Gibson, Cincinnati, on Feb. 21, was the most successful meeting ever held by that organization. Fifty central-station men from Ohio, Kentucky and Indiana companies attended. All of the papers were enthusiastically received and brought forth a good amount of discussion.

A paper on "Shall Transformers Be Banked in a Distribution System?" by M. E. Grah, Toledo Railways & Light Company, discussed the transformer spacing, the percentage of rated load for which the primaries should be fused, whether or not the secondaries should be fused to prevent overload on any one bank of transformers, and what size this fuse should be. The paper contained data helpful in handling these problems.

E. D. Monk, Cincinnati office of the General Electric Company, presented a paper on standardization of transformers, pointing out the trend of the work of the National Electric Light Association, the Electric Power Club and of his company toward the establishment of standards in transformers.

A paper on cut-out problems by C. A. Harrington, Mahoning & Shenango Railway & Light Company, Youngstown, outlined definitely what the operating companies desire a cut-out to do.

The papers were discussed by W. E. Beatty, Cincinnati; G. M. Miller, Louisville; B. L. Chase, Columbus; I. L. Rankin, Chicago; J. W. Bryant, Cincinnati; M. H. Wagner, Dayton; F. R. Healy, Cincinnati, and Messrs. Conrad and Snyder.

Lack of Coal Stops Power in New Jersey

Active Industrial District in Northern Part of State Paralyzed by Inability of Company and Authorities to Get Coal

POWER shortage, due to coal shortage, is now a vital issue in the populous industrial district of northern New Jersey, crowded with manufacturing plants making war materials. Power has been shut off, stopping industries abruptly, because the necessary coal was unobtainable.

The Public Service Electric Company of Newark, supplying this busy district, is on such short rations that its entire service has been in almost constant peril. It has been obliged to stop service on various occasions, with the immediate result that industrial plants discontinued operation and the accompanying result that thousands of men were thrown out of work and production of essential war materials was delayed.

The district in which this situation has developed is not remote from railroad service, it is not far distant from mines abundant with coal. The generating stations of the Public Service Electric Company are accessible by both rail and water; the northern New Jersey district is a grillwork of railroads. Great coal-carrying systems—the Pennsylvania, Reading, Lackawanna, Erie, Lehigh Valley, Baltimore & Ohio, and Central Railroad of New Jersey—stretch their lines thickly through this region.

The story of the inability of the Public Service Electric Company to give continuous service to its thousands of industrial consumers is simply a story of coal shortage. It is a recital of facts that can be found in lesser degree in many central-station properties in different parts of the country, but which are intensified and revealed to public gaze by the extreme degree to which they developed in this case.

Here is a property with new stations, well equipped with thoroughly modern generating apparatus and distribution systems to meet the normal demands upon it. It is not a case of a company which has had to abandon the performance of its public duty because its system was inadequate to meet the load, or because its equipment was obsolete. Under broad policies of construction and co-ordination efficient stations had been created to meet the expanding business which was foreseen.

Yet the company, the Washington authorities and the New Jersey representatives of the Fuel Administration, individually and collectively, have been unable to provide the coal supply for the boilers which alone would have kept the vast industrial resources of the northern part of the State actively mobilized for war.

In its efforts to get coal the company has had a representative at Washington continuously. Many official and unofficial investigations have been made in an endeavor to accelerate relief.

One unofficial investigation of this character followed an acute condition of shortage as a result of which the company shut off about 50 per cent of the power usually furnished to consumers. The majority of the customers affected were commercial-power consumers. They included practically all of the large industries engaged in manufacturing war munitions or in other work incident to the war. A slight curtailment of

service on the lines of the affiliated Public Service Railway was also found necessary at that time. Since Jan. 1 the company has been dependent largely on the Shipping Board for fuel, but when this shutdown was enforced that board was unable to provide a supply. The small amount of coal received by the company from the mines had supplemented the other source of supply, and assisted in keeping the plants in operation. The total supply found at various generating stations was very small compared with the normal daily requirements.

HEARING BEFORE NEW JERSEY COMMISSION

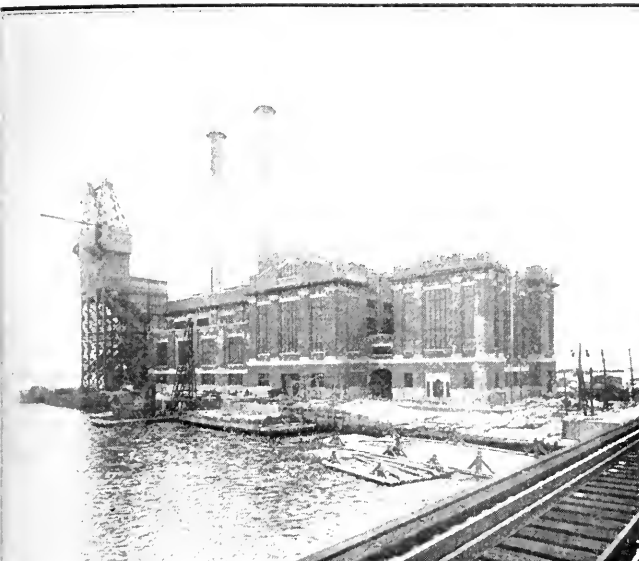
At a hearing before the New Jersey Board of Public Utility Commissioners Thomas N. McCarter, president of the company, testified at length regarding the difficulties confronting the company.

The coal situation of the Public Service Electric Company has been acute for nearly a year, said Mr. McCarter. The company has a contract for coal for its electric plants with the Barnes & Tucker Coal Company, a large concern in the Pennsylvania coal field having several mines, for the exclusive output of four of its mines. The average tonnage, worked to capacity, of those four mines would give the company, if delivered, 900,000 tons of coal during the year beginning in March or April, 1917. The requirements for coal at that time were between 700,000 and 800,000 tons.

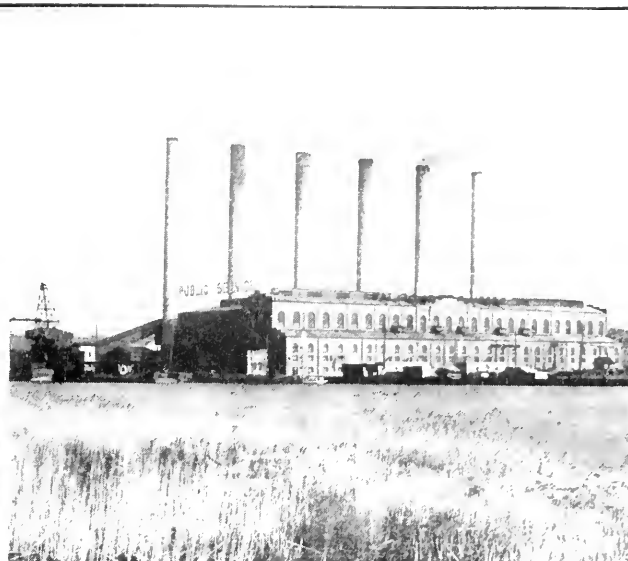
Not wishing to rely on that contract altogether, or have all the eggs in one basket, the company made other contracts with different coal contractors for lesser but still very substantial amounts, running to 100,000 or 200,000 tons apiece. Had the coal contracted for been delivered there would have been no trouble.

About a year ago, when the transportation difficulties began to be acute, Mr. McCarter went to Washington, accompanied by J. A. Pearson, purchasing agent of the company. They went to the Interstate Commerce Commission and then to the Railroad War Board. The latter board agreed to see that railroad cars were put into the Barnes & Tucker mine sufficient to carry to the company all the coal that those mines could mine. This was done, said Mr. McCarter, until it developed that there were mine troubles as well as transportation troubles. The coal miners are very largely foreigners from southeastern Europe. They are very independent. They are making, in most cases, larger wages than they have been in the habit of making, and hence are a little more independent as to the number of days in the week they work, their necessities being met by the advanced wages. The result was that it became impossible for the Barnes & Tucker company—and, as far as Mr. McCarter knows, any other coal miners in that district—to mine their full quota of coal during the year. The witness said that he thought that the Barnes & Tucker company had done its best, and he was sure the railroads had done their best in putting cars into the mines.

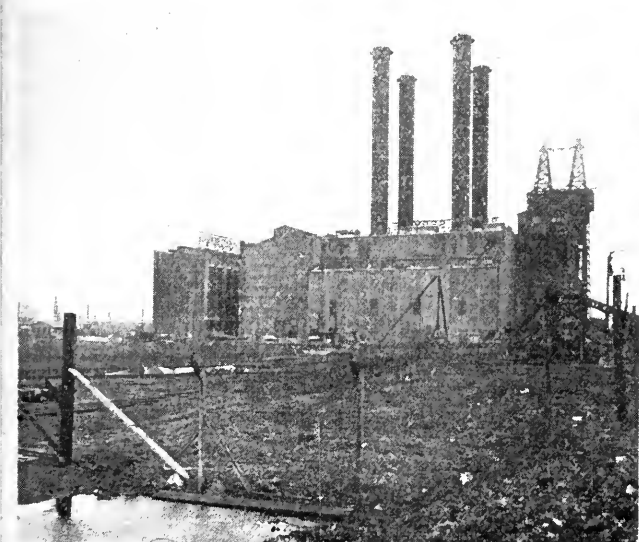
In the summer the Federal Trade Commission in Washington, acting in co-operation with Secretary Lane,



Essex Station



Marion Station



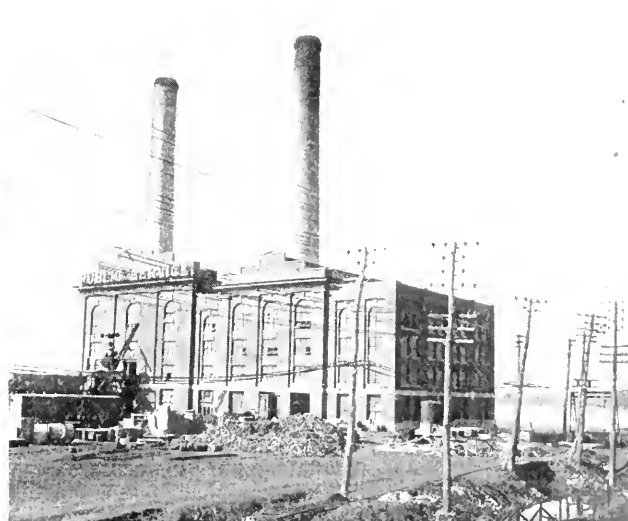
Essex Station
No coal in yard storage
Usually full of coal



Marion Station
No coal in yard storage. These black piles are ashes to be loaded on cars for removal. Usually this space is full of coal.



Perth Amboy Station



Burlington Station

fixed the price of coal at \$3 per ton at the mines. This price did not meet with the approval of certain other departments, notably the War Department, and that arrangement, which Mr. McCarter thinks would have been satisfactory to the miners and would have produced a far larger quantity of mined coal at that time, was upset and a subsequent price of \$2 or thereabouts was made. That has since been raised. Mr. McCarter added:

In this period a large amount of coal that was mined was shipped away from the United States to Canada by the coal operatives. We were endeavoring all this period of the summer to store coal, not only to get coal enough for our daily needs, but to store coal for the present day, foreseeing, as every operator of these properties does, that his winter season is the busy season, and the difficulties of coal transportation in winter are increased; but the most we could accumulate during the summer, owing to the causes which I have tried to outline, was 100,000 tons of coal, when the order came fixing the price at \$2.

We had opportunities to buy coal after that at varying prices named by coal men, which we declined to do because we believed it our patriotic duty to obey the mandate of the government and, inferentially, we didn't care to go to prison for not obeying. It was a state's prison offense to buy coal at the excess price as much as it was to sell it at the excess price. Some people did buy and sell coal at the higher prices, and we didn't.

The situation has been further complicated by the troubles of the winter. Some of our coal, some of our Barnes & Tucker coal, has been taken away from us by government mandate and sent to departments in Washington and forwarded to the Shipping Board. Many orders of that kind have been made, some of which we have succeeded in having canceled. About a month or six weeks ago I spent the major portion of the afternoon with Dr. Garfield in Washington, whom I have known many years, and he went over the whole situation thoroughly with me. He told me that the situation was very acute, but his last word to me was:

"Mr. McCarter, you will be taken care of. We cannot allow the Public Service to get out of coal."

He has been unable to keep that promise. I don't blame him for it. I don't know that anybody else would have done any better, but I simply state the fact.

Answering an inquiry as to the cause of the failure, whether lack of mining coal, transportation troubles or diversions, or all three, Mr. McCarter said:

I think it was due to them all, made acute by the severity of the winter and the transportation troubles that have taken place more recently. Owing to the weather conditions, our Barnes & Tucker and other coal began to fail us even to the extent we had been getting it. The Fuel Administration made every effort to help us. For the last three or four weeks since the earlier shutdown it had been keeping us going from day to day by diverting to our use coal in the tidewater pool consigned to other people, in some cases taking it away from ships in the harbor and in other cases taking it from other consignees; in all events, getting to us about the quantity we were failing to get owing to the other troubles.

On Saturday of last week, out of a clear sky, the Fuel Administration notified us that it would be unable to continue giving coal to us any longer, for two reasons—because it practically had no coal in the coal pool, and what it did have it was under peremptory orders from Washington to give to the ships in the harbor.

This found us with a mere pittance of coal for such a property as ours, and there seemed to be nothing to do but to notify the public of the necessity for the immediate shutdown, having enough coal in our bunkers to keep reasonable lighting going, and such power as to keep the elevator power in operation and a limited number of cars on the street, besides a small amount of power being used by the Shipping Board at Port Newark Terminal. I am speaking now of the northern section of the State. There is no shutdown in power, at the moment, in what is known as the Southern Division, from Trenton south, where we are going

on from hand to mouth, from day to day; but the shutdown I refer to is in the other division, embracing the northern section of the State.

The hearing then proceeded along the following lines

Commissioner Donges asked: "Is there any governmental agency, as far as you know, which could do anything to relieve the situation, or which is diverting coal to any other properties which ought to come to the Public Service, or are they, as far as you know, all being treated alike?"

The witness replied: "I think the Fuel Board—the Fuel Board has a great big job; it is being managed by a great many different men, as heads of departments, and I think they are treading on each other's toes. It seems to me foolish (and yet I don't like to criticize; we don't know all their burdens)—it seems to me Washington is straining every nerve to get coal to us and then stealing 100 tons of our coal from Tucker for somebody else. That is constantly going on. It does not seem to me in the Fuel Department there is very much co-ordination. I say it with a great deal of deference, and I have been considerate in the extreme of the whole question."

Commissioner Donges: "What I meant was whether, compared with what other industries were getting, you were getting your share."

Witness: "I think we are, and perhaps more."

Commissioner Donges: "That is what I had in mind."

Witness: "That is all. Shall I proceed?"

Commissioner Donges: "Yes."

Witness: "I am glad to have the opportunity of stating to the commission, and in the presence of these people, the facts I have stated. It is very annoying and distressing to all power manufacturers by reason of it."

Mr. King: "You made a remark to the effect that you hoped you would not have to keep closed down after you had accumulated a stock of coal, just now. Is it your thought that you will keep shut down until you accumulate a stock of coal?"

Witness: "Not any great stock. I don't like intermittent shutdowns, from one day to another. I thought if we stayed down a week more or less now we could accumulate more coal than we have had for the last two months, and with the breaking up of the winter, as we have had, we would be better off than by starting up the very first day and then perhaps shutting down the second day. But we are open to persuasion about that. Perhaps our view is wrong."

As indicated by the remarks of Mr. McCarter, the situation is beyond the control of the company. As this issue goes to press the company has succeeded in getting enough coal to resume full operation of its plants, although it is still moving on a day-to-day coal supply.

ELECTRICAL MEN PUSH WAR SAVINGS STAMPS

Committee of New York Apparatus and Supply Men
Report that About 75 per Cent of "Prospects"
Have Agencies

Considerable interest is being shown in New York electrical circles in the distribution and sale of war savings stamps. An electrical apparatus and supply division of the National War Savings Committee has been appointed for the greater city of New York, with offices at 195 Broadway.

The division committee, under the chairmanship of H. A. Halligan, vice-president of the Western Electric Company, is composed of R. Edwards, H. T. Hockhausen, M. A. Oberlander, G. L. Patterson, E. W. Rockafellow, C. P. Scott, P. L. Thomson and J. M. Wakeman. A. E. Beling is secretary.

M. A. Oberlander, who is campaign manager, states that about 75 per cent of the "prospects" have been induced to take out agencies for the sale of stamps.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 495 of this number.

Los Angeles Synchronous Club.—Lecture No. 9 of the Synchronous Course on "Steam, Gas and Oil Engines" was given at the Feb. 21 meeting by J. W. Andree, department of generation, Southern California Edison Company.

St. Louis Jovian League.—In his address before the St. Louis Jovian League Feb. 19 Major John R. Fordyce, Engineers' Reserve Corps, constructing quartermaster in charge of the building of Camp Pike near Little Rock, Ark., showed conclusively the efficiency and dispatch with which the work was completed.

New York Electrical Society.—On Feb. 26 Major Frederick Palmer, Intelligence Section, on General Pershing's staff, presented a paper on "Our Army in France." Capt. Alexander Macomber spoke on "The Searchlight Regiment, the Fifty-sixth," and Major A. B. Kratz spoke on "The Electrical Regiment, the Thirty-seventh." This meeting was the society's thirty-seventh anniversary and its eleventh war meeting.

San Francisco Electrical Development League.—At a meeting of this association on Feb. 13 a new constitution was adopted and the name of the organization was changed from the San Francisco Electrical Development and Jovian League to the San Francisco Electrical Development League. The new constitution is so drafted as to make the organization entirely independent of any other and provision is made for developing it along broad lines. New officers elected for a term of one year, beginning March 1, are as follows: president, R. E. Fisher; first vice-president, H. C. Reid; second vice-president, C. P. Pitts, and new members of the executive committee, F. J. Bennett and Frank Roerber.

Minnesota Electrical Association.—The annual convention of the Minnesota Electrical Association will be held at the Hotel Radisson, Minneapolis, March 11, 12 and 13. In a statement issued by the officers and board of directors of the association concerning the convention it was stated that members were showing lively interest in it. The increasing difficulty of central-station problems makes especially timely all the advice and assistance that it is possible to get through an interchange of ideas. Among the important papers to be presented are "Minnesota Water Powers," by R. J. Thomas, superintendent of the St. Anthony Falls Water Power Company, and "Iron-Wire Transmission Lines," by Prof. W. T. Ryan of the University of Minnesota. H. E. Young of the Minneapolis General Electric Company is secretary-treasurer of the association.

Inter-Section Meeting of the A. I. E. E. and the A. I. S. E. E.—The three hundred and thirty-eighth meeting of the A. I. E. E., which will be held at Cleveland, March 8, is an inter-section meeting in which the Cleveland, Pittsburgh, Toledo, Toronto and Detroit sections of the Institute will participate. This meeting will be held in conjunction with the Association of Iron and Steel Electrical Engineers. The morning session will include a paper by George J. Newton on "Design of Underground Distribution for Electric Light and Power," and a paper by Robert F. Hamilton on "Some Considerations in Determining the Capacity of Rolling-Mill Motors." At the evening session J. D. Wright will present a paper on "Selection of Steel-Mill Auxiliary Motors and Control as Affected by Mechanical Features of the Drive," and the standardization committee of the A. I. S. E. E. one on "Steel Industry Motors Standardizing."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Sales of Electrical Energy in New York.—The report made by the New York Public Service Commission, First District, to the Legislature says: "The most recent statistics for gas and electric companies are for the calendar year 1916. In that year gas companies in New York City manufactured and sold 44,565,753,000 cu. ft., an increase of 4.76 per cent. Sales of electricity, however, showed a very much higher percentage of increase, the enlarged use being accounted for in great part by the material reductions in Manhattan, the Bronx and Brooklyn. Increase in population was also partly responsible. Electric companies sold to the public 846,201,369 kw.-hr. and received therefor \$38,687,806, an increase of 16.40 per cent. Consumers numbered 360,669, against 306,217 in 1915. Gas sales were about \$6.61 per capita and electric about \$7.03 per capita."

Large Demand for Additional Service.—In its annual report to stockholders for the year ended Dec. 31, 1917, the Continental Gas & Electric Corporation, Cleveland, says in part: "Costs of coal, oil, labor and material reached during 1917 what is felt to be their peak and it follows therefore that the net earnings of your company for the past year are less than its normal earning capacity. Coupled with this is the fact that no advances were made in rates to consumers, so that in a year of average material costs net earnings on the common stock would have been approximately 8 per cent greater. Steps have already been taken to advance rates of the subsidiary companies 20 per cent. Profitable extensions are de-

manded on all sides. So desirous are many communities of receiving our service that they are offering bonuses which would, of course, increase the company's profit in such districts. Stockholders, therefore, are invited to make further investments in the securities of the company."

Electric Range Finds Cook Book Recognition.—Mrs. Ida C. Bailey, editor of the "Housewives' Forum" department of the *Pictorial Review*, has recently published a comprehensive cook book which is the first work of its kind to devote any considerable space to the electrical range as a practical unit in household kitchens. Through the efforts of Miss Grace Hadley of the Society for Electrical Development this favorable treatment of the electric range was included.

New California Hydroelectric Plant Put in Service.—The new hydroelectric plant of the California-Oregon Power Company on the Klamath River at Copco, Siskiyou County, Cal., has been put in service. It was dedicated officially on Feb. 2 in the presence of a small group of company officials, together with Prof. C. D. Marx, Stanford University; Prof. D. M. Folsom, Western Petroleum Administrator, and Captain Boyden, U. S. A. Construction work has been under way since 1911. When the site for the dam was stripped it was found necessary to excavate to a depth of 125 ft. before solid bedrock was encountered. The dam rises 125 ft. above the river bed and is approximately 500 ft. across the top. The plant ties in with the company's system serving Siskiyou and Trinity Counties, California, and all of southern Oregon.

New York Edison Savings and Loan Association Results.—With a total membership of 2453 and with assets of more than \$500,000, the New York Edison Savings and Loan Association has closed its sixth business year. A new item in the dividend schedule is the shares in military suspense created for the benefit of members, in the army and navy. To these members are apportioned dividends at the installment share rate so that they may have their installment holdings continued without penalty for non-payment during the war. Arrangements have also been effected to cover mortgage accounts of members serving Uncle Sam. The report of the treasurer showed total resources of \$547,437, an increase of \$121,666 over the previous year. This includes deposits by employees, totaling \$486,025. Dividends for the period ended Dec. 31, 1917, were: Installment shares, accumulative prepaid shares and shares in military suspense, 6.25 per cent per annum; saving shares, juvenile saving shares and installment shares in suspense, 5 per cent per annum. The following were re-elected for the ensuing year: Arthur Williams, president; A. A. Pope, vice-president; E. E. Bondy, corresponding secretary; Adolph Hertz, treasurer; J. C. Robinson, financial secretary. E. M. Van Norden, Albert Goldman, W. J. Meara and F. C. Henderschott were re-elected directors to serve for three years.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Illinois Rate Change.—The Illinois Public Utilities Commission has given the Central Illinois Public Service Company, Mattoon, permission to put in effect a rate of 11 cents per kilowatt-hour for residence lighting, this rate covering the first thirty hours, and 9 cents per kilowatt-hour for the excess. The ruling affects twenty-seven towns.

Preferred Stock at Net Price of 90.—The California Railroad Commission has authorized the Western States Gas & Electric Company to issue \$178,000 of 7 per cent preferred stock for not less than par, but with permission to allow 10 per cent commission. The proceeds are to pay current indebtedness as hereafter authorized by the commission. The company expended during eleven months of 1917 for improvements and the purchase of properties \$816,097.

Free Service Held Unjust Discrimination.—The Indiana Public Service Commission has entered an order denying the responsibility of the Interstate Public Service Company to continue giving free utility service to cities and towns where it operates under indeterminate permits, its former franchises from the cities and towns in question having been surrendered under the public utility act. The ruling is the first on this question by the reorganized commission. The Interstate company asked the commission for relief from further continuance of the practice of giving free service. A recent court decision gave the commission authority to deny free service to a town or city, it is held. The commission order held that such free service constitutes an "unjust discrimination against other consumers."

Reduced Rate in Brooklyn District.—On the recommendation of Commissioner Hervey, the New York Public Service Commission, First District, has ordered the Flatbush Gas Company to reduce maximum electric rates in the Twenty-ninth Ward in the borough of Brooklyn from 12 cents per kilowatt-hour to 10 cents for the six months beginning March 1, 1918, 9 cents for the succeeding six months, and 8 cents thereafter, that is, beginning March 1, 1919; from and after March 1, 1918, not more than 6 cents per kilowatt-hour for energy consumed in excess of two hours' average daily use of maximum demand. The order is to take effect on March 1, 1918. The Flatbush Gas Company serves the Flatbush area of Brooklyn with gas and electricity, but the order affects only the electric rate. The present maximum rate of the Flatbush Gas Company is 12 cents per kilowatt-hour.

Holding Company Control Denied in New York Case.—A decision has been given by the New York Public Service Commission, Second District, on the petition of the Kingston Gas & Electric Company for authority to acquire all of the stock of the Ulster Electric Light, Heat & Power Company and 775 shares of stock of the Upper Hudson Electric & Railroad Company. All of the \$700,000 stock of the Kingston company has been owned by the American Gas Company since 1902. Early in 1916 the American Gas Company, without knowledge or consent of the commission, purchased the entire outstanding \$30,000 stock of the Ulster company and 775 shares, slightly more than a majority, of the Upper Hudson company \$150,000 stock. The object was to consolidate the operations in the area of the three companies. "While the record discloses, and this commission is satisfied, that the American Gas Company acted openly and in good faith in the matter of these purchases," says the decision, "it is, nevertheless, the law of this State that, first, no holding company, domestic or foreign, shall purchase, acquire, take or hold more than 10 per cent of the total capital stock of any domestic gas or electrical corporation (with certain exceptions that are not germane to the particular point now under consideration); and, second, no gas corporation or electrical corporation shall directly or indirectly acquire the stock or bonds of any other corporation engaged in the same or a similar business, unless authorized so to do by this commission. . . . As to the proposed purchase by the Kingston company of the capital stock of the Ulster light company there seems to be no objection raised, and we are of opinion that the same properly may be approved. But purchase by the Kingston company of stock of the Upper Hudson company is strenuously opposed by practically all of the minority interests. While we do not accept all the conclusions of these interests as sound in either law or equity, we are unhesitatingly of opinion that . . . there is no proof in the case that the public interest will be advanced by approval of the proposed purchase. Ordinarily such purchases are justified by alleged economies in operation following a merger which is predicated as an essential part of the subject. But as matters stand there can be no merger in this case until the minority interests shall have been acquired; no proposition for a merger or consolidation of the Kingston company with the two others mentioned has ever been made by the present controlling interests, and it is expressly stated that while the American Gas Company desires to effect such consolidation or merger 'eventually,' it has no definite plans in regard thereto at present. We are not convinced . . . that to legalize continuance of such an unsatisfactory state of affairs through authorization of something merely not in itself illegal would be proper. Approval of the proposed purchase by the Kingston company of the 775 shares of stock of the Upper Hudson company accordingly should be denied."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Death Brought About by Contributory Negligence.—Where a painter employed by a contractor to paint an iron smokestack used the restricted space of the roof of the substation of a power company as a place to rest his ladder when live copper power wires, uninsulated, sizzling and hissing with current were exposed to view, there being no necessity for the use of the substation roof as a place to rest the ladder, such painter was guilty of negligence contributing to his death by electric shock the Supreme Judicial Court of Massachusetts held in *Chartier versus Gardner Electric Light Company* (118 N.E. 263).

Indemnity in Concurrent Negligence.—Where defendant negligently allowed its high-tension wire to sag so that it burned through plaintiff railway company's trolley wire, causing it to fall and kill a horse, and plaintiff was required to pay a judgment in favor of the owner of the horse, plaintiff could recover from defendant, though they were joint tort-feasors, since while plaintiff might have adopted some precautions to protect the public, yet as between it and the defendant it could rest upon its rights; and was not required to make structures to protect itself from defendant's negligence, the Supreme Court of New York, Appellate Division, held in *Hudson Valley Railway Company versus Mechanicsville Electric Light & Gas Company* (167 N. Y. S. 428).

Right of Citizens to Inspect Municipal Records.—The District Court of Appeals in Los Angeles, Cal., has reversed a decision of the Superior Court and holds that W. C. Mushet is not entitled to a writ of mandate directing the Board of Public Service Commissioners of Los Angeles to allow him to examine the records and papers kept by this board in connection with the municipal power project. The board had appealed from the decision of the lower court on the ground that the Los Angeles Gas & Electric Corporation was the party beneficially interested in the suit, rather than the citizens and taxpayers of the city, and that Mr. Mushet was seeking to gain access to the records for the use and benefit of that corporation as a competitor of the city. The District Court of Appeals did not hold that a taxpayer really acting for himself might not examine the books of the Public Service Department, but held that a taxpayer only pretendedly acting for himself, but in fact acting for another person or corporation, had no right to maintain a suit for the purpose of gaining access to its records. The data sought were not public records as defined by the statute.

Harrison Williams has succeeded Samuel Scovil as president of the Cleveland Electric Illuminating Company.

James Favor has been appointed general manager of the Central Power & Light Company, Walnut Ridge, Ark., to succeed John F. Wilson.

F. C. Pratt, after spending six or seven months as manager of the Alliance (Ohio) Gas & Power Company, is again attached to the Doherty general engineering staff.

Terrell Croft has become connected with the Luminous Unit Company of St. Louis, Mo., as chief electrical engineer. Mr. Croft is well known as the author of several practical works on electrical engineering.

Albert R. Thompson, general superintendent of the electric distribution department, San Francisco district of the Pacific Gas & Electric Company, has gone to Camp Lee, Petersburg, Va., as captain in the Engineers' Reserve Corps.

M. H. Aylesworth has resigned as a member of the Colorado Public Utilities Commission, of which he was chairman, to become assistant to the vice-president and general manager of the Utah Power & Light Company. Mr. Aylesworth is a practicing attorney.

W. B. Miser, manager of the Oklahoma Gas & Electric Company, Drumright, Okla., has been appointed chairman for Drumright of the Military Training Camp Association, which has for its object the securing of competent men for inspection of equipment for the division signal corps.

J. M. Atkinson has been transferred from the post of manager of the Missouri Valley Light & Power Company, El Dorado Springs, Mo., to manager of the Big Horn Light & Power Company, Worland, Wyo. Prior to going with the Missouri Valley property, late in 1915, Mr. Atkinson was manager of the La Plata Light, Heat & Ice Company.

H. L. Thomson, assistant superintendent, has been appointed superintendent of the lighting department of the Hartford Electric Light Company, to succeed F. W. Prince, April 1. Mr. Thomson has been with the Hartford company for about six years and has been in close touch with both technical and commercial lighting work on the system, including the service of the model meter laboratory at the lately completed offices of the company.

G. McKew Parr, general sales manager of the Hart & Hegeman Manufacturing Company, Hartford, Conn., is on an indefinite leave of absence to serve under the War Trade Board, at Washington, as a volunteer worker. Mr. Parr, who is a graduate of the United States Military Academy at West Point, has been associated with the Hart & Hegeman company since 1909. For two years he represented the company in the Southern territory, when he became advertising manager, continuing in that position until early in 1914, when he was appointed general sales manager.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

R. E. Williams, formerly superintendent of the Little Rock Railway & Electric Company heating department, has been appointed assistant superintendent of the company.

L. E. Brown of Jackson, Mich., has been appointed superintendent of distribution for the Springfield (Ohio) Light, Heat & Power Company to succeed R. L. Gouty, who resigned because of ill health.

J. A. Perkins, formerly manager of the rate and statistical department, has been elected a vice-president of the United Gas & Electric Engineering Corporation. Mr. Perkins assumed his new office Jan. 10, and will continue the direction of rate and statistical matters.

P. T. Philips of the Little Rock (Ark.) Railway & Electric Company has been appointed general superintendent of both the electric and heat departments and will have full authority over power-house operation. This appointment is incidental to the merging of the heating business with the other departments.

Robert H. Whitten, after some five years of city planning work with the Heights of Buildings Commission and as secretary of the Commission on Building Districts and Restrictions and the committee on the city plan of the Board of Estimate and Apportionment of New York, has opened an office for consulting work on city planning and zoning at 277 Broadway, that city. Mr. Whitten was for some time librarian-statistician for the New York Public Service Commission, First District, during which time he contributed considerably to the technical press besides compiling a standard work on commission regulation.

G. A. Strain has been promoted from being superintendent of the gas department of the Helena (Mont.) Light & Railway Company to the position of general superintendent of the following properties, with headquarters at Ithaca, N. Y.: Homer & Cortland Gas Light Company, Cortland, N. Y.; Ithaca Gas & Electric Corporation, Ithaca, N. Y.; Norwich Gas & Electric Company, Norwich, N. Y.; Oneonta Light & Power Company, Oneonta, N. Y.; Standard Light, Heat & Power Company, Sidney, N. Y.; Van Wert Gas Light Company, Van Wert, Ohio; Cayuga Power Corporation, Ithaca, N. Y.; Groton Electric Corporation, Groton, N. Y.; Ovid Electric Company, Ovid, N. Y. Mr. Strain has been associated for the last twelve years with the operating organization of the J. G. White Management Corporation, New York City, the manager of the aforementioned companies.

George E. Erb has been appointed a member of the Idaho Public Utilities Commission, succeeding Axel P. Ramstet, former president of the commission, who resigned about a year ago.

Alfred C. Jordan, commercial manager of the Cumberland County Power & Light Company, Portland, Me., has been appointed superintendent of the railway, succeeding George S. Brush, resigned.

Loyall A. Osborne of New York, vice-president of the Westinghouse Electric & Manufacturing Company and chairman of the executive committee of the National Industrial Conference Board, has been appointed by the Secretary of Labor as a member of a committee on industrial peace during the war. This committee, which consists of five representatives of employers, five labor leaders and two public men, will provide a definite labor program in order that there may be industrial peace during the war, thus preventing any interruption of vital industrial production.

H. W. Fuller, who has been associated with H. M. Byllesby & Company for seven years, devoting a large part of his time to the solution of special operating problems, has been appointed vice-president in charge of operation of the Northern States Power Company, a newly created position. Mr. Fuller was born in New York and received his early education in the public schools of Bayonne, N. J., the State Model School of New Jersey and Rutgers College, being graduated in 1891. He entered the service of the Consolidated Traction Company of Newark, N. J., and became assistant superintendent and assistant general manager, leaving this position in 1901 to become general manager of the Washington Railway & Electric Company and the Potomac Electric Power Company. In 1911 he severed his connection with these properties to become associated with the Byllesby interests. He was appointed vice-president and general manager of the Appalachian Power Company, Bluefield, W. Va. The following year he went to Louisville, where, under General G. H. Harris, he had general supervision of the local Byllesby properties.

Obituary

Judson D. Holden, chief night electrician for the Aurora, Elgin & Chicago Railroad Company, was instantly killed a few days ago by an excessive charge of electricity.

L. R. McBroom, formerly superintendent of the Burlington (Vt.) light plant, died recently at the naval base, Norfolk, Va. At the time of his death Mr. McBroom was an electrical engineer at the government shipyards.

William Clegg, Jr., formerly district manager for the Westinghouse Electric & Manufacturing Company, with headquarters at St. Louis, died recently in that city. He was born in Franklin, La., and was graduated from the Louisiana State University at Baton Rouge.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

DISCOUNT CHANGES SCHEDULED FOR HEATING APPLIANCES

Greater Differential Between Central Stations and
Jobbers on Socket Appliances—Central Stations
Recognized in Range Discounts

A new schedule of discounts on electric heating devices has been arranged, effective April 1. It appears that the licensors in making the present readjustments of the schedules under the Marsh patents have had in mind granting to the central stations an improved discount relative to jobbers on electric ranges and on the other hand have improved the jobbers' discount relative to central stations on socket devices.

Under the old schedule the socket device discounts to central stations were 30 and 10 with an extra $7\frac{1}{2}$ for a bona fide order placed at any one time for \$5,000 worth of material for shipment within thirty days. Under the new schedule the basic central-station discount on socket devices will be 30 and $7\frac{1}{2}$ with an extra $7\frac{1}{2}$ for a bona fide order placed at any one time for at least \$5,000 worth of material for shipment within thirty days.

On electric ranges the former schedule to central stations of 25 and 10 (5 per cent for carload lot) with an extra 5 for a bona fide order placed at any one time for at least \$6,000 worth of material for shipment within one year will still be 25 and 10 (5 per cent for carload) for small orders, but for a bona fide order placed at any one time for at least \$10,000 the discount will be 25, 10 and 10 (5 per cent for carload).

The changes actually amount to increasing the differential between the jobbers and central stations by about 2 per cent on socket devices and to recognizing the quantity purchases of ranges by the central station. For some time the jobbers have been outspoken in the contention that the discount differential between the jobbers and the central stations was not great enough to insure a profit. The new schedules, it will be noticed, have not changed the differential between the jobber, the contractor-dealer and the department store.

On ranges there has been a disposition on the part of central stations, particularly those on the Pacific Coast, where the development of the electric range load has been large and rapid, and those others that are active on a large scale in the electric range business, to protest against a wider margin of profit for the jobber than for the central station, which it was pointed out assumes almost the entire retail development burden.

In making these changes in schedule on socket appliances the central stations purchasing heating devices in small quantities are placed on the same basis as the dealers and other merchants who purchase heating devices in small quantities for resale. The jobbers, on the other hand, who as the socket device business has developed have been recognized as becoming more and more the logical outlet in the distribution of socket appliances, are given an opportunity for making a better profit than under the old schedule.

On electric ranges it is apparent that the contention of the central stations that are purchasing ranges in large quantities and are conducting expensive campaigns for the introduction of the electric range, together with assuming the burden of exploiting the business, that they should receive the maximum discount on ranges, namely, the same as the largest jobber discount, has been recognized.

As was stated in these columns, there will be no schedule increase at the present time. Although the greatly increased costs seemed in many instances strongly to warrant higher lists, the licensors did not feel that an advance was just now advisable.

NEW FREIGHT ARRANGEMENTS TO IMPROVE TRANSPORTATION

With Few Exceptions, All Eastern Shipments Are
on a Priority Basis—Consignee, Not Shipper,
the One Considered

Early this year A. H. Smith, assistant to Director General of Railroads McAdoo, as a war emergency measure, created a "Freight Traffic Committee, North Atlantic Ports," for the issuance of inland shipping permits on export freight and also on all matters pertaining to domestic freight in its jurisdiction. A domestic division was also named, with offices in New York City.

For the present the domestic division will only assume control of carload domestic freight, embargoed as defined as follows, for Manhattan Island, the Bronx (New York City), and station or lighterage deliveries on New York Harbor: On Jan. 15, 1918, embargoes became effective on carload domestic freight (except food for human consumption, newsprint paper, live stock, perishable freight, coal and freight consigned to an officer of the United States government or to officers of the railroads); exceptions thereto will be covered by shipping permits to be issued by the domestic division, Freight Traffic Committee, North Atlantic Ports, and no railroad shipping permits will be issued except by the domestic division.

In observance of the procedure on carload domestic freight it is necessary that the consignee (not the shipper) shall make application for permit as follows: (a) For lighterage deliveries, to lighterage representative of the delivering road; (b) for pier, station or team track deliveries, to railroad representative at the delivery desired.

The lighterage representative or the railroad representative, as the case may be, will then present to the domestic division application for the issuance of railroad shipping permit for the forwarding of the freight from point of origin. Shipping permits will be sent to the consignee through the same channel. Consignee will send the permit to the shipper, which permit must be surrendered by the shipper to the initial road's agent, with bill of lading and shipping order. Permits will be issued under serial numbers bearing "F. T. C." prefix and waybilling agents must indorse on card and revenue billing reference to authority "F. T. C. No. —," otherwise cars will be rejected at junctions.

On Feb. 8, also, as a war emergency measure, the Pennsylvania Railroad system put into effect on all of its lines east of Pittsburgh a new plan of handling freight under embargoes. The purpose is to render every possible assistance to shippers and consignees in securing transportation of materials and supplies that are most urgently required, and also to simplify the procedure necessary to obtain authorization for the movement of essential freight in times of general embargoes.

The new plan will be applied to the administration of the present embargoes on the Pennsylvania lines east of Pittsburgh, as well as to all future embargoes that may be laid, until further notice. It will probably remain in effect for the duration of the war and as long thereafter as necessary.

Under the new plan, during the existence of an embargo, freight will be handled through a system of special permits covering each individual shipment. In this connection, a radical change will be introduced by which the consignee, and not the shipper of the freight, must apply for the permit. This changes completely the present system under which either the shipper or the consignee may apply for exceptions to embargoes.

The essential feature of the new plan is that before

authority will be granted to move freight affected by embargo the person who is to receive the shipment must demonstrate, to a reasonable degree, two things:

1. That the shipment is necessary to meet his existing requirements.
2. That he will be able to accept the freight promptly on arrival, unload the cars without delay and take the shipment off the railroad's hands.

In determining whether or not a permit shall be granted for a given shipment, two factors will control: (1) Road and terminal conditions existing at the time; (2) the urgency of the consignee's needs and his ability to unload.

In the past, where shippers instead of consignees frequently obtained permits, it was found that much freight was started on the road far in advance of the consignee's needs. It was also found that many shipments were made which the consignee was unable to accept upon arrival.

Much confusion and delay is expected to be obviated by this arrangement, which does not apply to export traffic via New York, Philadelphia and Baltimore, or to domestic carload shipments to New York. The latter is in charge of the Freight Traffic Committee above mentioned. No other railroad system has formulated a similar declaration. Increased transcontinental freight rates, which go into effect March 15, were granted by the Interstate Commerce Commission. These rates were asked for by the railroads prior to government control.

Conditions have improved in the East on deliveries, but they are far from normal. They are expected to reach that stage, weather permitting, about the middle of the month. Express and parcel post transportation is being used by shippers wherever possible, notwithstanding the extra cost, for emergency deliveries. The express companies are said to be literally swamped with business, and with the labor scarcity they find it impossible to handle it all.

METAL MARKET SITUATION

Copper in Small Lots in Good Supply—Official Price on Zinc Announced

Very little fluctuation is occurring in copper; that is as to supply or price. Producers and speculators are usually in a pessimistic frame of mind when discussing the amount of the metal coming from the mines and are doubtless sighing for a higher government price on the ground that it would stimulate production. The speculators are playing a good hand, when opportunity serves, a strong second, when it comes to boosting the market along price lines. It is evident, however, that there is enough copper for jobbers and sellers of less than car lots for commercial manufacturing uses. Wire manufacturers of rubber-covered, cable, weather-proof, insulated tape and other varieties are selling large bills to the government.

An official or government price has been established by the War Industries Board for zinc on practically the same conditions as control the sale of copper, subject to revision June 1. The minimum price is 12 cents per pound f.o.b. East St. Louis for producers; sheet zinc, 15 cents per pound, and plate zinc 14 cents per pound f.o.b. plant or smelter, subject to the usual trade discounts.

NEW YORK METAL MARKET PRICES

	Feb. 18			Feb. 25		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake.....	Govt. price	23.50		Govt. price	23.50	
Electrolytic.....	Govt. price	23.50		Govt. price	23.50	
Castings.....	Govt. price	23.50		Govt. price	23.50	
Wire base.....		27.00			27.00	
Lead, trust price.....		7.00			7.00	
Nickel, ingot.....		50.00			50.00	
Sheet zinc, f.o.b. smelter.....		15.00			15.00	
Pelter, spot.....		7.92½			7.92½	
in, Straits.....		*85.00			*85.00	
Aluminum, 98 to 99 per cent..	34.00	to	36.00	35.00	to	37.00

OLD METALS

Heavy copper and wire.....	21.50	to	22.00	21.50	to	22.00
Brass, heavy.....	14.00	to	15.25	14.00	to	15.25
Brass, light.....	10.00	to	10.50	10.00	to	10.50
Lead, heavy.....	6.25	to	6.50	6.25	to	6.50
Zinc, old scrap.....	5.50	to	5.75	5.50	to	5.75

*Nominal.

THE WEEK IN TRADE

FEBRUARY showed an increasing business over January in the volume and value of sales for all lines of staple electrical goods. A large proportion of this growing trade is due in great measure to the requirements of the government in its varied enterprises connected with the war. In fact, as has been noted before, this buying, in some instances on a gigantic scale, practically dominates every branch of the industry. On this account shortages are either imminent or a reality in lamps of various types, floodlamps, conduit, porcelain goods, etc. The civilian demand is strong for domestic appliances—heating and cooking equipment especially—dry batteries and vapor lamps. Freight embargoes East and West continue to hamper deliveries and in some cases cause uneasiness for needed stock, but improved weather conditions will doubtless relieve the present acute situation.

Collections are mentioned as being favorable with a weakness in connection with public utility accounts. Credits are held along firm lines.

NEW YORK

With a great deal of improvement in the clearing up of freight congestion at Atlantic seaboard points, particularly in and about New York City, yet no measurable relief is being afforded receivers of electrical equipment or the general line of merchandise. Where priority orders prevail for governmental needs goods have been given a preference and deliveries made. Notwithstanding the natural curtailment of trade on this score, business is reported in very satisfactory volume. The demand for electrical supplies and accessories of every description has not shown any falling away, according to the statements of representative jobbers and dealers. The difficulty of obtaining goods at a specified time is annoying and disturbing, and for the promises of manufacturers and distributors due allowance is made when fulfillment is lacking. Everybody is in the same dilemma, and therefore commendable patience and consideration seems to be the rule and not the exception.

From a financial standpoint the trade, as a whole, express satisfaction with collections, and some houses with numerous accounts are rather pleased they are in such excellent condition. A watchful policy is enforced on credits.

CODE WIRE.—With building operations not only at a very low level and still further restricted by the government, which advises that materials, labor and credit be not utilized for this purpose unless the need is urgent, the sale of code wire is not running into large amounts. Prices are at a stationary figure and likely to remain so.

DRY BATTERIES.—A fair business is reported in dry batteries. The supply has bettered, and jobbers specializing on these goods report strong stocks, with no variation in quotations.

LAMPS.—For a while the sale of carbon incandescents was large and increasing, but now, the trade states, the specifications are not so heavy as before the first of the year. The demand is dropping off, and the metallic-filament lamps receive preference in a majority of the important orders booked.

PIPE FITTINGS.—A short market is spoken of in describing the situation on pipe fittings. They go out as fast as received from the manufacturers, and it is difficult to buy, let alone accumulate stock.

INTERPHONES.—The demand locally is of considerable volume owing largely to a number of gigantic hotels now being erected, such as the Commodore, with 2000 rooms; the Pennsylvania, with nearly the same high rooming capacity, and several others, and to the shipyards in the harbor—

about forty besides those all along the coast—which are to be equipped. Local jobbers, as a rule, do not aim to bid on such contracts, as it would exhaust their stock, with poor expectation of early replenishment.

CONDUIT.—On large size it is almost impossible to obtain any stock, as the embargoes are holding up shipments from the producers. Both on non-metallic and metallic flexible conduit stocks are said to be low.

OUTLET BOXES.—A very satisfactory supply is held in this market. Prices have not changed, discounts ruling about the same for quite a while.

HEATING DEVICES.—A steady sale in irons is spoken of. In fact, in the regular line of household table and energy-consuming devices trade is all that could be expected, with prospects better as the spring trade opens. The new discounts, effective April 1, are given in another column.

ATTACHMENT PLUGS.—Jobbers report a business above the normal with no revision in the selling figures.

SOCKETS.—Standard sockets are said to be in good supply. On special makes, with fixtures for saving energy, a good sale, due to effective merchandising methods, is recorded.

PORCELAIN.—On cleats and knobs, for which the government has called in heavy lots, stock is not easily to be had. This applies also to everything on the list of staples which are being requisitioned officially for the equipment of either foreign or domestic military and naval establishments.

CHICAGO

The more pleasant weather which prevailed in the latter part of February and the nullification of the Garfield order seem to have permitted people to get back to work on a more serious basis. Buyers appear to be in the market to replenish stocks. There is every indication that February will show itself as a good month in the trade. There have been no price changes in the past week, but certain small changes are expected to develop shortly. The big event in the trade in Chicago in the last week was the meeting of the contractor-dealers to organize as a State association under the Pacific Coast merchandising plan. About 325 contractor-dealers, jobbers, central-station men and manufacturers attended the sessions of this convention.

WIRE.—One firm which has been selling partly on a 30-cent base, but on a slightly higher base for small quantities, is now entirely on a 30-cent base for rubber-covered wire. The manufacturers of weatherproof wire are telling the trade to expect higher prices on account of the higher prices of cotton. These manufacturers state that they would not be able at the present time to make the prices to the trade which they are quoting were it not for the fact that they bought cotton considerably in advance of requirements. A price change based entirely on the increased cost of cotton would not be large, it is thought, on account of the small amount of cotton per pound of weatherproof wire which enters into the manufacture. Nevertheless it is believed by some jobbers that it might affect the delivery situation on weatherproof wire, since cotton is very difficult to secure.

CONDUIT.—A study of conduit sales made by one Chicago jobber showed that during the month of December 61 per cent of the conduit shipped from his stock had been used for what was construed to be war purposes.

DOMESTIC APPLIANCES.—The demand which has been noted for lower-priced merchandise is said to be continuing until it has developed into a well-defined tendency in that direction. It is understood that the demand for lower-priced portable lamps will be met by one manufacturer, who is putting out a new line especially for this class of trade.

DRY BATTERIES.—The markets are absorbing practically all that can be manufactured and delivered. There have been persistent rumors about higher prices of batteries, but it is stated on good authority that there will probably be no increase at the present time, despite the fact that the cost of producing batteries is higher now than it has been in the past. There seems to be a desire on the

part of producers to keep battery prices as low as consistently possible.

ELECTRIC RANGES.—Orders are beginning to arrive from widely separated sections of the country, but it is noticed that most of the buying and inquiries is from central stations in the smaller communities. Nevertheless large shipments are being made in some instances.

BOSTON

Business holds up well with the larger jobbers, but a perceptible falling off is reported among the smaller houses. Well-informed opinion, however, regards the slackening as temporary. With the country hitting its full stride in war preparations, readjustments cause some uncertainty, but the absolute necessity of co-ordination among distributing agencies as well as in production insures the maintenance of a heavy volume of trade for the duration of hostilities. Stocks are increasing in many quarters and the larger establishments are already planning to meet the demands for electrical supplies and equipment which will accompany the construction of a new eight-million-dollar transatlantic shipping terminal at Boston by the government. Labor is uneasy this week in this district, strikes being threatened in Massachusetts telephone operators' ranks and on the Boston Elevated Railway. It is expected that the latter difficulty will be settled through arbitration and that local industry will not be further disrupted. Jobbers and retailers alike are rejoicing over the stoppage of workless Mondays, which have caused much disorganization and which threatened to lead to no little industrial emigration from New England. Collections are fair and deliveries improving somewhat on small motors, asbestos insulation and wire. This is apparently due to improved conditions at the factory rather than to better railroad service. A price advance of \$25 in Delco lighting sets was scheduled for March 1.

LAMPS.—Orders are now being well handled; portables are quieter, and lengthening days are curtailing service to the betterment of stocks. Bulk orders are not encouraged, however. Government business is exceedingly active.

WIRE AND CABLE.—Railroad conditions show no improvement as yet with respect to wire transportation. Prices remain unchanged, with rubber-covered wire quoted at 30 to 31 cents base and weatherproof at 28 to 29 cents. On quantity orders some manufacturers are quoting perhaps 4 to 5 cents less than the above in extreme cases.

CONDUIT.—Deliveries are reported worse than ever. Pipe from 2 in. up is in great demand, and one jobber stated that 3-in. and 5-in. conduit is almost worth its weight in gold at present. The government is a heavy buyer. No prospect of unloading large stocks of small-sized conduit as yet appears capable of realization.

MOTORS.—Smaller sizes are getting fairly plentiful. Prices are firm, and early advances have been rumored on single-phase outfits, but nothing can be found to support this view at the moment. Large motors are scarce, and a Boston dealer seeking eight 350-hp. machines for early service reports no success in filling the order. Delivery in six weeks is now quoted on motors as large even as 40 hp. and smaller sizes down to one week, with immediate shipment from stock on fractional motor orders in many cases.

DRY BATTERIES.—Three dry cells are now sold to one wet battery, one large dealer reports. Dry cells are quoted at 40 cents each in less than dozen lots, and 35 cents in the latter. No advance has occurred for three months. Flash-lamp business is quiet except for military use, but in a few weeks the stir of the vacation trade will begin to be felt.

FARM LIGHTING SETS.—These units are in good demand. A price advance of \$25 on Delco sets was scheduled for yesterday, making the 80-amp.-hr. outfit \$395, and the 160-amp.-hr. outfit \$465.

FIBER CONDUIT.—Central-station demand is very small, and the prospects are unfavorable except in the industrial field. Four feet to 6 ft. of frost will delay outside work somewhat this spring, it is felt.

EBONY BOARD.—Government demands are heavy; deliveries are somewhat improved, probably on account of increased factory facilities. Prices hold firm.

ATLANTA

The embargo on the Eastern railroads covering shipments for the Southeast is beginning to be keenly felt by the various manufacturers and distributors in this section. Quantities of electrical supplies have been received lately, but this was due largely to the fact that the freight in question had been started and was consequently moved out of the embargoed area. Moreover, these shipments were long overdue. The method of freight movements now in use, by which the railroads are permitted to receive freight on two days and to embargo on five, has helped to relieve the situation to some extent in individual cases; but on the average shipment, where no priority movement can be secured, the hardship is great and a number of important jobs are being delayed considerably. On the whole, the problem of deliveries covering all lines is more serious now than for some time.

Secretary McAdoo's expression regarding the financing of public utilities and the recommendation for higher rates was favorably received and came at a time when the needs of all public service companies are very pressing. While the necessity for higher rates and additional funds for extensions is great over all this section, the Atlantic and Gulf ports appear to be in the worst shape. The shipbuilding industry and the phenomenal demands for energy in all associated lines has placed a burden on these stations. It is expected, then, in view of the administration's policy along this line, that much-needed equipment will be purchased even in the face of long shipments.

BELL-RINGING TRANSFORMERS.—The demand continues steady. Shipments heretofore have been good, but stocks are getting low owing to poor deliveries to jobbers from the East.

HEATING DEVICES.—Activity in all lines is very strong and the volume of sales shows a slight increase over January.

TEXTILE MOTORS.—The call for this type of apparatus shows some stimulation over last week, manufacturers reporting a large number of inquiries and some good orders. This field is handicapped at present by the fact that most of the power companies are pretty well loaded.

CHARGING OUTFITS.—The market for these is excellent and trade is very brisk. Deliveries have been good.

SEATTLE

The volume of business generally was gratifying during the past week, with wholesalers and retailers showing increases over the corresponding week of last year. Sales over last week showed but a slight increase, except in the case of floodlamps, wiring devices and sewing machines, which continue prime movers. In domestic appliances, washing machines are selling well, and sales of electric irons show a slight increase. There is no noticeable increase in buying from government or industrial plants. The volume to shipyards increased slightly, particularly in Portland and Gray's Harbor. Stocks of motors, conduit of the larger size, wire and lamps are very low. There is no change in prices in any line worthy of comment and no strikes are imminent in the Northwest. Collections to date are satisfactory. Credits are well in hand.

Authorities agree that unless something is done to relieve labor shortage, there will be a smaller acreage under cultivation this year in the Northwest. Dire shortage is threatened in the agricultural sections on account of enlistments, the draft and the rush to shipbuilding cities. Business houses, including jobbers, will be forced to resort to female help or run short-handed. The government may have to enlist men for farm work, as it has for shipbuilding and lumber production. It is impossible to obtain household help. Dealers say this accounts for the heavily increasing sales of electrical labor-saving devices. Residence building and remodeling continues to increase in Tacoma, Seattle and other shipbuilding centers. Residence building in Portland is beginning to rush.

Freight destined for Seattle and Northwest points, held up in the East by embargoes against Western freight, has begun to move slowly, and there is a gradual increase in freight receipts. Contracts will be awarded shortly for two

additional units for cantonments at the Puget Sound Navy Yard and five units at Camp Columbia, near Vancouver, Wash. Plans for materially increasing the size of Camp Lewis, near Tacoma, are being formulated. The production of lumber the last week was 8 per cent of normal; shipments 71 per cent of normal.

FLOODLIGHTS.—Orders are pouring in faster than can be supplied. The biggest demand is from Portland and the Gray's Harbor shipbuilding districts. There is an extreme shortage of certain types. Prices have not advanced.

LAMPS.—There is a heavy movement and stocks are extremely low. The usual volume to the shipyards and industrial plants is supplemented by heavy buying for new construction. Prices are firm.

WIRING DEVICES.—These goods are experiencing a lively movement, with residence construction making fresh demands. Stocks are in fair condition; prices remain the same.

CONDUIT.—The demand from shipyards has decreased in the past two weeks, but the demand for new construction is increasing. Deliveries are causing considerable alarm. Shortages exist in jobbers' stocks. Apparently shipyards have ample for immediate needs.

FIXTURES.—The volume of sales by retailers is increasing daily. Indirect lighting is in great demand for new residences. Stocks appear ample.

SAN FRANCISCO

The past week has been noticeable for the first steady rain of the season, averaging 2 in. along the coast and 4 in. in the interior valleys. The rain was accompanied by a snowfall 3 ft. deep on the mountains, and the long line of snow-covered Sierra peaks was a most gratifying sight to central-station men.

However, the sale of pumping plants continues brisk, although hampered by diminishing stocks. Speedy replacement of sales is impossible because of the freight embargo placed east of the Mississippi River upon all commodities except foodstuffs and munitions. The time in transit required for cars to the Pacific Coast from Atlantic and central points is double what it was before the congestion, and with the rail tie-up it is evident that no early relief may be expected. Conduit stocks are very low with no prospect of improvement because of the war-time activities of the producing mills.

Electrical contracting business continues good, with plenty of small wiring jobs, in spite of the fact that early prophecies of 1918 conditions discounted such work in favor of industrial and governmental contracts. Rubber-covered wire sales are brisk, and the anxiously awaited shipments speedily melted before the back orders awaiting them. Factory shipments are fair. Interphones are evidence of the increase in private installations, for several jobs have been recently let in the interior cities.

Fuel shortage, the scarcity and high wages of household help and a feeling of personal sacrifice engendered by war conditions have united to form a wedge long needed to pierce popular ignorance and indifference to the merits of household electrical devices. The fuel situation, which cripples Eastern central stations, results in more business for California's hydroelectric plants. The officer in charge of the army hospital at Camp Fremont recently stated that were there another shortage of coal in the camp (the government having provided coal stoves) he would ask for an electrified heating and cooking equipment. The officials of the navy hospital, at Mare Island, have already made such a requisition. Camp Curry, an exceedingly popular resort in the Yosemite Valley, has just purchased two large hotel-type ranges, a 180-loaf baking oven and a hotel-size bread toaster, with a cottage radiator and water-heating system to follow. The Southern Pacific company intends to equip its fine modern hotel on the Apache Trail, near Yuma, Ariz., with an electrical kitchen grill and water-heating system.

So much for the larger equipment; but unless the mountain snowfall continues heavy and packs harder for frozen storage, there will be no organized campaigns for the sale of domestic ranges and water heaters this year.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00
Twin-Conductor	
No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
Less than coil.....	List to \$61.00
Coil to 1000 ft.....	10% to 59.17
No. 12 Solid	
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	10% to 68.87
Twin-Conductor	
Less than coil.....	List to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
No. 12 Solid	
Less than coil.....	List to \$135
Coil to 1000 ft.....	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor	
Less than coil.....	+ 10% to + 20%
Coil to 1000 ft.....	5% to 10%
No. 12 Solid	
Less than coil.....	+ 10% to + 20%
Coil to 1000 ft.....	10% to 5%
Twin-Conductor	
Less than coil.....	List to \$115
Coil to 1000 ft.....	10% to \$80
No. 12 Solid	
Less than coil.....	+ 10% to + 20%
Coil to 1000 ft.....	10% to 5%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to \$24.00
1/5 to std. pkg.....	20% to 19.80
Std. pkg.....	34% to 18.75

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175	.3275
Barrel lots.....	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/4-in. s. stp... Net to \$75.00	15% to \$69.75
3/4-in. d. stp... +10% to 75.00	List to 72.00
1/2-in. s. stp... List to 100.00	15% to 93.00
1/2-in. d. stp... +10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/4-in. single strip....	\$75.00 \$63.75
3/4-in. double strip....	78.25 to 78.75 71.25
1/2-in. single strip....	100.00 85.00
1/2-in. double strip....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in. \$25.00-\$55.00	\$20.50-\$24.50	\$20.00-\$21.50
1/4-in. \$28.00-\$60.00	\$22.50-\$27.00	\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in. \$36.67-\$55.00	\$25.00	\$22.50
1/4-in. \$40.00-\$60.00	\$27.00	\$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2
Couplings, List	
1/4.....	\$0.05
1/2.....	.06
3/4.....	.07
1.....	.10
1 1/4.....	.13
1 1/2.....	.17
2.....	.21
2 1/2.....	.28
3.....	.40
Elbows, List	
1/4.....	\$0.19
1/2.....	.19
3/4.....	.19
1.....	.25
1 1/4.....	.37
1 1/2.....	.45
2.....	.50
2 1/2.....	1.10
3.....	1.80
3.....	4.80

DISCOUNT—NEW YORK

Less than 2500 lb. 1/4 in. to 1/2 in.	4% to 6%	3/4 in. to 3 in. 7% to 9%
2500 to 5000 lb. 1/4 in. to 1/2 in.	6% to 8%	3/4 in. to 3 in. 9% to 11%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

Less than 2500 lb. 1/4 in. to 1/2 in.	2.8% to 3.7%	3/4 in. to 3 in. 5.8% to 6.7%
2500-5000 lb. 1/4 in. to 1/2 in.	4.8% to 5%	3/4 in. to 3 in. 7.8% to 8.7%
(For galvanized deduct six points from above discounts.)		

FLATIRONS

NEW YORK

List price.....	\$6.00
Discount.....	30%

CHICAGO

List.....	\$5.00
Discount.....	25%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard package, 500. List, each,	\$0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard package, 500. List, each,	\$0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt-B	100	\$0.30
60-watt-B	100	.35
100-watt-B	24	.70
75-watt-C	50	.70
100-watt-C	24	1.10
200-watt-C	24	2.20
300-watt-C	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt-G 25	50	.53
25-watt-G 25	50	.55
40-watt-G 25	50	.55
Round bulbs, 3 3/4 in., frosted:		
60-watt-G 30	24	.77
Round bulbs, 4 3/4 in., frosted:		
100-watt-G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$24.90 to \$31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$29.00 to \$30.00
Coil to 1000 ft.	21.50 to 22.50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.75 to \$24.00
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OUTLET BOXES

	List, per 100
No. 01—A, A1 1/2, 4 S.C., 6200, 320	\$30.00
02—B.A., 6200 S.E., 300, AX, 1 1/2, 4 S.	30.00
03—C.A., 9, 4R, B 1 1/2	25.00
06—F.A., 7, C.S., 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list	25%-37%	20%-32%
10.00 to \$50.00 list	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list	40%	35%
10.00 to \$50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200. List per 1000,	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75	
1/5 to std. pkg.	15.60 to 20.75	24.20	

CHICAGO

	Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N.C.			
Less than 1/5 std. pkg.	\$11.85	\$30.75	
1/5 to std. pkg.	11.10	24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push		
1/2-in. cap key and push sockets, 500	\$0.33	
1/2-in. cap keyless socket	500	.30
1/2-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	14% to \$25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
60-amp. 3 P. S. T.	1.80
100-amp. 3 P. S. T.	2.68
200-amp. 3 P. S. T.	5.08
300-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

High Grade	
Less than \$10 list	List to + 5%
\$10 to \$25 list	11%
\$25 to \$50 net	14% to 15%
Low Grade	
Less than \$10 list	5% to 10%
\$10 to \$25 list	16%
\$25 to \$50 list	24% to 25%

DISCOUNT—CHICAGO

High Grade	
Less than \$10 list	+ 5%
\$10 to \$25 list	10% to 11%
\$25 to \$50 list	14%
Low Grade	
Less than \$10 list	5%
\$10 to \$25 list	16%
\$25 to \$50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to 30%

SWITCH BOXES, SECTIONAL CONDUIT

	Union and Similar—	List, Each
No. 155		\$0.34
No. 160		.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list		Net
\$2.00 to \$10.00 list	10% to 20%	5%
\$10.00 to \$50.00 list	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25%	15% to 20%
\$2.00 to \$10.00 list	25%	20%
\$10.00 to \$50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$6.00
Discount	30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	\$0.44 1/4
No. 18, full spools	0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools	\$0.57 1/2 to \$0.65
No. 18, full spools	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

Price per 1000 Ft. Net				
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	5000 Ft.
11	\$15.00-\$18.00	\$13.00	\$10.25-\$11.50	
12	23.25-25.41	21.30-21.78	15.97-19.35	
10	32.40-35.21	29.70-30.18	22.13-27.00	
8	45.70-49.12	41.90-42.12	30.88-38.00	
6	72.40-77.84	66.35-66.72	48.93-60.30	

CHICAGO

Price per 1000 Ft. Net				
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.	5000 Ft.
14	\$18.00	\$13.00-\$13.50	\$11.50-\$12.00	
12	25.52-\$25.69	22.02-25.33	18.35-20.93	
10	36.48-36.82	27.94-31.26	22.86-29.23	
8	42.54-51.73	38.99-44.13	31.90-41.36	
6	67.38-81.83	56.15-75.61	50.50-70.70	

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$35.50 to \$40.00
25 to 50 lb.	34.50 to 39.00
50 to 100 lb.	33.50 to 38.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Industrial Lighting Fixtures

The Luminous Unit Company of St. Louis, Mo., has developed the industrial light shown herewith, which is made in sizes to accommodate lamps ranging from 100 watts to 1000 watts. It is said that this unit is scientifically cor-

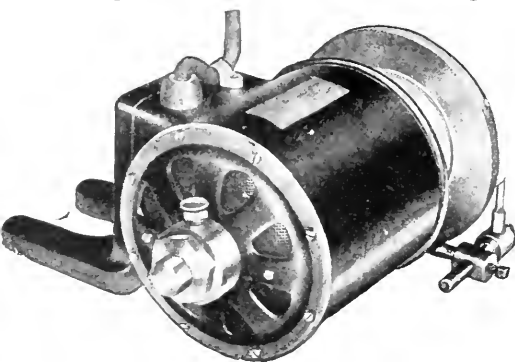


ADAPTABLE TO PRESENT LIGHTING EQUIPMENTS

rect in design, making possible high physical efficiency and at the same time eliminating all objectionable glare. This fixture is composed of two elements, an upper element of white porcelain enameled steel and a white porcelain enameled-steel reflecting cone suspended below the upper reflector in such a manner that all light above the angle of 40 deg. is intercepted and reflected to the working plane. This fixture can be attached to any socket in a minute and is adaptable to present lighting equipments.

Tool-Post Grinder

Gilfillan Brothers Smelting & Refining Company of Los Angeles, Cal., is manufacturing a tool-post grinder adapted for use on lathes. An angle



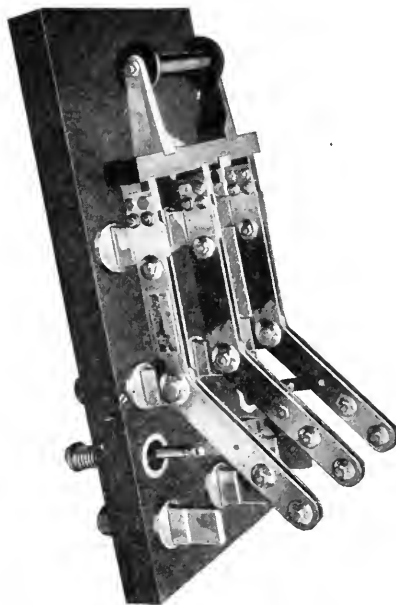
FOR USE ON LATHES

plate can be clamped around the tool post. There is a vertical adjustment of the grinder provided. This grinder

is equipped with a Westinghouse $\frac{1}{4}$ -hp. motor running at 3400 r.p.m. It is provided with a 6-in. by $\frac{3}{8}$ -in. (15.2-cm. by 0.9-cm.) grinding wheel, an extension mandrel for internal grinding fitted with a $1\frac{1}{2}$ -in. by $\frac{3}{8}$ -in. (3.8-cm. by 0.9-cm.) wheel, a tooth rest for cutter grinding and an electric attachment plug with $7\frac{1}{2}$ ft. (2.3 m.) of cord.

Automatic Knife Switch

The Electrical Engineers' Equipment Company of Chicago is now manufacturing a line of automatic knife switches. The switch proper is constructed according to the company's standard design, having double blades which are driven home over clip contacts, spring washers being employed to secure proper contacting. Normally



WELL ADAPTED WHERE CONTINUITY OF ENERGY IS IMPORTANT

the switch is closed into the upper contacts. These contacts are supplied from the customary source of power. In case this supply is interrupted a low-voltage coil operates, releasing springs which throw the switch blades into the lower row of contacts. These latter contacts are supplied from some independent source of power. When the normal source of energy is restored a bell alarm is sounded which is a signal for the attendant that the switch should be thrown manually into the upper contacts. The maker says that this type of switch is well adapted for use where continuity of energy supply is important. While the switch shown herewith is a 300-amp., 110-volt type, it can be made for all kinds of service.

Keyless Socket

Especially in millwork, it is frequently helpful to take advantage of the opportunity to place a larger number of lamps per circuit than the code permits for general wiring. In order to provide a keyless socket for pendent



FOR PENDENT DROP LIGHTS

drop lights wired with No. 14 portable cord, the Bryant Electric Company of Bridgeport, Conn., has added to its line of "New Wrinkle" socket caps one having a strain relief porcelain bushing with $\frac{1}{2}$ -in. (1.3-cm.) hole. The catalog designation of this socket cap is CB. When used in connection with the Bryant Company's No. 13 "New Wrinkle" keyless socket body, it provides a device that meets the conditions contemplated by rule 23-D as to inspection departments, the contractor and the customer.

Motor-Operated Therapeutic Machine

The Sanitarium Equipment Company of Battle Creek, Mich., has developed a motor-operated magneto which produces alternating current for medical purposes, including hydroelectric baths and automatic exercise. The equipment consists of an insulated table on which are mounted the driving motor, the magneto which generates the sinusoidal current, the interrupter, the speed and current controls and the connection posts.

A fractional-horsepower motor made by the General Electric Company is used. This drives the magneto through a leather-insulated friction disk. Speed is regulated and controlled by a hand screw which moves the motor on sliding-base rails to change the relative position of the friction disk on the motor shaft to the friction wheel on the generator or magneto shaft. The nearer the center of the disk the point of contact of the wheel, the slower the speed of the magneto.

Alternating current generated by the magneto is made and broken by a silent chain-drive interrupter which always acts at the same point in the wave in order to make the current painless. By the addition of a rotary converter on the magneto the cycles of the sin-

solid current all flow in the same direction, producing its characteristic waves.

This current is thoroughly insulated from that supplied to the motor via the lamp socket, and there is complete insulation to prevent the current supplied to the motor from reaching the patient.

Electrical Control for Calenders

A system of semi-automatic control for 115-230 volt, four-one-speed, double-voltage, shunt-wound motors for driving rubber calenders has been developed by the General Electric Company. The calender drive is operated through a master controller designed to give 115-volt or 230-volt operation with eighteen speed points on each voltage for speed regulation.

Throwing the master controller in one direction starts the motor on 115 volts, and the field is automatically kept at full strength during acceleration. The accelerating contactors are of the series-current limit type and have a load pick-up to insure that they will come in on light loads. When the final accelerating contactor closes the motor will further accelerate to the full weakened speed at which the controller is set.

If a still higher speed is desirable, swinging the controller handle in the opposite direction will put the motor on the 230-volt line, where armature and field acceleration will occur as on the 115-volt line, eighteen additional speed points being now available. There is no objection to starting directly on 230 volts if the operator so desires. Bringing the controller to the "off" position will allow the motor to stop.

A "safety first" feature of the equipment is the "quick stop" device. This is a small inclosed switch with a lever arranged to be operated by a rope which runs across the calender where the workman can easily reach it. When this switch is pulled all line circuits are broken and the calender equipment is brought to a very quick stop by means of three-point dynamic braking. The calender drive cannot be started again until the stop switch is reset.

The entire system is extremely simple. There is not an electrical interlock on the control panel. This is an important feature, as in previous methods of control which utilized electrical interlocking the sulphur in the rubber mills formed a coating in the interlock contacts, which at times prevented them from making circuit. Mechanical interlocks are used in the new system and afford protection against the possibility of contactors sticking in. The accelerating contactors have a self-contained operating and calibrating coil, and the contactor is cut out after operating.

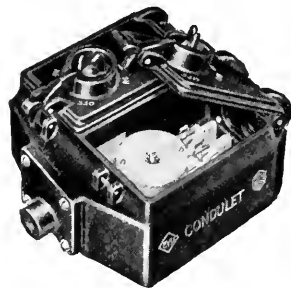
The motor used for the calender drive is the type RF motor, which is applied in sizes up to 75 hp. for single-voltage and 125 hp. for double-voltage equipments. Where the single-voltage system is used either automatic or semi-automatic control can be provided.

Small Motor Switches

Here is shown an illustration of one of two switch condulets of the ZY series—the latest addition to the line of conduit fittings manufactured by the Crouse Hinds Company of Syracuse, N. Y. It is claimed that these condulets protect the switch operator and the person renewing fuses from shock; they cannot be operated by accident; they withstand the roughest usage; water will not drain into them, and it is impossible for lint or other inflammable particles to lodge upon the current-carrying parts and thus create a fire hazard.

Both the body of the condulet and its cover are cast iron. Inside is a combined 20-amp. snap switch and fuse block. The switch is externally operated, and its handle interlocks with the latch of the door in such a way that the latter cannot be opened when the switch is in the "on" position. As a result of this arrangement the circuit is dead when the door is open and fuses can be replaced without danger of shock or short circuit.

As the machine operator or any other person not skilled in electricity



TWO-GANG FORM

can change fuses with perfect safety in ZY condulets, their use prevents all the loss in productive time which is unavoidable where an electrician must be sent for to replace fuses. This in the course of a year means a considerable saving in the operating time of the average mill.

The manufacturers list ZY condulets in one-gang and two-gang forms and in sizes and arrangements of threaded conduit hubs to meet various conduit wiring arrangements.

Quartz Mercury-Vapor Lamp for Ultra-Violet Light

An improved form of quartz mercury-vapor lamp which embodies new features in construction and application is manufactured by the R U V Company of New York City. This lamp produces an ultra-violet component several times stronger than that yielded by other forms of quartz-mercury vapor lamps. The wave lengths of its light have been measured as low as 0.18μ , indicating a high degree of activity, it is claimed.

The lamp has an exceptionally clear crystal-quartz frame containing mercury, fitted at each end with terminals and provided with an unusually high vacuum. The cathode terminal of the lamp under running conditions contains

practically all of the mercury, as the pressure built up in the luminous tube forces the mercury back into the cathode end. The anode end is fitted with a tungsten terminal that is refined to a point approaching 100 per cent purity in order to prevent discoloration of the luminous tube.

This type of lamp is known as the "hot anode" type and differs from all other designs in that no mercury chamber is used at the anode end. This feature permits of operation of the lamp in any plane from vertical to horizontal, and therefore permits of application to practically any equipment used by the chemical manufacturer.

To support the mercury-vapor arc, as in the case of all mercury-vapor arcs ballast resistance is required, and such resistance is placed in series. When the lamp is started cold, about 20 ohms resistance is placed in series, but when the lamp is normally operating one-half of this resistance is cut out so that normally 10 ohms is constantly in series with the lamp terminals. This cutting out of resistance is accomplished automatically on a small switch-board that is provided as an accessory.

The starting characteristics of the lamp are therefore 8.5 amp. at 220 volts direct current, which is required normally for 10 to 15 minutes. As soon as the starting resistance of 10 ohms is cut out, the lamp, then being in normal running condition, consumes 3.5 amp. at 220 volts direct current.

Convenient Current Transformer

In towns where construction men are not familiar with "wiped" joints on ornamental lighting circuits the new General Electric current transformer for series circuits, with a union joint, is a great convenience. With the transformer it is not necessary to "wipe" the joints inclosing the gap between the lead sheath of the underground cable and the sleeves surrounding the cable



PROVIDED WITH STRONG UNION JOINT

going from the transformer. This device is provided with a strong union joint which, when screwed up tight, is entirely waterproof.

Trade Notes

THE HARTCOCK & WILCOX COMPANY of New York City has removed its Boston office from 35 to 19 Federal Street.

THE METROPOLITAN ENGINEERING COMPANY of Brooklyn, N. Y., has moved from New York City to 1250 Atlantic Avenue, Brooklyn, N. Y.

THE C. W. HUNT COMPANY, INC., manufacturer of coal-shoveling machinery, New York City, has removed its offices from 45 Broadway, to the Astor Trust Building, 501 Fifth Avenue.

THE MARRON MANUFACTURING COMPANY of Rock Island, Ill., has absorbed the Trio Manufacturing Company, which has been making a line of approved knife switches for years.

THE LIGHTOLIER COMPANY of New York City on Feb. 15 became the name of the New York Gas & Electric Appliance Company. All goods that it manufactures will be sold under the registered trademark of "Lightoliers."

THE DEPARTMENT OF COMMERCE of Washington, D. C., has published "Foreign Tariff Notes," No. 26, issued by the Bureau of Foreign and Domestic Commerce. The pamphlet has a special chapter on "Effect of the War on Tariff Policies."

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., announces the removal of its branch office from Phoenix to Tucson, Ariz. J. H. Knost and W. G. Wilson, the company's representatives, will have headquarters in the Immigration Building.

THE H. C. ROBERTS ELECTRIC SUPPLY COMPANY of Philadelphia, manufacturer of electrical supplies, has completed the removal of its establishment from 905 Arch Street to the new five-story building at the corner of Eleventh and Race Streets. The new location provides for increased capacity.

FRED WILMARTH will represent the Greusol-Quarfort Electric Company of Milwaukee, Wis., in northern Illinois and southern Wisconsin, with headquarters at Rockford, Ill. Frank W. Greusol, president of the company, who has looked after this territory heretofore, will remain at the home office.

THE H. W. JOHNS-MANVILLE COMPANY of New York City has opened a branch house in its new building, corner of Olive and Eleventh Streets, St. Louis, Mo. It is a six-story structure of modern fireproof construction. Whenever practicable the company's products were used in the finishing of the building.

THE SWAN & FINCH COMPANY of New York City has just celebrated its sixty-fifth birthday, having started in February, 1853, in a small way. At the present day the company has classified 103 industries in which one or more of its products are used. Its main plant at Bayway, N. J., covers more than 15 acres.

J. HOWARD SANDIDGE, who has been employed in the Chicago office of the Cooper Hewitt Company, has opened an office for that company in Milwaukee, with headquarters at 1011 Majestic Building. This change has been made in order to cultivate more intensively a territory with which Mr. Sandidge is familiar.

THE ESTERLINE COMPANY of Indianapolis, Ind., announces the appointment of the Northern Electric Company, whose main office is at Montreal, as exclusive distributor of Esterline products for the entire Dominion of Canada. The Northern company has branch offices in Halifax, Ottawa, Toronto, London, Winnipeg, Calgary and Vancouver.

THE DRIVER-HARRIS COMPANY of Harrison, N. J., regrets to announce the death of its treasurer, George J. Althen, on Feb. 15. Mr. Althen for the past four years had been connected with the company and was well known on account of his affiliation with the National Credit Men's Association. He represented New Jersey on the executive committee of that body.

THE NATIONAL LAMP WORKS OF THE GENERAL ELECTRIC COMPANY has purchased the automobile plant and land of the Abbott Corporation at Cleveland, Ohio, which is now in financial trouble. The plant is at One Hundred and Fifty-second Street and the Nickel Plate Railroad Company tracks. The consideration was about \$200,000. The deal includes a one-story building, 110 ft. by 681 ft., and five acres of land.

L. K. COMSTOCK & COMPANY, contracting engineers, announce the establishment of an office in the Union Trust Building, Washington, D. C. This action is taken by the Comstock company for the purpose of co-operating with the various government departments and general contractors in the execution of electrical and mechanical installations arising out of the government war construction program. E. C. van Cleaf and C. E. Stewart will be located in Washington for the purpose of rendering service to the various departments and contractors.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., to insure service and every possible assistance to the various departments of the United States government, has arranged to station H. W. Knowles of its New York office permanently in Washington for the period of the war. Mr. Knowles entered the service of the Cutler-Hammer company shortly after being graduated from Cornell University in 1912. He spent nearly five years in the shop, engineering and sales department at Milwaukee. Since May of last year he has been connected with the New York district office. The Washington branch will have its headquarters at the Bradford, Eighteenth and K Streets.

New Incorporations

THE GARDEN CITY (KAN.) POWER COMPANY has been incorporated with a capital stock of \$750,000 by J. P. Nolan, F. A. Gillespie and J. S. McNamara.

THE SOUTHWESTERN ELECTRIC COMPANY of Tulsa, Okla., has been chartered with a capital stock of \$3,000 by C. D. Shamel, H. D. Maxwell and R. W. Shamel.

THE SHERIDAN STORAGE BATTERY COMPANY of Creston, Iowa, has been incorporated with a capital stock of \$20,000. The officers of the company are: L. J. Sheridan, president, and Harold Davis, secretary.

THE CENTRAL KENTUCKY LIGHTING & POWER COMPANY of Lexington, Ky., has been incorporated by E. L. Uncapher of Cincinnati, Ohio; W. I. Katterjohn of Paducah and Edward Johnson of Lexington, Ky.

THE CUMBERLAND ELECTRIC MANUFACTURING COMPANY of Memphis, Tenn., has been incorporated with a capital stock of \$6,000 to manufacture electrical supplies, etc. The incorporators are: M. W. Wilson, H. A. Beckmann and others.

THE AMERICAN BURGLAR ALARM COMPANY of Buffalo, N. Y., has been chartered with a capital stock of \$10,000 by C. J. and William Stroke of Buffalo. The company proposes to manufacture electric burglar alarms and kindred products.

THE THORP (WIS.) ELECTRIC LIGHT & POWER COMPANY has been chartered with a capital stock of \$10,000 by P. D. Kline, Donald Boyd and E. C. Dearth. The company proposes to take over the municipal electric-light plant in Thorp and enlarge same.

THE WEST SIDE ELECTRIC CONTRACTING COMPANY of New York, N. Y., has been incorporated by Samuel Berkowitz, S. Berkowitz and E. Jacobson. The company is capitalized at \$1,000 and proposes to do a general electrical contracting business.

THE WEBSTER ELECTRIC COMPANY of Racine, Wis., has been chartered by Walter Brown, P. G. Crewe and John B. Simmons. The company is capitalized at \$600,000 and proposes to manufacture small electric motors and electrically driven devices and appliances.

THE CUMBERLAND ELECTRIC MANUFACTURING COMPANY of Memphis, Tenn., has been incorporated by M. W. Nelson, H. A. Beckham, E. L. Nelson, J. S. Nelson and William C. Burton. The company is capitalized at \$6,000 and proposes to manufacture electrical supplies.

THE LOWENSTEIN RADIO COMPANY of New York, N. Y., has been incorporated with a capital stock of \$500,000 by F. Lowenstein, 397 Bridge Street, Brooklyn, N. Y.; H. G. Wilson, 233 Broadway, New York, N. Y., and A. Harris of Newark, N. J. The company proposes to manufacture wireless apparatus.

THE COLE STORAGE BATTERY COMPANY of Chicago, Ill., has been incorporated with a capital stock of \$100,000 by William Navigate, Samuel Goldfarb and H. A. Silverstein, all of Chicago, Ill. The company is capitalized at \$100,000 and proposes to do business in storage batteries and other kinds of batteries.

Trade Publications

LAMP GUARDS.—Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared a leaflet descriptive of its Hubbell lamp guard.

LINE SPECIALTIES.—W. N. Matthews & Bro., Inc., of St. Louis, Mo., is distributing a catalog descriptive of its line-material specialties.

HEADLIGHTS.—The Ohio Brass Company, Mansfield, Ohio, has prepared a folder descriptive of its luminous and incandescent type of headlights.

FOREIGN TRADE INFORMATION.—The American Express Company of New York City has prepared a booklet descriptive of its foreign trade information.

TELEPHONE BRACKET.—The Northern Electric Company of Minneapolis, Minn., is distributing a leaflet descriptive of the Burns adjustable telephone bracket.

PUMPING UNITS.—The Allis-Chalmers Manufacturing Company of Milwaukee, Wis., has prepared a circular descriptive of its type "S" centrifugal pumping unit.

CIRCUIT BREAKERS.—The Roller-Smith Company, 233 Broadway, New York City, has prepared bulletin No. 500, descriptive of its inclosed type plain no-voltage circuit breakers.

FANS.—Century alternating-current stationary and oscillating desk and bracket fans are illustrated and described in a circular prepared by the Century Electric Company of St. Louis, Mo.

DISCONNECTING HANGERS.—The Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, has prepared catalog B-17, descriptive of its Thompson safety disconnecting hangers.

DIES.—The Wells self-opening die is illustrated and described in a bulletin prepared by the Greenfield Tap & Die Corporation of Greenfield, Mass. The advantages of self-opening dies are pointed out.

REFLECTORS AND FIXTURES.—The George Cutter Company of South Bend, Ind., is distributing bulletin No. 3337, descriptive of its Sol-Lux industrial lighting reflectors and fixtures. This bulletin takes up the value of good industrial lighting, describes holder sockets, reflectors, industrial lighting reflectors, reflector-cap diffusers, one-piece reflectors, pendent fixtures, bracket fixtures and sign lights. This company has also prepared bulletin No. 3338, descriptive of its universal and standard flood-lighting projectors.

AMMONIA COMPRESSOR.—The De La Vergne Machine Company of New York City has prepared an attractive bulletin entitled "Ammonia Compressor Capacity." In this bulletin it is pointed out that 222 new-style vertical safety compressors of this company's make have been installed in place of old compressors during four years. A few letters from satisfied customers are appended. This company has also prepared a bulletin descriptive of its counter-current ammonia condenser, including information regarding two batteries of ammonia condensers at the plant of Wilson & Company, New York City.

SAFETY-SWITCH BULLETIN.—Safety auto-lock switches are described and illustrated in some detail in special publication No. 1586-A, just issued by the Krantz Manufacturing Company, Inc., of Brooklyn, N. Y. These switches are designed for use on circuits wherever the ordinary knife switch may be applied. They are especially designed for safety, it being absolutely impossible to touch the live parts regardless of the position of the switch or of the door. They are particularly adapted for use in steel mills, factories, mines and other similar locations where men are employed who have no practical knowledge of electricity.

CONDENSATION UTILITIES.—The Farnsworth Company of Conshohocken, Pa., has prepared an illustrated bulletin descriptive of its condensation utilities. The following apparatus are described: Duplex boiler feeder, duplex condenser-vacuum boiler-feed pump, duplex pumping trap, duplex condenser-vacuum pumping trap, direct-return condenser-vacuum trap, direct-return trap, pumping trap condenser-vacuum pumping trap, high-vacuum trap, separating or non-return trap, variable-pressure trap or combined pumping and non-return or separating trap, and variable-pressure condenser-vacuum pumping and separating trap. A chart showing the goal which can be saved by increasing the temperatures of the feed water by using the machines made by this company with closed system, or keeping the condensation under pressure, is given.

New England States

BRATTLEBORO, VT.—The Public Service Commission has granted the Twin State Gas & Electric Company permission to issue \$40,000 in bonds to cover extension of transmission lines in Brattleboro, Bennington and St. Johnsbury, and for improvements at its West Dummerston power plant.

ADAMS, MASS.—The Renfrew Manufacturing Company is contemplating the construction of a power plant to supply electricity to operate its several mills. The proposed plant, it is reported, will be located on Columbia Street, on the site now occupied by the old Broadley mill, from which electricity would be transmitted to the main mill in Renfrew and to those in the Maple Grove district of the town.

NEW HAVEN, CONN.—A new power plant is being erected at the plant of the Harlin Arms Corporation, Willow Street, in connection with the construction of a new factory building. Frederick T. Ley & Company of Springfield, Mass., has the contract.

Middle Atlantic States

HAVERNE, N. Y.—Walter H. Goehagen, c. 147 Remsen Street, Brooklyn, is planning to construct a shipbuilding plant at Haverne, including erection of one-story machine shop, 200 ft. by 300 ft., a wood-working shop and saw mill, 200 ft. by 300 ft., boiler house, etc., to cost about \$100,000.

BUFFALO, N. Y.—The City Council has authorized George H. Norton, city engineer, to engage a consulting engineer to report on the feasibility of constructing a hydroelectric power plant near Niagara Falls for the city, to cost about \$1,000,000.

BUFFALO, N. Y.—Arrangements have been made by the Westinghouse Electric & Manufacturing Company for the lease of a factory building, located at Milton and Harrison Streets, formerly occupied by the Standard Mirror Company. This building will replace the plant of the company on Locke Street, recently destroyed by fire.

JAMESTOWN, N. Y.—The erection of an electric power plant on the Jamestown Cotton Mills property is under consideration at the Crescent Tool Company. The present plans provide for the installation of a 100-kw. turbo-generator; electricity to be transmitted to the main plant at the corner of Harrison Street and Foote Avenue, which is now operated by gas (natural) engine power.

NEW YORK, N. Y.—Contract has been awarded by Kyle & Purdy, 282 King Avenue, City Island, ship and boat builder, for three-story addition to its plant on Fordham Street, 60 ft. by 180 ft., and the erection of a boiler house, 30 ft. by 50 ft.

NEW YORK, N. Y.—Plans have been prepared by H. Harlach, 451 East 144th Street, for an addition to the boiler house of the Arabol Manufacturing Company, 100 Hillam Street, New York City, on Sanford Street, near Flushing Avenue, Brooklyn.

HARRISON, N. J.—The Driver-Harris Company is contemplating rebuilding its plant recently destroyed by fire. Two buildings, one three stories, 40 ft. by 200 ft., and the other 25 ft. by 100 ft., will be erected. The company manufactures wire and wire products.

JERSEY CITY, N. J.—Recommendations have been made to the City Commission by the Department of Public Safety, Roger Boyle, fire chief, providing for extensive improvements to the fire alarm system, which include the installation of underground conduits to replace overhead wires, installation of gong circuits, to remove all fire houses from box or strait circuits; installing an auxiliary switchboard, and the installation of new fire alarm systems in all school buildings.

NEWARK, N. J.—The contract for the installation of electrical work for large warehouses and port terminals to be erected at Newark, N. J., by the United States Government has been awarded to the Grand Electric Company of Louisville, Ky.

SUMMIT, N. J.—Plans are being considered by the Commonwealth Water Company of Summit for the installation of a steam-turbine centrifugal type pumping unit having a daily capacity of 1,000,000 gal., at its Canoebrook pumping station. Frank C. Kimball is general manager.

CHESTER, PA.—To meet the increasing demand for power service the Delaware County Electric Company, controlled by the Philadelphia Electric Company, is constructing a large steam power station in Chester on the Delaware River. The new station is designed for an ultimate output of 120,000 kw., of which it is expected that an initial 60,000-kw. unit will be in operation by Aug. 1, 1918. This plant will supply energy to the United States government shipyards at Hog Island, now under construction and in partial operation.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

LEBANON, PA.—Preparations are being made by the Metropolitan Edison Company of Reading for the installation of a new rotary converter at its local plant.

PHILADELPHIA, PA.—Plans have been prepared for the construction of a new power house, 50 ft. by 60 ft., at 2626 Martha Street for the Cocoa Butter Manufacturing Company. Andrew J. Sauer & Company of Philadelphia are architects.

PITTSBURGH, PA.—Plans have been prepared for the installation of electrical, switchboard and heating apparatus in the proposed new five-story factory building of the Pennsylvania Chocolate Company.

CHARLESTON, W. VA.—The construction of a terminal station on Kanawha Street is under consideration by the Charleston-Dunbar Traction Company.

FIRECO, W. VA.—The Battleship Coal Company of Princeton, recently incorporated with a capital stock of \$150,000, contemplates the installation of a central electric power plant in connection with a coal and coke mining camp at Fireco. The project includes the erection of 50 houses for miners. H. E. Hines is president.

WASHINGTON, D. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, for the construction of a new one-story boiler shop, 100 ft. by 200 ft., at the Washington Navy Yard, to cost about \$81,100.

WASHINGTON, D. C.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, for the construction of a new substation and frequency changer house at the Washington Navy Yard, to cost about \$200,000.

WASHINGTON, D. C.—Contract has been awarded by the Bureau of Standards, Department of Commerce, Washington, D. C., to the Turner Construction Company for the construction of an industrial testing laboratory, 167 ft. by 350 ft., four stories, with two courts, 85 ft. by 107 ft., to cost about \$630,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 4 for furnishing and installing two 220-ton, one 100-ton, three 25-ton, three 20-ton, nine 15-ton, one 10-ton and two 5-ton overhead electric traveling bridge cranes at the navy yard, Washington, D. C. Drawings and specifications (No. 2775) may be obtained on application to the above bureau or to the commandant of the navy yard named.

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North Central States

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company, it is reported, will build an addition, 105 ft. by 161 ft., to its power house on East Seventieth Street. New equipment, including a 25,000-kw. turbine, will be installed.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until March 8 for station transformers for the division of light and heat. Specifications may be obtained at the office of division of light and heat.

FLOODWOOD, OHIO.—The Central Electric Producing Company of Athens has started work on the installation of new equipment at its plant as follows: Additional boilers of 2000 hp., three 2500-kw., 2300-volt General Electric turbo-generators, with necessary transformers, switching apparatus and other accessories. J. T. Magruder of Nelsonville is superintendent of overhead distribution.

MANSFIELD, OHIO.—Negotiations have been closed whereby the Westinghouse Electric & Manufacturing Company has leased the plant of the Baxter Stove Company in Mansfield. The Westinghouse Company will take possession of the property immediately and will expend from \$20,000 to \$25,000 to equip the plant for the manufacture of electric ranges, electric heating stoves, electrical cooking devices, appliances, etc.

MARION, OHIO.—The Columbus, Delaware & Marion Electric Railway, it is re-

ported, will ask the city of Marion for a new 25-year franchise for the operation of the local electric-light plant and street railway system. Improvements involving an expenditure of about \$1,000,000 will be made to the power station and street railway system. Bonds to the amount of \$7,000,000 will be issued for improvements to the entire property, including the inter-urban road.

TOLEDO, OHIO.—The Toledo Electric Steel Company, it is reported, will construct a plant, 92 ft. by 350 ft., for the manufacture of high-speed and carbon tool steel. D. E. Rowe is president.

GREENVILLE, KY.—Plans are being prepared for the construction of a new central power plant, about 65 ft. by 80 ft., at the works of the W. G. Duncan Coal Company. Charles M. Means, Oliver Building, Pittsburgh, Pa., is consulting engineer.

RICHMOND, IND.—James P. Dillon, superintendent of the municipal electric-light and power plant, has made formal request to the City Council for an appropriation of \$200,000 for extensions to the municipal electric-light plant. Owing to the coal shortage several manufacturing plants are considering abandoning steam power next winter, provided the city can furnish the necessary electrical service.

GREAT LAKES, ILL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 11 for construction of three brick buildings, including heating, electric-lighting and plumbing systems, at the Naval Training Station, Great Lakes, Ill., under specifications (No. 2816), as follows: A two-story radio quarters, about 46 ft. by 28 ft.; a two-story residence, about 26 ft. by 42 ft., and a post office building, 73 ft. by 48 ft. Drawings and specifications may be obtained on application at the above office or to the commandant of the naval station named.

HARRISBURG, ILL.—The Illinois Public Utilities Commission has authorized the Central Illinois Public Service Company of Mattoon to purchase the plant and property of the Southern Illinois Railway & Power Company of Harrisburg.

STEWARTSON, ILL.—Steps have been taken for the installation of a joint electric lighting plant with Strassburg. A company is being organized with a capital stock of \$35,000 to operate the proposed plant. Energy will be secured from the high-tension lines of the Central Illinois Service Company at Windsor. Stewartson already has an electric plant, but Strassburg is without lighting facilities.

MENOMONIE, WIS.—Estimates, it is reported, are being received by Thomas L. Thorson, mechanical engineer, Menomonie, for the construction of the proposed co-operative central steam heating plant at Menomonie, consisting of a brick and concrete building, 111 ft. by 174 ft., equipped with eight 1200-hp. boilers, with provision for four additional boilers, pump room, power room and coal bunkers equipped with automatic stokers, coal-handling apparatus, ash conveyors, vacuum system, etc. The initial installation will have a capacity of 1800 hp. and provide a radiation of from 350,000 to 400,000 sq. ft. Electric equipment may also be installed in connection with this plant and exhaust steam and electricity both be used for heating.

NEW LONDON, WIS.—Preparations, it is reported, are being made by Albert M. Mayo & Company of New London, to reopen the wood-working plant, formerly owned by Kenkel Manufacturing Company. A new 100-hp. motor-generator set will be installed. Electricity from the municipal electric-light plant will be utilized.

REEDSBURG, WIS.—Improvements are contemplated to the municipal electric-light plant, including the installation of a new electric generating unit of 250 or 300 kw., directly connected to either a uniflow engine or a steam turbine, this summer. Otto F. Luepke is superintendent.

THORP, WIS.—The Thorp Electric Light & Power Company, recently incorporated with a capital stock of \$10,000, will take over the local municipal electric plant. The new owners, it is understood, will enlarge the plant and improve the system. P. D. Kline is one of the incorporators.

BEMIDJI, MINN.—Bids will be received by the Minnesota State Board of Control, State Capitol Building, St. Paul, until March 12 for the construction of the State Normal School Building, including the general contract work, heating and ventilating, plumbing and electrical work. Separate bids to be submitted on each division of the work. Copies of plans and specifications may be obtained upon application to C. H. Johnson, architect, 715 Capital Bank Building, St. Paul.

CEDAR RAPIDS, IOWA.—Bids will be received by the Board of Education, Cedar

Rapidly, until March 11, for the construction of a high school building, including hot water heating, electric wiring, plumbing, vacuum cleaner, etc. The cost of the building is estimated at \$75,000. K. T. Snyder, 933 Plymouth Building, Minneapolis, Minn., is architect.

CONCORDIA, MO.—Plans are being considered by the trustees of St. Paul's College for the construction of a new power plant at the institution. Charles F. May, Merchants' Laclede Building, St. Louis, is architect.

GREGORY LANDING, MO.—The installation of a pumping plant, to cost \$75,000, exclusive of building, is contemplated by the Gregory Drainage District. Edmund T. Perkins, Illinois State Bank Building, Quincy, Ill., is engineer.

META, MO.—The installation of an electric-light plant in Meta is reported to be under consideration. Fritz Schallert is said to be interested.

ST. LOUIS, MO.—The St. Louis Malleable Castings Company is planning extensions to its plant, including the erection of a machine shop, forge shop, foundry, electric power plant, etc.

FARGO, N. D.—Bids will be received by the Board of Education of Fargo, N. D., until March 25 for the construction of a new high school building. Plans and specifications may be obtained on application to William B. Itner, architect, Board of Education Building, St. Louis, Mo. A deposit of \$50 will be required for plans covering the general work and a deposit of \$20 for plans for electric work.

UPLAND, NER.—Preparations are being made for the installation of a municipal electric-light plant, to cost about \$6,500, for which bids have been received.

FORT RILEY, KAN.—The local substation of the Union Light & Power Company of Junction City was recently destroyed by fire, causing a loss of about \$10,000.

LAWRENCE, KAN.—The Bowerstock Mills & Power Company, it is reported, contemplates the construction of a large boiler house soon. The company supplies energy to the Kansas Electric Utilities Company of Emporia to operate the local system.

OTTAWA, KAN.—The City Council is contemplating extending the electric transmission line on South Willow Street from Eleventh to Fifteenth Street, and then east in Fifteenth from Willow to Locust Street.

PITTSBURG, KAN.—Bids will be received by the Sisters of St. Joseph, care of Sister Superior Martini, Pittsburg, for construction of addition to the Mount Carmel Hospital, to cost about \$100,000. Separate bids to be submitted on heating, electric wiring, electric or hand power elevator, vacuum cleaner, plumbing, etc. G. W. Van Meter, 504 Caldwell-Murdock Block, Wichita, is architect.

POTWIN, KAN.—The City Council has adopted an ordinance granting the Kansas Gas & Electric Company of Wichita a franchise to install and operate an electric lighting, power and heating plant or a distributing system in Potwin.

Southern States

DUNN, N. C.—The General Utility Company, recently incorporated, is planning to install an electric plant, to cost about \$25,000. As yet an engineer has not been engaged. B. O. Townsend, Marvin L. Wade and G. M. Tilghman are interested.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Light Company is considering increasing the output of its Meeting Street power house.

SPARTANBURG, S. C.—Plans are being considered by the South Carolina Light, Power & Street Railway Company for the construction of a new branch line to Camp Wadsworth, to cost about \$300,000.

SAVANNAH, GA.—The County Commissioners have granted the Chatham County Traction Company a franchise to construct and operate an electric railway from Stiles Avenue, on the Augusta Road, to the Brampton tract of the Foundation Shipbuilding Company.

HUMBOLDT, TENN.—Improvements will be made to the municipal electric-light plant, including the installation of a 300-kw. General Electric turbine, together with a Westinghouse La Blanc condenser and auxiliaries, about Aug. 1, 1918. W. M. Case is secretary and general manager.

NASHVILLE, TENN.—The Welch-Millard Company of Nashville would like to receive prices, etc., on second-hand drills and electrically driven pumps and a 60-kw. to 100-kw. generator with boiler and engine for delivery in 60 or 90 days.

MUSCLE SHOALS, ALA.—President Wilson has signed an order authorizing the

construction of a power dam at Muscle Shoals as part of the \$60,000,000 project for a government plant there for the fixation of atmospheric nitrogen for the use in the manufacture of munitions and fertilizer. The dam site has been offered to the government without cost by the Alabama Power Company, which has also agreed to transfer options on about 75 per cent of the land which would be affected by the overflow from the dam.

CONWAY, ARK.—The Council committee on light, heat and sewer systems has authorized E. W. Leverett, superintendent, to secure bids for the installation of a 150-hp. engine and generator for the municipal electric-light plant.

OAK GROVE, LA.—The Town Council of Oak Grove will accept proposals for thirty days for the installation of an electric-lighting plant and will issue franchise to parties with best plant and inducements. For further information address L. Grathwell of Oak Grove.

BLACKWELL, OKLA.—At an election to be held March 5 the proposal to issue \$82,500 for extensions to the municipal electric-lighting plant, \$77,500 for extending water-works system and \$15,000 for the purchase of fire-fighting apparatus will be submitted to the voters.

MADILL, OKLA.—The construction of a new plant in Madill is reported to be under consideration by the Consumers' Light & Power Company.

BOWIE, TEX.—An issue of \$15,000 in electric-light bonds has been approved by the Attorney General.

GRAPEVINE, TEX.—The Grapevine Light & Ice Company will install an entire new plant some time during 1918. It is proposed to enlarge the entire system.

YOAKUM, TEX.—The Yoakum Power, Light & Water Company is contemplating increasing its boiler capacity, also building additional water lines and installing additional water meters. John A. Donaldson is superintendent.

Pacific and Mountain States

BELLINGHAM, WASH.—The Puget Sound Traction, Light & Power Company is contemplating the erection of an electric transmission line to the Cokedale Mine to furnish 500 hp. to the plant there.

FERNDALE, WASH.—The British Electric Company, it is reported, is considering extending its electric transmission lines to Ferndale to supply electricity here for lamps and motors. The company also proposes to furnish electrical service to farmers in the Glendale district.

POMEROY, WASH.—The City Council is considering an application of the Pacific Power & Light Company for a franchise to supply electricity for lamps and motors in Pomeroy for a period of 50 years.

SEATTLE, WASH.—The Board of Public Works has changed the date of opening bids for a completed new power plant from March 1 to March 15.

SEATTLE, WASH.—The City Building Department has decided to erect the proposed power substation for the city lighting department at Fourteenth Avenue Northwest and West Forty-ninth Street by day labor instead of letting a general contract. Bids for material and sub-contracts will be handled through the city purchasing agent. The plans call for a two-story reinforced concrete building, 55 ft. square. Daniel Huntington, architect, has supervision of construction work.

SPOKANE, WASH.—Contract, it is understood, has been awarded by the Washington Water Power Company for a third generator (22,500 hp.) for its Long Lake plant to the General Electric Company.

DEL MAR, CAL.—The State Railroad Commission has authorized the sale of the electric distributing system of the Del Mar Water, Light & Power Company to the San Diego (Cal.) Consolidated Gas & Electric Company, for a consideration of \$11,055. The water system of the company is not included in the sale.

SACRAMENTO, CAL.—Application has been made to the Board of Supervisors of Sacramento by C. H. Slocum and R. A. Rose for a franchise to erect and operate an electric transmission line through Sacramento for a period of 50 years.

DUBOIS, IDAHO.—The Dubois Light & Power Company, recently incorporated with a capital stock of \$25,000, is planning to construct an electric plant to furnish electrical service in Dubois. A power site has been purchased on Beaver Creek near Dubois, where a dam 46 ft. wide at the top and 26 ft. high, will be built.

SALT LAKE CITY, UTAH.—The city

recorder has been instructed to advertise for bids for the installation of a special street-lighting system on Regent Street.

CHESTER, MONT.—Steps have been taken by local citizens to secure a better lighting system in Chester. It is proposed to have the Montana Power Company extend its service to the town.

HARLEM, MONT.—Bids will be received by the town clerk of Harlem until March 6 for the installation of an ornamental lighting system. Plans and specifications may be obtained on application to C. P. Wells, municipal engineer, Great Falls, Mont. Frank E. Meyer is town clerk.

COLORADO SPRINGS, COL.—The Golden Cycle Company is considering the construction of an electric power plant. At present the company secures electricity from the Colorado Springs Light, Heat & Power Company under a contract, which does not expire until 1920.

Canada

PRINCETON, B. C.—Work has been started on the extension of the West Kootenay Power Company's system across country from Greenwood to Princeton and Copper Mountain, a distance of more than 100 miles.

FRASERVILLE, ONT.—The City Council is considering a power development next summer in connection with the municipal electric-light plant and also other improvements to the system. E. Talbot is city clerk.

LONDON, ONT.—The London Electric Company, owned by the Mackenzie and Mann interests, it is reported, is planning to close down its power station on March 31. Unless taken over by the power controller the plant, it is said, will be scrapped.

MATTAWA, ONT.—The Mattawa Electric Light & Power Company is planning to make improvements to its waterwheel house this spring. T. H. Dougall is secretary and treasurer.

PARRY SOUND, ONT.—The city of Parry Sound is planning a 1500-hp. water power development in connection with the municipal electric-light plant as soon as conditions will permit. J. D. Broughton is treasurer.

ST. THOMAS, ONT.—A new distributing station was erected during 1917 for the municipal electric-lighting system, at a cost of \$40,000. The arc lamps now in use will be replaced with incandescent street lamps this year. Orders have already been placed for the equipment. E. H. Coughell is manager.

TILSONBURG, ONT.—The erection of a new substation in the near future is under consideration by the Tilsonburg Hydro-Electric Commission. M. G. Dean is mayor.

MONTREAL, QUE.—Work, it is reported, has begun on an extension from the main line of the Grand Trunk Railway to the Military Hospital at Whitby. This line, it is stated, will be equipped for electrical operation and will ultimately form a part of the electric lines to be built under the plans of the Hydro-Electric Power Commission of Ontario.

THREE RIVERS, QUE.—The Page Wire Company of Canada of Walkerville, Ont., which proposes to erect a plant at Three Rivers at a cost of about \$150,000, it is stated, will soon be in the market for equipment, including motors, etc.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 11, for iron or steel sheets, pipe straps, steel wire and cable, electrical switches, lighting projectors, copper cable, condenser tubes, etc. Blanks and information relating to this circular (No. 1201) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 23 for furnishing generator sets, switchboards, copper cable, end bells, transformer connectors, terminals, receptacles, copper rod, busbar supports, pipe fittings, and floor flanges. Blanks and general information relating to this circular (1203) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, New Orleans, La.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark. Annual convention, Hot Springs, Ark., May 21-23.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dushin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreuccetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, September, 1918.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, M. C. Gilman, Toronto Electric Light Company.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

CONNECTICUT ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavelly, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flation Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting, May 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga. Annual meeting, June, 1918, Tybee Island, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuy, Central Electric Co., Peoria, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER, Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MASSACHUSETTS ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. E. Wilson, 263 Summer St., Boston, Mass.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

MISSOURI ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekun Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PENNSYLVANIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual meeting, June 19-20, Atlanta.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex. Annual convention, April 15-16, Galveston.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex. Annual meeting, April, 1918.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

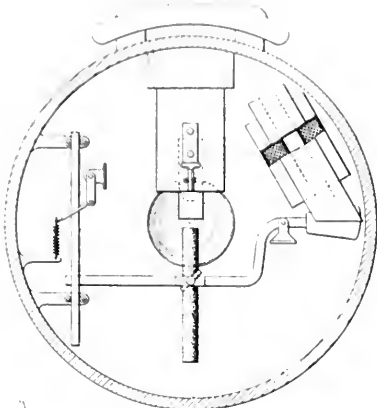
WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, March 27-28, 1918, Milwaukee.

WISCONSIN ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. C. Staff, 575 Jackson St., Milwaukee, Wis.

(Issued Jan. 29, 1918.)

1,254,929. MEANS AND METHOD FOR METERING ELECTRICITY; Edmund O. Schweitzer, Chicago, Ill. App. filed March 6, 1916. Adaptable for use in the measurement of alternating-current supply and affording a basis for payment to the central-station company by the consumer for electrical energy furnished to and consumed by him.

1,254,951. STREET INDICATOR FOR STREET CARS; Adolf A. Winkler, Great Falls, Mont. App. filed Sept. 27, 1915. Relates to improvements in card, picture and sign exhibiting, and more specifically to street indicators for street cars.



1,255,445—Regulating Mechanism for Arc Lamp

1,255,026. ELEVATOR SIGNALING SYSTEM; Harry G. Lee, Tacoma, Wash. App. filed March 29, 1915. Improvements.

1,255,037. LEAD-WIRE TERMINAL; Bernard H. Oestricher, New York, N. Y. App. filed July 10, 1917. Improvement.

1,255,069. IGNITION DEVICE; Harry R. Van Deventer, Sumter, S. C. App. filed Sept. 18, 1917. Including electrodes, a magneto generator electrically connected thereto, and a tripped-spring-actuated mechanism for operating said generator.

1,255,084. SWITCH; William W. Dean, Chicago, Ill. App. filed Feb. 18, 1913. For telephone systems.

1,255,096. ELECTROLYTIC APPARATUS; George F. Jaubert, Paris, France. App. filed July 26, 1917. For the electrolysis of compounds, water for instance, from which gases are produced and are to be collected separately.

1,255,119. ELECTRICAL BOND; Edwin S. Slick and Charles W. Parkhurst, Westmont Borough, Pa. App. filed April 29, 1915. Improvements.

(Issued Feb. 5, 1918.)

14,430 (reissue). PARTY-LINE TELEPHONE SYSTEM; Henry Hovland, East Orange, N. J. App. filed Oct. 31, 1912. Improvements.

1,255,121. PIVOTAL JOINT BETWEEN AN ALTERNATING-CURRENT ELECTROMAGNET AND ITS ARMATURE; Albert Aichele, Baden, Switzerland. App. filed Dec. 30, 1916. Improvements.

1,255,126. ELECTRIC SWITCH; Clarence A. Bates, Bridgeport, Conn. App. filed March 27, 1917. Two-way type.

1,255,139. ELECTRICAL INSULATION; William T. Cushing, Milwaukee, Wis. App. filed Sept. 9, 1915. Relates to that class of materials employing an inert filler as a base and a varnish-like binder.

1,255,152. ELECTRIC SOCKET; Frederic P. Gates, Hartford, Conn. App. filed April 7, 1917. Applies particularly to extension sockets for candle fittings.

1,255,157. ELECTRIC SWITCH; Gilbert W. Goodridge, Bridgeport, Conn. App. filed Nov. 6, 1916. Means for cushioning the operation of the switch mechanism so as to lessen the noise usually incident to its operation.

1,255,175. VACUUM CLEANER; John B. Kellogg, Orange, N. J. App. filed July 10, 1916. Adapted to receive the inner end of a flexible hose to which a cleaning tool is attached.

1,255,176. WALL RECEPTACLE FOR VACUUM CLEANING APPARATUS; John B. Kellogg, Orange, N. J. App. filed Dec. 26, 1916. Embodies a quick-break switch suitable for directly interrupting the motor circuit of the suction cleaning apparatus.

1,255,180. TELEPHONE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed April 26, 1917. Improved means for testing

Record of Electrical Patents

Notes on United States Patents

the busy or idle connection of a called telephone line.

1,255,181. FLUSH RECEPTACLE; Charles J. Klein, Milwaukee, Wis. App. filed Oct. 28, 1913. Receptacle and plugs therefor.

1,255,185. ADJUSTABLE SUPPORTING APPARATUS; William B. Lehmkuhl, Cambridge, Mass. App. filed July 13, 1916. Improvement.

1,255,197. CELL; John L. Malm, Denver, Col. App. filed April 16, 1915. Applies particularly to electrolytic cells utilized in treating metallic salts to drive off the gaseous anion and deposit the metal.

1,255,205. BRUSH CONNECTION FOR DYNAMO-ELECTRIC MACHINES; Charles P. Monto, Cleveland, Ohio. App. filed March 26, 1917. Flexible connections.

1,255,211. SYSTEM FOR THE SUCCESSIVE AMPLIFICATION OF ENERGIES; Alexander McL. Nicolson, New York, N. Y. App. filed June 8, 1915. Improvements.

1,255,225. ELECTRIC SWITCH; Guy R. Radley, Milwaukee, Wis. App. filed Dec. 8, 1911. Method of disrupting the arcs produced between the switch contacts.

1,255,241. COMPRESSION-OPERATED IGNITION DEVICE; Warren F. Stanton, Pawtucket, R. I. App. filed June 24, 1916. For use in conjunction with internal-combustion engines, pumps and other devices.

1,255,242. COMPRESSION-OPERATED IGNITION DEVICE; Warren F. Stanton, Pawtucket, R. I. App. filed June 24, 1916. Improvements.

1,255,248. SWIVEL FOR TELEPHONE BOXES; Alfred Toll, Kansas City, Mo. App. filed May 10, 1915. Device for facilitating the untwisting of the wire cord of an ordinary desk telephone.

1,255,250. RECORDING MECHANISM; James C. Warren, Emporia, Va. App. filed Jan. 11, 1916. Recording elements are operated by electromagnetic means.

1,255,264. TERMINAL COUPLING FOR ELECTRICAL CONDUCTORS; Charles W. Wright, Topeka, Kan. App. filed July 29, 1915. Improved connector.

1,255,277. ELECTRIC FIRE AND BURGLAR ALARM; Lewis E. Bates and Vellie V. Hanks, Houston, Tex. App. filed Nov. 10, 1916. The relay and the permanent magnet associated therewith are so utilized that a very small amount of energy will be required.

1,255,289. ART OF UTILIZING HIGH-FREQUENCY ELECTRIC OSCILLATIONS; David W. Brown, New York, N. Y. App. filed Aug. 9, 1916. Improvements.

1,255,310. WIRE-ENGAGING BATTERY TERMINAL; Albert E. Henderson, Middleton, Mass. App. filed March 15, 1917. Eliminates the binding post and screw.

1,255,326. ELECTRICAL HEATING UNIT; Arnold N. Macnicol, Melbourne, Victoria, Australia. App. filed June 16, 1914. Parts of which are readily detachable and renewable.

1,255,374. TELEPHONE SYSTEM WITH UNIVERSAL CORD CIRCUIT; Charles S. Winston, Chicago, Ill. App. filed July 30, 1914. Improvements.

1,255,387. PROTECTIVE SYSTEM FOR ELECTRICAL APPARATUS; Lewis W. Chubb, Edgewood Park, Pa. App. filed Jan. 5, 1916. Energy-absorbing means which are adapted to be connected across the terminals of the apparatus to be protected.

1,255,400. DYNAMO-ELECTRIC MACHINE; Ralph E. Ferris, Swissvale, Pa. App. filed Aug. 7, 1914. Arrangement of magnetic field circuits.

1,255,418. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 21, 1915. Control of electric motors that are adapted for the propulsion of vehicles during the accelerating periods thereof.

1,255,419. CONTROL SYSTEM FOR DYNAMO-ELECTRIC MACHINES; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Nov. 29, 1915. Method whereby motors may be accelerated and otherwise controlled in a smooth and uniform manner and with substantially sparkless commutation.

1,255,437. ELECTRODEPOSITION OF METALS; Frederick Laist and James O. Elton, Anaconda, Mont. App. filed June 16, 1916. Provides a simple means for determining the efficiency of the purification and the suitability of the solution for electro-deposition of the metal.

1,255,439. PROCESS OF RECOVERING ZINC FROM ORES; Frederick Laist and James O. Elton, Anaconda, Mont. App. filed July 10, 1916. Improvements.

1,255,440. PROCESS OF TREATING COMPLEX ORES OR CONCENTRATES THEREFROM; Frederick Laist, Anaconda, Mont. App. filed Nov. 3, 1916. Improvements.

1,255,441. ALTERNATING-CURRENT ELECTROMAGNET; David C. Larson, Yonkers, N. Y. App. filed Dec. 1, 1915. Consists in the proportioning of the secondary conductor and in the construction and relative arrangement of the core and conductor.

1,255,445. REGULATING MECHANISM FOR ARC LAMPS; George M. Little, Pittsburgh, Pa. App. filed Feb. 3, 1915. Improvements in the clutching and regulating mechanisms for such lamps.

1,255,447. MOTOR-CONTROL SYSTEM; Walter O. Lum, Wilkensburg, Pa. App. filed April 24, 1913. In which starting resistors are controlled by sets of automatically operated switches.

1,255,457. DYNAMO-ELECTRIC MACHINE; George H. Murray, Jr., Wilkensburg, Pa. App. filed Nov. 6, 1914. Relates to amortisseur windings.

1,255,475. CONTROL SYSTEM; Karl A. Simon, Wilkensburg, Pa. App. filed Dec. 4, 1913. Protective means for avoiding the effects of abnormal conditions in certain of the control apparatus.

1,255,486. DYNAMO-ELECTRIC MACHINE; Norman W. Storer, Pittsburgh, Pa. App. filed May 22, 1913. Special reference to railway motors of the twin-armature type.

1,255,487. DYNAMO-ELECTRIC MACHINE; Norman W. Storer, Pittsburgh, Pa. App. filed May 11, 1914. Direct-current railway service.

1,255,517. STARTING AND CURRENT-SUPPLYING SYSTEM FOR AUTOMOBILES; Thomas A. Edison, West Orange, N. J. App. filed July 31, 1912. Improvements.

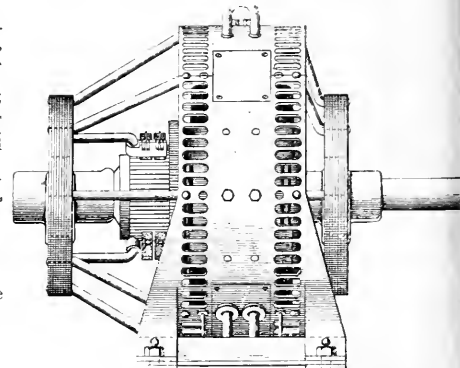
1,255,531. ELECTRICAL SNAP SWITCH FOR WATER-PURIFYING APPARATUS; Harry B. Hartman, Scottsdale, Pa. App. filed Nov. 8, 1915. Automatic type.

1,255,535. ELECTRICAL SYSTEM FOR DISTRIBUTION; John W. Jepson, Depew, N. Y. App. filed Jan. 21, 1914. Car-lighting systems.

1,255,536. GALVANIC BATTERY; Heinrich H. M. Kammerhoff, Orange, N. J. App. filed Feb. 9, 1914. Improved arrangement whereby the necessity of insulating from each other the conducting containers of a pair of storage-battery cells composing a battery is obviated.

1,255,541. CASTING MACHINE FOR DENTAL WORK; Sigmund M. Lauter, Brooklyn, N. Y. App. filed July 3, 1914. Improvements.

1,255,552. SWITCHING MECHANISM; Carl P. Nachod, Louisville, Ky. App. filed Sept. 18, 1914. The closure or opening of an electric circuit or plurality of electric cir-



1,255,606—Dynamo-Electric Machine

cuits is effected in response to different relative angular positions assumed by members stepped or otherwise rotated in like directions.

1,255,589. TURBINE-DRIVEN ELECTRIC GENERATOR; Arthur S. Dysart, United States Navy. App. filed Dec. 21, 1916. Provision of novel means for collecting the current from the rapidly revolving rotor or armature.

1,255,606. DYNAMO-ELECTRIC MACHINE; William T. Hensley, Connersville, Ind. Improvements.

Electrical World

ork, March 9, 1918

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**OUR VAST RESOURCES OF
MEN, MUNITIONS, MATERIALS
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New Impetus Given to Hydroelectric Development

THE action of the President in signing the bill authorizing the hydroelectric development of Muscle Shoals on the Tennessee River in Alabama should kindle anew the interest of the people of this country in their water powers. This site, which has remained unused until now because of government inaction, possesses potentialities exceeded only by Niagara. Time and time again have attempts been made to develop the powers of the Tennessee River at Muscle Shoals and to improve navigation, and it is only through the patience and perseverance of the business men of the South that success was finally achieved. The West and other sections of the country may therefore take heart and petition in season and out of season until their undeveloped water powers, too, are harnessed for the service of man. It is only by throwing on the spotlight of reason and argument that the profligate waste of power in our watercourses will cease.

The Sociological Problems Confronting Us

MANY constructive minds are now at work on the sociological and other problems arising from the labor situation in the electrical industry. The war has brought a great change upon us, and it is well that industry and society in general should take cognizance of it. It must be apparent that no real progress can be made without the elevation of the character of the whole people. The wildest of Bolsheviks is no more harmful to the body politic than the reactionaries who, ignoring changed conditions, continue to play on passions which at length break out in the fire of revolution. The spirit of national service has cast into oblivion the idea of special privilege and class. Rather does it extend the hand of fellowship and of co-operation. The humanizing of industry is its chief function, and this carries with it the principle of joint industrial councils.

In all groups there are good and bad, in the moral sense. There are good lawyers and bad lawyers, good employers and bad employers, good engineers and bad engineers, good laborers and bad laborers. If the old clannishness of the professions does not disappear—and that quickly—the outlook is ominous. If all employers stick together as a class, the lawyers as a class, the industrial workers as a class, regardless of the good and evil among them, Heaven help us. But if the up-sweeping protest against the poker players of all classes destroys clannish proclivities and aligns the good against the bad, then we are saved. The hope of sal-

vation grows day by day. Our fight against a ruthless autocracy to which people are pawns has stirred our deepest age-old moral instincts.

Saving Public Utilities for War Service

BY RECOGNIZING the paramount needs of public utilities President Wilson places those properties under a deep obligation—not an obligation alone to him personally, but an obligation also to the public whose chosen leader he is, an obligation to the nation mobilized in the war for freedom of the world from German militarism. The President has no legal authority to compel state and local authorities to (in his words) “respond promptly to the necessities of the situation,” but he has a moral authority greater to-day than that of any other man on earth. His correspondence with Secretary of the Treasury McAdoo, published in last week's issue of the *ELECTRICAL WORLD*, is a historic milestone in the public utilities industries. May it bear fruit!

Our readers are generally familiar with the course of the proceedings which culminated in the letter of President Wilson. The committee representing electric, electric railway and gas utilities found that its problems were not ignored by national officials. It was fully appreciated that these properties are vitally essential in the war, that their costs of operation have been advanced heavily, that their securities have suffered severely in the markets. Comptroller of the Currency Williams and Secretary McAdoo sense the facts. Both of them see clearly that the credit and earning power of these great properties must be sustained to protect the entire banking fabric. Mr. McAdoo tells the President that the data presented by the committee “indicate the existence of genuine apprehension regarding the adequacy under present conditions of the service and rates of local public utilities.” Let there be no mistake on the part of any petty city or state official who mixes politics with true patriotism. “Our public service utilities are closely connected with and are an essential part of our preparations for the successful prosecution of the war,” says Mr. McAdoo.

There will be no permanent lessening of the demand upon electric utilities for power. On top of the overwhelming need for war industries we now have a clear indication that the Fuel Administration may urge the closing of isolated plants and the substitution of central-station energy so that every possible pound of coal may be conserved. Upon the showing of the facts, the national administration is using its vast influence to safeguard the utilities. It remains for the state and

local authorities to make vital the recommendations of the President, to grant rate increases wherever they are justified. And if there is more sympathetic co-operation on the part of the regulating bodies in meeting serious requirements due to the war, the obligation upon the utilities to make their service all that it ought to be, to keep it from being anything that it ought not to be, will be strengthened. The need is urgent, the response should be prompt.

Motor Drive in a Shipyard

EQUIPPING shipbuilding plants just now is emphatically a hurry job, and the use of electric power for the various drives involved has proved greatly to facilitate installation, not to say operation. David Elwell's account of the electrical drives installed for the Staten Island Ship Building Company describes a capital example of the way in which intelligent engineering brings its reward in quick and certain operation. The case is unusually interesting because this new plant for steel vessels is on the site of a wooden shipbuilding yard already equipped with a 220-volt direct-current plant. As noted in a recent issue of the *ELECTRICAL WORLD*, it was found desirable with the new equipment to contract for alternating-current service, so that the problem of suitable selection of alternating-current motors came to the front. At the start-off the 220-volt direct-current plant was, to save time, utilized in the plate shop, the first building erected. Individual drive has been adopted throughout in this plant. The character of the machinery and the circumstances of its use made it undesirable to attempt group driving, as is very likely to be the case in operating heavy machinery.

A study was made of power requirements of the machinery based on the performance of the direct-current motors, and it was found, as is very generally the case, that most of the machines were equipped with motors unnecessarily large for the service. The data thus accumulated made it possible to make an intelligent choice of alternating-current motors for the purpose. Most of the machines start running light, and it was found that the standard squirrel-cage motors were entirely adequate for giving good service. In a few instances—particularly with the punching and shearing machines, which run idle and then deliver power almost instantaneously—another type had to be chosen. Machines of this class, to escape extremely high demand on the motor during the power stroke, are best fitted with flywheels, and the ordinary squirrel-cage motor fails to meet the necessities. For cases of this kind a squirrel-cage motor with high-resistance end connections was found to fill the bill excellently, giving sufficient starting and accelerating power without the complication of slip-rings. Only a few of the motors needed to be equipped with compensators, so that the whole motor plant is reduced to extremely simple terms.

At the voltage selected, 220, oil switches were unnecessary, and this again simplified the switching needs of the plant. In order to take the large starting currents required on the type of motor used the switches had to be heavily fused, but the character of the work is such that there is little chance for serious overloading of the individual motors belted to the machines in spite of the big fuses. The whole plant is wired in iron

conduit, lighted by general illumination above the level of the crane, and affords an excellent example of emergency work quickly and skillfully done.

Saving Second-Hand Line Material

CONSIDERING the prices to which line material of every kind has risen within the last two or three years, the need of checking waste of every sort is obvious. A central station cannot afford to throw away or sell for a nominal figure anything which can be put to good use and will so save the cost of new material. A brief discussion of the situation by L. M. Klauber gives some very useful hints as to the ways in which second-hand line material can be effectively utilized. Some of these ways are altogether familiar, like cutting down and resetting poles. Others are not so universally practiced and deserve especial attention. Poles, of course, are the chief item of distribution-line renewals. The classification of old poles here made is a serviceable one. They are divided into three groups—those which can be replanted after the bases have been treated, those too short or light to be again used in the standard construction, and those so far gone as to have no value as carrying poles at all. With judicious inspection a good many poles can be reset on outlying lines or even where they are. Decay is usually at the ground line, and sawing them off above the line of decay and treating the new base, preferably by tank treatment, may very often make a pole capable still of a good many years' service.

Poles removed by reason of being too light for new conditions can still be used on outlying lines as poles for service lines and in similar ways. Those too light even for this service but in otherwise good condition can sometimes be utilized for telegraph and telephone construction in rural districts. Finally, the poles too far gone to cut down can find divers uses as guy stubs, braces, dead-men, and even fence posts, for all of which purposes they are worth more than mere waste wood.

Cross-arms present a tougher proposition. They may be in excellent condition, but are likely to be too short or too small to be easily put to use. Here again arms too light for electric light wires may be of value in building the extension of a country telephone line, for occasional house services, and for offset arms when too short for regular work. At the worst they may, like the stubs of poles, be utilized for rough construction work, and last of all for firewood, it being the common experience that discarded poles like discarded railway ties do not furnish convenient or high-grade fuel, although considerably better than nothing.

Old wire, which used to be almost universally sold for scrap, is now worth too much to put to such base use. If of the weatherproof kind, it is apt to be in bad shape before being taken down, but it can be skinned and as bare wire may serve a new term of usefulness. Old splices, of course, are overhauled and inspection made for kinks and weak spots. Short lengths make good tie wire in the smaller sizes, and in the larger sizes they are available for grounding neutrals and short connections of various kinds. Insulators are more troublesome than either wire or poles, unless they are of a size which can be worked in on secondary systems for services. Second-hand porcelain insulators, being

f a somewhat special kind, are less likely to be useful. To a certain extent the insulator pins and bolts taken down from a line may be utilized again readily if of standard size, but only at some little inconvenience if not of such size. And so one may go on.

Unipolar Induction Theory

THE December number of the *Physical Review* contains an article by Prof. George B. Pegram on "Unipolar Induction and Electron Theory." The article describes certain experiments on unipolar generator apparatus and analyzes the results obtained.

The first little unipolar direct-current generator was brought out by Faraday. Ever since that time the unipolar machine, or acyclic generator, has been recognized as a generator of continuous currents without needing a commutator. In recent years many such machines have been constructed in different types, although mostly in small sizes. There has been a perennial controversy carried on as to the correct way of explaining the action of some of them. A typical example consists of a cylindrical permanent bar magnet rotated by power about its axis and having two stationary brushes applied to its rotating surface. One of these brushes is placed, say, at or near the mid-length of the magnet. The other is applied near to one end of the magnet. These two brushes form the generator terminals and are connected by an external circuit in the usual way. A current is observed to flow in the circuit, say into the middle brush, through half the magnet and out from the end brush. The question agitated has been whether the emf. is generated in the substance of the rotating magnet, in spite of the fact that if the magnet carries its magnetic field around with it like a broom this field cannot cut the moving substance. Or is the emf. generated in the stationary part of the circuit external to the brushes?

The article pronounces in favor of the emf. being generated in the substance of the moving magnet. The reasoning is conducted in terms of the electron theory, but it may of course be presented in other terms. The emf. generated in an element of a conducting circuit may be produced either by a real rate of change in the vector potential at that point or by the transverse motion of the element with respect to a magnetic field. It is not necessary in the latter case that the field should be stationary. The field may or may not be in motion. If the conducting element moves, an emf. will be generated therein by the field. According to this deduction, a bar magnet generates an emf. in its own substance

when it rotates. It is not an essential question whether the field rotates with the magnet or not. The only essential fact is that elements of conductor are moving, and they are also permeated by a transverse magnetic field.

Business Men Indorse Daylight Saving

A PRESS bulletin issued by the Chamber of Commerce of the United States brings once more before the public eye the question of daylight saving which is provided for in the Calder bill now before committee. We have several times taken up this subject and have adhered consistently to the opinion that it is an interesting and probably useful program, not likely to produce any notable results on the prosperity of the lighting industry, and to which the only material objections are the possible inconveniences that would be felt at certain places owing to the division of the country into time belts each extending over a considerable range in latitude.

The results obtained last year abroad were very various, according to the reports from different regions, but on the whole there is general agreement that the plan worked out very well and did not involve material inconveniences. The actual saving in fuel which may be obtained cannot safely be predicted since much depends on the completeness with which the general habits of the people adjust themselves to a new clock time. It will be hard in fact to estimate the real results even after a year's trial, since they will vary from city to country and will be profoundly influenced by the increasing amount of work in three shifts which is now going on in war industries and which obviously will not be materially affected one way or the other by the change. In certain communities one of the advantages pointed out in the bulletin will prove to be of considerable importance for a portion of the period involved; that is, the separation of the transportation and lighting peaks, which are now commonly nearly coincident.

The experiment is well worth trying for the sake of uniformity and on the strength of foreign experience, if for no better reasons. There do not seem to be any substantial arguments against it, since trials elsewhere have failed to develop any. If Congress thinks it wise to inaugurate the change, we trust that it will act promptly enough to have the experiment begin by the middle of April, and not allow the proposition, as last year, to drag on until really too late for action.

SHORTAGE of coal and the fact that fuel represents a very large portion of the total operating expense of central stations demand that every possible method of increasing the efficiency of energy utilization be tried. Prevention of heat radiation from boiler and engine room equipment is one such means. In an early issue the magnitude of heat losses due to radiation from pipes, fittings, etc., the characteristics required in heat insulation, the thickness necessary for modern power-plant pressures and superheats, and the value of insulation as an investment, will be discussed. Bearing on the general problem occasioned by slow deliveries of equipment and the consequent difficulty of meeting

The Coming Issues

service demands, two articles will shortly be presented—one pointing out how larger outputs can be obtained from generators already installed by precooling the air, the other dwelling on how installations of self-cooled transformers can be made to carry larger loads through simple changes that permit circulating the oil. Data are given in each case to show the effectiveness of these methods. For engineers who hesitate about using formulas involving hyperbolic functions in making transmission-line calculations an early issue will reproduce charts which permit obtaining all the line constants graphically so that complex calculations are avoided and the effect of different conditions on their constants can be easily studied.

Coal Supply Made Sure by Buying Mines

Forehanded Policy by Which Commonwealth Edison Company of Chicago Made Large Purchases of Coal Mines and Land to Protect Its Supply of Fuel and Safeguard Against Ever-Increasing Cost

This article gives the reasons why the Commonwealth Edison Company of Chicago began fourteen years ago to buy coal mines and lands. The costly experiences of the last year have led a number of other central-station properties to purchase, or to inquire into the advisability of purchasing, similar properties.

ADEQUATE coal supply at reasonable cost is the keystone of successful operation by electric utilities with steam generating plants; without it these properties cannot profitably furnish service. The companies may have capital investment whittled to a minimum, with fair rates, economical operating methods and happy public relations, but unless they have in addition an assured steady supply of fuel at a price which they can afford to pay they face serious fetters upon their economic welfare.

LESSONS OF TWO WINTERS

The last two winters brought dismay to many central-station companies relying upon steam-generated energy for their service to their communities. They were not fully prepared for revolutionary changes in the coal industry. Trying to follow the established policy of buying coal as cheaply as they could and maintaining as good a reserve as possible against exigencies, the great bulk of the companies got caught in 1916-1917 in the war-time vise of short supply, runaway demand and sky-rocketing prices. To keep generating plants going they paid exorbitant figures for fuel. They invoked the favor of coal producers and suppliers, the efficiency of transportation agencies, the power of city authorities. And they came through the winter of 1916-1917 without general service interruptions, though the margin in many cases was a very tender one. The record of the winter of 1917-1918 was less satisfactory.

Distressing experiences carry a twofold lesson which, notwithstanding all other trials and problems of the times, is impressed deeply upon the executives and managers of central-station properties:

First, the stirring necessity of providing amply in advance for the coal requirements of the winter.

Second, looking ahead to future years when the scrambling will be over and coal conditions are again more normal, it is realized that in all probability permanent changes in coal cost will have to be faced.

With the two aspects of this situation the ELECTRICAL WORLD has dealt in frequent articles and editorials during the last year; the longer outlook is presented in this article, describing methods adopted by certain companies which not only strengthen and protect their present position but farsightedly safeguard their coal supply for the future.

The first large electric utility to take positive steps to assure its future coal supply at reasonable cost through the purchase of coal-producing properties was the Commonwealth Edison Company, Chicago. Its action in so doing is the more conspicuous because it is

not a policy brought about by recent serious developments; it was conceived and inaugurated, after a careful survey of conditions and the outlook for the future, as early as 1904.

It was on the personal initiative of Samuel Insull the president, that the Commonwealth Edison Company began to purchase coal lands about thirteen years ago. Mr. Insull decided to follow this policy as a result of study of several considerations. One of these was that the entire coal business was then in a state of demoralization. This demoralization lasted for a number of years following the initial purchases of coal lands to protect the supply of the Commonwealth company, but Mr. Insull felt confident that it would not continue permanently. At the time when the foundation policy was laid down, much coal was being sold in Chicago at less than the fair cost of production. It was believed that continued operation of the central-station company at a cost which included fuel at less than the fair cost of production was a dangerous basis for a public utility. Under these conditions the company would be selling its product of energy at unjustifiably low rates. It was reasoned that at some future time the coal industry would reach a more stable basis and that thereafter coal would be permanently higher. Any company selling energy at abnormally low rates because it was benefiting by demoralization in the industry from which it obtained a large part of its raw materials would have to confront, when the demoralization was overcome, the necessity of increasing rates to consumers.

Another consideration which influenced Mr. Insull to take action was that Illinois coal lands, as compared with similar property in other sections of the country, were cheap. Some of the early purchases, for instance, were made at prices as low as \$15 an acre. Besides being an operating safeguard, it was confidently believed that the purchase of coal lands would therefore be an excellent investment from a financial standpoint. This judgment has been borne out by the course of events. In 1913 and 1914 the lands had enhanced in value to about \$50 an acre, while at present, under the stimulus of the extraordinary war conditions, they are rated as worth \$75 an acre.

SAFEGUARDING THE FUTURE

In addition to these considerations was the vital one of raising safeguards for the coal supply for the future. Controlling enough lands to assure a source of supply without regard to what other producers did, the company could be more independent of general conditions in the coal market. As a matter of fact, it is estimated that the Commonwealth Edison Company owns enough coal lands to provide for its supply for a hundred years.

Following the same general policy, newer organizations under the direction of Mr. Insull and his associates—the Middle West Utilities Company and the Pub-

c Service Company of Northern Illinois—have also required interests in operating coal properties.

The main coal-land holdings of the Commonwealth Edison Company aggregate about 45,000 acres of land, after deduction of the acreage already mined. The nucleus of this large holding was acquired on April 1, 1904, by the Illinois Midland Coal Company, controlled by the Commonwealth interests and the Peabody Coal company. These companies had equal shares in the coal property. The Chicago & Illinois Midland Railroad was also acquired. This line is operated between Taylorville and Auburn, Ill., and connects with four roads reaching Chicago—the Illinois Central, the Chicago & Northwestern, the Chicago & Alton and the Wabash.

EXTENDING THE INVESTMENT IN COAL LANDS

Some years after the initial investment was made it seemed advisable to the Chicago company to purchase one-half of the coal lands owned by the Peabody Coal company, and this was done. By that time the coal lands had appreciated materially in value, but not to so great an extent as they have done under the later stress of war conditions. In connection with this transaction the Midland Counties Coal Company was formed to take over the properties.

The main holdings of the Midland Counties Coal company are at Kincaid, Christian County, Ill., and aggregate 40,000 acres. This company has also a mine at Pawnee, Sangamon County, Ill., and another at Sherman, near Springfield, the capital of Illinois. It has, in addition, 1300 acres of coal land in Vigo County, Ind., which have not been developed.

In the extension of the policy of buying coal lands on other Insull properties some mining lands were acquired on a co-operative plan. Last year the Midland Counties Coal Company (the Commonwealth subsidiary) and the Public Service Company of Northern Illinois acquired coal rights in 600 acres of land near Shelburne, Sullivan County, Ind. There was also bought for the Public Service Company 600 acres near Johnson City, Williamson County, Ill. In each of these purchases the Middle West Utilities Company bought an interest of 15 per cent. Ownership of the Indiana mine rests in the Indiana Hocking Coal Company. The mine in Williamson County, Ill., is owned by the subsidiary Muddy Fuel Company.

All of these mines are operated by the Peabody Coal company of Chicago. The contract covering the large Midland Counties properties is for a period of twenty-five years. The output of these mines at present is about 2,000,000 tons per year. It has been increased gradually to this figure. When first acquired only two mines were in operation on the property. In 1912 the work of opening No. 7 mine at Kincaid was started. This construction, which equipped the mine to hoist 4000 tons daily, was finished in 1913, and in that year the company began to sink another shaft. This mine, called No. 8, has also capacity to hoist 4000 tons daily. These two mines are among the most modern in equipment in the country.

As the two original mines had capacity to hoist 2200 tons each daily, the production is 12,400 tons every twenty-four hours. Electrical energy is used to a large extent in the entire operations. Preparations are being made to sink another mine of the same size as the last

two. This mine will be of modern type of construction.

Different arrangements have been worked out with the operating company, the Peabody Coal Company, so as to stimulate and safeguard the production desired by the central station. From the time the Midland property was bought until Dec. 15, 1913, the amount of coal produced was divided evenly between the Commonwealth company and the Peabody company. Then, under a new agreement, the Peabody company contracted to furnish 1,000,000 tons of coal per year to the Commonwealth company. On May 1, 1917, a supplemental contract was made whereby the Peabody company furnishes an additional 500,000 tons, making a total of 1,500,000 tons. As the requirements of the Commonwealth company for 1917 are 2,100,000 tons, it is necessary for that company to purchase in the outside market 600,000 tons. The Commonwealth company purposely takes less than its fuel requirements from its own mines, because it is able to buy screenings in the Chicago market at advantageous prices and thus to conserve its own supply longer.

Under the contract the Commonwealth subsidiary, the Midland Counties Coal Company, pays the Peabody company the cost of production plus reasonable charges on a per ton basis for administrative expenses, accident insurance, amortization of bonds and contingencies. Included in the cost of production are bond interest, labor, repairs and mining.

Supervision of the contractual relations between the Commonwealth subsidiary and the Peabody Coal Company is under the direction of the fuel agent of the Commonwealth company and the Public Service company, who also acts in an advisory capacity for the Middle West Utilities Company. Daily fuel statements, showing the cars en route, total supply, etc., are received. An inspector is at the mines all the time, and it is his business to check costs and make suggestions as to economical methods of mining, etc.

COST OF MINES STILL RELATIVELY LOW

The vice-president of the Commonwealth company, under whose jurisdiction the coal mining and purchasing interests of the company are placed, said to a representative of the ELECTRICAL WORLD in commenting on the fuel policies outlined above:

"Ownership of the coal mines assures us of a coal supply in the winter when other sources are overburdened with the general demand. During seasons when there is plenty of coal on the market we are frequently able to buy at low prices, and this reduces our average cost of coal and also protects our own supply. For instance, screenings are often offered in the market at a low price by operators who have sold their lump coal at such a good figure that they can well afford to take a low rate for screenings, for the average obtained in this way is ample compensation.

"The policy of Mr. Insull in planning ahead for years to protect our sources of coal supply has been amply justified by the events of the last twelve months. I should not hesitate to advise other companies to purchase coal lands in order to strengthen their future position regarding the serious problem of coal supply. Although prices of coal mines and land have risen rapidly, the investment cost is still relatively small, and the relief and financial advantages of a reserve supply are demonstrated forcefully by present conditions."

Flexible and Accurate Method for Dielectric Tests

Description of a Series-Inductance Bridge for Measuring Dielectric Energy Losses at Low Frequencies and High Potential Gradients—Method of Using the Apparatus

BY CHESTER ARTHUR BUTMAN

At the present time there is a notable lack of data on the dielectric constants which pertain to a large variety of substances. This bridge affords a means of obtaining the information. As alternating currents are used, no trouble is caused by the dielectric after-effect, as is the case with direct currents. The bridge gives a means of determining the geometric capacity of condensers having a capacity from 1 mfd. to 0.0001 mfd., with one setting of the bridge arms, with an accuracy of about 0.01 per cent of the capacity measured.

The bridge is especially valuable in investigating anomalous dielectrics. The change of a dielectric to the state of a conductor can be traced by changing the temperature.

Moreover, it is now generally recognized that a measure of the dielectric energy loss is the best single test that can be applied to insulation. In designing electrical machinery it is now necessary to take into account, besides the other losses, the dielectric energy loss. This bridge gives a means of determining this loss under the same conditions that obtain in practice.

HAVING had to develop a method of measuring the dielectric losses in insulating materials at low frequencies (60 cycles) and high-potential gradients (31,500 volts per cm.), and believing that the method would be of interest to other investigators, the writer has undertaken, in the following paper, to give full directions for setting up and operating the apparatus used. The equipment consisted principally of a series-inductance bridge (Fig. 4).

While the advantages of this type of bridge had been recognized¹ for measuring small changes in the dielectric loss angle, it was thought that it lacked the flexibility necessary to measure large changes in the angle conveniently. The present series-inductance bridge, as developed by the writer, however, has been found to have such great flexibility that large or small dielectric loss angles can be measured easily. The chief changes made were the development of general formulas for the determination of the geometric capacity, the dielectric loss angle, the total current and the dielectric energy loss, the use of aluminum wire as the vibrator in the Einthoven galvanometer used and the method of grounding adopted.

MEANING OF SYMBOLS USED IN DEVELOPMENT OF FORMULAS

ϕ = phase angle of condensers involved. -

$\theta = 90^\circ - \phi$ = dielectric loss angle.

$\cos \phi = \sin \theta$ = power factor of dielectric.

$P = 2\pi f$ where f is the frequency of the alternating current.

C_x and C_s = geometric capacities of the condenser under test and standard comparison condenser respectively.

r_s = equivalent resistance which would give the same phase-angle displacement ϕ_s when used with a perfect geometric capacity having the same value as C_s as would be actually obtained by C_s .

r_x = equivalent resistance corresponding to C_x .

L_1 = inductance in bridge-arm 1.

L_2 = inductance in bridge-arm 2.

R_1 = non-inductive resistance in bridge-arm 1.

R_2 = non-inductive resistance in bridge-arm 2.

$a_s = r_s - (j/PC_s)$ = impedance in bridge-arm.

$a_2 = R_2 + jPL_2$ = impedance in bridge-arm.

$a_x = r_x - (j/PC_x)$ = impedance in bridge-arm.

$a_1 = R_1 + jPL_1$ = impedance in bridge-arm.

Capacity Equation.—The geometric capacity is the same whether measured by alternating current or direct current and may be obtained from the relation showing the condition of balance for the bridge.—Lord Raleigh² and others have shown that the condition for balance in such a bridge is

$$a_s a_2 - a_x a_1 = 0, \quad (1)$$

or, substituting the values of a_s , a_2 , a_x and a_1 , multiplying, collecting real and imaginary terms:

Real terms—

$$R_2 r_s + (L_2/C_s) - R_1 r_x - (L_1/C_x) = 0 \quad (2)$$

Imaginary terms—

$$(-jR_2/PC_s) + jPL_2 r_s - jPL_1 r_x + (R_1 j/PC_x) = 0 \quad (3)$$

From the diagram (Fig. 1) it may be seen that $r \div 1/PC = \tan \theta = Pcr$, whence from (2)

$$\frac{\tan \theta_s R_2 + PL_2}{\tan \theta_x R_1 + PL_1} = \frac{C_s}{C_x} \quad (4)$$

Equation (4) may be used to determine the geometric capacity of C_x if the geometric capacity of C_s is known. However, for most purposes the capacity equation derived similarly from (4) will be found most convenient:

$$C_x = C_s \frac{R_1 \div PL_1 \tan \theta_x}{R_2 - PL_2 \tan \theta_s} \quad (5)$$

Equation (5) is the equation which has been used in all the subsequent calculations for capacity. If the condensers C_x and C_s are perfect, there will be no dielectric loss angle. Consequently $\tan \theta = 0$, so that the correction term $PL \tan \theta$ will vanish and

$$\frac{C_x}{C_s} = \frac{R_1}{R_2}.$$

Hence, the measurement of the capacity is primarily based on the measurement of the resistances R_1 and R_2 . In any case the correction term to be applied is small, although in most cases it is necessary to use the full formula in order to obtain the correct value of the geometric capacity.

It is important to notice that this formula gives the geometric capacity at any frequency and with any dielectric loss angle. Hence the geometric capacity can be determined for a given condition of the condenser by balancing the bridge only once.

Formula for the Dielectric Constant.—The dielectric constant or specific inductive capacity (S. I. C.) for two parallel plates is given by the equation,

$$\text{S. I. C.} = 4\pi DC_x/S \quad (6)$$

where D is the distance between the plates in centimeters and S is the area in square centimeters of one of the plates. Using equation (5) and substituting in (6)

¹First proposed by Dr. Rosa and developed for measuring small dielectric loss angles at low voltages, but not for dielectric energy loss, by F. W. Grover. (Bulletin of the Bureau of Standards, Vol. 3, 1907.)

²Proceedings Royal Society, Vol. 49, p. 203, 1885.

$$S. I. C. = \frac{4\pi DC_s(R_1 - PL_1 \tan \theta_s)}{S(R_2 - PL_2 \tan \theta_s)} \quad (7)$$

Dielectric Loss-Angle Equation.—Using equations (4) and (5) and equating equals,

$$\frac{\tan \theta_s R_2 + PL_2}{\tan \theta_s R_1 + PL_1} = \frac{R_2 - PL_2 \tan \theta_s}{R_1 - PL_1 \tan \theta_s}$$

Multiplying out

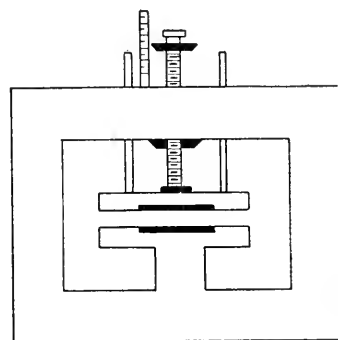
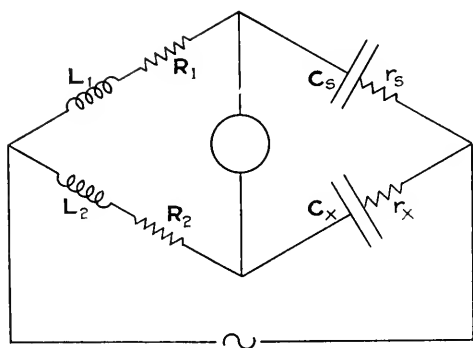
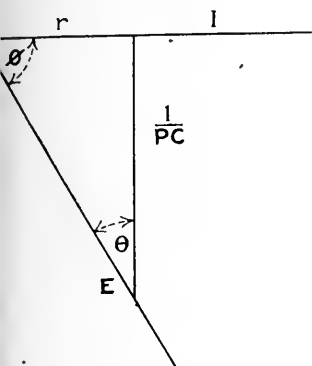
$$\frac{\tan \theta_s - \tan \theta_x}{1 + \tan \theta_s \tan \theta_x} = \frac{PL_1 R_2 - PL_2 R_1}{R_1 R_2 + P^2 L_1 L_2}$$

Substituting trigonometric equivalents,

$$\tan(\theta_s - \theta_x) = \frac{P(L_1 R_2 - L_2 R_1)}{R_1 R_2 + P^2 L_1 L_2} \quad (8)$$

Or multiplying the equation before (8) by (—1)

$$\tan(\theta_x - \theta_s) = \frac{P(R_1 L_2 - R_2 L_1)}{R_1 R_2 + P^2 L_1 L_2} \quad (9)$$



FIGS. 1, 2 AND 3—RELATION BETWEEN E , I , $1/PC$ AND PHASE AND DIELECTRIC LOSS ANGLES; SERIES-INDUCTANCE BRIDGE FOR MAKING DIELECTRIC TESTS; FRAME FOR HOLDING SAMPLES

The dielectric samples (45.72 by 45.72 cm.) were held in place by two pieces of special dried, oil-soaked maple, the same size as the samples. These wooden pieces were made of several layers of wood to prevent warping and of sufficient thickness to prevent bending. In the center of the wooden pieces a square copper sheet (30.48 by 30.48 cm.) was placed flush with the surface of the wood. The copper plates were held in place by screws, the ends of which were attached to a wire serving as an electrical connection. The lower fixed plate was used as the low-potential plate and was supported by a post of treated maple, so that the two

plates were highly insulated from one another. No iron was used in any part of the frame.

The upper plate was supported by a brass micrometer screw arrangement. The end of the screw was attached to a metallic piece which allowed the screw to turn but which fitted so tight that there was no play. There was no back-lash in the screw. Two wooden rods attached to the upper wooden piece prevented the upper plate from moving out of position while it was being moved up or down. Hence the copper plates were always lined up in the same way.

If the dielectric loss angle of the dielectric under test is greater than that of the standard condenser, equation (9) is used; if it is less, it will be found necessary to use (8). Using equation (9),

Let $\tan(\theta_x - \theta_s) = \tan A$

then $\theta_x = \theta_s + A$

$$\text{whence } \theta_x = \theta_s + \tan^{-1} \frac{P(R_1 L_2 - R_2 L_1)}{R_1 R_2 + P^2 L_1 L_2} \quad (10)$$

It will be noted that the measurement of the dielectric loss angle is independent of the measurement of the capacity. On the other hand, the capacity is dependent on the accurate measurement of the dielectric loss angle.

Formula for the Current.—In developing the bridge formula it has been assumed that a condenser with a perfect dielectric and capacity c is placed in series with an equivalent resistance r . The current through a perfect condenser in series with a resistance is given by the equation

$$I_x = \sqrt{\left(\frac{1}{PC_x}\right)^2 + r_x^2} E_x$$

where E_x is the effective voltage applied to the condenser. From the diagram (Fig. 2) it is seen that $r_x = \frac{\tan \theta_x}{PC_x}$, whence, substituting and simplifying,

$$I_x = E_x PC_x \cos \theta_x \quad (11)$$

Formula for the Energy Loss.—

$$\begin{aligned} \text{Ergs per second} &= I_x E_x \sin \theta_x \times 10^7 \\ &= E_x^2 PC_x \cos \theta_x \sin \theta_x \times 10^7 \end{aligned} \quad (12)$$

An examination of the energy loss formula shows that, at constant frequency, if θ_x and C_x do not change with the strength of field, the energy loss will be directly proportional to the square of the applied potential. Experiments which have so far been made on the change of the capacity with the applied potential show for the most part that there is no change. In any case the change is an extremely small one, so that C_x may be regarded as a constant when measured at different potentials. Therefore, whether or not the energy loss is proportional to E_x^2 depends on whether θ changes with the applied potential.

The experiments which follow show conclusively that

in some cases θ increases and in others decreases as the applied potential is increased. Hence the energy loss is usually not proportional to the square of the applied potential, but may increase faster or slower than E_x^2 as E increases. The governing factor is the product $\cos \theta_x \sin \theta_x$. This product is equal to zero when $\theta_x = 90$ deg., hence there is no energy loss when the condenser has a perfect dielectric. If $\theta_x = 0$ there is also no energy loss, in which case the condenser is a perfect conductor, having no resistance. In this last case the capacity would be infinite and consequently the dielectric constant would also be infinite. The product $(\cos \theta_x \sin \theta_x)$ is a maximum when $\theta_x = 45$ deg. Hence, if a substance has a dielectric angle of loss less than 45 deg. it is primarily a dielectric. On the other hand, if θ is greater than 45 deg. the substance is primarily a conductor. Hence, it will be seen that a new and exact definition of a dielectric and a conductor can be given, viz., a dielectric is a substance whose dielectric loss angle is less than 45 deg. A conductor is a substance whose dielectric loss angle is greater than 45 deg.

From the foregoing considerations it will also be seen that if θ increases the substance is becoming more like a conductor. On the other hand, if θ decreases the substance is becoming a more perfect dielectric. Hence, the dielectric loss angle gives the degree of imperfection of the dielectric.

Features of Apparatus Employed.—The standard condenser C_s is a very important part of the apparatus, because the determination of the absolute value of the dielectric loss angle and the geometric capacity of the condenser under test depend upon it. The standard air condenser used consisted of fifty sheet-iron plates with an air space of 2.54 cm. between them. The flash-over voltage was 15,000 volts. The plates were inclosed in an air-tight box which was kept free from moisture by phosphorous pentoxide.

When the condenser was first constructed it was supposed it would have no dielectric loss angle. However, it was found on testing it that on account of the insulation used between the plates it had a small dielectric loss angle. The dielectric loss angle was determined by comparing C_s with two aluminum plates 72 cm. in diameter suspended in air at a distance apart of about 4.5 cm. The upper plate was connected to the high-potential side of the transformer and the lower plate was placed on three large porcelain insulators. The aluminum plates were therefore substituted in place of C_x .

It will be observed that, provided a spark does not pass between the plates, the distance apart is not important as the dielectric loss-angle measurement is independent of the capacity. Under these conditions it was found that the absolute value of the dielectric loss angle of the standard condenser was 0 deg. 54 min. 25 sec. \pm 20 sec. The testing voltages applied were from 1500 volts to 4000 volts inclusive. Numerous independent check tests have made it certain that the value obtained is correct. The corresponding power factor $\sin \theta_s = 0.01583$.

Effect of Applied Potential on Dielectric Loss Angle.—It is important to know whether the dielectric loss angle of the standard condenser changes with the applied potential. This point was tested by placing the testing frame (see Fig. 3) in the bridge arm as C_x . The plates of the frame were widely separated and the bridge was balanced at 2000 volts. Then the voltage was raised in steps to 10,000 volts, no change being found necessary from that obtained at 2000 volts. This proved conclusively that there was no change in the dielectric loss angle of the standard condenser due to a change in voltage.

The dielectric loss angle of the standard condenser was constant over a long period of time, as was shown by check tests made on a standard sample of micarta from time to time.

Capacity of the Standard Condenser.—The capacity of the standard condenser was obtained by comparing its capacity with a standard mica Leeds & Northrup condenser, with a Westinghouse condenser terminal of known value, and a section of a cable that had been tested in another laboratory. The value of the capacity of all the plates of C_s in parallel was found to be 0.012000 microfarad.

The value of the capacity was found not to change

with a change in the applied potential, or to change over a long period of time, the tests being similar to those made for the constancy of the dielectric loss angle.

Testing Frame.—A special testing frame was designed by the author in order that the dielectric constant could be determined with accuracy at the same time the other measurements were made. It is important that the distance between the plates be accurately known and that it does not change because of the stress produced by the potential. This frame also serves to hold the dielectric under test in a convenient manner and does away with the necessity of attaching condenser plates by means of shellac, etc., to the samples of dielectric under test. The frame also provides a means whereby a liquid can be tested so that nothing but the dielectric under test is between the condenser plates (Fig. 3).

The frame had no leakage, as was shown by the test of the standard condenser already mentioned. The matter of edge correction is of no importance as the correction is so small it can be neglected.³ When the distance between the plates $D = 0.3175$ cm., then the S.I.C. = 3865.2 C_x .

Corona Effect Avoided by Immersion in Oil.—As it was impossible to test dielectrics at high voltages in air on account of the corona effect, it was necessary to test them under oil. The oil used had a paraffine base and was free from moisture. The tank was a large transformer case which was surrounded on the outside by several layers of fullerboard to prevent radiation. It took three days for the tank of oil to cool from 100 deg. C. to room temperature. The heating of the oil in the tank was regulated by large electric grid heaters placed in the bottom of the tank in contact with the oil. The current through the heaters was controlled by an auto-transformer.

Source of Potential.—The source of potential was a 60-cycle alternating-current generator, giving a sine wave as shown by the oscillograph. The voltage and frequency were constant with the accuracy usually obtained in practice. The frequency was obtained from a frequency meter, and the potential across the condenser terminals was obtained (when required) by an auxiliary measuring transformer not shown in the diagram. The value of the potential was adjusted by means of a Westinghouse 10-kw. variable-ratio testing transformer, the primary of which was connected to the source of the potential. The transformer had a range from zero to 10,000 volts in 200-volt steps, or zero to 5000 volts in 100-volt steps. One side of the secondary was grounded, and the other side leading to the bridge had a fuse in it to break the current in case the condenser under test broke down.

The Resistances.—The resistances used were of the Leeds & Northrup non-inductive dial type. The resistance in one arm had a range from zero to 100 ohms in 0.1-ohm steps. The resistance in the other arm had a range from zero to 8000 ohms in 10-ohm steps. It should be noted that the resistance of the inductance in each arm must be added to that of the variable resistance. The resistance of the bridge wires was neglected as they were 0.2032 cm. in diameter. All joints in the bridge were soldered.

The Inductances.—The standard fixed inductance

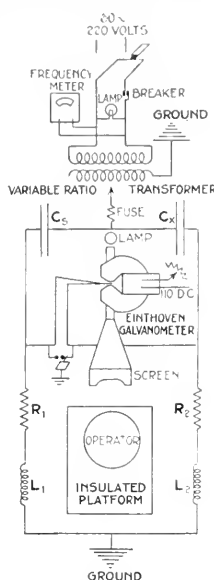


FIG. 4—TESTING ARRANGEMENTS

³J. A. Pollock and O. U. Vonwiller. *Phil. Mag.*, Vol. 3, p. 589, 1902.

was made by Leeds & Northrup and had a range from zero to 100 millihenries in 2.5-millihenry steps. The variable inductance was of the Ayrton-Perry type and was made by Leeds & Northrup. It had a range of 6 to 43 millihenries, being graduated in millihenries so that tenths of a millihenry could be estimated accurately.

Vibration Galvanometer.—The Einthoven vibration galvanometer used was made by the Cambridge Scientific Instrument Company, England. It is essentially a light current-carrying wire placed in a strong electromagnetic field. An increase in the current causes the wire to be deflected by the mutual electromagnetic repulsion. A notable improvement in the usual method of using it was made by placing the vibrator directly in the circuit as shown in the diagram. The galvanometer frame is usually grounded, but in this case the frame was removed as far from ground as possible. This was done by placing sufficient insulation between it and the pier on which it was placed. The pier was free from vibration. The change in the method of grounding also made it necessary to reconstruct the case which holds the vibrator so that the case would be insulated from the vibrator. Thus the vibrator was insulated from the frame.

By using this method the use of an auxiliary bridge for balancing the capacity of the main bridge to ground, as used by K. W. Wagner and others, was avoided. With this method it was also found unnecessary to use a substitution method in measuring the capacity as described by F. W. Grover.⁴

The vibrator was illuminated by an incandescent lamp and its shadow was allowed to fall on a ground glass screen 114.3 cm. distant. The screen was inclosed in a box from which all stray light was excluded while being observed. By focusing, the edges of the shadow of the vibrator could be sharply defined so that a slight vibration could be readily detected by noticing the relative blackness of the edges as compared with the central portion. The galvanometer is used simply as a detector as to when the bridge is balanced. When the bridge is balanced the vibrator has no motion. A short-circuiting switch protected the galvanometer during adjustment.

No trouble was experienced in tuning, and the vibrator usually remained in adjustment during a series of readings. The adjustment was facilitated by a belt-like arrangement which ran from the tuning device on the galvanometer to a roller above the ground-glass screen.

When the galvanometer was first used it had a silver vibrator. This vibrator was very sensitive to a change in resistance, but was comparatively insensitive to small changes in the inductance. On account of the sensitiveness of the bridge to changes in the resistances which cause a relatively large change in the current, it is possible to obtain an approximate value of the capacity when it is impossible to make an accurate measurement of the dielectric loss angle. This is illustrated by the fact that with all of the substances examined at room temperature it was found impossible to use a potential gradient less than 3150 volts per centimeter and obtain the dielectric loss angle with accuracy. However, the galvanometer was still sensitive to small changes in resistance so that capacity could

be determined to a degree approximating exactness.

The two factors which determine the sensitiveness of a vibrator are its conductivity and its mass. A metal which has a high conductivity for its mass is aluminum. A wire of this material 0.0762 cm. in diameter when used as a vibrator was found to increase greatly the sensitiveness of the galvanometer to small changes in inductance. It is essential that small changes of inductance be detected in order that the dielectric loss angle and the dielectric energy loss be determined accurately. The choice of a vibrator is a very important one when 60 cycles is used because the galvanometer becomes more insensitive the lower the frequency becomes.

General Considerations.—The bridge wires and the various portions of it were arranged in a symmetrical manner. In this way the capacity relative to ground of the different arms of the bridge was symmetrically distributed. Since it is important that the capacity to ground be reduced to the least possible amount, the bridge wires, for the most part, were placed high in the air. There was no mutual induction of an appreciable amount between the different units of the bridge. Strong, steady electrostatic and electromagnetic fields caused no difficulty in operating the bridge.

Since results can be compared only when they are obtained at the same potential gradient as well as the same temperature and frequency, it is necessary to know the distance between the plates in order to determine the exact potential gradient as well as the specific inductive capacity. The two factors which determine the potential gradient are the applied potential and the thickness of the material. As these can both be varied, a wide range of gradients is available with the maximum applied potential of 10,000 volts. The practical limits are, on the one hand, the insensitiveness of the bridge to a change in inductance with a gradient less than 3150 volts per centimeter, and, on the other, the breakdown strength of the material.

Manipulation of the Bridge.—The bridge is adjusted best by first finding an approximate adjustment of R_1 and R_2 , then of L_1 and L_2 , then make a final adjustment of the finer resistance, then make a final adjustment of the variable inductance. If the bridge is working properly, a change of 0.1 ohm greater or less in the resistance, or of 0.1 millihenry greater or less in the inductance, should cause a change in the balance of the bridge.

The bridge is best manipulated when R_1 is about equal to R_2 . This is secured by making the capacity of C_s about the same as that of the condenser under test. However, the bridge has been found to be accurate when the ratio of the resistances was sixty to one. The amount of resistance to be used is dependent on the number of significant figures required in the capacity calculations, and on the amount of current flowing through the bridge. The more current flowing in the bridge the more sensitive is the galvanometer. However, care must be taken that the current is not too great, otherwise the vibrator will burn out. The greatest current passing through a condenser under test at any time was 0.36125 amp. and the smallest was 0.000371 amp.

The resistances and inductances can be chosen so that, however small the difference between $R_1 L_2$ and

⁴Bulletin, Bureau of Standards, Vol. 3, p. 392, 1907.

⁵Einthoven, *Ann. der Phys.*, Vol. 1, pp. 483, 665, 1906.

R/L , becomes, it can always be made the difference between two *large* quantities. In this fact lies the great advantage of the series inductance method for the measurement of small differences in the dielectric loss angle.

If the dielectric loss angles are large (for instance 35 deg.), it is sometimes convenient to use the bridge with $L_1 = 0$. In this case $\tan(\theta_r - \theta_s) = PL_2/R_2$ and the calculations are much simplified. However, this is not a convenient formula to use for small dielectric loss angles (such as 14 deg.) because it is difficult, practically, to make L_2 sufficiently small, or R_2 suffi-

ciently large. Hence it will be seen that this method has great flexibility and is capable of universal application in this field of work.

There is always the possibility that the condenser under test will break down. In this case the operator is protected somewhat by the insulated platform. The circuit has a fuse and breaker in it which also affords some protection.

The experimental part of this paper was done at the high-tension research laboratory of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., of which C. E. Skinner is director.

Selection of Motors for Shipbuilding Plant

Conditions Influencing Individual Drive and Determination of Proper Rating, and Some Characteristics That Have Been Found Requisite in Motors for Plate-Shop Machines

BY DAVID ELWELL

Electrical Engineer Lockwood, Greene & Company

ONE of the largest and most complete hull, engine and boiler plants along the Atlantic coast for the construction of steel vessels is being rapidly completed for the Staten Island Shipbuilding Company at Mariners' Harbor, New York City. The yard is built on the site of an old plant formerly used by the company for the construction of wooden vessels and equipped with a 220-volt direct-current power plant.

The first of the buildings in the new development to be completed was the plate shop, in which the steel for plating the hulls is prepared. Since it was necessary to put this shop in service as soon as the building was up, and as the question of electric power supply for the whole plant had not been worked out at that time, the direct-current energy then available was used. The machine tools listed in the accompanying table were installed and equipped with individual motors, in most cases belted directly to the machines.

CONDITIONS INFLUENCING INDIVIDUAL DRIVE

Every consideration involved in connection with the plate-shop machines led to individual drives. Neither the type of building, the arrangement of machines nor the operating conditions surrounding the use of them makes group drives desirable.

The building is a high studded steel-frame building with peak roof and two longitudinal bays, with a traveling crane in one of them. Under these circumstances the shafting necessary for group drives would be cumbersome and expensive. Furthermore, in order to secure sufficient space around the machines for handling the large plates and angles that are being fabricated considerable clearance had to be left between machines. This would further add to the expense of providing group drive.

The other controlling factor is the fact that while the final product of the yard may be standardized (*i. e.*, a number of identical vessels) on a given contract, each machine tool is used for several operations. The work on any given machine is, therefore, very much of a "jobbing" proposition, and the use of any machine is required for long or short periods at indefinite intervals.

To give the greatest flexibility of service, maximum utility and the lowest power cost for the output involved individual motor drive was therefore chosen without question.

The arrangement of tools in the plate shop and routing of materials to and from other buildings is shown

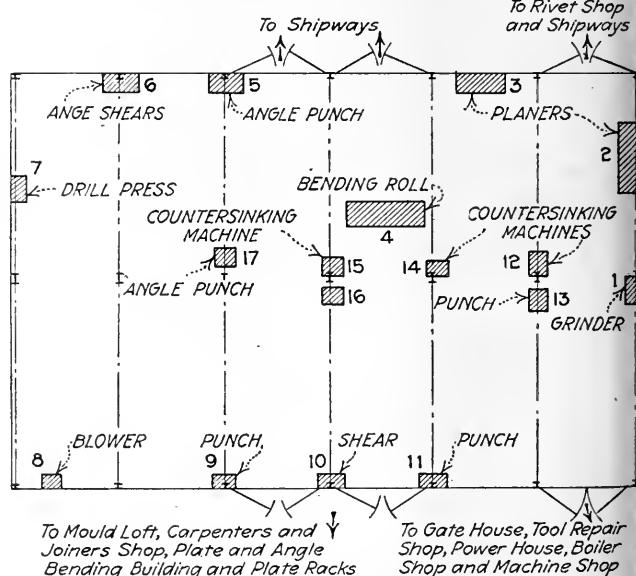


FIG. 1—LAYOUT OF MACHINES IN PLATE SHOP

in the accompanying diagram. The demand for immediate operation was so pressing that no opportunity was offered for any testing, and the motor sizes were chosen with the idea of not having them too small even if they were too large.

Soon after the building had been successfully put into service the question of permanent electric power supply for the plant was taken up, the old direct-current plant being entirely inadequate for the requirements of the new yard and occupying a site needed for other buildings. As pointed out in the Jan. 5 issue of the *ELECTRICAL WORLD*, a careful analysis of all power requirements led to a contract for alternating-current ser-

vice being entered into with the Richmond Light & Railroad Company.

The necessity of changing the motor drives from direct current to alternating current for operation on the purchased-power lines therefore afforded the opportunity for determining the actual duty cycle of work on the machines and the proper alternating-current motor to install. Ammeter and voltmeter readings were taken on the individual direct-current motors on each of the drives, with the results which are given in Table I.

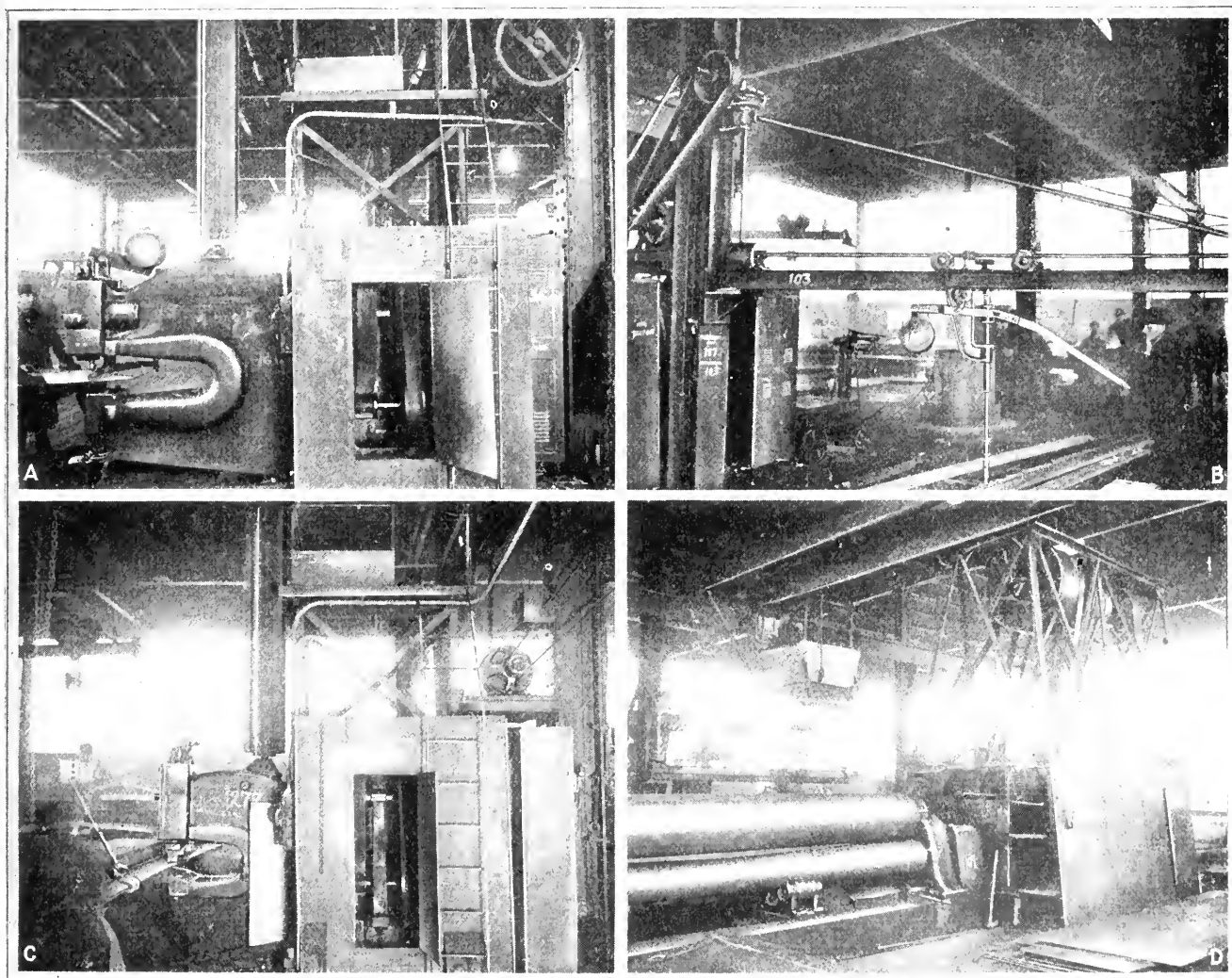
DETERMINATION OF PROPER RATING

Considering the test data on the direct-current motors, item 1 is the conventional grindstone and emery wheel used for sharpening the shop tools. The motor drives a small counter-shaft from which both grinding

tool is held on a carriage which travels parallel to the edge of the plate on a long screw. The tests showed that both the plate planers were considerably overmotored as then equipped and that 10-hp. and 15-hp. motors for items 2 and 3 respectively would be found to be ample.

The bending rolls (item 4) are for bending plate cold into circular shape, the relative location of the rolls being adjusted manually to increase the curvature as the plate is passed back and forth through the rolls. The motor is belt-connected with a counter-shaft from which open and crossed belts operated by a shifter drive the rolls in either direction. While the rolls were equipped with a 30-hp. motor, the tests indicated that a 25-hp. motor was proper for this drive.

Instead of a 10-hp. motor on the drill press and blower (items 7 and 8), 3-hp. and 5-hp. motors respectively



ENCLOSURE OF GEARS AND FLYWHEELS AND ELEVATED POSITION OF MOTORS TYPICAL OF STATEN ISLAND SHIPBUILDING COMPANY'S PLATE SHOP

A—Plate punch No. 13 with door to gear and flywheel housing open; the driving motor is situated on the elevated platform. B—Countersinking machine No. 15 driven by motor just above the pivoted end of the swinging arm. C—Plate shear No. 16; the

flywheel and gears are inclosed and the motor elevated. D—Plate-bending machine No. 4; the metal inclosure at the right serves as a control house and also to protect the workmen from the gears and to house the motor.

wheels are belted. This group was found to be considerably overmotored, a 2-hp. motor proving sufficient for the load.

The plate planers (items 2 and 3) have long beds, on which the plates whose edges are to be planed are placed, the plate being held firmly by adjustable jack screws on the upper frame of the machine. The cutting

were found of ample size. On the countersinks (items 12, 14 and 15) a 5-hp. motor for No. 12 and 3 hp. each for the other two were found to be suitable.

No unusual starting conditions existed in connection with the foregoing drives. On some of them the motor is started light and the load applied by shifting the belt, and on others the tool starts directly with the

motor; but as there is little inertia to overcome on account of the absence of flywheels, etc., standard squirrel-cage motors were used.

The most interesting motor applications are the punch and shear installations (items 5, 6, 9, 10, 11, 13, 16 and 17). They are low-speed machines and ones in which the working interval is very short, being simply the

TABLE I DATA ON PLATE-SHOP ELECTRIFICATION (STATEN ISLAND SHIP-BUILDING COMPANY)

Machine No.	Machine	Original Direct-Current Motor			Work During Test	Maximum Expected Work	Hp. Input to Motor While			Note*	Expected Maximum Load, Hp.
		Hp.	R.P.M.	Pulley Diam., In.			Starting	Running Light	Working		
1	Grindstone and emery wheel	3.5	1800	4	.....	.....	3.2	0.9	2.3		2
2	Niles Tool Works 25-ft. plate planer	15	1000	7.5	$\frac{1}{2}$ -in. plate	$\frac{1}{2}$ -in. plate	20	2.3	4.4		9
3	Hilles & Jones 30-ft. plate planer	20	950	14	$\frac{1}{2}$ -in. plate	$\frac{1}{2}$ -in. plate	22	3.5	6.2		12
4	Niles Tool Works 18-ft. bending rolls for $\frac{1}{2}$ -in. plate, main roll 21 in. diameter	30	600	15	$\frac{1}{2}$ -in. plate	$\frac{1}{2}$ -in. plate	26	4.4	2.3		30
5	Hilles & Jones angle punch	7.5	475	7.5	$\frac{1}{2}$ -in. angle	$\frac{1}{2}$ -in. angle	11.7	1.5	2	F	4
6	Hilles & Jones angle shears	7.5	825	6	$\frac{3}{8}$ -in. angle	$\frac{1}{2}$ -in. angle	7.3	1.5	2.3	F	5
7	Drill press, 2 $\frac{1}{2}$ in.	10	730	12	$\frac{1}{2}$ -in. hole	$\frac{1}{2}$ -in. hole	8.8	1.8	2		5
8	Blower for forge	10	730	20	.....	.....	11	2.6	2.6		5
9	Hilles & Jones No. 4 plate punch	7.5	825	6.5	$\frac{1}{2}$ -in. hole $\frac{1}{2}$ -in. plate	1-in. hole 1 $\frac{1}{2}$ -in. plate	11.5	2	2.6	F	5
10	Long & Allstatter No. 2 plate shear	5	550	6	$\frac{1}{8}$ -in. plate	$\frac{1}{2}$ -in. plate	8.8	1.5	4.1	F	5
11	Long & Allstatter No. 2 plate punch	5	550	6	$\frac{1}{2}$ -in. hole $\frac{1}{2}$ -in. plate	1-in. hole 1 $\frac{1}{2}$ -in. plate	8.8	1	2.6	F	5
12	Detrick & Harvey radial countersink	6	1465	5.5	.....	.....	7.3	2.9	4.7		4
13	Cleveland Punch & Shear Company's plate punch	7.5	475	7	$\frac{1}{2}$ -in. hole $\frac{1}{8}$ -in. plate	1-in. hole 1 $\frac{1}{2}$ -in. plate	11.7	1.2	3.8	F	5
14	Detrick & Harvey radial countersink	3.5	625	10	.....	.....	6.8	1	2.6		3
15	Fitchburg Machine Works radial countersink	3.5	625	10	.....	.....	6.8	1	2.6		3
16	Long & Allstatter No. 1 plate shear	7.5	475	7	$\frac{1}{2}$ -in. plate	$\frac{1}{2}$ -in. plate	11.7	1.8	3.2	F	5
17	Angle punch	7.5	825	8	$\frac{3}{8}$ -in. angle	$\frac{1}{2}$ -in. angle	11.7	1.5	2.3	F	3

*F—These machines provided with fly-wheels.

stroke during which the tool is punching or shearing. At that moment, however, the instantaneous power requirement is very heavy. Rather than use a motor big enough to carry the tool through its working stroke, the machine-tool designers adopted the wise expedient of using a heavy flywheel, which stores up energy when the machine is running light and delivers it as the machine slows down on the cutting stroke.

The presence of the flywheel permits a much smaller motor than would otherwise be required, but proper acceleration of the machine presents quite a problem. The severe starting conditions which resulted are indicated by the accompanying test data.

SOME FACTORS THAT AFFECT SELECTION

Three important points which have to be recognized in the selection of a motor are the power required to

start the machines, that required to run them, and the maximum horsepower necessary which the motor can develop at starting without throwing off the motor belt.

The tests indicated that 9 hp. to 12 hp. was necessary to start the punching and shearing machines. Since a standard squirrel-cage motor of about the sizes required would only develop a starting torque equivalent to one to one and a half times full-load torque, it is evident that a motor of proper size to handle running conditions would stand no chance of starting these machines under the conditions shown to exist. If the driving belt happened to be too loose, the motor pulley might slip and throw it off, but it could not develop sufficient torque to meet the starting requirements indicated by the test. If a starting compensator were used, it would lower the starting torque still further by reducing the applied voltage. For these reasons it was impossible to use a standard squirrel-cage motor either with or without starting compensator.

The proper drive for punching or shearing machines is therefore one which gives a powerful yet gradual starting characteristic. This may be secured from an alternating-current motor with slip rings and external starting device or from a squirrel-cage motor with high-resistance end rings. From the standpoint of simplicity, price and quick delivery, the high-resistance end-ring type was considered preferable, as a number of manufacturers carry a stock for elevator service.

When this type of motor is thrown directly on the

TABLE II—ALTERNATING-CURRENT EQUIPMENT INSTALLED IN PLATE SHOP (STATEN ISLAND SHIPBUILDING COMPANY)

Mach. No.	Machine	Hp.	A. C. MOTORS INSTALLED			Starting Device†
			Type*	Full Load, R.P.M.	Pulley Diameter, In.	
1	Grinders	2	S	1720	4.5	A
2	Plate planer	10	S	1150	6.5	B
3	Plate planer	15	S	1740	7.5	E
4	Bending rolls	25	S	1160	8.0	E
5	Angle punch	5	SH	680	5.5	C
6	Angle shears	5	SH	850	6.0	C
7	Drill press	3	S	1730	5.0	D
8	Blower	5	S	1735	8.5	C
9	Punch	5	SH	850	6.5	C
10	Shear	5	SH	680	5.0	C
11	Punch	5	SH	680	5.0	C
12	Countersink	5	S	1730	4.5	C
13	Punch	5	SH	680	5.0	C
14	Countersink	3	S	1730	4.0	D
15	Countersink	3	S	1730	4.0	D
16	Shears	5	SH	680	5.0	C
17	Angle punch	5	SH	850	8.0	C

*S=squirrel-cage motor, standard design; SH=squirrel-cage motor with high-resistance end rings.

†A=three-pole, 250-volt, 30-amp. inclosed switch fused for 20 amp.; B=three-pole, 250-volt, 100-amp. inclosed switch fused for 90 amp.; C=three-pole, 250-volt, 60-amp. inclosed switch fused for 50 amp.; D=three-pole, 250-volt, 30-amp. inclosed switch fused for 30 amp.; E=starting compensator arranged for conduit wiring with inverse-time-element overload and no-voltage-release coils.

line the high resistance in the rotor end rings causes considerable slip at starting, allowing the motor to accelerate powerfully and yet gradually. Another advantage of the high-resistance type is its falling speed characteristic with increasing load, which results in an increasing torque and helps the flywheel over the peak of the load. The speed-torque characteristics of this motor are very similar to that of the series direct-current motor used for traction purposes, and they fit it admirably for this work. The greater complexity of the slip-ring motor and its susceptibility to trouble

from dirt and grit in machine shops were other factors which affected the selection of high-resistance end-ring squirrel-cage motors for the punching and shearing machines.

The only compensators in the shop are used on items 3 and 4. These were necessary, as the motors are rated in excess of 10 hp., the compensator being used to limit the inrush of current at starting.

On the other motors, because of their small size, no compensators are necessary to limit the starting current, while on the high-resistance end-ring motors no compensator is permissible, as full line-voltage is necessary on these motors to give the proper starting torque.

A motor voltage of 220 was chosen for the plant to secure maximum safety for the operatives. With this

low voltage it was not necessary to use oil circuit breakers for starting the motors, so safety inclosed fused knife switches were chosen. The switch is opened or closed by a handle outside and offers complete safety for the operative.

To take the large starting current of the squirrel-cage motors it was necessary to fuse their switches so heavily that no protection is afforded to the motor at moderate overload. In case of grounds or dead short circuit in the motor, however, the fuses would cut it off. With individual motors on machines which are always under the eye of the operative there is little chance for overload on the motor which the operative will not know about. The plant was designed and equipped under the supervision of Lockwood, Greene & Company, Boston and New York.

Utilization of Second-Hand Line Materials

Some Material of This Description Can Be Renovated and Utilized
for Service Which Is Not So Exacting as the Use
for Which It Was Originally Intended

BY L. M. KLAUBER

Superintendent Electric Department San Diego Consolidated Gas & Electric Company

NEVER before has there been such a need for increased economy of operation and for more efficient utilization of labor and material. Of course, economy must not be allowed to interfere with maintaining a high standard of service; but, in attempting to decrease expenses by the standardization of equipment and the adoption of more efficient or durable apparatus, sight should not be lost of the economy of utilizing discarded material and equipment. Here is where the construction department, which acts in the capacity of contractor to the operating department, has an opportunity to determine how this so-called scrap material can be utilized to best advantage.

With the increased cost of all raw materials, a careful study of scrap, that is, material which can be disposed of only as junk, should be instituted by all central stations. Metals, alloys, scrap rubber, etc., should be carefully segregated as to quality, so that the highest price may be obtained for each. The degree of segregation which should be practiced will depend upon the specific conditions in each case, the quantity of each class of scrap accumulated, and proximity to raw material markets. Disposal direct to junk dealers will save much trouble, but in any case a certain segregation is advisable. A miscellaneous scrap heap is the junk man's picnic; he pays a skim-milk price, based on the least valued metal in the pile, and then separates the cream in the privacy of the junk yard. Other material and equipment can be renovated and used for a new service which is not so exacting.

METHODS OF UTILIZING OLD POLES

Poles form the greatest bulk of distribution plant removed. Poles of adequate length and size can be retreated and used again, if not too badly deteriorated; others may be too light or too worn. It becomes necessary, therefore, to segregate returned poles into three

general groups—those which may be reissued as poles for standard work, those too light or short for such work, and those no longer of any value as poles.

Retired poles which are deemed adequate to re-use as such by a power company must first be carefully examined for soundness. The butt can usually be sawed off about 6 in. (15.2 cm.) above the old ground line if weakened by decay. In fact, it usually pays to discard the butt if decay has advanced beyond a surface sap rot. Sometimes about 3 ft. (0.9 m.) of the butt can be removed so that when the pole is reset the deteriorated portion falls so far below the surface that it will not be subject to rot. In any case the pole should be carefully treated to arrest further decay, otherwise the life after reinstallation will be short. Brush treatment is better than nothing, but an open-tank treatment is much to be preferred.

In these days of greater strength of construction and wider clearances, the 30-ft. (9.1-m.) poles with 5-in. (12.7-cm.) tops, commonly referred to by linemen as "toothpicks," have little place. In a rapidly growing community they accumulate in considerable quantities. Installation on rural branch lines often solves the problem of their disposal. In some locations villa lots are so large that a special-service pole is required between the main lead and each house. An old 30-ft. or 25-ft. (9.1-m. or 7.6-m.) pole serves well for this purpose. Short poles can sometimes be used in rolling country on long-span work, where necessary clearances can be secured by taking advantage of the hilltops. A short pole as a push brace will often solve a difficult problem where anchor rights cannot be obtained. One avenue of disposal of light poles which must not be overlooked is to communication companies. Telephone and telegraph construction, especially in rural districts, is ordinarily of lighter quality than that of supply lines, and often a lot of light second-hand poles in sound con-

dition can be disposed of to such companies at a price well above scrap value.

If a pole is no longer fit to use as such, the next best service to which it can be put is as a guy stub. Ordinarily a guy is a poor location for second-hand material, since failure is expensive and care must be taken not to employ stubs that are too light. If insuf-

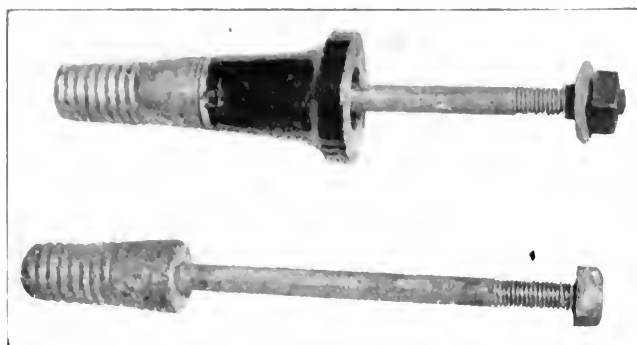


FIG. 1—WOOD THIMBLES ON PINS REPLACED WITH LEAD THIMBLES CAST IN HOME-MADE MOLDS

ficient for use as stubs, poles may be cut up as anchor slugs or for crib-bracing unguyed poles under strain. Light pieces may be sold to farmers for fence posts. Poles are useful in all heavy construction work and can be disposed of to contractors, house movers and the like. Square redwood poles were once used considerably in some parts of the country before the price became prohibitive. They may be sawed up and put to a variety of uses, particularly in rough building work. They are also valuable in the construction of mudsills, bog shoes or crowfeet for holding poles in marshy ground, owing to the durability of redwood in the presence of moisture. A piece of redwood makes an especially good anchor slug.

Failing in all other uses, poles may be cut up for firewood. Yet they are not so well adapted to this use as might be thought. Cedar soon chars in the ordinary fireplace and burns with difficulty. It is a fact testified to by many operators that a pole which catches fire from a defective insulator will easily burn down at 2 a. m. in a heavy rainstorm, but will when cut and dry stubbornly refuse to burn up in a perfectly good fireplace.

USE OF DISCARDED CROSS-ARMS

Non-standard cross-arms, even though in good condition, are difficult to place, since they will not match with new material and are especially bothersome when double-arm pairs are desired. Older cross-arms are liable to be small in every dimension—shorter, of smaller cross-section or with less clearance between pinholes. The clearance between the pins next to the pole is often less than permitted by law or good practice. A solution of the difficulty as to second-hand arms lies in their use as service buck-arms. Though more expensive than brackets, the buck-arm has advantages as to clearances, making a neat and safe installation, especially where a number of services leave a pole in a variety of directions.

One company which utilizes retired non-standard arms for buck-arms places an average of 2000 arms per year in such service, thereby utilizing the entire non-standard accumulation. If these second-hand arms are found to have a "pole-pin" separation too narrow to

comply with standard practice, it is a good plan to fill one of the pole-pin holes with a 1½-in. (4.31-cm.) wooden plug which can be nailed in place. A new through-bolt hole can then be drilled about 4 in. (10.16 cm.) off center toward the plugged hole and the arm mounted off center. This increases the clearance between the remaining pole pin and the pole by 4 in. Three pin positions remain available for use, these being all that are required for a lighting service. The offset buck-arm does not look bad on a pole, and, besides the advantage of increase clearance, it permits the use of one short or non-standard cross-arm brace with each arm, thus utilizing an additional second-hand item (see Fig. 4).

Other uses to which old cross-arms may be put are those which might be filled by any lumber of similar size, such as fence posts for wire fences, blocking for the storage of poles, cross-arms and other materials, cross-pieces for pole-hole covers, and, in general, rough construction work.

REINSTALLING OLD WIRE

Weatherproof copper wire removed from the lines should be carefully examined before it is reinstalled. If the impregnating compounds have been fried out, it will be better to skim it at once and use it where bare wire is permissible rather than to have it become stringy and an eyesore in a short time. Many places will be found in suburban and agricultural districts where bare wire is as useful as weatherproof, provided that it has retained its strength. Some of the very oldest wire removed, particularly solid wire in sizes from No. 2 up, will be found to be crystallized and weakened by repeated bending. Such wires should not be reinstalled on the lines, as they will only result in failures. In reeling up second-hand wire for line use, the old splices should be carefully examined. Many will be found weak and of poor workmanship, since

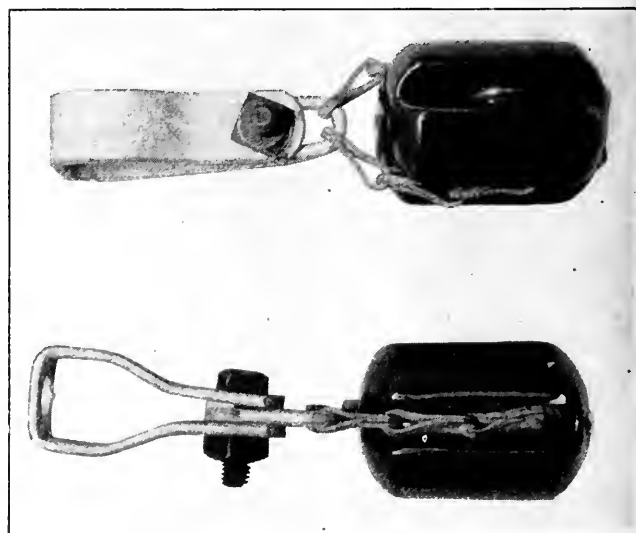


FIG. 2—HOME-MADE SECONDARY DEAD-ENDS USING ARC CHAIN

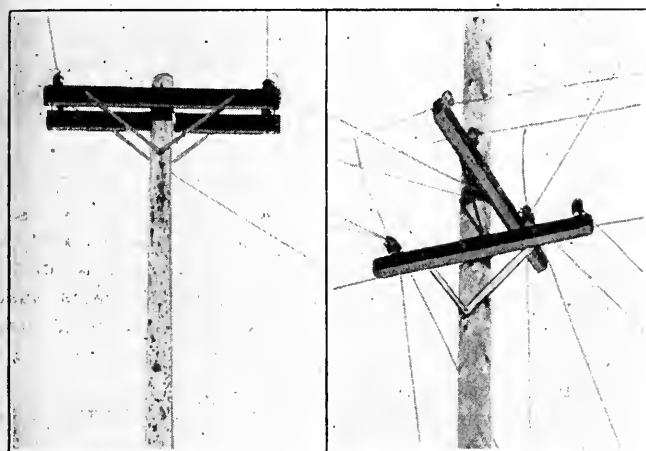
splicing was not so carefully done in the old days as now.

Short lengths of good quality, either weatherproof or bare, should be saved for ties. Annealed wire makes a better tie than medium hard-drawn, particularly when tying bare wire with bare wire. If wire is annealed and the insulation is removed by burning, the fire

should be started in the open, not in any form of furnace, and the wire must not be allowed to become overheated or it will lose its strength.

One use to which larger sizes of copper can be put after the insulation has worn off, and even after the wire has crystallized, is for grounded neutrals in underground secondaries. Where secondaries are well grounded at transformers and where practically every service conduit is likewise grounded and tied to the neutral, insulated neutrals would appear an unnecessary expense. Such systems are in operation, using bare neutrals entirely from the transformers to the various branch terminals at customers' entrance fuses, and no difficulties have been experienced due to loading and heating of adjacent cable coverings by leakage currents.

Bare scraps may be used as ground wires on transformer poles, provided that the vertical run is covered



FIGS. 3 AND 4—UTILIZATION OF OLD POLES AND CROSS-ARMS

Fig. 3 is a square redwood pole originally set in 1888, removed in 1913, cut from 45 ft. to 40 ft. and now doing duty in a suburban line. The pole was in service thirty years and is good for twenty more. Fig. 4 is an offset service buck-arm using second-hand arm and one short brace.

with a wood molding or fiber conduit, as is usually done even where non-weatherproof wire is employed.

PLACES FOR RETIRED INSULATORS

Insulators, especially pin-type insulators, present a different problem. Unless entirely destroyed they are more liable to be unsuitable because of inadequacy than because of deterioration. Owing to developments made by the manufacturers, greater factors of safety can be required and are used than were deemed necessary some years ago, so that many of the insulators being retired may no longer be utilized for their designed voltage. Companies having lines of various voltages are sometimes enabled to use old insulators on lower-voltage systems. This seldom pays, however, if the voltage steps are large, so that cumbersome insulators, subject to breakage and unnecessarily large pins, must be provided for use at the lower pressure. Some companies serving extensive territories in which a variety of service conditions are encountered find that insulators which have become inadequate in one district may be utilized for lines of similar voltage in sections where conditions are less severe. For instance, companies with lines along the seacoast may find that insulators which have proved to be inadequate under fog and spray conditions will give perfect service on the same lines in interior valleys.

Glass insulators, even of obsolete type, will ordinarily be found useful on secondary systems, provided that they have standard pin holes. Sizes smaller than those now standard for line construction should be used on service brackets.

On the whole, porcelain insulators, on account of their limited uses, offer a difficult problem when obsolete, and large numbers must be scrapped. It pays to have a few old types available for emergency connections and testing about any plant, for insulating stools and staging and for temporary service during construction work.

Strain insulators are more flexible devices, and if in good condition use may be found for most obsolete types. Glass "bobs," formerly used in large quantities in guys, are being abandoned for more dependable porcelain, but they will be found quite adequate for the house ends of service loops. They may also be used in the lighter types of guys, such as arm and bridle guys, and in dead-ending light secondaries. Two-bolt and small obsolete three-bolt guy chains should also be used up on these light guys.

Some prototypes of the modern clevis cap suspension insulator which are useful in dead-ending 11-kv. to 22-kv. lines are with difficulty made up into strings, as they have an eye at each end. These may be made up into neat pairs by using one new clevis cap unit at the line end of each pair, thus eliminating connecting links.

USES FOR OLD PINS, SPACE BOLTS, ETC.

The lead bushing is an exceedingly useful device in remodeling metal pins. Combination pins having a steel through bolt, porcelain base and wood thimble are becoming obsolete with most companies in high-voltage work, owing to the rapid digesting or destruction of the wood. The wood thimbles may be readily split off, and by means of plaster-of-paris molds these may be replaced by new lead thimbles, resulting in a pin actually superior in strength and durability to the original article. Renovated pins of this type are shown in Fig. 1. Metal pins with obsolete threads may sometimes be bushed with lead and thus rendered serviceable where otherwise they must be scrapped.

All-wood pins are of little service when deteriorated, although the shanks may be used as the pin-hole plugs for three-pin service buck-arms as previously mentioned.

One use of obsolete small cross-arm braces was mentioned in connection with these buck-arms. Other applications will be found in connection with special construction work, particularly around substations.

Light space bolts and through bolts, usually $\frac{1}{2}$ in. (1.27 cm.) where $\frac{5}{8}$ in. (1.59 cm.) are now standard, will of course be found of service in construction around any plant. There are also a few special uses to which these may be put in connection with line work. Where angle-iron braces are used with large-size cross-arms, two $\frac{1}{2}$ -in. (1.27-cm.) bolts are required with each brace, and these may be made up from old through bolts which have been shortened. The threaded end of a cut-off space bolt may be used as a stud with that type of pin which consists of a malleable-iron top and a separable stud bolt. Such studs with two nuts (one battered on) make good short bolts for attaching strain insulators to universal dead-ending clevises or similar devices. It is interesting to note that one of the few

advantages which cut-thread have over rolled-thread bolts is in their use as second-hand material, the cut thread permitting modification for other uses better.

Pole steps are not installed by power companies these days to such an extent as formerly. At one time all poles were stepped. Now it is usually the custom to step only transformer, switch and arc-lamp poles and sometimes not even these. Consequently most companies accumulate a considerable stock of second-hand pole steps. On account of the hook shape they have many useful purposes in miscellaneous work. They can be employed as spikes for industrial railways, as tent stakes, as cable racks in manholes, and as form hooks and anchors for future extensions in concrete work. They are useful about a warehouse as hooks for tools and ropes. A few may be used inverted as hooks to hold the ring at the lower end of arc-lamp chains or ropes where reels are not used. Occasionally they may serve as lag screws. The communication companies are still faithful to pole steps, and they should not be overlooked as a possible outlet for the surplus.

Many forms of metal scrap are useful as reinforcing in concrete. If concrete anchor slugs are used, old bolts, pole steps and braces will make excellent reinforcing. Short pieces of guy cable, whether new or retired, are also useful as reinforcing in any concrete building work. There is always a considerable waste in guying a line unless the men are careful in cutting to length and use short ends between the pole and the strain insulator. Where steel conductors are used short pieces of guy cable are unraveled for ties.

Brackets of old types can usually be disposed of in special service work. In these days of military camps wood brackets are useful for distribution systems among the tents. One company wiring a large camp used up a year's accumulation stringing secondaries bracketed on short square poles between tent groups and to latrines and messhouses.

Inclosed carbon arcs are giving way to gas-filled tungsten-filament units. The retired arcs may often be employed with slight modifications to house the incandescent lamps. Arc-lamp coils, whether series or shunt, are very useful around repair shops or laboratories and in the manufacture of home-made relays, switch mechanisms, etc. Therefore a number should be saved when lamps are scrapped. Arc-lamp carbons of obsolete size may be set up in groups and used as rheostats. A few old arc reels will be found serviceable around any plant as light hoists. Old shades, whether glass or steel, may be employed as reflectors with incandescent lamps. Clear-glass globes of the closed type can be sold to furniture stores for fish globes. Arc-lamp chains in long or short pieces will be found to serve many useful purposes. They are handy in threading through vertical runs of conduit. Short lengths will serve as pipe or conduit hangers under buildings. A secondary dead-end of the strain type, readily attachable to the end of any space or through-bolt and having all metal parts galvanized, may be cheaply made up with a porcelain strain insulator, a short piece of arc chain, a lap link and a dead-ending clevis (Fig. 2).

DISPOSING OF OTHER MATERIALS

Transformers and meters when retired are generally returned to the manufacturers for credit on new goods. When this is not done some parts may be

saved from the scrap pile to advantage. Transformer cases with leads intact make excellent waterproof cases for the installation of meters, instrument transformers or relays in the open. Occasionally a transformer case is needed in camouflaging a check meter on the service of a suspected customer, and a small quantity of transformer laminations are always of use about a shop and should be saved out of the scrap heap. The same is true of coils with the insulation burned off, if the wire is not damaged, as a quantity of binding wire is needed about any shop or test room for connections, etc.

Linemen's gloves after breakdown on test are useful where acids or other corrosive substances are employed, as for instance in handling materials in the lye solution in gas-meter shops, packing plants, etc.

The disposition of short lengths of lead-covered cable is always a problem. These accumulate with startling rapidity, even when every effort is made to utilize the shortest length in stock on each new installation. When cable is scrapped it generally pays to strip the lead. When flattened out this is useful for packing, washers, pipe saddles, etc. When these are not needed the sheath can be melted into solder or pin thimbles.

Packing material should be conserved in the same manner as supplies. Sacks are useful in putting up orders for local line crews, and boxes, barrels and crates should be available for goods sent to district storerooms. Heavy lumber from large crates should be saved for pole-hole covers. Barrels are often necessary when holes are to be dug in sandy or marshy ground.

It is advisable to provide a special workbench for the renovation of discarded line material and to keep at least one storeroom employee continuously at this work, so that he may become expert in decisions upon the utility and proper disposal of the various devices retired. In any case the foremen of the plant blacksmith, machine and carpenter shops, who ordinarily do not come into close contact with the line department, should be made familiar with overstock and obsolete materials, such as braces, bolts and lag screws. A knowledge on the part of these men of what is available will frequently save time and expense by permitting the substitution of second-hand line hardware for new stock in various routine repair and construction jobs.

It is hoped that this discussion will lead engineers to contribute ideas on how other economies can be effected.

Plan Coal-Saving Campaign Among Industrial Consumers

A nation-wide campaign for economy in the use of coal among steam plants will be undertaken by the United States Fuel Administration. The campaign was determined upon following a conference of representatives of the Fuel Administration, the Bureau of Mines and the American Society of Mechanical Engineers. The intention is to provide for an inspection of steam plants and practical demonstrations in scientific firing that will afford higher efficiency and smaller consumption of coal. The educational campaign planned will be conducted by the Bureau of Mines, with the full backing of the Fuel Administration.

Public Steam and Electrical Systems

An Analysis of the Building Heating Situation in Large Cities, Made with Reference to the Distribution of Power from Central Stations—Comparative Tables of Steam and Electric Heat

BY J. A. M'HOLLAN

Vice-President of the Martin-McHollan Company

COMPARED with the remarkable expansion which has taken place within recent years in the public systems of electrical supply, the development of public systems of steam distribution has been practically at a standstill. Such extensions as have taken place have been confined chiefly to cities of moderate size or to territories where the buildings served are of the smaller or residential class. Yet a public system of steam distribution has manifest advantages for the business districts of a large city, and the purchase of steam would be generally adopted by manufacturers and building operators if the service was provided at reasonable rates. As a companion service to that provided by the electrical corporations a public system of steam supply presents many features of advantage, but before such a development can receive serious consideration from the electrical interests it must be shown not only that the steam can be produced, distributed and disposed of at rates sufficiently low to secure the business, but that the sale of steam to such buildings will also promote the purchase of the electric service.

The striking success which has attended the operation of electric companies in the great cities of America has no direct bearing on the practicability of a public system of steam supply. There is a fundamental difference between the conditions that govern the production, distribution and sale of steam as compared with electricity, and the advantages are almost entirely on the side of the electrical industry.

A forceful illustration of the difference between steam and electric systems is furnished by the percent-

pened this year, the cost of steam at the station is increased by 39 per cent of the assumed sale price of 45 cents per 1000 lb., while that of electricity is increased by 10 per cent of the assumed sale price of 3 cents per kilowatt-hour. In a steam system an increase in the cost of fuel is of prime importance. In an electrical system it affects the margin of profit to only a moderate extent. The sale prices assumed for steam and electricity in the above comparison are arbitrary, except in the sense that each price may be regarded as

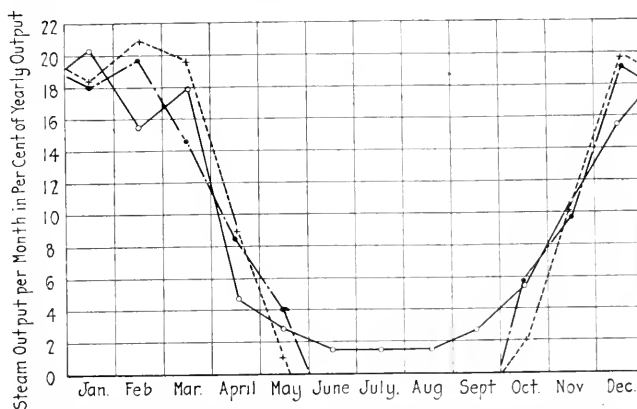


FIG. 1—MONTHLY VARIATIONS AND STEAM OUTPUT IN OFFICE BUILDINGS WHERE ELECTRICITY IS PURCHASED

a wholesale rate on a large quantity used. The comparison may be applied on the basis of retail prices with similar results.

The opinion is generally held by engineers that inasmuch as each system deals with the production and distribution of energy, and as steam is required in many large buildings for purposes which cannot at the present time be served economically by electricity, there are substantial advantages in having both systems under one control so as to avoid wasteful competition and unnecessary duplication of equipment. A few years ago such a view would probably have been correct, but a review of steam and electrical development up to the present day will serve to show that the field for electrical application in the large commercial buildings is as steadily increasing as that for steam is decreasing.

This is well illustrated by the figures given in Table II for two large office buildings in New York City.

Perhaps the most important factor in determining the future of steam companies in the larger cities of America will be the outcome of the controversy over the economy of operating private electrical power plants as compared with purchasing the electricity from outside sources. The extent to which the operation of these power plants is likely to be displaced by the purchase of the electricity has a most important bearing on the future of steam supply companies. When a private electrical power plant is operated to produce electric energy the effect is to maintain a high monthly

TABLE I—COMPARISON OF STEAM AND ELECTRIC PRODUCTION COSTS IN CENTRAL STATIONS

	STEAM COSTS			ELECTRIC COSTS		
	Cents per 1000 Lb.	Per Cent of Net Production Cost	Per Cent of Sale Price at 45 Cents per 1000 Lb.	Cents per Kw.-hr.	Per Cent of Net Production Cost	Per Cent of Sale Price at 3 Cents per Kw.-hr.
Labor.....	2.6	10.5	5.8	0.08	17.3	2.7
Fuel.....	17.5	71.5	38.8	0.3	65.2	10.0
Waste removal.....	0.7	2.8	1.5	0.01	2.2	0.3
Water.....	1.9	7.8	4.2	0.004	0.9	0.1
upkeep, repairs and supplies.....	1.8	7.4	4.1	0.066	14.4	2.2
Cost at station....	24.5	100	54.4	0.46	100	15.3

age of operating costs in large central stations given in Table I.

These figures are based on fuel prices prevailing before the war and would vary according to locality. In the event of fuel costs being doubled, as actually hap-

load factor, and when the electric service is purchased from outside sources there is a marked decrease during at least one-half of the year in the total amount of steam used. In the more modern buildings it now is an established policy to purchase the electric energy, and the other machinery is usually selected so that no steam-

TABLE II—USAGES OF STEAM AND ELECTRICITY IN OFFICE BUILDINGS

	Old Office Building	New Office Building
Volume	3,200,000 cu. ft.	6,500,000 cu. ft.
Total steam used per year	78,400,000 lb.	25,200,000 lb.
Total electricity used per year	700,000 kw.-hr.	950,000 kw.-hr.

*High electrical consumption due to design of building—interior corridors, insufficient window surface for natural lighting.

OLD OFFICE BUILDING			NEW OFFICE BUILDING		
Services	Method of Production or Operation	Per Cent of Total Steam Used	Method of Production or Operation		Per Cent of Total Steam Used
General power and lighting	Steam*	45	Purchased electricity	..	..
House heating	Steam	27	Steam	..	93
Water heating	Steam	3	Steam	..	7
Elevator service	Steam	18	Purchased electricity	..	..
Water pumping	Steam	3	Purchased electricity	..	..
Auxiliary pump operation	Steam	4	Purchased electricity	..	..

*To produce electricity.

using machinery has to be operated in the summer season. The monthly variations of the steam usages in three large office buildings are shown in Diagram I. In two of these steam is used only during the winter season, no steam being required in the summer months of the year. Diagrams II and III show the steam re-

its most desirable business, not in new buildings, but in existing buildings where the elevators and pumping services are steam-operated, and particularly in those where the electric service is produced by means of private power plants.

The purchase of electric service in large commercial buildings divides itself into two distinct and separate subdivisions:

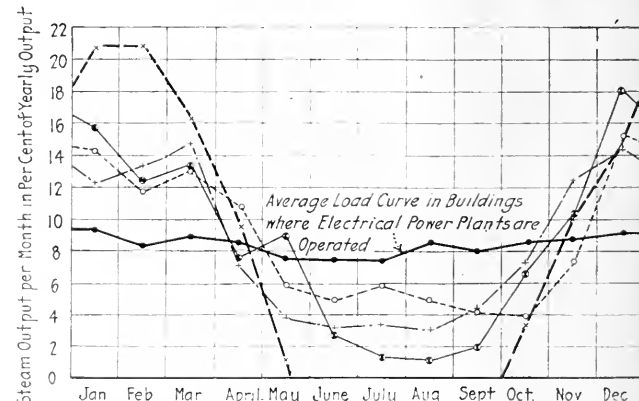
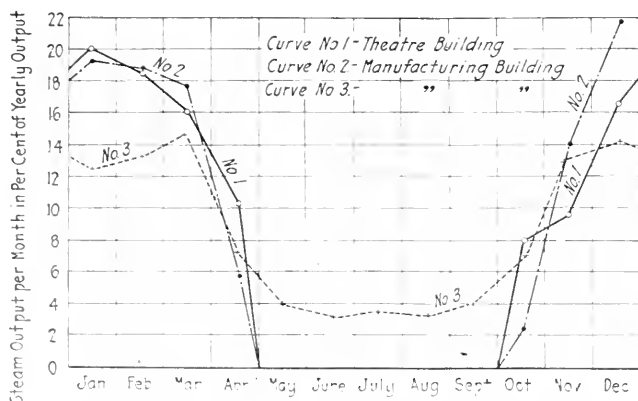
(1) In new buildings where the purchase of the electric service is considered at the time of the erection of the building.

(2) In existing buildings where private power plant machinery is already provided and in operation.

In existing buildings where private power plants have already been installed and are maintained in operation the situation is less favorable to the central station. In the older buildings, where the machinery is provided, the operation of the power plant is more or less a fixed feature and likely to be disturbed when a failure in operation occurs, when extensions or alterations become necessary, or when electric rates are reduced.

Perhaps the greatest obstacle to the extension of the central-station service to such structures is the uncertainty that surrounds the cost of operating the steam services other than the production of electricity. When electric service is purchased it is always necessary to continue operating certain high-pressure steam services.

The electrical corporations are in a most peculiar situation. To secure business which would increase their load factor and would ultimately enable them to effect a general reduction in rates both to large and small consumers, they must step out of their particular field of supplying electric energy and must guarantee or satisfy prospective large customers, in some way or other, as to the cost of the steam services which are left to be provided when the electricity is purchased. The cost of the steam services is almost invariably higher than the cost of the purchased electricity, although this



FIGS. 2 AND 3—MONTHLY VARIATIONS IN STEAM OUTPUT IN BUILDINGS WHERE ELECTRIC POWER PLANTS HAVE BEEN DISCONTINUED

quirements in several types of modern buildings where private plants have been shut down.

In buildings where machinery is operated to produce electric energy the monthly output of steam is more constant. A high rate of usage is maintained over the summer season and the load is of a character that would be a desirable addition to a steam supply company. Load curves of various classes of buildings are shown in Diagrams IV and V. A brief study of these will serve to show that a steam company can derive

fact is not generally appreciated. The general proportion in buildings where electricity is purchased is as follows: Cost of purchased electricity, 30 per cent of total annual costs; cost of high-pressure steam services and heating (inclusive of fuel, labor, ash removal, supplies and repairs, labor insurance, supplies and repairs to machinery), 70 per cent.

It is to be noted that the items which make up the cost of the steam services are flexible and subject to increase or decrease proportionately with the care and

telligence with which the equipment is operated, and is clearly to the interests of an electrical corporation to see that they are provided at the minimum cost. The tendency of the present age in the large cities of America is towards electrification, and the steady extension in this direction is a menace to the future of the steam supply business. Elevators can be more

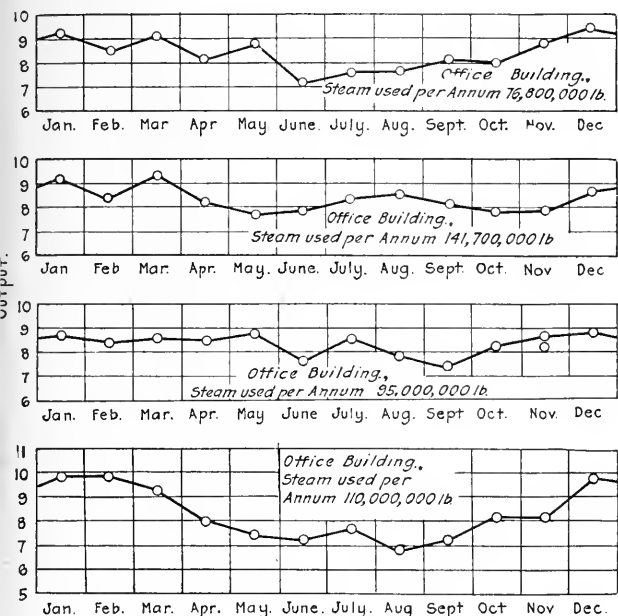


FIG. 4—MONTHLY VARIATIONS IN STEAM OUTPUT IN OFFICE BUILDINGS WITH PRIVATE POWER PLANTS IN OPERATION

economically and more effectively operated by electricity than by steam-produced hydraulic power. Pumping, not only of water, but of sewage, can be economically provided by electric energy. Refrigeration lends itself to the use of electricity, and it is almost certain that the public steam systems must find their future business largely in the heating of buildings. They will have to meet a problem of transacting a profitable business with equipment which may have to remain disused for one-half of the year, and the significant fact must not be lost sight of that the use of exhaust steam has not thus far been found practicable in central-station heating systems. The enormous expense of installing the large mains when exhaust steam is required and the necessity of maintaining a high pressure throughout the system has led to the general use of piping systems supplied with high-pressure steam. If the electrical corporations can completely displace the operation of private power plants, there is left for the steam company only the heating business, extending over the winter months and of a variable character that does not lend itself to a profitable use of the equipment.

The question arises whether the use of steam for heating may be displaced by gas or electricity or other heating agent. Steam is superior to gas in that the air in the space heated is not polluted by the gases of combustion. Electrical heating, on the other hand, is superior both to gas and steam, but cannot be used on account of the excessive cost. A series of interesting experiments conducted by J. D. Ross, superintendent of the Seattle municipal plant, discloses that electrical heating is comparable to steam with coal at \$6 per ton and electricity at 0.4 cent per kilowatt-hour. In connection with this question of electrical heating it may

be of interest to consider the magnitude of the problem of heating a large building by means of electricity. An interesting example is available in the group of institutional buildings in New York City upon which observations were made on the power, lighting and heating services over an entire year. The usages for light and power in this group of buildings amounted during the year of the test to approximately 712,000 kw.-hr. In this, as in most other tall buildings, the heating of the building is only one of the services that are steam-operated. The elevators are driven by steam pumps; the house water, refrigeration and auxiliary engine-room services are provided by means of steam-using apparatus. If these appliances were rearranged so as to be electrically operated, the increase in the electrical usages would be approximately doubled, or a total usage, without the heating of the building or the hot-water supply, of 1,500,000 kw.-hr. The heating of the buildings absorbed 30,000,000,000 heat units and the heating of the water supply absorbed 2,000,000,000 heat units. Of these amounts perhaps about 20 per cent was used in the form of piping losses and other wastages, leaving a net total of about 26,000,000,000 to be provided electrically, which at 100 per cent efficiency in electrical heaters would correspond to a total usage of energy for heating purposes of about 8,000,000 kw.-hr., or about eleven times the consumption under test conditions with only the power and lighting services provided by means of electricity. In the case of a twelve-story hotel the electric energy required for heating would be about 2,500,000 kw.-hr., or fifteen times the usage of electricity for power and lighting purposes. These totals are for individual buildings and serve to show the magnitude of the prob-

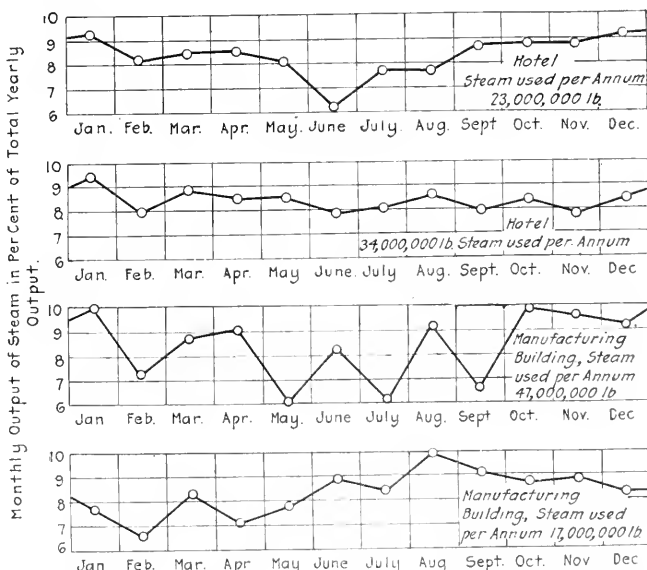


FIG. 5—MONTHLY VARIATIONS IN STEAM OUTPUT IN FACTORIES AND HOTELS WITH PRIVATE POWER PLANTS IN OPERATION

lem of electrical heating in large buildings. It is impossible to predict future developments in the electrical industry, but if an increasing price of fuel and a decreasing rate for electric service should force electrical heating to be considered as an economic development it can readily be seen that not only will costly and radical changes be required in the underground electrical systems in our large cities, but the present huge power stations will be totally inadequate to meet requirements.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

FEATURES OF CHICAGO'S NEW PARKWAY LIGHTING SYSTEM

Details of Construction, Including Method of Running Circuits and Use of Series-Multiple Transformers with Special Couplings

Several unusual engineering features are included in the three additions to the extensive boulevard and parkway lighting system now being completed by the South Park Commission in Chicago.

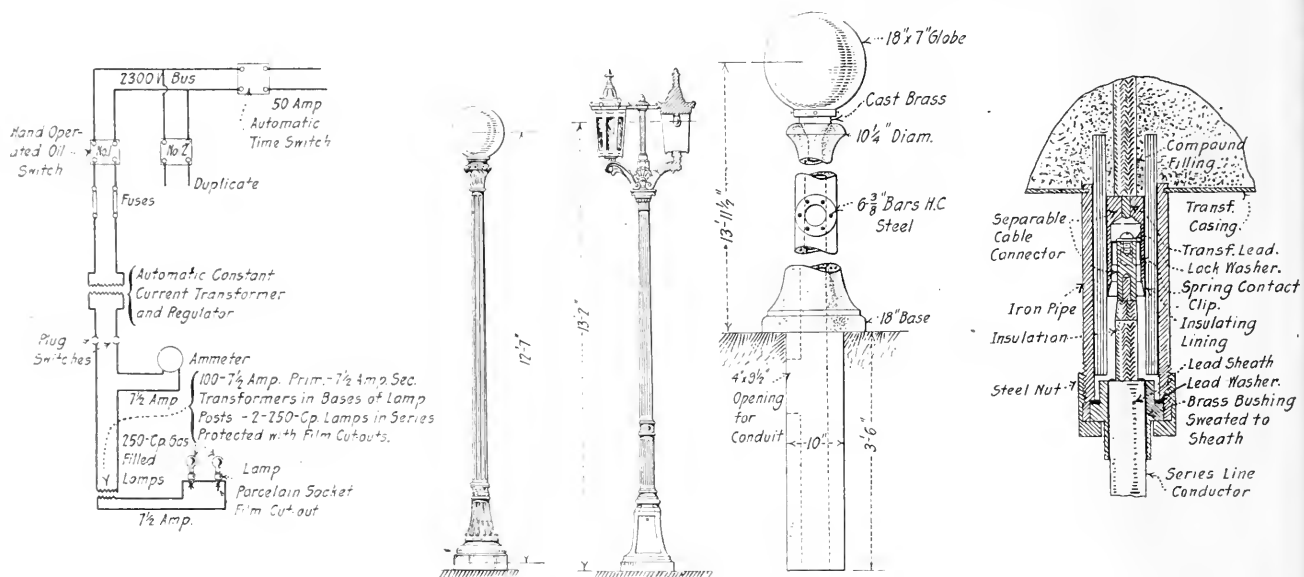
The typical parkway block contains four lamps between street intersections. In so far as possible the existing 5000-volt cable will be used, since it has been determined that the rubber insulation, although some of it has been in service since the World's Fair of 1893, is as good as can be purchased to-day. The adoption of this plan made it possible to purchase 50 per cent less cable than would otherwise have been necessary. All circuits will be laid in 3-in. (7.6-cm.) fiber conduit in the grass plot.

The standards and lanterns, which were selected for their artistic design, stand 13 ft. 2 in. (4 m.) high to the lamp center and are bolted to a concrete base. The lantern faces are fitted with "Synite" glass to diffuse

each. The standards which these units will replace are of the old World's Fair type.

The primary leads of each series-multiple transformer will be equipped with detachable couplings. This feature, in addition to eliminating the slow and expensive construction involved in using wiped joints, also makes it possible to disconnect any lamp-post transformer readily. This is of value in testing and changing transformers. The details of the disconnecting feature are shown in Fig. 5. The estimated cost of this part of the system will be about \$57,000, or \$178 per standard.

In the 0.5-mile (0.8-km.) stretch of Garfield Boulevard which will be relighted 124 single-lamp standards will be set. These units will be placed four abreast on two parallel drives separated by a grass plot and will utilize circuits laid to serve eighteen old 1000-watt lamps on World's Fair standards. The new units will be mounted on the Universal Concrete Products Company concrete posts set about 80 ft. (24.4 m.) apart. The posts will be set in concrete and will be of such height that the light center will be 10 ft. 6 in. (3.2 m.) above the street. In order to take the fullest advantage of the existing cable and at the same time to give as much light as possible to the merchants who are



FIGS. 1, 2, 3, 4 AND 5—CIRCUITS FOR SUPPLYING DOUBLE-LANTERN STANDARDS; UNIT FOR RESIDENTIAL STREETS; MICHIGAN BOULEVARD STANDARD; CONCRETE STANDARD FOR WHITE-WAY LIGHTING; DISCONNECTING FEATURES FOR PRIMARY LEADS OF SERIES-MULTIPLE TRANSFORMER

the light from the 250-cp. gas-filled tungsten lamp which each will contain. The two lamps on each standard will be operated in series from a 7.5-amp. circuit connected to a series-multiple transformer in the base of the post. Low-voltage film cut-outs of special design will prevent the complete failure of a unit through the failure of a single lamp. According to reports these lighting standards, which cost \$40 each when the contracts were let two years ago, could not be duplicated now for \$80

helping pay for this 0.5-mile (0.8-km.) stretch, larger lamps will be used in those units on the property sides than in those on the boulevard planting space. It is probable that the property-side lamps will be rated at 250 cp. and the others at 100 cp. Alba diffusing globes will be used throughout. The total estimated cost of this lighting, which is of the straight-series type, will be about \$15,000, of which the merchants will pay one-third. This makes the cost per post about \$120.

PREVENTING INSTALLATION OF WRONG-SIZED FUSES

Two Types of Stickers Printed in Red Ink Are Used to Caution Unskilled Workmen Regarding the Sizes of Fuses to Use

Safety stickers pasted on fuse cabinets by the Oklahoma Inspection Bureau serve a twofold purpose. They are a precaution against the use of wrong-sized fuses, and they emphasize the fact that it is danger-

**FOR SAFETY
USE ONLY
10 AMP. FUSES
OKLA INSPECTION BUREAU**

CAUTION!
DO NOT STAND IN DAMP PLACE
OR TOUCH ANY GROUNDED
METAL OR CONDUIT WHILE
TOUCHING METAL SOCKETS OR
LIVE WIRES. - - - - -
KEEP CABINET BOX CLOSED
OKLAHOMA INSPECTION BUREAU

SAMPLES OF STICKERS PASTED ON FUSE CABINET BOXES TO GIVE EVIDENCE OF PREVIOUS INSPECTION

ous to let the body become the connecting link between live wires and a good ground. When the fuse sticker is pasted in the cabinet box and an inspector later discovers the wrong fuse in use he has tangible evidence that previous warning had been given and can act accordingly. H. J. Clark of the inspection bureau reports that the stickers are very effective.

METHOD OF TRANSPORTING LARGE POWER TRANSFORMERS

Core Packed and Case Crated So that the Entire Unit Could Be Shipped Lying Down—Skidding and Upraising Transformer

In shipping three 7500-kva. water-cooled transformers to the Northern States Power Company, St. Paul, Minn., the Westinghouse Electric & Manufacturing Company adopted a novel method of skidding and packing the transformers which might be used to advantage anywhere for transporting extra-heavy transformers where head room is limited. The units were so large that if shipped in the upright position on a drop-frame car they would have barely been within the maximum height permitted by structures over the railroads, etc. To avoid this difficulty a cradle was made for each transformer, in which it could be laid on one side.

The cradle consisted of three skids with heavy timber cross-pieces shaped to receive the curved case and a framework at right angles to one end of the skids. The parts were firmly fastened together and those at right angles braced by tie rods. The transformer case was laid in this cradle with its base against the vertical end of the cradle and held in place with straps and tie rods running through the skids. The ends of the skids under the vertical frame were cut diagonally to permit rocking the case into an upright position.

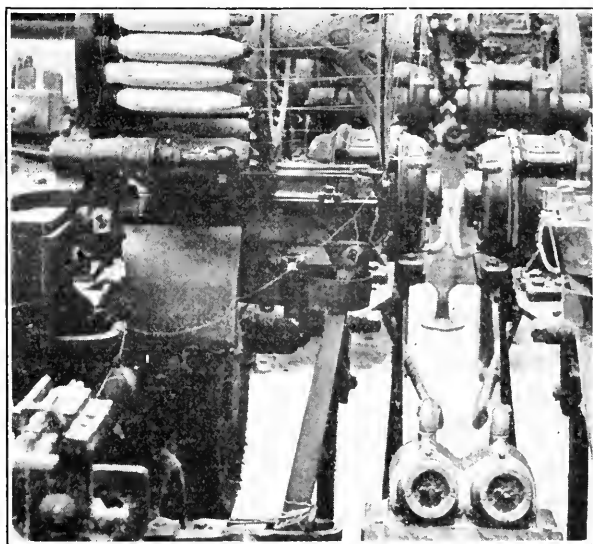
To prevent injury of the transformer windings, wood slats were fastened around the core so it would fit the case snugly. The cooling coils were left fastened to the transformer cover and a bracing was provided through the center of the coils to the top of the cover. The latter in turn was braced against the end of the car, thus serving to hold the transformer in place inside the tank.

In handling the cradle equal-length chains were attached to the top of the cradle side and the end of the skids under the top of the transformer so that when lifted by a crane each one would share the weight. To tilt the transformer into an upright position the chain fastened near the head of the transformer was raised while the other was let out. In this way rough jostling was avoided.

MOUNTING LOOM-MOTOR SWITCHES IN PAIRS

Handles Are Recessed in Disks and Short Connections by Means of Conduit Are Made to the Motors

Heavy duty switches for use on loom motors are now mounted in pairs on a single fuse box in some of the latest installations, as shown in the accompanying photograph. In a weave shed where hundreds of looms are in service and tended by young girls with no electrical or mechanical training simplicity of control, combined with entire safety of operation, is of vital importance, particularly where the motors are wound for 220 volts and upward. In the installation shown the looms are mounted with ends reversed, and the adjacent motors are thus brought within 2 in. or 3 in. (5 cm. or 7.6 cm.) of each other. Near the floor the intervening space is occupied by the pedestal, fuse box and switch pair shown.



HEAVY-DUTY SWITCHES FOR LOOM MOTORS

Each switch is of the most rugged type, capable of withstanding much abuse. The handles are recessed in disks marked for "off" and "on" positions, and short connections are run to the motors with BX conduit. Nothing short of deliberate destruction is likely to affect the operation of these units. It is feasible by staggering the loom motors with respect to the inter-

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

COST OF OPERATION OF CLUB ELECTRIC GRILL

Figures on Energy Consumption and Repair Cost at
New York Engineers' Club for Period
of One Year

Figures kept for one year on the cost of operation of the Buzzini electric grill at the Engineers' Club, New York City, show a weekly expense of \$11.02 for six grills with energy at 1 cent per kilowatt-hour, or less than \$2 per week per grill. The figures are as follows:

Number of grills	6
Grill renewals per year	12
Current, amp.	17.5
Voltage	240
Grill hours per week	245
Kilowatt-hours per week	1,029
Kilowatt-hours per annum	53,508
Per Year	
Cost of wire	\$25.00
Cost of wire coiling	2.50
Cost of millboard	1.00
Cost of labor	9.32
Total cost of renewals	\$37.82
Cost of operation per week for six grills:	
Energy, at 1 cent	\$10.29
Repairs, $\$37.82 \div 52$	0.73
Total cost	\$11.02
Total cost per annum	\$573.00

RANGE SALES SITUATION IN THE COMING YEAR

Evidence Points to a Curtailment of the Free-Time
and Installment Plans Formerly Followed by
Central Stations

Individual opinions of central-station sales managers in the electric range business in 1918 have been solicited by the ELECTRICAL WORLD. How the outlook appears to these men, some of whom are members of the electric range committee of the National Electric Light Association, may be summarized as follows: First, the sale of electric ranges will not be discontinued; second, there has already been established a certain amount of consumer demand for ranges; third, the methods of selling electric ranges will be changed, particularly in that it will be found difficult by the utilities to finance installations through long periods of free trials and installments to the extent formerly practiced.

A summary of the general situation by C. E. Michel, acting sales manager of the Union Electric Light & Power Company and chairman of the electric range committee of the N. E. L. A., is given in this letter:

I have about reached the following conclusions in connection with the range business:

First, the electric range has a very definite place in the economic conditions of to-day. This is particularly true of those communities in which coal can either not be secured at all or where, if secured, the price is so high that it is impossible to use it in the inefficient coal cooking range.

Second, other places in which electric range activity is clearly indicated are those sections of the country where natural gas is beginning to fail or has already failed and where electricity is available at a reasonable price.

Third, an important field is open in those sections where generating and line capacity is available and an intensified use of available circuits is desirable.

In the large central stations where intensive selling campaigns have been going on for the last two or three years I look for certain well-defined and carefully thought-out retrenchments. I do not believe that as a whole the central-station industry will continue to finance this business as it has in the past. It is quite possible, however, that this will have a wholesome effect on the business in general, as the objectionable trial feature which a great many of us have felt necessary in the introduction of the article will be sharply restricted and customers will be educated to pay a legitimate price for the range and its installation.

We are entering upon a difficult period of business life, and when we come out of the war a great many things will have a different aspect from that of to-day. Customs will probably be different, and readjustments will have to be made. The range manufacturer must be alert and awake to see that he shall find his proper place in the new arrangement of things. That this place will exist seems absolutely certain to me.

For the immediate future I see a sharp restriction in one fertile field, the apartment house, as, from the standpoint of both labor and material, the cost of apartment-house construction is to-day almost prohibitive. Buildings of a kind in which the electric range man is interested are not generally being constructed; there are a few notable exceptions to this, of course, but the statement as a whole is true. On the other hand, the field not affected by the slackness of building is so enormous and virgin in its nature that there should be a substantial sale of electric ranges.

Another prominent central-station sales manager, whose success with range selling is recognized, after stating that central stations would probably not push range sales this year on account of the prices of coal, capital and line materials, said:

In spite, however, of the above-mentioned factors, I think the demand for electric ranges is greater than ever, and if past methods could be employed during the coming year, I feel certain the sales would far surpass those accomplished in past years. Also past efforts have resulted in many central stations getting a considerable number of ranges on their lines, and this has served to educate the public to a large extent and is gradually creating a very healthy demand.

The fact that it has become almost universal practice in the sale of household equipment to sell it on the installment plan of course makes it difficult to sell ranges in quantities for cash and at list prices, as people have been educated to purchase all such household equipment on the installment plan. Moreover, the facts that the price of the electric range is about four times that of a gas range of similar style and size and that the customer can purchase a gas range on the installment plan will be factors working against sales in large quantities.

I dare say central stations will, however, be able to find enough customers who can pay cash and pay full price, and who live where the central station has the line capacity to care for the range without additional investment, to make possible a substantial sale of electric ranges. At least, we are finding this to be the case and at the same time have a number of attractive inquiries for range equipment for apartment buildings.

"CASH-AND-CARRY" PLAN APPLIED TO LIGHT BILLS

Instead of Delivering Bills to Customers Small Company Asks Customers to Call for Them and in This Way Reduce Expense

Lighting companies operating in small communities have been under a greater comparative strain during the past two years than those operating in larger places. With little opportunity to increase their load, with fixed

Electric Light and Power Bills

Will be ready for distribution at the Company's office

January 1st

We are discontinuing the old practice of delivering bills, and will be pleased to have you co-operate with us by calling for your bill promptly.

Respectfully,

Fayette County Utilities Co.

ADVERTISEMENT USED TO ANNOUNCE CHANGE IN BILLING METHOD

rates and the increasing cost of operation, these small companies, which never did as a class enjoy an enviable net profit, have been hard pushed these days to show any profit at all. To prevent disaster economies must be put into practice wherever possible. A single example of an economical measure particularly adaptable to the small-town property is outlined below. It is a method for cutting the cost of billing.

Several subsidiaries of the Utilities Development Corporation of Chicago have discontinued their old practice of distributing or mailing bills for electric service to consumers. Instead they now advertise that the bills are ready for distribution at the company's office and request customers to call for them. The companies which have tried the plan, according to Miss L. M. Beefield of the Utilities Development Corporation, are enthusiastic over its success.

The Fayette County Utilities Company, Oelwein, Iowa, one of the subsidiaries using the plan, reports that in November the expense of sending out the bills was approximately \$18.65 under the former method, and this represented the situation generally throughout the industry. This figure included payment of 1 cent per bill to the high-school boy who delivered the majority of the bills, besides the cost of envelopes, labor of folding, inclosing, sealing and stamping the remainder, plus postage. In December, under the new system, the expense was only \$7.50, namely \$2 for the advertisement and \$5 for postage on the bills which were not called for, plus about 50 cents for the envelopes. Seventy-five per cent of the bills were called for by Jan. 15 after the advertisement was printed making the announcement as of Jan. 1. A far greater proportion of bills called for is expected in succeeding months,

inasmuch as many customers failed to notice the advertisement and were awaiting the receipt of their bills by carrier.

In commenting on the plan the Oelwein company stated: "As a labor-saver the plan is a wonder. It does away with the folding and inclosing of the bills, together with the sealing and stamping of envelopes, and we certainly appreciate this extra time along about the latter part of the month!"

In trying out this plan, however, a word of caution is necessary. If a customer does not call for his statement, he should be billed. Otherwise a customer might get two or three months in arrears and find it difficult to make a settlement. In such a case not only does the company stand to take a loss which might wipe out the saving of a whole month but it is also likely to make an enemy.

SPECIAL CARTOON HELPS COMPLAINT DEPARTMENT

Indiana Commercial Department Finds that a Comic Drawing Is of Use in Solving the Problem of the Chronic Kicker

The commercial department of the Indiana Railways & Light Company, Kokomo, Ind., working in close co-operation with the claim department, has used the cartoon reproduced herewith to good advantage during the winter. O. M. Booher, contract agent for the company, speaking about the use of the cartoon, said: "Many hard-boiled kickers on winter lighting bills have been softened considerably by a tactful display of this picture. Of course we did not show it to the general public.



THIS CARTOON HAS HELPED A MIDDLE WEST COMPANY'S CLAIM DEPARTMENT BY APPEALING TO THE "KICKER'S" SENSE OF HUMOR

We picked our men with discretion. I find that if you can touch the funny spot of a man in the proper way, no harm comes from it, and he not only forgets to kick about his light bill but leaves the office a friend of yourself and the company. We used this picture so much during the last winter that we almost wore it out."

POSSIBILITIES IN THE ELECTROCHEMICAL LOAD

Outlook from the Standpoint of the Average Utility
Outlined, with a Discussion of the Limiting
Features

Considerable interest is being shown by central stations in the possibilities of electrochemical loads. At the recent meeting of the new-business men of the Ohio Electric Light Association C. A. Winder of Niagara Falls discussed the possibility of this load from the standpoint of the average company.

In considering the power consumption, Mr. Winder pointed out that aluminum consumed the largest amount of power per pound of finished product, approximately 2.5 kw.-hr., and is extremely dependent upon the low cost of power. Aluminium manufactories may exist a thousand miles from the center of gravity of distribution provided that power can be obtained at \$20 to \$25 per kilowatt-year. Artificial abrasives are next, with an energy consumption per pound of product of about half that for aluminum. The weight of finished material, however, is high, bringing the question of freight to the front; so much so, it is said, that if the haul of the finished material were 2000 miles (3218 km.), it is doubtful if an artificial abrasive plant could exist were power free. Under the prevailing price of water power, a 500-mile haul is given as a minimum. Calcium carbide, ferro alloys, sodium, chlorates and phosphorus are stated to be in practically the same position as artificial abrasives, namely, all require power at the prevailing water-power rates and within close proximity to the center of gravity of their consumption.

Ferrosilicon from an engineering standpoint can be made economically under normal circumstances in furnaces of about 10,000-hp. input, and the author states that apparently those companies now entering this field, contemplating this action, are planning on small furnaces. Such engineering, however, it is pointed out, cannot withstand the rigors of competition that will follow the war, the product now being very high in price. On the other hand, where companies insist upon entering this field to take advantage of the present high prices limited capital requires the installation of small furnaces. An engineering detail in this consideration that has been overlooked is that of frequencies. As a rule, central-station frequency is 60 cycles, but this practically precludes the operation of a ferrosilicon furnace of any size because of poor power factor resulting from high current and high frequency. Low frequency, it was stated, is a prime requisite to the successful operation of ferro-alloy, calcium carbide and similar furnaces. Most of the electric furnace products have been developed at Niagara Falls, where 25 cycles is the prevailing frequency. Even lower frequencies than this are perhaps preferable for electrochemical loads.

Furthermore, it is stated, if we consider off-peak power for such loads as artificial abrasives, ferro-alloys and calcium carbide, it is found that an 80 per cent load factor will so greatly increase the overhead costs that the power would have to be obtained without any cost at all to be attractive. Daily off-peak power for a carborundum furnace is absolutely out of the question, as the carborundum furnace operates for thirty-six hours. Neither, for the same reasons, can the

graphite furnace be considered. Valley power coming in periods of eight months is of economic possibilities that are not attractive to the average electrochemical industry.

The smallest user of power per ton output is perhaps the caustic and chlorine industry, and it is consequently the most affected by long freight hauls. Therefore these materials are manufactured near the market and are two of the few electrochemical industries that the central station perhaps may hope to attract. The only difficulty is primarily one of rates.

Summarizing, the author says: "It will be those companies located at the present economic positions and possessing water power, which in itself leads to the reduction of cost, whether it be by virtue of price, quantity or frequency, that will survive this ordeal. The central station may then find itself in a position of having connected load without the ability of the load absorbing its power, and it will take a long time again to build up the load to where it was when the war began. Obviously, the only classes of power users that the modern central station in large cities should solicit are japanning ovens, brass-melting and steel-melting furnaces where good scrap is available and other conditions correct, as well as hundreds of industrial power-consuming devices now being perfected or which have not as yet become commercially applicable but will be perfected under the present war stimulus."

POINTS TO CONSIDER IN CONNECTION WITH PUMPING

Data that the Power Engineer Should Provide the
Pump Manufacturer When Seeking a Choice of
Pump for Certain Application

R. L. Yates, assistant manager of the Platt Iron Works, Dayton, Ohio, in a paper presented before the industrial heating committee of the Ohio Electric Light Association, discussing pumping from the hydraulic point of view and defining the relation of the central-station power sales engineer to such jobs, included a list of questions the answers to which will acquaint the pump manufacturer with the requirements of any situation where pumps are to be installed. The questions are listed herewith:

1. Number of pumps required.
2. Nature of service.
3. Is vertical or horizontal installation desired?
4. Capacity required in gallons per minute.
5. Total pumping head, including suction, discharge head and friction head.
6. Maximum suction lift, including all friction.
7. Length and size of suction and discharge pipes, giving number and kind of elbows.
8. If pumping head is variable, give maximum variation for both suction and discharge.
9. If pump is below source of supply, will it be submerged or placed in a dry pit?
10. Will pump be required to operate continuously? If not, at what intervals?
11. Nature of liquid to be pumped—hot, clear, fresh, alkaline, cold, gritty, salt, acidulous.
12. If pump is belt-driven, give speed and diameter of pulley.
13. Furnish certified motor-dimension print.
14. Make sketch of proposed pump setting, showing piping.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Armature Reaction in Rotary Converters.—G. BADEY.—Armature reaction in rotary converters is not negligible. It may be classified as of two kinds—fixed and oscillating. The first, expressed in terms of direct-current ampere-turns, affects the performance in the same manner as the attenuated armature reaction of direct-current apparatus. The second should be deadened or attenuated by the proper grouping of the machines. Examples are worked out for (1) a theoretical case of an infinite number of phases and a sinusoidal field; (2) a case of a finite number of phases and a sinusoidal field; (3) the case of a monophasic converter.—*Revue Générale de l'Electricité*, Feb. 2, 1918.

Generation, Transmission and Distribution

Electric Waves.—W. S. FRANKLIN and BARRY MC-NUTT.—Discussion of the simplest aspects of the dynamics of wave motion. While differential equations are used throughout, mechanical analogies are used extensively to make the explanations intelligible to any one who has studied physics. The discussions may be divided into the following parts among others: Expression of a traveling curve as a partial differential equation; method of handling undetermined constants and functions in the solution of ordinary and partial differential equations respectively; reflection of waves and change of phase caused thereby; differential equations of electric wave motion on a transmission line; effect of traveling distribution of current and voltage; mutually sustaining current and voltage distributions; what determines wave form; transmission-line oscillations which follow switching, etc.—*Journal of Western Society of Engineers*, November, 1917.

Bonus Plan Reduces the Consumption of Coal at Manila.—B. H. BLAISDELL.—By dividing any saving effected with power-plant employees the Manila Electric Railway & Light Corporation has been able to increase wages of eighty men, more or less, by about \$700 per month. An outline of the bonus system for the power-plant employees is given in the article by the author. An illustration of a peg board, 18 in. (45.7 cm.) in diameter, used in stimulating competition in fuel saving among the power-plant watches, is also shown. The author states that the bonus system of wages has been in operation for about two and one-half years, with the most gratifying results. The B.t.u. consumption per switchboard kilowatt-hour at the present time is nearly 25 per cent less than it was three years ago. The present saving in fuel cost, based on the latest standard of fuel efficiency, put in effect Sept. 1, 1917, is 8.75 per cent. The company and the employees are equal partners, sharing alike the results obtained from fuel saving, a procedure which escapes the criticism that is sure to arise when a company appropriates the lion's share of the gain for itself.—*Electric Railway Journal*, Feb. 16, 1918.

Installations, Systems and Appliances

Calculation of Discharge Resistances.—PAUL GIRAULT.—In designing a discharge resistor intended to protect apparatus possessing self-inductance against rupture from excessive tensions the following should be determined: (1) The maximum rate of voltage rise (2) the energy dissipated in the discharge resistor after the rupture; (3) the power lost permanently in the resistor. All these are easily calculable. The author presents simple formulas, with a particular application to an inductor circuit.—*Revue Générale de l'Electricité* Jan. 19, 1918.

Electric Pumping.—H. W. WAGNER.—An analysis of operating records collected from various sources, information obtained from discussing different operators problems, the design and characteristics of different types of pumps, cost data, and various tests and service records and general statistics. The booklet is limited to those phases which affect directly electric pumping as compared with engine pumping. Considerable space is given to pumps, while related material which may be found in handbooks, textbooks, etc., is omitted or condensed as much as possible. Conclusions drawn from actual practice as well as live data are elaborated. The booklet is divided into five general sections, the introduction, the summary and conclusions, the equipment and operation, analyses of costs, and results of tests and operating records. The summary is written for the reader who wishes condensed information in plain words. Numerous tables are included giving summarized data, manufacturers' specifications, water consumption, results of tests and operating records.—*Bulletin 46, Engineering Experiment Station, Ames, Iowa*.

Electric Welding.—JEAN GUERNER.—An examination into the advantages of electric welding as compared with other methods. Welding by the arc process, mixed (gas and electric) welding and welding by the resistance method are discussed in turn, and the author considers how these different methods apply to various metals and products. He holds that, except for very large pieces, electric welding is always advantageous for continuous work of an extent sufficient to warrant the installation of special generating machinery.—*Revue Générale de l'Electricité*, Feb. 2, 1918.

Electrophysics and Magnetism

Unipolar Induction and Electron Theory.—GEORGE B. PEGRAM.—The author describes experiments that confirm the conclusions of Barnett and Kennard regarding unipolar induction, that the seat of electromotive force is in a moving conductor and is entirely independent of the rotation of the magnetic field. The facts regarding unipolar induction are in accordance with the theory of relativity. According to the well-known mathematical development from the Maxwell field equations in the Lorentz form, there is no force exerted on a sta-

tionary electron, therefore there is no emf. induced in stationary conductors in the vicinity of a steadily spinning solenoid carrying a constant current. On the other hand, when the electron is moving there is an emf. on electrons in moving conductors, which may be easily seen to be quantitatively just what would be computed on the "rate-of-cutting-magnetic-lines scheme," supposing that the lines of the magnetic field would remain stationary with the conductors rotating. Although the conclusion that no emf. is set up in stationary parts of the circuits in a unipolar induction experiment follows immediately from the electron theory, many well-trained physicists and engineers at first are inclined to disagree with the conclusion. They are accustomed to the experience that in general the motion of magnetic fields sets up an electromotive force in the neighboring conductors. They have not examined the rate of variation of the vector potential, which is the only function adequate to express the emf. at a point in the stationary conductors.—*Physical Review*, December, 1917.

Thermal Expansion of Tungsten at Incandescent Temperatures.—A. G. WORTHING.—From experiments made by the author of this paper, the coefficients of expansion at 300 deg. K., 1300 deg. K. and 2300 deg. K. are respectively 4.44×10^{-6} , 5.19×10^{-6} and 7.26×10^{-6} . These values are about one-third greater than those given by Fink.—*Physical Review*, December, 1917.

Electrical Porcelain.—G. I. GILCHREST and T. A. KLINEFELTER.—The object of this article is to bring about a better understanding between production and operating engineers, particularly that the latter may understand the manufacturing standpoint. First, the manufacture of electrical porcelain is outlined step by step; next, the data obtained from an investigation of porcelain mixes and ingredients and their influence on design are discussed, and finally the design itself is taken up.—*Electric Journal*, February, 1918.

Units, Measurements and Instruments

An Optical Pyrometer.—PAUL D. FOOTE.—Two forms of current-measuring instrument are described, one of which is strictly a hot-wire ammeter with the hot wire at a temperature between 600 deg. and 1500 deg. C., and the other a device for adjusting a current, by optical methods alone, to any preassigned value. The first method should prove especially useful for the accurate measurement of alternating current of high frequency. The precision that may be expected in measurement of current through the pyrometer lamp when the instrument is sighted on a source of constant brightness is shown.—*Journal of Washington Academy of Sciences*, Feb. 19, 1918.

The Selection of an Electricity Meter.—A comprehensive method by which different meters can be classed is described. Electricity meters are usually bought in quantities on period contract terms. This makes a right choice particularly desirable, because of the large numbers of meters involved, the long period which must elapse before any desired change can be made, and, for reasons of standardization, the disadvantage of frequent changes. The qualifications of a meter fall under two heads, namely, quality and cost. There are certain other considerations relating to the commercial service given by the different manufacturers. The author tabulates his conclusions thus:

Choice of meter should be guided by:

1. Quality, denoted by:

1. Accuracy, viz.:

(a) Initial accuracy, depending on, first, electrical design (affecting errors due to variation of load, voltage, temperature, frequency, power factor and balance of load) and also concerned with starting current, external magnetism, shunt running, insulation resistance and overload capacity; second, workmanship, affecting friction.

(b) Accuracy after service, depending on, first, durability of materials, jewels etc.; second, stability of adjustments, general robustness, etc.; third, type.

2. Finish.

3. Convenience in handling, fixing, sealing and reading.

II. Cost: (1) Prime; (2) running; (3) maintenance.

III. Commercial service: (1) Delivery; (2) facilities for examination and repair on customers' premises; (3) guarantees; (4) courtesy.

—London *Electrical Review*, Jan. 25, 1918.

Telegraphy, Telephony and Signals

Artificial Telephone Lines.—J. B. POMEY.—The artificial line known as the H line, so useful in the telephonic studies of laboratories, is patented, and the author therefore considers whether a natural line cannot be represented without infringing on this method. He describes how an artificial line can be constituted with a Wheatstone bridge or any other arrangement desired provided that an adjustment of the branches for the frequencies desired presents no obstacle.—*Revue Générale de l'Electricité*, Jan. 26, 1918.

Miscellaneous

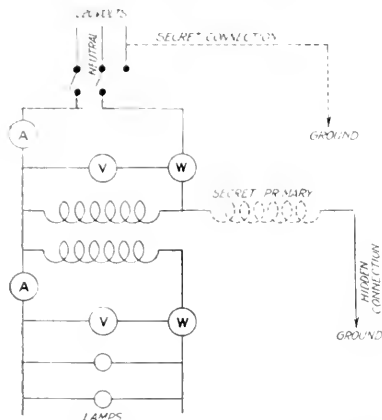
Collapse of Short Thin Tubes.—A. P. CARMAN.—Data are given in this paper which may be applied in designing condenser tubes. The greater part of the paper refers to a series of tests on short, thin tubes of seamless steel, seamless brass, aluminum, glass and rubber. The purpose of these tests was to find an equation by the application of which the pressure required to collapse a tube can be calculated when the dimensions of the tube and the elastic properties of the material are known.—*Bulletin 99, Engineering Experiment Station, Urbana, Ill.*

Charging for Electrical Energy According to the Consumer's Power Factor.—P. BOUCHEROT.—Power-factor conditions in France have become very bad since the war began, and not the least important of the means advocated for ameliorating them is that of obtaining the co-operation of the customers of the central station by the adoption of a rational tariff for electrical energy based upon their individual power factors. The author of this article maintains (1) that it would be neither easy nor right to charge for the apparent power; (2) that it is almost exclusively the reactive power of the customer that affects the expenses of the network; (3) that there is a simple method easily applicable to existing meters that will take account of this reactive power. This method consists of the introduction of a small coil of self-induction in the wattmeter circuit where it enters the meter, so as both to reduce and retard the current. By this means, the author holds, rather than by the Arno system, to which he is opposed, the various factors which enter into the problem—the inductor current, the fall of tension, the Joule effect, the losses in the iron, etc.—may be properly handled and a fair method of accounting be made possible. Formulas in support of his conclusions are worked out.—*Revue Générale de l'Electricité*, Jan. 19, 1918.

An Electrical Swindling Scheme To the Editor of ELECTRICAL WORLD:

SIR: The writer recently had occasion to expose the following novel scheme for swindling innocent laymen who were asked to put their money into a new method of greatly increasing the number of lamps lighted from the secondary of a "wonderful" transformer, many more than it was possible to light from the ordinary one. This transformer was said to show that the regular transformers are all wrong in principle, that modern electrical engineers do not understand their true principles, etc.—a kind of statement at which capitalists are apt to bite, swallowing the hook and bait before they find that they have been caught.

The transformer for 110 volts, primary, was inclosed in a box supported on insulators and was provided with only two primary wires leading to the neutral and to one of the outside poles of the switch of a three-wire, 220-volt house



THE DOTTED LINES SHOW THE SECRET CONNECTIONS AND SECOND PRIMARY COIL

circuit; the other outside pole was disconnected and not used. The primary ammeter, wattmeter and voltmeter were connected in this circuit. A similar set of instruments was connected in the secondary circuit, from which a set of lamps was lighted. Any one, including the shrewdest of capitalists, could convince himself from these instruments that the power delivered by the secondary was far greater than that entering the primary circuit. The "secret" was in the transformer, hence it was not open for examination.

A careful examination, however, revealed that there was a small wire, carefully hidden from view, leading from the transformer box through the floor. It was found to be attached to a grounded water pipe, to make it appear innocent; the increased amount of power was supposed to come from this great, big earth, where it would not be missed and would cost nothing. In the cellar, however, there was also another secret and supposedly innocent "ground connection" to the other outside supposedly unused pole of the three-wire, 220-volt system as it entered the building. There was evidently a second primary coil in this secret transformer which was getting its current from the street circuit through these

Readers' Views and Comments

two "innocent" ground connections. This, of course, was not going through the primary measuring instruments. The capitalist who was financing this "great inventor" was very ungrateful to the writer for having pricked the bubble, and the writer later regretted greatly not having asked for payment in advance. This swindling scheme will probably crop up again in the South or West. The writer regrets that he cannot publish the names of both the inventor and his capitalist.

Philadelphia, Pa. CARL HERING.

Daylight Saving

To the Editor of ELECTRICAL WORLD:

SIR: In view of the prospect that some sort of a daylight-saving bill will be passed either by the federal government or by the various states, it is proper that the central-station interests should consider the possible results. One possible result is that this change of the clock would reduce the use of artificial light and thereby save fuel and other expenses. If this is going to be the result, it is very clearly the patriotic duty of the central-station people to encourage the change.

Another possibility, and in my opinion a much greater probability, is that the change in the clock will have no appreciable effect on the use of artificial light. I say this in spite of the reports from England and other countries, as I believe the reduction in the use of artificial light there has been due to the numerous other changes caused by the war, rather than to the change in the clock. However, even under this assumption there is no reason why the central-station people should oppose the change and every reason why they should remain neutral in the matter. There are so many well-meaning people who apparently believe that the change in the clock will change everybody's habits that it will require a considerable effort to make an effective opposition to them. Such opposition would be unpatriotic if these well-meaning people are right, while if they are wrong, they will nevertheless do so little harm that the central stations may wisely confine themselves to a position of neutrality.

The reason why we now get up at 5 o'clock (or 6, or 7, or 8, as the case may be, or even at 9, as we often do on those days when we are at perfect liberty to do as we choose), and the reason why we take our rest at noon, and the reason why we go to bed sometimes with the chickens and sometimes with the owls, is because on the whole these hours really satisfy us best, on account of their relation to the sun. When we make a voyage on an ocean

steamer we can keep exactly the hours we choose, and we match our hours with the sun so as to enjoy or avoid the sun as suits us best. When we go hunting or fishing we match our hours with the hours of the birds or of the fish. In any small town (not a suburb of a large town) the factory hours are fixed to suit the population of that town, so as to give them the daylight they really want. All these hours of our present habits are flexible and are continually being changed either forward or backward.

Now, if we should have a change in the clock, then the next time, as the next spring or the next fall, that the factory hours and schedules are readjusted they will be readjusted to suit the sun, and that means that even if daylight-saving should temporarily result in our getting up a little earlier in relation to the sun or going to bed a little later in relation to the sun, nevertheless every spring and every fall there would be a tendency to shift back so as to make the hours just as convenient in relation to the sun as they were before the daylight-saving plan went into effect, until within a few years our habits in relation to the sun would be exactly as they used to be.

The result of that would be that the man who now gets up at 7 a.m. would under the daylight-saving plan get up at 8, thinking that he had had an hour's more sleep. He would then dine at 8 instead of at 7, thinking he had got an hour's more golf, and would go to bed at 12 instead of at 11, thinking he had had an hour's more recreation in the evening. In order to gain these advantages, however, he would have to adjust his hours so that his rising time, his dining time and his going-to-bed time would be just the same in relation to the sun as they are now; in other words, he would disregard the daylight-saving clock.

The essential point is that the daylight-saving plan does not increase the number of hours in a day, but only tries to shift them. The baseball people and the golf people may think that it is going to give them an hour more, but the hour that they get is taken from their sleep or work.

Therefore, so long as the daylight-saving law is not going to oblige the offices to open at 8:30 a.m. if the management and the employees prefer either 8 or 9 or some other hour, so long as the law is not going to oblige the factories to start work at 7 a.m. if the operatives and the management prefer 6:30 or 7:30 or some other hour, then the whole daylight-saving scheme will be very much like the story of the man whose wife was beating him. An outsider started to interfere, but the man said, "Don't bother; it amuses her and it does not hurt me, so let her keep on."

If it amuses the daylight-saving people to push their law, the central stations should let them keep on and should not bother about the results either way.

R. S. HALE.

Boston, Mass.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ANNUAL MEETING OF THE ASSOCIATED MANUFACTURERS

Spirit of War to Pervade Gathering on March 21 in
New York—The Industry in Active
War Service

The spirit of war will be dominant in the annual meeting of the Associated Manufacturers of Electrical Supplies at Delmonico's, New York, on Thursday, March 21. War service work for the government, conditions growing out of the war and to be anticipated in the future will be discussed, together with other kindred matters.

At the business meeting to be held at 2:30 o'clock in the afternoon, reports will be presented dealing with international trade conditions of the post-war period, the work of the General War Service Committee of the Electrical Manufacturing Industry and the activities of the association and its sections during the year. Trade acceptances will also be considered. Governors will be elected to take the place of board members whose terms expire.

At the dinner at 7:30 p. m., also at Delmonico's, the war will be in the forefront again. Thus the members will emphasize the fact that, in addition to their enormous output of material for use in the war, a large number of their employees of all ranks are in active service in army and navy.

During the week of the meeting a number of section meetings will be held at the association rooms, including the following:

Monday, March 18.—Interlocking standardization committee, 2 p. m.

Tuesday, March 19.—Snap Switch Section, 10 a. m.; Molded or Formed Insulation Section, 10 a. m.; Socket Section, 2 p. m.; Outlet Box Section, 2 p. m.; Industrial and Street Lighting Fixtures, 2 p. m.; Attachment Plug Section, 4 p. m.; Insulating Materials Section, 4 p. m.

Wednesday, March 20.—Panelboard and Switchboard Section, 10 a. m.; Fuse Section, 10 a. m.; Fan Motor Section, 10:30 a. m.; Knife Switch Section, 2 p. m.; Non-Metallic Conduit Section, 2 p. m.; inclosed externally operated switches, immediately following Knife-Switch Section.

Friday, March 22.—Line Material Section.

SIGNALING APPARATUS SECTION FORMED

In response to an invitation to manufacturers of bells, buzzers, annunciators, fire-alarm and telephone apparatus, signal gongs, etc., a meeting was held in the quarters of the Associated Manufacturers of Electrical Supplies, New York, on Feb. 20, for the purpose of considering the formation of a section.

The following manufacturers were represented: Ansonia Electrical Company, L. F. Anschutz; Edwards & Company, Inc., R. Edwards, Jr.; Holtzer-Cabot Electric Company, M. J. McElevy; Manhattan Electrical Supply Company, E. Whitmore; Patrick & Wilkins Company, E. Ward Wilkins; Stanley & Patterson, George L. Patterson and Albert S. De Veau.

Charles E. Dustin, general secretary of the association, explained the objects and aims of the association and the work being done by the various sections along lines of standardization, co-operation, etc. After an extended discussion it was voted unanimously to form the Signaling Apparatus Section, to embrace in its membership the manufacturers of signal gongs, telephone apparatus, fire-alarm apparatus, annunciators, bells and buzzers and contact devices.

R. Edwards, Jr., Edwards & Company, Inc., was elected permanent secretary of the section, and E. Whitmore, Manhattan Electrical Supply Company, permanent treasurer. George L. Patterson, Stanley & Patterson, has been elected to serve as permanent chairman of the new section.

Lessons to Employees on the Waste of Food and Materials



To impress upon employees evils of waste the management of the Westinghouse Electric & Manufacturing Company has fitted up a storage-battery truck as a traveling exhibit. Upon it is a collection of food wasted, including bread, butter, meat, cakes, crackers, pickles, cheese, fruits, etc., as well as a quantity of manufacturing materials, such as copper, zinc, lead, mica, rubber, felt, gum and similar materials, much of which could be used to considerable advantage.

It is estimated that foodstuffs wasted per day amount to between \$35 and \$50, the cost of which comes out of the pockets of employees. The waste of material amounts to hundreds of dollars per day, which would be a loss to the company if it were not that men are continually sorting the seemingly scrap material and turning it back for use or so that the highest price may be obtained for it from dealers in such material.

This truck was driven up and down the shop aisles so that employees could look upon it.

STREET-LIGHTING CURTAILMENT UNPOPULAR IN NEW ENGLAND

Inquiry by Representative of "Electrical World"
Leads to Belief that Such Attempted Economies
Give Unsatisfactory Results

As a result of the recommendations of James J. Storrow, Fuel Administrator of New England, a substantial cut in street lighting has been on trial in some of the larger cities since the middle of February. The cut was made with the object of saving coal, but the results do not appear to have justified the curtailment. In some cases a moonlight schedule was adopted; in others heavy cuts were made in the "white-way" type of lighting used locally and in regular street-lamp service.

Talks with various central-station officials by a representative of this journal lead directly to the belief that street illumination by ordinary arc or incandescent units offers one of the poorest opportunities in existence to attempt to secure coal economies by curtailment.

EXPERIENCE IN CITY OF BOSTON

In the city of Boston 3200 gas lamps have been cut out, of a total of 9813 single-mantle and 70 double-mantle units. About 1000 magnetite-arc lamps have been cut out, the total of the latter (500 watts rating each) in service Jan. 1 being 5180. Twenty-two Thoran arc lamps have been replaced by magnetites in the public squares, Common and Public Garden. Over 5600 series incandescent lamps were in street service Jan. 1, and none of these has been cut out.

Nothing has been attempted in the city of Boston in the way of running the street lamps on a moonlight schedule. The arc lamps cut out of service in Boston were largely in parks, playgrounds and residential districts in the outlying wards. The general policy followed was to cut out lamps in the middle of street blocks, but to avoid cutting out those on street corners unless the service was duplicated. A total of forty arc lamps was cut out in the Common and Public Garden alone, in the downtown area. Business streets downtown were left almost entirely free from cuts, not a dozen lamps all told being shut down in the business section. Sixty-two white-way or boulevard type of lamps were cut out. The water-front and bridge lamps were untouched.

A good deal of complaint has been received since the shutting off of lamps, and the police authorities have contended in some cases that crimes would not have occurred had the lighting been up to the usual volume. In one particular case where an arc lamp was cut out in front of a store the establishment was twice broken into and it was necessary to replace the lamp.

Just what basis of settlement will be made with the Boston Edison company for these curtailed lamps has not yet been made public. In his letter to the chairmen of local fuel committees, Mr. Storrow pointed out that it is probable that, owing to existing definite contracts for street lighting, utility companies will expect a definite adjustment in remuneration to be made before adopting any restriction in street lighting.

This, Mr. Storrow said, "is of minor importance in comparison to the necessity for fuel conservation at this particular time, and we therefore ask you to use your best efforts to get an immediate curtailment of

street lighting in your district and leave the adjustment of remuneration between the public utilities companies and local authorities to a later period, when it can be satisfactorily worked out."

SPRINGFIELD OPPOSED TO CURTAILMENT

At Springfield, Mass., Mayor Stacy declined to favor street-lighting curtailment, contending that such policy invites danger and tends to lead to increase in crime.

William E. Hodge, deputy superintendent of street lighting, Springfield, informed a representative of the ELECTRICAL WORLD that he was opposed to street-lighting curtailment and was convinced that the saving in fuel so obtained would be merely nominal. Mr. Hodge pointed out that the street-lighting load is for many stations about the only load which is of any value from the standpoint of station efficiency during the small hours of the night, and its cutting off might in some cases affect station economy adversely. The total connected load of the Springfield street-lighting system is only about 1000 kw., and the service is supplied partly from steam-driven plants and partly from hydroelectric plants.

Mr. Hodge also said: "If only 3 per cent of the coal burned in the country, as the ELECTRICAL WORLD states, is consumed by central stations, and only a fractional part of the central-station output is street-lighting load, the saving of coal to be effected by curtailing street lighting is altogether too small to be justified, considering the importance of proper street lighting in community life."

IN CAMBRIDGE, WORCESTER AND SALEM

In Cambridge, Mass., a moonlight schedule was attempted for a time, but it aroused so much opposition on the part of women residents that the lamps were restored. At present all street lamps in Cambridge are operated until 11:15 p. m. only, including the all-night white-way lamps. The midnight white-way lamps are not at present operated.

At Worcester, Mass., all lamps have been put back on the former schedule except the luminous arcs of the white-way type which used to be run until 1 a. m. The luminous-arc system in Worcester comprises 600 lamps, half of which were run 4000 hours yearly and half until 1 a. m. daily. For about six weeks the regular street-lighting system, composed of 400-watt direct-current magnetite-arc lamps and series incandescents, was cut out at midnight. These are now run from dusk to daylight.

No special increase in crime or accidents was noted in Worcester, and the restoration of most of the service as above outlined followed improvement in the delivery of coal to the Worcester Electric Light Company.

Salem, Mass., cut off all its street lighting for a few days early in the year to save coal. The results were bad walking and a serious assault case which aroused public sentiment to the point of demanding the restoration of the lamps. The service was soon restored. In this case the Salem Electric Lighting Company did not credit the city in cash for the lamps cut out, but adopted the plan of burning lamps in future extensions a certain period to offset the hours lost owing to the lamps that were cut out.



Let Us Build Up the Best Machine to Win the War

LOS ANGELES AQUEDUCT POWER TO SAVE OIL CONSUMPTION

California Fuel Administrator Is Advised that
Surplus Power Could Supply Demand Now
Served by Steam Plants

Moves toward economizing fuel consumption were considered at a recent conference in Los Angeles between the Public Service Commissioners and a representative of the California State Fuel Administrator. The chief topic was the diversion of city funds for duplication of the present distributing system to the development of aqueduct water power, this consideration being the result of the Federal Fuel Administrator's recommendation to develop hydroelectric power.

E. F. Scattergood, electrical engineer Aqueduct Power Bureau, reported that of the \$5,000,000 voted for a distributing system nearly half was available. Aqueduct power could be developed to supply all consumers now served by the Los Angeles Gas & Electric Company steam plants. This could be effected within a year, he believed, by completion of Power Plant No. 2 in San Francisquito Canyon and utilizing to the full the capacity at No. 1. This would mean a total of 33,000 hp. added to the present capacity.

The total cost of consolidating the three Los Angeles systems and increasing city generating capacity to a point where it could meet all needs would be about \$1,400,000 at present machinery quotations, but 35 per cent of this could be saved and prompt delivery of machinery assured if government intervention could be secured. Of this total about \$40,000 represented cost of connection with the Los Angeles Gas & Electric Corporation, which could be effected in about a month.

Mr. Scattergood's written report read, in part:

In addition to supplying the 9000 consumers and the street-lighting load connected to municipal lines as well as power requirements under the operating agreement with

the Southern California Edison Company, the city plants have a large surplus capacity. From this surplus the city is now supplying all power used by the Pasadena municipal plant, thus eliminating consumption of approximately 5000 bbl. of fuel oil per month at the Pasadena steam plant. In addition to supplying Pasadena, the city plants have surplus sufficient for practically all of the electric power generated by the Los Angeles Gas & Electric Corporation steam plants for use of electric consumers of that company within the city.

It is understood that the substitution of aqueduct power for that generated by the private company in steam plants would save 45,000 bbls. of oil per month. The private company has offered to purchase the available power from the city or to co-operate in oil conservation in such other manner as the Fuel Administrator may direct.

MONTHLY MEETING OF THE NEW YORK ELECTRIC CLUB

Jobber Has Three Functions in Distributing Goods,
Says F. M. Feiker, in Addressing
the Members

The second monthly meeting of the New York Electric Club was held March 5 at the Hotel Breslin, New York. F. M. Feiker, editorial director of *ELECTRICAL WORLD* and *Electrical Merchandising*, addressed the meeting on "The Place of the Jobber in the Electrical Industry." He stated that the jobber has three functions in distributing goods. First, he carries a stock, in many large houses running as high as 50,000 different items; second, he takes the credit risk, and, third, he creates new business.

J. C. McClernon of the Northwestern Electrical Supply Company is president of the club, and W. J. Krieger, with offices at 47 West Thirty-fourth Street, New York City, is the paid secretary.

CAPITAL ISSUES COMMITTEE ENLISTS STATE COMMISSIONS

War Committee of the Public Service Commissions
Meets Federal Reserve Board Committee
to Co-operate in Conservation

On the invitation of the capital issues committee of the Federal Reserve Board, that committee and its advisory committee held a conference on Feb. 28 in Washington with the war committee representing state public service commissions. There were outlined to the representatives of the public service commissions the aims and purposes of the capital issues committee along the lines of conservation of capital, labor and materials.

The efforts of the committee to bring about curtailment of capital expenditures throughout the country, except where absolutely necessary for prosecution of the war or health and welfare of the community, were stated to the commissioners and received their hearty approval. The commissioners have already accomplished a great deal on these lines and expressed the greatest desire to co-operate in every way possible to subserve national interests during the war.

At an early day a statement of the aims of the capital issues committee will be presented to the commissioners and transmitted by them to the various public service commissions, accompanied by a bulletin recommending nation-wide co-operation and prescribing forms of procedure.

PUSHING THE SALE OF THRIFT STAMPS

Twenty-eight New York Lighting Companies Selling
the Government War Savings Stamps to Em-
ployees and Customers

In their work of promoting the sale of War Savings stamps the New York lighting companies are under the active leadership of Frank W. Smith, vice-president and general manager United Electric Light & Power Company, who is doing effective work in co-operation with the National War Savings Committee appointed by the Secretary of the Treasury. Mr. Smith is chairman of the executive committee of the gas and electric light, heat and power group of the pioneer division. The other members of the committee are F. R. Barnitz, H. M. Edwards, S. H. Giellerup, secretary; L. A. Coleman, director of War Savings Societies; R. B. Grove, director of speakers.

There is also a publicity committee, composed of a representative from each of the companies, as follows: R. W. Allen, F. R. Barnitz, I. M. Beatty, J. I. Blanchfield, J. T. Brown, Jr.; W. L. Bruce, D. Darlington, M. E. Dillon, C. J. Ferdon, M. M. Graham, George Kerr, H. G. Leask, W. F. O'Brien, P. J. Schneider, Henry Schreiner, J. L. Thomas, C. H. Webster, H. L. Wilder, E. S. Young, S. H. Giellerup, chairman.

A number of those who are active in furthering the sale of the stamps through the companies met at a lunch at the Engineers' Club, New York, recently, together with representatives of the New York branch of the national committee. Plans were formulated for reaching all employees and customers. The gas and electric group has been assigned \$1,500,000 of New York's quota of \$100,000,000. In order to sell these stamps it will

be necessary for the twenty-eight companies in the group to dispose of more than \$30,000 worth each week for the rest of the year.

Outdoor signs, posters, collectors and advertising material were among the mediums suggested. The United



Electric Light & Power Company has painted all of its signs with war savings stamps copy. Hundreds of lithographed posters, it was announced, had been distributed and were now prominently displayed at every gas and electric office in Greater New York. The group has prepared a poster asking customers to take their



change in thrift stamps, and this now hangs in front of every cashier's window.

Since the luncheon war savings societies, under the direction of L. A. Coleman, are being established in all the companies so that every one of their 21,000 em-

employees who is able to do so may pledge himself to the purchase of one or more thrift stamps a week. Mass meetings of employees are being held at which short talks are given on the subject of thrift by speakers from the national committee.

Record is kept of the stamps sold by each company and a weekly report is circulated among them so that each may know how the others stand. The Edison Electric Illuminating Company of Brooklyn is in the lead at present, being seventeenth of the companies of all descriptions selling thrift stamps in New York City.

FIGURE FUEL SAVING BY CLOSING PRIVATE PLANTS

J. W. Lieb Estimates Economy of 500,000 Tons in New York District—Fuel Administration in Nation-wide Inquiry

The question of whether, in the interest of the coal conservation, private electric plants should not be closed down and energy obtained from central stations was the subject of a hearing March 4 before the New York Public Service Commission, First District. This step has been advocated by Albert H. Wiggin, State Fuel Administrator, in a letter sent to private-plant owners and operators recently. The United States Fuel Administrator was represented at the hearing by C. E. Stuart, engineer of the conservation division.

Another phase considered was as to whether it would be possible for private plants in business buildings to be shut down during the summer months, when energy could be purchased from the New York Edison or one of the other large electric corporations, but still to be operated during the winter months when the exhaust steam might be used for heating the buildings.

J. W. Lieb, vice-president and general manager New York Edison Company, thought that if all of the 650 private plants in Manhattan and the Bronx were shut down and energy purchased from the electric corporations, it should result in a saving perhaps as high as 38,000, or, conservatively, 500,000, tons of coal per year.

W. F. Wells, vice-president and general manager Edison Electric Illuminating Company of Brooklyn, stated that there were about 570 private plants in Brooklyn divided in various classes. He believed that about 100,000 tons of coal could be saved by using central-station energy.

An announcement of the Fuel Administration, issued in Washington, says in part:

Albert H. Wiggin, Fuel Administrator of New York State, has addressed a letter to the owners of fifty isolated electric generating stations in New York City, calling attention to the necessity of obtaining the greater economy of fuel which will result from the load of these and similar stations being carried by large central stations. Very gratifying replies have been received from many of the owners of such stations.

The hearings of the Public Service Commission will develop the means; also the complications attendant upon effecting a conservation of fuel in this manner. It is desired in no way to bring hardship to the owners of such plants or to the tenants or interests dependent upon such plants.

A nation-wide investigation is now being made on this subject. It has already been demonstrated in many localities that centralization of power may be effected not only without hardship but also with a considerable saving from these angles.

Representatives of the United States Fuel Administration have left Washington for New York to attend a series of hearings before the Public Service Commission of that city at which the general proposition will be discussed of saving coal through the elimination of isolated and non-economical private electric power and heating plants.

According to reports made to the Fuel Administration, millions of tons of coal can be saved and turned to domestic supply and war uses if these plants are closed down in the industrial centers of the country for the period of the war. In addition, the rail and barge trains and cartage problem would be lessened and terminal congestion relieved.

LONDON ELECTRIC COMPANY WILL SUSPEND OPERATION

Unable to Meet Competition of Hydro-Electric Power Commission of Ontario, Private Corporation Will Dismantle Plant

Unable to meet rates of the Hydro-Electric Power Commission of Ontario, Canada, the London Electric Company, Ltd., a corporation controlled by Mackenzie & Mann, will suspend operation.

The London Electric Company has served notice on customers taking approximately 2500 hp. that it will terminate its business in London about March 15. Its plant will be dismantled and scrapped.

The London Electric Company formerly sold power for 9 cents per kilowatt-hour net, plus meter rent. When the Hydro-Electric Commission entered the field it charged 4.5 cents per kilowatt-hour. It gradually reduced charges to 1.5 cents per kilowatt-hour, and the London Electric Company was unable to compete.

When the private company was unable to secure coal for its plant during the recent shortage, directors decided to suspend operation. It is reported that the Ontario government has ordered Mackenzie & Mann to turn over two of its generating machines at Niagara Falls, Ont., to the Hydro-Electric Commission.

War-Saving and Food-Saving Signs in New York City



Electric signs have been donated and are being maintained by the O. J. Gude Company, New York, without charge to the government, for war savings stamps and the Food Administration.

The "W.S.S." sign is on the roof of the fourteen-story Mecca Building, on Forty-eighth Street between Broadway and Seventh Avenue, towering above Longacre Square and showing many blocks down Broadway. The structure is 45 ft. (13.7 m.) high by 107 ft. (32.6 m.) long and the letters are 16 ft. (4.8 m.) high.

The "food" sign is at the northeastern corner of Longacre Square and shows down Broadway toward the Hotel Astor. In the center of the artistic wreath the words "Eat Less Meat" and "Eat Less Wheat" flash alternately. The structure is 33 ft. (10 m.) high and 48 ft. (14.6 m.) long, and the letters are 4 ft. (1.2 m.) high.

NEW JERSEY RATE INCREASE AUTHORIZED BY COMMISSION

Public Service Electric Company of Newark Granted
Higher Schedule to Yield About \$1,000,000
Additional Revenue

As a war emergency measure the New Jersey Board of Public Utility Commissioners has authorized an increase in rates of the Public Service Electric Company, Newark. The higher rates are designed to yield an increased revenue of approximately \$1,000,000 a year.

In acting, the board emphasizes that the advance is solely a war emergency measure and does not affect the reasonableness of the proposed rates in normal times. It also reserves the right to abrogate or modify the new rates should conditions indicated by operating results warrant such action.

The decision allows a war addition to each bill of power consumers of 25 per cent. There is also a surcharge for coal cost.

OTHER INCREASES

Supplementing the announcement of the decision of the Pennsylvania Public Service Commission, published in the issue of the ELECTRICAL WORLD for Feb. 23, 1918, granting higher rates to the Philadelphia Electric Company, it may be stated that the added charge of 10 per cent applies to the entire schedule of light and power rates, with the exception of residence and municipal rates. The increase applies to the railway and railroad rates.

An increase in electric rates of the Wilmington & Philadelphia Traction Company in Wilmington, Del., has been authorized. The domestic rate will be advanced about 1 cent per kilowatt-hour, making it 9½ cents.

DATA ON RETAIL COSTS ARE TO BE CO-ORDINATED

Directors of Society for Electrical Development Vote
to Promote Proper Electrical Merchandising
and Appoint a New Committee

A special meeting of directors of the Society for Electrical Development was held at the offices, New York, on Tuesday, March 5.

The directors present were: President Henry L. Doherty, in the chair; Joseph E. Montague, Gerard Swope, W. E. Robertson, Fred Bissell, Earnest McCleary, James R. Strong, J. Robert Crouse, Charles W. Price, James H. McGraw, represented by F. M. Feiker; J. M. Wakeman, general manager; James Smieton, Jr., secretary-treasurer.

General Manager Wakeman read his report, which was approved and ordered printed for distribution to members.

The committee appointed at the November, 1917, meeting to consider the plan to promote proper electrical merchandising, with James R. Strong as chairman, reported:

Whereas the electrical business is capable of great expansion, and whereas this can be partly accomplished by improving the merchandising abilities and facilities of those engaged in it, and whereas such expansion will be aided by collecting information on the best ways of merchandising and distributing this to members and others engaged in the industry, and whereas in such expansion a

full knowledge of the best methods of proper cost accounting and their application and its broad dissemination is of the utmost importance, it is hereby

Resolved, that the committee recommend to the Board of Directors of the Society for Electrical Development that it take steps to extend the work of the society along these lines.

President Doherty spoke of the possibilities of improving electrical merchandising conditions and expressed sympathy with the idea that such merchandising should be done on a profit-bearing basis.

The report of the committee was accepted and approved.

After considerable discussion, Fred Bissell, Toledo, offered the following resolution:

The general manager to collect information on the best methods of accounting on costs, expenses and earnings in the retail electrical merchandising field, and to arrange this information in a form suited to the needs of the merchants and report to the committee to be appointed by the chair with power to act, and when approved to print and distribute the report to our members.

This was carried unanimously.

The following committee was appointed to receive the report of the general manager as soon as the necessary material has been got together and a tentative plan outlined: Gerard Swope, chairman; H. B. Crouse, J. R. Strong, J. E. Montague, F. M. Feiker.

Encouraging Loyalty and Good Work by Employees

You are at work on a percentage contract, in relation to which the Lord Electric Company is acting as a trustee to safeguard the owner's interests.

In this case the owner is the United States of America, which is spending billions of dollars and is committed to spend millions of lives if necessary, in the cause of Liberty, Honor and Happiness.

Every citizen of this country is expected to "Do his bit." You can do yours by giving us the very best services of which you are capable. Keep yourself fit at all times. Hustle every minute while at work. Report any slacker to your foreman.

Follow these simple rules; then the unit costs of the work will be as low, if not lower, as work on flat contract basis; furthermore, you will uphold the good name of your employer while performing your duty to your country.

LORD ELECTRIC COMPANY

(signed) F. W. Lord,

President.

The notice reproduced herewith is posted by the Lord Electric Company, New York, at places where work is being done by the company for the government. It was received by the ELECTRICAL WORLD from a Washington correspondent.

F. W. Lord, when asked by the ELECTRICAL WORLD whether he cared to make any comment in connection with the publication of the notice, said that the men employed by the company on government contracts were doing fine work and that he believed that the appeal to their loyalty had met with a warm response.

SUPREME COURT DECIDES NEW RETAIL PRICE CASE

Folding that Alleged Price-Fixing Contract Was Contrary to the General Law, Highest Tribunal Follows Previous Rulings

The United States Supreme Court rendered on March a decision holding that contractual notices on patented articles cannot be drawn for the purpose of fixing the retail price. The case was that of the Boston Store, Chicago, against the American Graphophone Company and the Columbia Graphophone Company.

Chief Justice White, in announcing the decision, said in part:

In a general sense the questions involve determining whether the right to make the price maintenance stipulation in the contract stated and the right to enforce it were secured by the patent law and, if not, whether it was valid under the general law and was within the jurisdiction of the court, on the one hand because of its authority to entertain suits under the patent law, or its power on the other to exercise jurisdiction because of diversity of citizenship. We at once say, despite insistence in the argument to the contrary, that we are of the opinion that there is no room for controversy concerning the subjects to which the questions relate, as every doctrine which is required to be decided in answering the questions is now no longer open to dispute as the result of prior decisions of this court, some of which were announced subsequent to the making of the certificate in this case.

Under this situation our duty is limited to stating the results of the previous cases, to briefly noticing the contentions made in argument concerning the non-applicability of those results to the case in hand, and then to applying to the questions the indisputable principles controlling the subjects which the questions concern.

Applying the cases thus reviewed, there can be no doubt that the alleged price-fixing contract disclosed in the certificate was contrary to the general law and void. There can be equally no doubt that the power to make it in derogation of the general law was not within the monopoly conferred by the patent law, and that the attempt to enforce its apparent obligations under the guise of a patent infringement was not embraced within the remedies given for the protection of the rights which the patent law conferred.

It becomes, we think, unnecessary to do more than say that we are of opinion that the attempt in argument to distinguish the cases by the assumption that they rested upon mere question of the form of notice on the patented article or the right to contract solely by reference to such notice is devoid of merit, since the argument disregards the fundamental ground upon which, as we have seen, the decided cases must rest.

BUSINESS RECOMMENDATIONS

FOR USE OF WATER POWER

Report of Special Committee of Chamber of Commerce Is Basis of Questionnaire Sent to 500,000 Business Men

What legislation, if any, might Congress wisely pass for encouraging the development and conservation of the water-power resources of the United States? Would their extensive development, involving such enormous quantities of unused energy, estimated as greater than the total steam power now in service, be industrially practicable? Is it possible, in the case of any enterprise so costly to initiate and so heavily burdened with fixed charges, to outline the essentials of a fair contract which shall protect the interests of the public and at the same time shall make water-power projects sufficiently attractive to capital to secure their develop-

ment? What legislation can be devised for obtaining this result?

That briefly summarizes the question sent out to more than 500,000 business men by the United States Chamber of Commerce for a referendum vote.

COLLECTING WAR DATA FROM ELECTRICAL MANUFACTURERS

Form of General Questionnaire Approved for Confidential Work of General War Service Committee of the Electrical Manufacturing Industry

Rapid progress has been made in the organization of the various groups of electrical manufacturers underlying the General War Service Committee of the Electrical Manufacturing Industry.

The form of questionnaire approved for the group committees states that "the information desired is for the single purpose of assisting the government and will be held absolutely confidential and used in no other way."

The questions follow:

1. Please list here the lines which you manufacture or assemble.
2. Please furnish printed matter descriptive of same, such as catalogs or bulletins.
3. Is your plant 100 per cent in service?
4. Are you doing government work directly or indirectly at present? What percentage of your government work is electrical? What percentage of your government work is in lines other than electrical?
5. Are you desirous of doing government work in your own line?
6. Are you desirous of doing government work in such other lines as your machinery or plant would be capable of?
7. Is your machinery suitable for any other class of work than the type you are accustomed to turning out?
8. What kind of work could you do outside of your regular line?
9. Can you do more work in your own line at present or in the near future?
10. Please give total square feet of floor area occupied at present.
11. Have you room for expansion on short notice?
12. Is your government work displacing commercial work? And to what extent in per cent?
13. How many hours per week constitute full time?
14. Are you running overtime and to what extent?
15. Have you all the labor required for your present business?
16. Could you obtain more labor if it became necessary?
17. Are you having any difficulty in obtaining raw material for government work?
18. Have you room for additional machinery? (square feet)
19. Have you a sufficient stock of raw materials for your present requirements, also for increase?
20. Have you sufficient coal for your requirements?
21. Do you make your own dies, jigs and tools?
22. Do you build any of your own machinery?
23. Can you build machinery?
24. Do you manufacture any materials (so-called non-essentials) which do not directly or indirectly contribute to the assistance of the war emergency?
25. If so, to what extent?
26. What percentage of the so-called non-essentials can be produced without interfering with your maximum production of articles essential in the war emergency?
27. Furnish any other information that you think would be of service to the government.

The questionnaire is varied slightly where necessary to meet the requirements of individual groups.

STREET-LIGHTING RATES ARE REDUCED IN BOSTON

Result of Arbitration Between Edison Electric
Illuminating Company and the City Is a
Lower Price for the Service

Sweeping reductions in Boston street-lighting rates are announced in a decision of the Massachusetts Gas & Electric Light Commission made public on March 2 in the celebrated arbitration case between the city of Boston and the Edison Electric Illuminating Company. The arbitration has extended over more than three years, involving over 10,000 pages of testimony and more than 360 tables and exhibits. It is estimated that the reductions established will save the city about \$600,000 during the life of the contract arbitrated from Nov. 6, 1914, to Nov. 6, 1924.

The arbitration took place as a result of the agreement between the city and the company, which requested the board to investigate and decide whether the street-lighting rates are as a whole fair, taking into account length of term, discount and all other pertinent matters. Under the agreement the commission had no authority to interfere with the contract rates unless it determined that a fair price for the entire service supplied to the city is less than the total amounts to be paid according to the schedule. Therefore the primary question was whether a fair price for the entire service was less than these amounts. The agreement authorized the board in that event to reduce one or more of the rates charged, substituting such rates from the beginning of the agreement for the corresponding rates in Schedule E. The schedule prices per lamp per year and the amounts awarded are as follows:

	Schedule	Board Price
Magnetite arc, 800-cp.	\$87.530	\$79.60
40-cp. incandescent	18.333	15.92
60-cp. incandescent	21.136	17.69
80-cp. incandescent	29.310	22.94
100-cp. incandescent	33.426	29.98

On the agreement date there were 4543 magnetite arcs, twenty-four flaming arcs and 4083 incandescent lamps of 40-cp. to 400-cp. rating, 2910 being of 40-cp. size. Lamps and equipment were supplied by the company at its expense, save certain former gas-lamp posts owned by the city and later used for electric lighting. The agreement provides for extensions of service, relocations of lamps and substitutions of other type lamps, but upon terms designed not to increase thereby the relative cost to the company of supplying service and to compensate the city for any reduction in such cost. Also, the number of lamps of any type required by the city shall not at any time during the agreement, save as streets may be discontinued, be less than 95 per cent of the maximum number of such lamps in service at any time prior to the agreement.

The company computed a cost greatly in excess of the aggregate price for the service expressed in the contract, but the figures were made before close analysis of costs was undertaken in its behalf. The greatest differences in estimated costs of the property involved arose with respect to the distributing system and especially the underground installation.

The aggregate cost to the city of the lamps in service on the date of the agreement was \$479,718.70 per year. The concrete question was whether or not this is a fair price for the entire service. The city con-

ceded the soundness of basing the price upon cost, but re-examined all expense and property items exhibited by the company and challenged many. Comparative summaries follow:

	Company	City
Operating expenses	\$314,013	\$235,986
Taxes	60,593	42,096
Depreciation	42,000	34,622
Return	197,994	96,571
Total	\$614,510	\$309,275

The decision of the commission says in part:

A fair price for the entire service supplied the municipality must in any event take into account such exclusive costs both of investment and operation. But, when it comes to the investment and expenses common to the company's entire system and business, any assignment to the city of a definite share in each item depends primarily on the assumed necessity of making such assignment.

The careful examination of every detail of the company's affairs during these long hearings made it clear that had the company never lighted the streets of Boston there is little, if any, of its plant other than that devoted exclusively to the service with which it could or would have dispensed. Even while the case was pending the growth of the commercial business changed substantially the ratio of the city's demand to the company's peak—a ratio used repeatedly in determining and stating with "illusory inexactness" items of investment and expense attributable to the city. Neither party sought to measure the fair price of the entire service by its cost if independently performed, and both parties recognized the community of interest alluded to in dealing with the generating and transmission expenses.

In view of the terms of the arbitration and for reasons already stated, it seems to the board unnecessary and inexpedient to consider and decide one by one the many issues tried by the parties. Were it to do so, it would at best have reached merely a theoretical estimate of an assumed investment for Boston street lights on the day when the contract became effective, and a finding as to the actual and reasonable costs of and their allocation to the service for the preceding year; whereas the terms of the arbitration call for a determination of "a fair price for the entire service" to be performed under the contract and during its life. Neither has the board deemed it appropriate to discuss in this finding the numerous questions of general policy raised at the hearings. Certain of them directly affected costs and expenses. Others did not find expression in figures, but rather in the assertion of equities favorable to the city.

The evidence disclosed hidden among the legal expenses of the company large payments made for the maintenance of lobbies at the State House and City Hall. Aside from the exclusion of such items, in finding a fair and reasonable cost of the service, the board, in view of its public character and of the paramount duty of seeing that the companies under its supervision in the conduct of their business and the uses and devotion of their resources practice and maintain high civic standards, feels bound to condemn such expenditures as wholly unwarranted and inconsistent with such standards.

Upon the whole, the commission finds that a fair price for the entire service supplied to the city is less than the total amounts to be paid according to Schedule E of the contract and is the sum of \$437,000, and it therefore reduces the so-called running costs per lamp-hour in the following rates charged according to Schedule E, with respect to the following described lamps and with the resulting prices for 3828 hours a year after deducting a discount of 10 per cent:

40-cp. series incandescent lamp from 0.25 to 0.18 cent....	\$15.92
60-cp. series incandescent lamp from 0.30 to 0.20 cent....	17.69
80-cp. series incandescent lamp from 0.40 to 0.30 cent....	22.94
100-cp. series incandescent lamp from 0.50 to 0.40 cent....	29.98
800-cp. series magnetite 500-watt d.c. arc lamp 1.60 to 1.37 cent.	79.60

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

New-Business Meeting of O. E. L. A. Postponed.—This meeting has been postponed from March 6 to March 20 and will be held at Columbus, Ohio.

The Electrical League of Cleveland.—Victor Morgan, editor of the *Cleveland Press*, addressed the Electrical League of Cleveland, March 7, on the subject "Germany To-day."

The Automobile Headlight Problem.—C. A. B. Halvorson talked on this subject at a meeting of the Schenectady Section of the A. I. E. E. on March 1. He discussed the general principles involved in the problem of obtaining adequate and safe headlight illumination for automobiles.

Automatic Substations.—The next meeting of the Pittsburgh Section of the American Institute of Electrical Engineers will be held March 12. R. J. Wensley will deliver a paper on "Automatic Substations." The paper will be illustrated with lantern slides and should be of especial interest to operators of steel mills and electric railways.

North Dakota Society of Engineers.—M. L. Hibbard, manager of the Fargo (N. D.) division of the Northern States Power Company, addressed the North Dakota Society of Engineers Feb. 21, on the subject "Illuminating and Heating." In the course of his talk Manager Hibbard predicted great development in the use of North Dakota's resources of lignite for fuel.

Los Angeles Jovian Electric League.—At the regular luncheon of the league on Feb. 27 U. Oyama, Japanese Consul at Los Angeles, spoke on "Japan." H. W. Doubrava of the Wagner Electric Company was chairman of the day. At the Feb. 23 meeting of the league F. R. Feitshans spoke on "Alaska," touching on its wonderful possibilities for commercial development. Mr. Feitshans has just returned from Alaska, where he was the guest of the Government Railroad Commission.

Anniversary Meeting of Spokane Section of A. I. E. E.—The fifth anniversary of the Spokane Section of the A. I. E. E. was celebrated in Spokane (Wash.) recently by a gathering of forty-five engineers. J. B. Fishken, J. W. Hungate, George Harding and M. W. Birkett were elected delegates to the Spokane Engineer-Technical Association, composed of all engineering chapters having headquarters in Spokane. Details on the distribution of electrical energy by overhead and underground systems were given in addresses by G. H. Hopkins, E. L. Blaine, F. L. Rohrbach, O. O. Coffman and J. G. Finley of Spokane.

Engineers and Architects' Club of Louisville.—A regular meeting of this club was held on Feb. 19, a paper on "Concrete Ships" being presented by J. E. Freeman. The officers elected for the ensuing year are: President, Addison W. Lee; vice-president, L. C. Baird; secretary, Hermann Wischmeyer. The National Bank of Commerce acts as treasurer.

California Joint Convention Plan.—A gathering which is to include the three important electric associations in California is scheduled to be held at Del Monte on April 22-28. The Pacific Coast Electrical Supply Jobbers' Association will convene early in the week and later join with the California Association of Electrical Contractors and Dealers and the Pacific Coast Section, N. E. L. A. One day will be devoted to the discussion of war emergency measures and another day to a discussion of commercial problems. Plans are to be discussed for the formation of a manufacturers' section of the N. E. L. A.

Illinois Contractors Adopt National Organization Plan.—At its annual convention in Chicago Feb. 22 and 23 the Illinois Electrical Contractors' Association went out of existence and was succeeded by a new organization known as the Illinois State Association of Electrical Contractors and Dealers. The new association, which adopted without discussion the form of constitution and by-laws prescribed by the National Association of Electrical Contractors and Dealers, turned over its entire membership of sixty-six and its funds, amounting to about \$400, to the new body. The meeting was notable as the first Illinois contractors' convention at which there were no closed sessions and all branches actively participated. Among those who addressed the meeting were E. M. Craig, secretary of the Associated Building Contractors of Illinois; William L. Goodwin of the General Electric Company, who is the guiding spirit of the trade movement for better merchandising; George B. Foster, assistant to president of the Commonwealth Edison Company; John G. Learned, assistant to vice-president of the Public Service Company of Northern Illinois; George H. Hughes, president of the Edison Electric Appliance Company; A. J. McGivern of the Manhattan Electric Supply Company; Perry R. Boole of the Electric Appliance Company; W. R. Johnson, secretary-treasurer of the Wisconsin Contractor-Dealers' Association, Madison, Wis.; John A. Piepkorn, state secretary of the Wisconsin Contractor-Dealers' Association, and L. A. Schwab of the American Electric Supply Company. Officers for the ensuing year were elected as follows: State chairman, J. A. Weishar of Rock Island; secretary-treasurer, L. B. Van Nuys of Peoria; assistant secretary, G. A. Engelken of Chicago; district chairmen, R. W. Poelma of Chicago, E. F. Pendergast of Rockford, A. J. Hebel of Peru, J. A. Weishar of Rock Island, W. S. Savidge of Macomb, L. B. Van Nuys of Peoria, J. Hughes of Champaign, John Haenig of Springfield and Edgar Rice of Alton.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Faulty Installation.—Maintaining an electric light and power plant transmitting 33,000 volts over wire constructed above a public road without ammeter, circuit breaker or ground detector is negligence little, if any, less than criminal, and the operators must be held to have anticipated severe shock or death from breaking of wire without shutting off the current, the Court of Civil Appeals of Texas held in *Abilene Gas & Electric Company versus Thomas* (1915 W. 1027).

Regulation of Municipal Utilities.—Under the public utilities act providing that no plant owned or operated by a municipality shall be deemed a public utility thereunder, the Public Service Commission cannot regulate water rates where the water system is owned by the city though operated by lessees, it was held by the Supreme Court of Oregon (168 P. 939). Whether it is good or bad policy to exclude water systems owned by cities and operated by lessees from the operation of the public utilities act is not a matter for the courts.

Injuries from Failure to Provide Safety Appliances.—Electric companies are bound to use the highest degree of care practicable to avoid injury to every one in lawful proximity to their wires, including their employees, and to know what safety appliances are suitable and in ordinary use for the protection of employees working in proximity to currents which may prove fatal, the Supreme Court of Pennsylvania held in *Donnelly versus Lehigh Navigation Electric Company* (102 A. 219). When a particular safety appliance has come into general use by others in same line an electric company must furnish its employees with the protection which the appliance affords. Where an electric company fails to furnish an employee with the safety appliances in general use, the employee, having no knowledge of their existence, does not, as a matter of law, assume dangers which would have been obviated by their use, unless they are so apparent and imminent that no reasonable person would risk them; and in such case the employer assumes the risks of the situation. In an action of damages for the death of a lineman engaged in connecting insulated live wires, held, on the evidence, that his assumption of risk of danger from the wires, where he was working without certain safety appliances, was a question for the jury. An employee of an electric company connecting live wires without shutting off the current, as was the practice and custom in such work, and without a safety appliance in general use, was not guilty of contributory negligence.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Lighting of Y. W. C. A. Hostess Houses.—The Judge Advocate General of the army has rendered an opinion that the appropriation for furnishing heat and light for buildings erected at private cost under the act of May 31, 1902, is not available for furnishing heat or light for hostess houses of the Young Women's Christian Association.

Western Association of Electrical Inspectors Memphis Meeting.—The report of the Memphis meeting of the Western Association of Electrical Inspectors published in the *ELECTRICAL WORLD* of Feb. 9, 1918, inadvertently used the words "National Electrical Safety Code," whereas the word "safety" should have been omitted, as the requirements in question are part of the National Electrical Code. The Western Association of Electrical Inspectors indorsed the National Electrical Safety Code and will co-operate in its enforcement during the trial period.

Cleveland Electric Illuminating Company Increases Stock.—The Ohio Secretary of State has authorized the Cleveland Electric Illuminating Company to increase its capital stock from \$15,000,000 to \$18,000,000. Vice-president Robert Lindsay stated that the \$3,000,000 will form a new series of preferred stock drawing dividends not to exceed 4 per cent. The company at present has \$14,000,000 common stock and \$800,000 6 per cent preferred stock, with \$200,000 preferred stock yet unissued. No plans have been made for the sale of the stock.

Facilitating Franco-American Technical Relations.—*La Technique Moderne*, which gives the best known scientific and industrial French reviews, discontinued publication for a time because of the war. Readers of the *ELECTRICAL WORLD* will be interested to know that this journal has resumed publication. Capt. Gustave P. Capart, who visited this country some months ago as a member of the special commission from the French government, writes that M. Painlevé, former president of the Council, sees in the rehabilitation of this publication the means of facilitating technical relations between the United States and France.

Private Interests and Public Rights.—In handing down a decision to the effect that the Cleveland Railway must pay for paving on Superior Street viaduct, and thus sustaining the claims of the city of Cleveland and affirming the decision of the Court of Appeals, Judge R. M. Wanamaker said: "In this day private interests and private rights must yield to the public interests and public rights, and where there is an

ambiguity or uncertainty as to which of two constructions should prevail in a franchise contract it is clear that the construction should be adopted by the courts that would be most favorable to the public interest and welfare."

Cleveland Rate Hearing.—The hearing on the appeal from the Cleveland 3-cent light rate ordinance has been resumed before the Ohio Public Utilities Commission. F. W. Ballard, employed as city expert engineer, declared that cost of production and distribution by the company has decreased steadily. Objections were made to an allowance of a return of 8 per cent on the valuation. The witness said that 7 per cent is considered fair and reasonable in all parts of the country. The company's claim for 3 per cent depreciation on all items was also attacked. Land, Mr. Ballard said, appreciates constantly and no allowance for depreciation should be made on it.

Consolidation of California Properties.—The Southern Sierras Power Company has joined with the Corona Gas & Electric Light Company, the Bishop Light & Power Company, the Rialto Light, Power & Water Company and the Coachella Valley Ice & Electric Company in asking the California Railroad Commission for authority for the last-named four companies to sell their properties to the Southern Sierras corporation. The prices of these properties are: Corona property, \$135,914; Bishop company, \$60,576; Rialto company, \$24,915, and Coachella company, \$821,687. The Southern Sierras company proposes to assume the obligations and pay the difference in cash. The Southern Sierras company is now selling these concerns all the electric energy they use, so that the purchase is the merging of the electricity manufacturing interests with the distribution interests.

Fuel Administrator Urges Water-Power Development.—Prof. D. M. Folsom, Pacific Coast Petroleum Administrator for Mark L. Requa, United States Oil Administrator, has issued a statement to the effect that the total power requirements of the Pacific Coast increase from 10 to 15 per cent per annum. At the present rate of oil consumption (110,000,000 bbl. per year in California) the reserve is not sufficient to supply long the demand, which now considerably exceeds production. At present approximately 20 per cent of the total power utilized on the Pacific Coast is developed from water power, while 70 per cent is obtained from fuel oil and natural gas. Taking into account various angles of the situation, the administrator states: "With the output of oil barely maintained or declining each year this increase must be entirely met through the development of more hydroelectric plants on the Pacific Coast. A conservative estimate of further requirements shows that the installed generating capacity of the plants now on the Pacific Coast should be doubled in five years and tripled in eight years to meet the local requirements for purposes of power, light and heat."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Denial of Increased Rates in Indiana.—The Indiana Public Service Commission has entered an order in the case of the Clay City Lighting Company, which sought to increase rates. The commission denied the petition, because of the financial showing made.

Incorrect Accounting.—The Indiana Public Service Commission has issued the following warning to utility companies that adopt incorrect methods of accounting: "Frequently a utility will fail to maintain a depreciation fund and while permitting its original property to depreciate will make extensions or additions out of so-called surplus income and then seek to capitalize these extensions and improvements, when the moneys so expended should have been set aside as a depreciation reserve, which legally is not susceptible of capitalization. This practice by utilities of setting up a fictitious book depreciation and ignoring proper depreciation debits against this account can only result in the commission taking such steps as will effectuate a complete and substantial obedience to the specific depreciation provisions of the act. In cases where the practice has continued the commission will naturally, for rate-making purposes, make such deductions from operating expenses as may be found proper and sufficient to cover a reasonable depreciation reserve."

Relief in Rates.—The California Railroad Commission has established new gas rates to be charged by the Western States Gas & Electric Company in its Eureka division. The company asked for only sufficient increase to offset higher cost of oil, materials and labor, and not for any increase in its rate of return. The commission says: "The commission realizes the difficulty under which public utilities are laboring on account of the present abnormally high cost of labor and materials of all kinds and is desirous of affording them such relief as appears to be fair and reasonable under all the circumstances. The utilities, on the other hand, should, of course, not expect the public to bear all the burden of such abnormal conditions, and in the present instance the company, recognizing its obligations in this regard, only asks for enough revenue to cover increased cost of oil and labor and taxes and does not expect any increase in its return on the value of its plant, although the rate of such return which it has hitherto received is considerably less than what might be considered a fair return under normal conditions. The rates herein established are calculated to accomplish approximately the result applied for."

Leroy P. Sawyer, formerly general manager of the Buckeye Electric Division of the National Lamp Works of the General Electric Company, has left to take up special work in the executive department of the National Lamp Works at Cleveland.

T. H. Soren, who became connected with the Hartford Electric Light Company in 1916 as assistant to the vice-president, has been elected vice-president in charge of construction. Prior to going to Hartford Mr. Soren was for twenty-three years with the General Electric Company.

N. A. Boynton has been promoted from publicity manager of the National Lamp Works to general manager of the Buckeye Electric Division of the National Lamp Works, succeeding Leroy P. Sawyer. Mr. Boynton was born in Minneapolis in 1885. His early connec-

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

quarters in Salt Lake City, vice-president of the Utah Light & Traction Company and vice-president of the Western Colorado Power Company, has returned to New York and has been elected a vice-president of the Electric Bond & Share Company. In his new position Mr. Groesbeck will have general supervision over the operating department of that company.

W. W. Briggs, who has been general agent of the Great Western Power Company at San Francisco since 1913, has resigned that position to become manager of the New York division of the Westinghouse Lamp Company. Previous to affiliating with the Great Western Company, Mr. Briggs was Pacific Coast manager of the Westinghouse Electric & Manufacturing Company. Mr. Briggs entered the industry in 1886 as a boy in the arc-lamp department of the California Electric Light Company. He was later connected with the Electric Improvement Company and from 1893 to 1896 was electrician for an Idaho mining company. He then joined the sales force of the Fort Wayne Electric Company. In 1899 he entered the sales department of the Westinghouse company and six years later became Pacific Coast manager. In 1911 he was appointed assistant sales manager of the Westinghouse company, with headquarters at San Francisco.

J. Parke Channing was elected chairman of the Engineering Council at the annual meeting held Feb. 21. Mr. Channing was born in New York City and was graduated from Columbia University with the degree of engineer of mines and master of science. Since graduation he has been engaged in mining, in Lake Superior iron and copper mines at first, and afterward in Montana, Utah and Tennessee, more particularly in copper. In 1900 he developed and equipped the Tennessee Copper Company and a few years later built one of the largest sulphuric-acid plants in the world to utilize the waste gases from its copper furnaces. In 1907 he discovered and developed the Miami copper mine in Arizona, now producing copper at the rate of 60,000,000 lb. per annum. He is also engaged in prospecting and developing new mines for the General Development Company. For three years he was president of the Mining and Metallurgical Society of America and is now its vice-president. He is a life member of the Aero Club of America. He was one of the founders of the Lake Superior Mining Institute and is one of its past-presidents. He was directly responsible for the founding of the

Michigan College of Mines. He is a member of the American Institute of Mining Engineers and was one of its vice-presidents for the years 1908-1909. He is vice-president of the Miami Copper Company and of the General Development Company, managing director of the Utah Consolidated Mining Company and director of the Tennessee Copper & Chemical Corporation, the Kerr Lake Mining Company, the South America Gold & Platinum Company and other mining companies.

Obituary

E. W. Stevenson, a well-known cable engineer, was one of the victims of the Florizel disaster. Since the war began Mr. Stevenson had been engaged in supplying the British government with insulated wire and cable and re-



N. A. BOYNTON

tions were with several Chicago printers in publication work and later with J. H. Hoelting, laboratory supplies, and with the Western Electric Company. He later attended the University of Illinois, from which he was graduated in 1909. Since that time he has been connected with the National Lamp Works in the engineering and publicity departments. He has been manager of the publicity department for the last six years.

J. E. North, formerly commercial manager of the Springfield (Ohio) Light, Heat & Power Company, has been appointed secretary of the Springfield Chamber of Commerce. Mr. North has been identified with the Springfield Light, Heat & Power Company for the last eight and one-half years. He started as a salesman for the company and was promoted to the position of commercial manager several years ago. Mr. North entered the electrical field in 1903 with a local traction company and later was appointed electrical engineer of the road. Five years later he joined the force of the Robbins & Myers Company in Springfield and in the following year became connected with the local lighting company.

C. E. Groesbeck, formerly vice-president and general manager of the Utah Power & Light Company, with head-



E. W. STEVENSON

cently more especially with storage batteries. It was on a trip to Newfoundland in connection with British government business that Mr. Stevenson lost his life. Mr. Stevenson, who was of English birth, comes from a family well known in the electrical industry, his father having established a considerable reputation as a submarine cable engineer in England. From 1880 to 1886 Mr. Stevenson was in the employ of the Telegraph Construction & Maintenance Company of London, England, and for two years thereafter was with the Commercial Cable Company. In 1889 he took charge of the cable circuits of the Old Brush Electric Illuminating Company of New York. In the early nineties he was engaged as a consulting engineer for two years and later spent four years as an electrical engineer with the Okonite Company. He left this company in 1899 to become connected with the Hazard Manufacturing Company, which at that time began the manufacture of insulated wire. He continued with that company, of which he was electrical engineer until late in 1913, when he resigned to become sales agent for Messrs. Smith & Nicolls, manufacturers of waxes. He leaves a large family, and his eldest son is a lieutenant in the Aviation Corps.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

JOBGING BUSINESS TOTAL

ESTIMATED AT \$150,000,000

Increase in 1917 Over 1916 30 to 33 per Cent in Value
and Not More than 15 per Cent in Volume
of Merchandise

Estimates on electrical jobbing business in the United States from a source known to be well in touch with the industry all over the country place the annual total at \$150,000,000. The increase in jobbing business in 1917 over the previous year amounted to between 30 and 33 per cent in value as nearly as can be estimated. During the same period the increase in volume of merchandise handled probably did not exceed 15 per cent. The difference, of course, is represented by the increased cost of merchandise. A conservative estimate on the increase in the jobbing business for the last ten years by the same authority is 60 per cent.

LUBRICANTS AND OILS

RAPIDLY ADVANCING

Sale of These Commodities to Public Utilities In-
creases 50 per Cent—Market for Them Is in
Chaotic Condition

The raw material—that is, crude oil—from which the great majority of machine lubricants are derived is not only high but is becoming scarce, refiners say. At least, it is not so easily obtainable as it was even a year ago. With a continually advancing market, the latest increase within a week, 25 cents a barrel, brings crude up to \$4 a barrel for Pennsylvania oil. There has also been an increase of 36 per cent on Southwestern crude. As one of the best known refiners or manufacturers explained the situation to the ELECTRICAL WORLD this week, an abnormal demand on crude stocks has drawn the reserve down rapidly. Last year 30,000,000 bbl. were taken from storage for domestic consumption; 50,000,000 bbl. were exported, 7,000,000 bbl. were imported and placed in storage.

Nevertheless, with apparently heavy stocks in various parts of the country, the danger line of insufficient crude for refining into lubricants and for other commercial purposes is not far off at the present rate of consumption, it is held. For transformer and other oils, which must be of the highest grade, for motors, dynamos, generators, turbines, and in fact all electrical machinery, prices are not only high but are constantly advancing. The last increase occurred two weeks ago, when 10 per cent was added. The supply of wood barrels is growing short, labor is difficult to retain, and the cost of delivery, declare refiners, is another controlling factor in to-day's refined-oil market. Manufacturers report great difficulty in securing proper quantities of oil to fill transformer orders. This situation is mostly due, it was said, to rail embargoes. The government is taking tremendous amounts of crude for fuel oil. In truth, its requirements dominate the oil market; or, as one representative refiner phrased it, oil will win the war. In 1915 crude oil sold at 9 cents. Now it sells for 20 cents, and at least 100 new refineries are under construction. Turbine and transformer oils absorbed at least 10 per cent of the surplus stock of crude oil. There is a comparatively easy market, deliveries are better, and government control would be an advantage. Further, according to the same authority, there has been fully 50 per cent increase in the sale of various fine oils for use by public utilities. Still another lubricant manufacturer stated that there had been from 10 to

50 per cent increase in the demand for electrical machinery oils and that deliveries were too impossible even to talk about.

NOTICE OF PROPOSED

PURCHASES FOR NAVY

Quotations Called for on Miscellaneous Electrical
Supplies for Mare Island Yard—Telephones
for Philadelphia Yard

Bidders desiring to submit proposals for the following electrical material should give the schedule numbers desired and forward same without delay. Applications will be filed as soon as the schedules are received from the public printer. Schedules can be obtained upon application to the navy purchasing office in or near to each navy yard.

Article	Quantity	Navy Yard	Schedule No.
Annunciators, water-tight..	13	Mare Island, Cal.	1707
Bells, vibrating, water-tight; non-water-tight; buzzers		Miscellaneous Mare Island, Cal.	1707
Carbon, plate, 12 by 12, ¾ in. to 1 ¼ in. thick.....	160	Mare Island, Cal.	1707
Cloth, insulating, mica.....	50 lb.	Mare Island, Cal.	1707
Condulets with wire porcelain covers.....	250	Mare Island, Cal.	1705
Knobs, porcelain, solid.....	3200	Mare Island, Cal.	1705
Mica, plate, pressed, 18 in. by 36 in.....	540 lb.	Mare Island, Cal.	1707
Mica, India, select, uncut.....	100 lb.	Mare Island, Cal.	1707
Paste, soldering, electric, non-acid	700 lb.	Mare Island, Cal.	1707
Plugs, attachment.....	2000	Mare Island, Cal.	1707
Receptacles, porcelain.....	2300	Mare Island, Cal.	1705
Rheostats for motor field..	15	Mare Island, Cal.	1707
Rubber, hard, rod, sheet...	80 lb.	Mare Island, Cal.	1707
Sets, ventilating, for hull ventilation, 1000 cu. ft....	2	Mare Island, Cal.	1706
Sets, ventilating, portable..	30	Mare Island, Cal.	1707
Sockets, keeless, brass.....	600	Mare Island, Cal.	1707
Sockets, pull.....	1500	Mare Island, Cal.	1707
Switches, knife.....	356	Mare Island, Cal.	1707
Switches, snap, non-water-tight	900	Mare Island, Cal.	1707
Tape, lino No. 10, ¾ in. wide insulating tape.....		Miscellaneous Mare Island, Cal.	1707
Telephones, fire control.....	500	Philadelphia, Pa.	1717
Zincs, crowfoot.....	400	Mare Island, Cal.	1707

ELECTRICAL EXPORTS FOR THE MONTH OF NOVEMBER

Figures Again Pass Five-Million-Dollar Mark, Bringing
Total for First Eleven Months of Last
Year Almost to \$50,000,000

Figures on electrical exports show shipments from the United States for November last to have amounted to \$5,374,117, in comparison with \$4,421,535 for the corresponding month of 1916. In spite of all the handicaps in export shipping, including government licensing and lack of tonnage, the exports for November last of electrical goods were the second largest in the history of the industry. Wire, cable and wiring supplies reached a total of slightly less than \$1,000,000, while batteries went to more than \$400,000 and motors to more than \$600,000.

For the first eleven months of the year 1917, the total value of electrical exports was \$49,761,700, in comparison with \$35,497,238 for the first eleven months of 1916 and \$22,164,250 for the same period of 1915. From the accompanying table, which has been prepared by the Bureau of Foreign and Domestic Commerce, it will be noted that during the first eleven months of 1917 the exports of every article listed were greater than those for the corresponding period of 1916.

	November		Eleven Months Ended November	
	1916	1917	1916	1917
Articles				
Batteries	\$308,005	\$409,968	\$1,812,793	\$3,253,736
Carbons		94,699		558,150*
Dynamos or genera- tors	182,653	164,179	1,561,806	2,078,330
Fans	21,169	33,361	290,349	549,967
Heating and cooking apparatus		48,596		197,832*
Insulated wire and cables	725,503	713,533	4,312,845	6,511,300
Interior wiring sup- plies, including fix- tures	55,069	241,265	790,907	1,271,374
Lamp lamps	731	732	14,321	14,884
Carbon-filament lamps	14,492	7,541	108,479	163,881
Metall-filament lamps	121,623	285,814	1,291,915	2,540,475
Magnetos, spark plugs, etc.		433,704		1,429,321*
Meters and measur- ing instruments ..	76,272	128,869	781,409	1,017,739
Motors	410,211	621,845	4,405,879	5,754,387
Thermostats and con- trollers		10,783		71,971*
Switches and acces- sories		219,302		768,981*
Telegraph apparatus, including wireless.	54,562	24,099	193,689	511,059
Telephones	189,923	228,554	1,512,862	1,934,075
Transformers	72,496	271,016	964,798	1,534,641
All other	2,188,826	1,436,257	17,455,186	19,589,600
Total	\$4,421,535	\$5,374,117	\$35,497,238	\$49,751,700

*Figures cover period beginning July 1.

METAL MARKET SITUATION

Agitation for a Higher Price on Copper—Wire in Active Sale—Tin and Aluminum Scarce

Agitation to secure an increase over 23.50 cents for copper—the established official price up to May 31—is again being commented upon. There seems to be a sufficient supply of the metal to meet all requirements—foreign, governmental and for domestic commercial needs. Wire manufacturers for jobbing and ordinary trade demands are still figuring on a 30-cent base. A lower figure is only quoted for a prospective heavy order. Business in all wire products is very active, especially in large sizes.

Tin is high and scarce with very little Straits to be had at even the high figures quoted. The metal has now been placed by the government with the American Iron and Steel Institute as consignee for all importations.

Orders were issued on Feb. 28 commandeering, for war purposes, all crude and unworked platinum in the hands of importers, jobbers and wholesalers. This step was made imperative by the increasing need for platinum in the production of munitions. The latest quotation on the metal is reported at \$110 an ounce.

Announcement was made Monday by the War Industries Board that President Wilson, after investigation by the Federal Trade Board as to the cost of production, has approved an agreement made with the producers of aluminum fixing a maximum base price of 32 cents a pound at the various American plants and their subsidiaries, subject to revision on June 1; such price to cover lots of 50 tons and over of remelt ingots of a grade 98 to 99 per cent. The differentials now in force for the different grades, quantities and shapes will continue in force for new contracts.

NEW YORK METAL MARKET PRICES

	Feb. 25			March 4		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base		*27.00			*27.00	
Lead, trust price.....		7.00			7.25	
Tin, ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter.....		15.00			15.00	
Pelter, spot		7.92½			7.77½ to 7.82½	
Tin, Straits		*85.00			*85.00	
Aluminum, 98 to 99 per cent..	35.00	to	37.00	Govt. price	32.00	

OLD METALS

Heavy copper and wire.....	21.50	to	22.00	21.50	to	22.00
Copper, heavy	14.00	to	15.25	14.00	to	15.25
Copper, light	10.00	to	10.50	10.00	to	10.50
Lead, heavy	6.25	to	6.50	6.25	to	6.50
Iron, old scrap.....	5.50	to	5.75	5.50	to	5.75

*Nominal.

THE WEEK IN TRADE

REPORTS confirm the general impression that each month from the opening of the year records larger sales and increasing values in the volume of business in electrical equipment and staple merchandise. In this respect February goes ahead of January, and it is expected that March will score a still higher mark. The demand for goods, particularly motors and other apparatus, floodlamps, conduit, rubber-covered and weatherproof wire for army cantonments, shipyards and allied industrial enterprises, is exceedingly heavy and is running into millions of dollars. Domestic specialties and appliances, such as refrigerators, sewing machines, washing machines, vacuum cleaners, etc., are moving rapidly. The demand and shortage of lamps is abating. Deferred shipments and rail deliveries are still disturbing elements but are gradually becoming better.

For February collections are reported from fair to the best on record. Credits are being carefully watched and the "loose rein" is not visible in any part of the country.

NEW YORK

With improved weather conditions and a decided relief in shipments and deliveries, trade in electrical goods has bettered greatly. Distributing agencies and jobbing houses are in a stronger position regarding stocks and report larger sales, with a demand for staples in particular. The announcement of the new discounts on heating appliances, published exclusively in last week's ELECTRICAL WORLD, came as a surprise to jobbers, dealers and central stations.

Collections continue to be fairly satisfactory, if not altogether prompt, and vigilance is exercised in the examination of credits.

ELECTRICAL TOYS.—The selling season, which opened Jan. 1 and closes about the end of March, has so far been excellent. As a matter of fact, reports from the leading manufacturers say that the buying of electrical toys exceeds last year's record greatly in volume and value. It appears also that very few new contrivances were brought out as compared with former years. Prices were increased about 5 per cent about the first of the year, and no further advances are expected. Shipments of goods will be made on contract stipulations and, according to trade custom, deliveries will be completed in September. From then to the midwinter holidays the buying will be of the filling-in order.

GEARS AND PINIONS.—Deliveries are about three or four months back, but conditions are slowly improving. Prices are not softening, and manufacturers' sales agents would not be surprised if an advance were made. Raw material is getting easier and the demand is active. In this market several large orders have recently been filled.

DRY BATTERIES.—The supply is referred to as only fair by leading primary distributors and jobbers. No revision of prices has occurred.

HEATING APPLIANCES.—It is evident that a drive is on in the sale of flatirons, toasters, grills, pads and radiators. This applies more especially to prominent department stores, which are having their annual sales this month on these lines.

LAMPS.—A shortage in all sizes is complained of by jobbers. A manufacturer figuring largely in the trade stated shipments had been somewhat delayed, owing to the embargoes and freight congestion. As a matter of fact there was no shrinkage in the actual supply so far as the factory was concerned. Stock in the sectional or local warehouses had been depleted by an unusual drawing upon the reserve. Orders are now being filled and deliveries made

direct from the factory, and consequently it is expected that the apparent shortage will soon be caught up with and disappear.

HOUSEHOLD SPECIALTIES.—Sales on sewing machines, washing machines and vacuum cleaners are running into large volume. The selling campaign inaugurated by the makers and distributors, now in vigorous swing, are having very satisfactory results.

SOCKETS.—Standard and special lines are said to be steady with no change in price or supply.

WIRING FIXTURES.—The market is very uncertain owing to natural conditions, which may brighten under the presence of better weather and improved deliveries.

CONDUIT.—Jobbers report that on some sizes there is a decidedly low stock. Shipments are still held up between Pittsburgh and Eastern territory points. As one distributor explained, owing to the difficulty of getting some sizes of iron conduit a higher charge may be made for immediate delivery. In such cases prices are quoted prior to shipping.

ELECTRIC FANS.—From all accounts it looks as if the sale will be the largest on record. Manufacturers are putting out publicity campaigns for reaching the ultimate consumer, and these efforts are already having their effect upon the trade, which is preparing for a wide public demand in the regular season.

SMALL MOTORS.—Deliveries up to 20 hp. and 30 hp. are more definite, but with no price change.

COLLECTIONS AND CREDITS.—There is no marked change in the status of collections. Jobbers, as a rule, say they are up to a high average mark. Credit men are not relaxing their care in scrutinizing orders on time accommodations. Short terms are the rule.

BRUSHES.—Ceylon graphite, of the best grade, once scarce, on account of the British embargo, is somewhat easier. Deliveries are prompt, going out by express and parcel post.

CHICAGO

Some men of prominence in the trade in Chicago, basing their judgment on the business of the last two months and on the future outlook, see an electrical supply business for 1918 of only 50 to 75 per cent of last year's volume. January with most of the jobbing houses was bad. To weather conditions and heatless days this condition is attributed. In nearly every instance February was better by comparison than January, in spite of the disadvantage under which all firms worked. One house reports that February, 1918, was ahead of February, 1917, but this condition is not general. Optimism as to spring business is general. There have been no changes in prices during the last week. Stocks are in good condition, and no shortage of material in addition to those already existing is foreseen.

The trade for the last week has been greatly concerned with the drive for the war camp recreation fund. The offices of several jobbing houses and manufacturing plants have been personally engaged in soliciting subscriptions from firms in the trade.

CONDUIT.—Deliveries are getting better. Manufacturers are managing to ship some conduit into the city, and this has relieved the jobbing situation.

LINE HARDWARE.—This is the season when jobbers usually stock up on line hardware. Some are buying and some are not. Those who laid in extraordinarily heavy stocks last fall in anticipation of the usual sleet-storm damage have some of it still on hand and are not in the market.

DOMESTIC REFRIGERATORS.—There is activity in this line that indicates some real developments shortly. Manufacturers who have been eminently successful in marketing other electrical goods are viewing the electric refrigerator as a load-building device that can be installed without additional central-station expenditure. A device of this kind that can be sold at a reasonable price has been promised to the trade.

FIXTURE PARTS.—Business in this line, following the slowing up of building activities, is poor.

PORCELAIN INSULATORS.—Standard stock goods are

holding up well, owing to jobber purchases, but a slowing up in the larger goods is noted. Six weeks are quoted on standard stock goods; eight weeks on 33,000-volt goods, and on the larger units longer deliveries are quoted. Practically all of the factories have enough work on hand to keep them busy for six months. No price changes are anticipated.

CEDAR POLES.—Producers are seeking Chicago connections to distribute cedar poles.

BOSTON

Business continues in large volume, although in many lines the total sales are still below those of the early winter. In response to good merchandising methods, increasing sales of heating appliances are reported in retail circles. Prices are firm, with no immediate changes forecast. Collections are a little slower, but the situation is not at all disquieting. Stocks are fairly large in most lines except conduit, heavy wire and large motors. Some improvement begins to be seen in deliveries. The labor situation is better.

Slowly but surely the electric railways bid fair to re-enter the electrical material market, a most encouraging sign being a special message of Governor McCall last week urging higher fares for the Boston system during the period of the war. Maintenance has been sorely neglected of late on many of the electric roads, and manufacturers and jobbers are bound to obtain more business from traction customers this year unless all signs fail.

Electrical manufacturers are suffering from the draft, but vigorous efforts are being made to train employees for increased responsibilities. The relaxation of some of the New England fuel rules this week means longer hours of business and increased consumption of electrical supplies. March will be a full-time and over-time month, and the industrial outlook is far ahead of that of February.

HEATING APPLIANCES.—Retail sales are spotty, but the public seems to be coming into the market more than of late for table appliances. A large Boston department store reports very rapid turnovers in its electrical heating stock, with irons moving fast. A healthy demand exists for percolators, toasters, heating pads and hot plates of small size. As compared with their midwinter attitude, central stations are waking up to the value of appliance business.

LAMPS.—The supply is rapidly increasing. Full-time factory operation is a decided factor in relieving the short stocks here and there reported. The demand for carbon lamps persists, but manufacturers are not encouraging its development and believe it will be short-lived.

MOTORS.—The situation shows little change compared with last week. Smaller sizes are coming more and more into hand, but long deliveries prevail in the larger units. Prices remain steady. Up to 50 hp. deliveries are generally improving and single-phase motors are now in good stock. While stock sheets in general show some gaps, buyers can approach the manufacturer now with greater confidence of being able to secure what is wanted within a reasonable period than for some months. Wooden shipyards are purchasing motors in good volume, but there is a slight lull in army and naval shipbuilding orders at the moment.

AUTOMOBILE SUPPLIES.—With the opening of the annual automobile show at the Mechanics' Building, March 2, a striking increase in interest in electrical supplies for automobiles was seen. Poor railroad service is turning many traveling men to consider car purchases for spring and summer business, and accessory dealers are sure to benefit. Batteries and lamps are very much in the public eye this week.

CONDUIT.—Larger sizes of pipe are still scarce and in great demand by munition plants and other war establishments. Seventy new buildings are being erected at the Watertown (Mass.) Arsenal, and this means a heavy local demand for wiring material and conduit. Delivery difficulties are receiving much thought, and it is believed that the improving railroad situation will show a better movement of pipe before long.

PORCELAIN FITTINGS.—Stocks are very low and railroad embargoes have caused much disquietude. The demand

for heavier wiring service is far beyond the available supply. Prices are holding tight.

FLOODLAMPS.—A fair business is being handled in connection with industrial plant extensions. It is likely that this business will grow somewhat this year as the supply of labor for outside work becomes diverted from one field to another.

ATLANTA

There is very little change in general conditions to record over last week, the undertone remaining strong in all lines. This section is pretty well assured that the government will not fix a price on cotton and this feeling has a tendency to strengthen confidence. Although nothing definite is known with reference to future steel prices, it is not expected that any material change will be made, and, if any, no reduction is looked for. In the face of this uncertainty industrial construction is moving along nicely. Quite a large number of new industrial enterprises have been incorporated in the Southeast this week which will call for considerable electrical equipment. Reports from Washington, D. C., indicate that approximately \$5,000,000 will be expended at Camp Gordon for concentrating troops and supplies and for aviation purposes in Atlanta. Another large hospital is contemplated for Camp Wheeler, Macon, Ga. The erection of fifteen Liberty theaters at various cantonments has stimulated the demand for theatrical appliances. Shipment on this class of equipment has slowed up materially of late. Rumors have been afloat regarding big electrical developments by the large power companies in collaboration with the government. It is expected that more definite information will be available next week.

The dealers state that the advent of springlike weather has increased activity in household appliances. Local stocks are in pretty fair shape to take care of this demand. While residence construction has shown a slump, owing to publicity of the capital issues committee, contracting business is holding up well in the industrial and governmental fields.

INSULATORS.—The demand continues steady and no change in prices or deliveries is noted. In fact, the entire line of pole and line material has registered little change lately, the volume of sales being comparatively heavy.

INDUSTRIAL CONTROL DEVICES.—This line continues very active, especially in motor-starting panels and speed regulators. Drum controllers and resistances for wound-rotor alternating-current motors are also in good demand, but shipment promises are very discouraging.

SEATTLE

Total sales for February were considerably lighter owing to the short month, but the volume for the month averages favorably with January in proportion to the number of business days. Both jobbers and retailers report that the week's business has been maintained at the preceding week's volume. Floodlamps were the prime mover, these going to shipyards and new industrial plants. Sewing machines were the next best seller, the week's sales exceeding last week's slightly. Other domestic appliances are moving satisfactorily, with a noticeable increase in the sales of ranges and flatirons. The full movement of these will not begin for two months or more. Sales to shipyards were as heavy as within the past three weeks. Mill buying is lighter. The volume to cantonments is very light but is expected to increase when construction begins on the additional structures. The freight situation as it applies to local jobbers is no better. Shipments of appliances, conduit, motors, etc., are delayed en route or are waiting at the factories for cars. Shipyard work has not been retarded to any extent, because the concerns have priority certificates entitling them to the best service available.

Oriental freight congestion in Seattle is reduced from 6000 to 4500 cars. Collections for February were the best in years in spite of the short month. Credits are being placed carefully; very few new credits being placed during the month.

At present the housing problem for shipyard workers in Seattle is serious but not critical. If the situation hampers

the government shipbuilding program the United States Shipping Board will use its commandeering power to provide living quarters. During the first two months of the year the building permits issued in Seattle totaled \$710,056, compared with \$265,480 for the same period last year. An additional unit to the five-hundred-thousand-dollar hotel at the American Lake cantonment, at a cost of \$400,000, is announced. A contract was awarded for twelve structures increasing the capacity of the cantonment hospitals, of which the cost will be \$262,000. Absolute control of the spruce industry in Oregon and Washington has been taken over by the government. Beginning March 1, the logging camps and lumber mills of both states established a basic eight-hour day. The British Columbia loggers' association will place an eight-hour day in effect March 11.

It is officially announced that the government stands by the formerly stated plan of adding thousands of skilled mechanics to the Seattle shipyards engaged in government work. The predicted movement will reach a heavy volume early in the summer. The transportation problem in Seattle to the shipyards is being greatly improved. It is assured that the solving of the transportation problem will result in the expansion of many industries and speed up the production of ships and other war necessities. The labor situation is slightly improved, but it is believed a tightening will follow the opening of spring work in the agricultural sections.

The lamp situation is relieved somewhat. Sales will decrease materially with the coming of longer days. Stocks are still low, prices are steady and the present demand is excellent. The motor supply is better, but the demand is less. Stocks are still depleted by recent orders for extensions and betterments in the shipbuilding and industrial field.

SAN FRANCISCO

With all fear of a serious drought past, a note of buoyant optimism pervades the California electrical industry. There is plenty of business, even though a great deal of it lies in channels which have been heretofore practically uncharted. While official February reports have not been tabulated, it is clear that the number of building permits and the total value of the jobs involved fall considerably below the pace set in January. Few hotel and apartment jobs have been recorded, and work on private dwellings is mostly confined to rewiring and small additions. The bulk of the permits issued in San Francisco, which may be taken as a fair example of Pacific Coast conditions, cover industrial buildings.

The past week has seen some very large orders from shipbuilding plants covering big rubber-covered cable, large-sized conduit and condulets, high-amperage motor-starting switches and large fuses. To acquire speed and accuracy a variety of ingenious mechanical devices are used which are motor-driven, hence an unprecedented demand for circular-mill rubber-covered wire which has exhausted the local stocks.

LAMPS.—Deliveries are easier, and lamp salesmen who have been harassed for many weeks past by demands which conditions rendered impossible to fill are now willing to admit that the worst of the situation is past. The volume of orders for the United States government, or for plants engaged in government work, continues at about the same high level, but it is no longer necessary to appeal to the dealers' patriotism and secure their consent to the diverting of their shipments to such plants.

HEATING DEVICES.—Surplus stocks carried over from an indifferent holiday season have cut dealers' purchases to a negligible demand, but a gradual sale of stock on hand, coupled with the usual spring business and the governmental plea for electrical devices, is expected to restore the tone. Many dealers are now soliciting the small heating-device business on a partial-payment scheme. This plan constitutes an innovation.

HOUSEHOLD APPLIANCES.—Although purchases of the smaller electrical household helps are curtailed, it is testimony to the far-sighted economy of a buying public that sales of such devices as washing machines and vacuum cleaners have doubled. Liberal credit terms are given by the electrical jobbers as an encouragement.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil.....	List to \$61.00
Coil to 1000 ft.....	10% to 59.17
	No. 12 Solid
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	10% to 68.87

Twin-Conductor

	No. 14 Solid
Less than coil.....	List to \$105.00
Coil to 1000 ft.....	\$70.00 to 10%
	No. 12 Solid
Less than coil.....	List to \$135
Coil to 1000 ft.....	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil.....	15% to + 20%
Coil to 1000 ft.....	20%
	No. 12 Solid
Less than coil.....	15% to 10%
Coil to 1000 ft.....	20% to 5%

Twin-Conductor

	No. 14 Solid
Less than coil.....	20% to \$115
Coil to 1000 ft.....	—15% to \$85
	No. 12 Solid
Less than coil.....	15% to + 20%
Coil to 1000 ft.....	—10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to \$24.00
1/5 to std. pkg.....	20% to 19.80
Std. pkg.....	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+ 10% to 12%
1/5 to std. pkg.....	20% to List
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175-.3195	.3275-.3295
Barrel lots.....	.2875-.2895	.29.75

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp... Net to \$75.00 —15% to \$69.75	
3/8-in. d. stp. +10% to 75.00 List to 72.00	
1/2-in. s. stp... List to 100.00 —15% to 93.00	
1/2-in. d. stp. +10% to 100.00 List to 96.00	

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip....	\$75.00	\$63.75
3/8-in. d'ble strip.....	78.25 to 78.75	71.25 to 71.75
1/2-in. single strip....	100.00	85.00
1/2-in. double strip....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
5/8.....	.09	1 1/2.....	.40
1.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in. — \$25.00-\$55.00	\$20.50-\$24.50	\$20.00-\$21.50
1/4-in. — \$28.00-\$60.00	\$22.50-\$27.00	\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in. — \$36.00-\$55.00	\$25.00	\$22.50
1/4-in. — \$40.00-\$60.00	\$27.00	\$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb. 1/4 in. to 1/2 in.	3/4 in. to 3 in.
2500 to 5000 lb. 4% to 6%	7% to 9%
(For galvanized deduct six points from above discounts.)	6% to 8% 9% to 11%

DISCOUNT—CHICAGO

Less than 2500 lb. 1/4 in. to 1/2 in.	3/4 in. to 3 in.
2500-5000 lb. 1.3%-4.7%	4.3%-7.7%
(For galvanized deduct six points from above discounts.)	3.3%-6.7% 6.3%-9.7%

FLAT IRONS

NEW YORK

List price.....	\$6.00
Discount.....	30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

	Std. Pkg.	List
250-Volt		
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Less than 1/5 std. pkg.	Per 100 Net
5 to std. pkg.	\$5.00 to \$5.75
Standard package, 500.	List, each, \$0.07.

CHICAGO

Less than 1/5 std. pkg.	Per 100 Net
5 to std. pkg.	\$6.25 to \$5.25
Standard package, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B.	100	\$0.30
60-watt—B.	100	.35
100-watt—B.	24	.70
75-watt—C.	50	.70
100-watt—C.	24	1.10
200-watt—C.	24	2.20
300-watt—C.	24	3.25

und bulbs, 5/8 in., frosted:	
15-watt—G 25	50 .53
25-watt—G 25	50 .55
40-watt—G 25	50 .55
und bulbs, 3/4 in., frosted:	
60-watt—G 30	24 .77
und bulbs, 4/4 in., frosted:	
100-watt—G 35	24 1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
l. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
l. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

Less than coil (250 ft.)	Per 1000 Ft. Net
1 to 1000 ft.	\$24.90 to \$31.00
	22.72 to 27.90

CHICAGO

Less than coil (250 ft.)	Per 1000 Ft. Net
1 to 1000 ft.	\$29.00 to \$30.00
	21.50 to 33.50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

t per 100	\$20.00 to \$29.00
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CHICAGO

t per 100	\$19.17 to \$24.00
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OUTLET BOXES

	List, per 100
—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
—B.A., 6200 S.E., 300, AX, 1 1/2,	
4 S.	30.00
—C.A., 9, 4R, B 1 1/2.	25.00
—F.A., 7, C.S., 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

Less than \$10.00 list.	25%-37%	Black Galvanized
0.00 to \$50.00 list.	42%-45%	37%-40%

DISCOUNT—CHICAGO

Less than \$10.00 list.	40%	Black Galvanized
0.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
5 to std. pkg.	20%
l. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
5 to std. pkg.	20%
l. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

Less than 1/5 std. pkg.	Per 1000 Net
1/5 to std. pkg.	\$20.00 to \$38.00
Standard package, 2200.	19.00 to 20.00
	List per 1000, \$20.

CHICAGO

Less than 1/5 std. pkg.	Per 1000 Net
1/5 to std. pkg.	\$15.80 to \$14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/8-in. cap key and push		
1/8-in. cap key and push sockets, 500		\$0.33
1/8-in. cap keyless socket, 500		.30
1/8-in. cap pull socket, 250		.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	24% to \$25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:			
30-amp. S. P. S. T.			\$0.80
60-amp. S. P. S. T.			1.20
100-amp. S. P. S. T.			2.25
200-amp. S. P. S. T.			3.48
300-amp. S. P. S. T.			5.34
Low Grade:			
30-amp. D. P. S. T.			1.20
60-amp. D. P. S. T.			1.78
100-amp. D. P. S. T.			3.38
200-amp. D. P. S. T.			5.20
300-amp. D. P. S. T.			8.00
30-amp. 3 P. S. T.			1.80
60-amp. 3 P. S. T.			2.68
100-amp. 3 P. S. T.			5.08
200-amp. 3 P. S. T.			7.80
300-amp. 3 P. S. T.			12.00
Low Grade:			
30-amp. S. P. S. T.			0.42
60-amp. S. P. S. T.			0.74
100-amp. S. P. S. T.			1.50
200-amp. S. P. S. T.			2.70
30-amp. D. P. S. T.			0.68
60-amp. D. P. S. T.			1.22
100-amp. D. P. S. T.			2.50
200-amp. D. P. S. T.			4.50
30-amp. 3 P. S. T.			1.02
60-amp. 3 P. S. T.			1.84
100-amp. 3 P. S. T.			3.76
200-amp. 3 P. S. T.			6.76

DISCOUNT—NEW YORK

High Grade	
Less than \$10 list.	List to + 5%
\$10 to \$25 list.	11%
\$25 to \$50 net.	14% to 15%
Low Grade	
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24% to 25%

DISCOUNT—CHICAGO

High Grade	
Less than \$10 list.	+5%
\$10 to \$25 list.	10% to 11%
\$25 to \$50 list.	14%
Low Grade	
Less than \$10 list.	5%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to 30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

Black	Galvanized
Less than \$2.00 list.	List Net
\$2.00 to \$10.00 list.	10% to 20% 5%
\$10.00 to \$50.00 list.	20% to 30% 15%

DISCOUNT—CHICAGO

Black	Galvanized
Less than \$2.00 list.	25% 15% to 20%
\$2.00 to \$10.00 list.	25% 20%
\$10.00 to \$50.00 list.	25% to 35% 20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/4
No. 18, full spools.	0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 to \$0.65
No. 18, full spools.	0.47 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

Price per 1000 Ft. Net				
Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	5000 Ft.	
No. 11..	\$15.00	\$18.00	\$13.00	\$10.25-\$11.50
12..	23.25	25.41	21.30	21.78 15.97- 19.35
10..	32.40	35.21	29.70	30.18 22.13- 27.00
8..	45.70	49.12	41.90	42.12 30.88- 38.00
6..	72.40	77.84	66.35	66.72 48.93- 60.30

CHICAGO

Price per 1000 Ft. Net				
Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.	5000 Ft.	
No. 14..	\$18.00	\$13.00		\$11.50
12..	25.33	\$26.28	22.02	\$25.33 18.35-\$20.93
10..	30.48	36.54	27.94	31.26 22.86- 29.23
8..	42.54	51.57	38.99	44.13 31.90- 41.36
6..	66.46	88.38	56.15	75.61 50.53- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$35.42 to \$40.35
25 to 50 lb.	34.50 to 39.35
50 to 100 lb.	33.42 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

CO₂ Indicator

The Dwight Manufacturing Company of Chicago has added to its line a second form of CO₂ indicator. The use of a mercury column calibrated to indicate directly the percentage of CO₂ is the distinguishing feature. The initial design, which is still retained, used a small spring-type gage for this purpose.

The instrument consists of the usual metal reservoir, a specially calibrated mercury gage and the carrying case for the complete outfit. When in service the reservoir is disconnected from the gage and a sample of flue gas pumped through the chamber. A comparatively large supply of potash solution fills the base, and on the surface of this solution floats a layer of mineral oil, sealing from the chemical the gas sample being collected. When the gas sample has been obtained both valves on top of the instrument are closed and the reservoir is shaken back and forth a few times to break the oil seal and allow the chemical solution to absorb the CO₂ from the gas sample. This "splash system" of mixing the gas and liquid produces rapid absorption of the CO₂ on account of the large surface area of fresh chemical brought in contact with the gas. Connection is then made with the mercury gage, and upon opening the communicating valve the percentage of CO₂ in the gas is indicated on the gage.

Duplex Switch

For controlling two independent lighting circuits from one point, the Bryant Electric Company of Bridgeport has designed a switch that can be used as a substitute for two separate single-pole flush switches requiring a two-gang switch box.

The device consists of two Perkins type "O" push-button switches mounted in a porcelain cup, each switch having its own line and circuit terminals, so that separate feeds for the two circuits can be brought into the switch.



FOR SINGLE-GANG BOX

The switch fits into any shallow single-switch box and takes the standard two-button plate.

This switch is specially advantageous where the public service company has a two-rate schedule. As the switch has

separate feeds, a circuit at each rate can be passed through one box and controlled at the same point.

The new device, which is known as type O, duplex gang switch, No. 2709, is National Electric Code standard and is rated at 10 amp., 125 volts; 5 amp., 250 volts.

Ornamental Lighting Unit

An ornamental lighting unit with the novel feature of an illuminated glass canopy has been added to the General Electric Company's line. This unit differs from most of the ornamental units previously furnished in that the canopy covering the opening in the top of the globe, which permits the removal of the lamp inside, is covered with a glass instead of a metal canopy. This new canopy is made of



EQUIPPED WITH ILLUMINATED GLASS
CANOPY

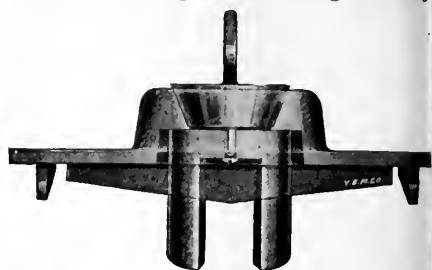
the same diffusing glass as the globe. It is pointed out that it adds wonderfully to the lamp's appearance, as it shows the outline of the complete fixture when illuminated.

Adapter for Snap Switches

A container or adapter for snap switches, to make them water-tight, is being placed on the market by the Barlow Electrical Specialties Company of Yonkers, N. Y., known as the Youmans water-tight switch box. Into one of these switch boxes the wireman may insert any make of snap switch, either 5-amp. or 10-amp., single-pole or double-pole, three-way or electrolier type. When renewal of the switch becomes

necessary the switch box is filled with a stock snap switch.

The switch box consists of a cast-iron box drilled and tapped for the reception of conduits. Upon this is placed the cover, having the snap switch suspended on a yoke piece, the rubber handle of the snap switch being held by



PROVIDES WATER-TIGHT RECEPTACLE FOR
SWITCH

an insulated clutch on the under side of the cover. This in turn is operated by the knob outside the cover through a conical-valve ground piece seated in the cover, thus avoiding rubber packing around the spindle as in most types of marine or water-tight switches. The cover is brass and is screwed to the box by four corner screws, with a rubber gasket between cover and box.

A round box is also made, 3½ in. (8.9 cm.) in diameter, the cover of which threads on like the cap on a water pipe, no rubber gasket being required. Both the square and round boxes are made in a larger size, adapted to receive any standard 20, 30 or 50-amp. switch. When filled with insulating oil the large round switch box with inclosed switch makes a low-priced oil-break switch especially suited for motor control in factories where no spark is permitted.

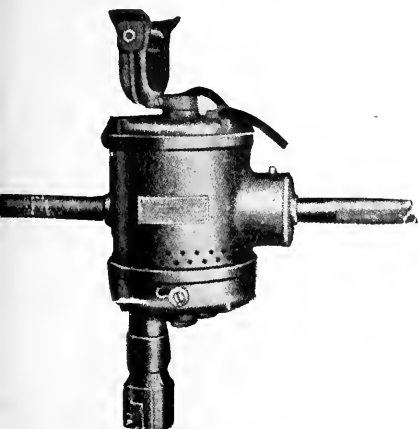
Motor-Operated Machine to Finish Cuts

The J. E. Richards Company of Kalamazoo, Mich., has developed a motor-operated machine for standardizing print-shop composing-room operations. The same machine buzz-saws, jig-saws, drills, touts, broaches, notches, undercuts and mortises electros, halftones, etchings, bases, "boilerplate" and lino-type slugs. A swinging-jig saw arm is provided, permitting this part to be swung at right angles with the circular saw to permit material of any length being run through the machine.

The various devices on the table of the machine are belt-driven from a fractional-horsepower motor made by the General Electric Company. Energy is obtained from the lamp socket, and a proper motor is furnished to operate on the energy available.

Portable Electric Drill

A portable electric drill, which is manufactured by Gilfillan Brothers Melting & Refining Company of Los Angeles, Cal., is equipped with gears to give two speeds. These are changed by means of a knob on the bottom of

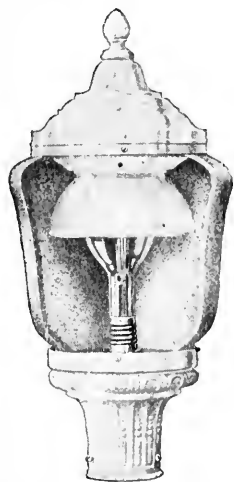


DRILL HAS TWO SPEEDS

the gear case. The gears themselves are made of chrome-nickel steel and run in grease. Ball bearings are used throughout. A ½-in. (1.27-cm.) standard chuck and a sturdy electric switch are provided. The speed range is 400 r.p.m. on low speed and 700 r.p.m. on high speed. Westinghouse motors are furnished.

Ornamental Lighting Unit

An ornamental lighting unit which diffuses the light with very little absorption and is of great value where low-candlepower lamps can be used, has been developed by the General Electric Company of Schenectady, N. Y. The stippled globe is in three sections, making renewal costs much lower than where a complete globe is used. This fixture can be furnished with or without dome refractor. In both cases there



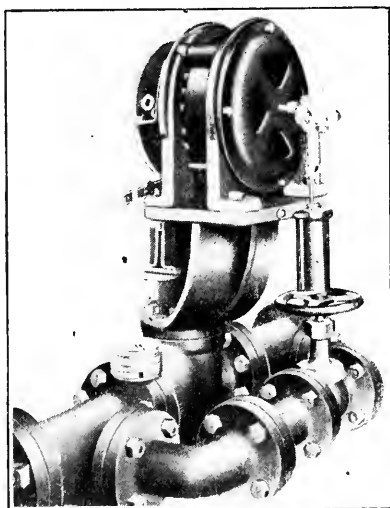
DIFFUSES LIGHT WITH LITTLE ABSORPTION

is enough light in an upward direction to illuminate the globe for its entire length. It is the only globe of a diffusing nature in which the refractor can be used to good advantage, especially with low-candlepower lamps, be-

cause it does not rob the light source of very much of its initial candlepower. When the refractor is used the lamps are of exceptionally high value for residential street lighting, because it collects all of the upward light and redirects it to the street surface away from the trees. The stippled glass globe is irregular on the inside, so as to split up the light rays and eliminate glare.

Grinder Regulator for Pulp Mills

To maintain a steady maximum output from electrically driven grinders in pulp mills the General Electric Company has developed a regulator which maintains a practically constant load on the grinder motors. The regulator maintains a practically constant load on grinder motors at any predetermined value, so that the current variations are held within such narrow limits that their influence on the electric system is practically negligible. This result is accomplished by automatically regulating the water pressure on the pockets



MAINTAINS MAXIMUM PRODUCTION OF ELECTRICALLY DRIVEN GRINDERS

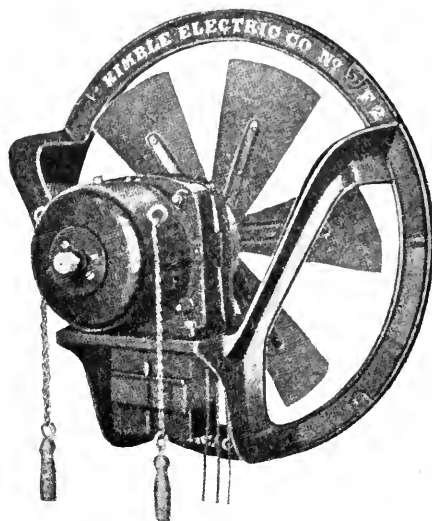
by means of a motor-operated throttle valve.

The regulator consists of a small induction motor which is connected through series current transformers to the feeder lines of the grinder motor. The rotor of the regulator motor rotates through a small angle and actuates the throttle valve of the main water supply to the grinder, automatically reducing the water pressure when the load on the grinder motor starts to increase and conversely opening the throttle valve and increasing the water pressure to compensate for a falling load.

While this regulating device is simple and strong mechanically, it is also very sensitive to the load changes and smooth in its operation. Actual service tests show that with a single three-pocket grinder, with instantaneous changes in load as great as 33 1/3 per cent, the fluctuations on the driving motor feeder circuit did not exceed 2 per cent.

Variable-Speed Alternating-Current Fans

The Kimble Electric Company, 634 Northwestern Avenue, Chicago, has prepared for the 1918 season a line of variable-speed alternating-current fans. These variable-speed fans will be made



SPEED IS CONTROLLED THROUGH USE OF THE TWO CHAINS

up in sizes ranging from 18 in. to 30 in. (45.7 cm. to 76.2 cm.) in diameter. These fans are reversible and variable in speed from any speed from 100 r.p.m. to maximum speed of the fan.

The entire control of speed is obtained by two chains suspended from the fan, and a slight pull on either chain will either increase the fan speed or decrease it, and maintain it at whatever speed is desired. If the chain is pulled beyond the neutral position the fan will reverse and instantly be converted from an exhaust fan to an intake fan. The fan equipment is built interchangeable from 110 volts to 220 volts. These fans will be equipped with a very small transformer, enabling the use of a low-voltage motor. The custom of using a 110-volt or 220-volt motor, or even higher voltages, has brought about the breakdown of fan motors when working under adverse conditions, such as in kitchens or very dusty atmosphere. For this reason the fans will be fully inclosed, and by using low-voltage motors they will run quietly and will, it is said, be proof against breakdown such as is common with motors of higher voltage.

The fans will be equipped with ball bearings, which will require the minimum of attention and will insure the running of the fans when other bearings have become inoperative because of the accumulation of grease or dust in the oil.

The fans can be built for 25-cycle and 30-cycle circuits, with slight modifications, and maintain the same rate of speed as will be common with the 60-cycle fan. All the fans will be complete units in themselves and will be ready for mounting upon the wall, it being only necessary to run two wires to the fan and no external wiring or regulator wiring being required.

Trade Notes

W. R. OSTRANDER & COMPANY of New York City will represent the Hygrade Lamp Company of Salem, Mass., in the New York and Brooklyn territory.

GEORGE SLESS, who has been stores manager of the Cleveland office of the Western Electric Company, was recently appointed assistant manager of that office.

THE TRIANGLE CONDUIT COMPANY of Brooklyn, N. Y., announces the appointment of Alva D. Stein, 156 Purchase Street, Boston, Mass., as its New England selling agent.

THE LUX MANUFACTURING COMPANY of Hoboken, N. J., announces that it has been awarded the municipal contracts for lamps for both New York City and Chicago for 1918.

W. W. BRIGGS has resigned as general agent of the Great Western Power Company to become manager of the New York division of the Westinghouse Lamp Company, taking effect April 1.

STEPHEN A. STAEGE announces the dissolution of the firm of Staegé & Dewey, and that he will continue in consulting engineering practice, with offices in the Light & Power Building, Watertown, N. Y.

NELSON P. HALL has been appointed district sales manager for the Chicago territory of the Van Dorn & Dutton Company. He was formerly connected with the sales force of the Electric Service Supplies Company of Chicago.

RAYMOND W. MURPHY, who was until recently in charge of the Pacific Coast offices of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been transferred to the Philadelphia office of the company, where he is assistant manager.

THE ILG ELECTRIC VENTILATING COMPANY of Chicago has purchased 214,282 sq. ft. of property in Chicago, involving the payment of approximately \$128,370, and it is reported that the new factory building which the company will erect on the site will cost more than \$600,000.

J. D. TODD, who until recently was connected with the Western Electric Company at Kansas City, Mo., as assistant sales manager, became associated with the Missouri Valley Electric Company, Jan. 1, as vice-president and manager. Mr. Todd will make his headquarters at Kansas City.

F. H. SMOCK, formerly commercial agent of the Eastern Wisconsin Edison Company, Sheboygan, Wis., has become a salesman with the Bryan-Marsh Division of the National Lamp Works, General Electric Company, in its Southern territory, consisting of Kentucky, Alabama, Tennessee, Mississippi and Louisiana.

THE GREENFIELD TAP & DIE CORPORATION of Greenfield, Mass., opened its new administration building March 5. This event is of more than ordinary importance to the company, as heretofore each plant has maintained its own office and shipping room. Now these functions are centralized in the new building, offering employment to 125 persons in the office alone.

VICTOR R. DESPARD has resigned as manager of the Chicago office of Pass & Seymour, Inc., Solvay, N. Y., to engage in the manufacture of electrical wiring devices, as Despard & Gordon, Inc., with headquarters in Chicago. Mr. Despard is widely known in the electrical industry of the Middle West. He entered the electrical business in 1906 as salesman for the Mohawk Electrical Supply Company and became associated with Pass & Seymour two years later.

SCHWEITZER & CONRAD, INC., of Chicago, Ill., has appointed R. L. Lunt district representative for the northern peninsula of Michigan, the States of Minnesota, North Dakota, South Dakota, the eastern portion of Nebraska, the western portion of Iowa and the northwestern portion of Wisconsin, with offices at Minneapolis and Omaha. The firm has appointed Charles Farnham district representative for the southern part of the State of California, with offices in the L. W. Hellman Building, Los Angeles. Both of these district representatives will handle the entire line of S. & C. high-voltage protective and switching devices.

THE WORTHINGTON PUMP & MACHINERY CORPORATION of New York City announces that the following appointments have been made, effective as of March 1: James E. Sasue, vice-president, in charge of engineering and manufacturing; Leon P. Feustman, vice-president, in charge of general commercial affairs; Frank H. Jones, vice-president, in charge of sales; Edward T. Fishwick, general sales

manager, Charles E. Wilson, assistant general sales manager, William Goodman, assistant to vice-president; William Schwanhauser, chief engineer. The offices of the foregoing will be at 115 Broadway. Neil C. Lamont, works manager, Laidlaw Works, with office at the works, Elmwood Place, Cincinnati.

Trade Publications

MOTOR-STARTING SWITCHES.—The Wells-Morris Manufacturing Company, 90 Second Street, San Francisco, Cal., has prepared a leaflet descriptive of its Wells motor-starting switches, designed for low-voltage and overload protection.

RECEPTACLES.—Pass & Seymour of Solvay, N. Y., have prepared three leaflets descriptive of their P. & S. 60,020 medium-base brass-covered receptacle, P. & S. 299 pull-chain brass splicing link, P. & S. porcelain receptacles and P. & S. sign receptacles.

CONVERSION TABLE.—The American Exporter Translation Bureau, 17 Battery Place, New York City, has prepared a set of conversion tables as follows: Avoirdupois pounds into kilograms, inches into centimeters, feet into meters, miles into kilometers, yards into meters, American gallons into liters, fractions of inches into millimeters, and metrical equivalent of wire gauges.

AMMONIA FITTINGS AND ACCESSORIES.—The De La Vergne Machine Company of New York City has prepared a well-illustrated book descriptive of its ammonia fittings and accessories. Special attention is called to a section which comprises a comparison of various kinds of ammonia fittings, detailed instructions for making soldered joints and some very useful tables.

HEAT INSULATIONS.—The Magnesite Association of America, Philadelphia, Pa., is distributing its anniversary advertising portfolio entitled "85 Per Cent Magnesite" for 1917. It is pointed out that the importance of heat insulation in the conservation of the nation's fuel cannot be overrated. Because of the present scarcity and cost of coal this subject demands more careful consideration than ever before. The Magnesite Association of America was founded to give publicity to the supreme results in heat insulation achieved by "85 per cent magnesite." Accordingly, as a timely contribution to the public consideration of the most efficient form of heat insulation, the Magnesite Association presents this anniversary book of the first year of educational advertising—1917. The exact information given in these advertisements and the wide field of application which they cover are such as to render them of pertinent value and interest to all engineers and architects. The technical value of these advertisements rests primarily on the fact that all the technical statements therein are the result of more than twenty-five years of the most exhaustive engineering experience, and, secondly, on the fact that all the statements regarding the properties of "85 per cent magnesite" are corroborated by the specific endorsement of the Mellon Institute of the University of Pittsburgh.

ELECTRICAL EQUIPMENT IN THE WOODWORKING INDUSTRY.—This is the title of a new circular just issued by the Westinghouse Electric & Manufacturing Company. The publication is profusely illustrated by views of motor-driven wood-working machinery both alone and as installed in representative woodworking plants. Starting with the general subject of motor drive, the reasons for its adoption, such as increased production, better light, greater safety to employees, higher efficiency of machines, more accurate knowledge of cost and greater freedom in power distribution, are explained. The next section is devoted to features of Westinghouse motors which make them suitable for this work, such as rigid construction, sparkless commutation of direct-current machines, and simplicity and reliability of oiling. Assistance which may be rendered to owners of woodworking plants is described. This includes advice as to layout of plant and proper motors to use and prompt repair service in case of breakdown. The woodworking plant of Ferguson Brothers Company, Hoboken, N. J., is described and illustrated in a third section. It manufactures furniture and wooden novelties of various kinds and is completely equipped with motors. The rest of the book gives horsepower requirements and other data for many different sorts of woodworking machinery which will be of much value to those having to do with this class of industrial activity.

New Incorporations

THE DESHLER (NEB.) LIGHT & POWER COMPANY has been chartered with a capital stock of \$100,000 by August F. Kollman and others.

THE MANCHESTER (WIS.) LIGHT & POWER COMPANY has been incorporated with a capital stock of \$3,000 by Gottlieb Pfeiffer and others.

THE WHY ELECTRIC COMPANY of Milwaukee, Wis., has been incorporated with a capital stock of \$15,000 by Albert H. Walker, William F. Horn and Lafayette Yakes.

THE SERVICE ELECTRIC COMPANY of Goshen, Ind., has been incorporated by Herman A. Schmidt, Harvey Miller and George E. Rohrer. The company is capitalized at \$8,000 and proposes to deal in electrical apparatus.

THE J. P. HAND COMPANY of Davenport, Iowa, has been chartered by J. P. Hand, Joseph Lewis and B. Simon. The company is capitalized at \$20,000 and proposes to manufacture automobile parts and storage batteries.

THE COLUMBIA BATTERY COMPANY of South Bend, Ind., has been incorporated with a capital stock of \$10,000 by Otto M. Knoblock, Frank L. Stedman and William B. Starr. The company proposes to manufacture storage batteries.

THE DISPLAY STAGE LIGHTING COMPANY of New York, N. Y., has been incorporated with a capital stock of \$10,000 by John Higham, Michael E. Kelly and William E. Price. The company will manufacture electrical stage apparatus.

THE DUBOIS (IDAHO) LIGHT & POWER COMPANY has been incorporated by C. N. Friday, J. M. Palmer and E. F. Palmer. The company is capitalized at \$25,000 and proposes to supply electricity for lamps and motors in Dubois and vicinity.

THE NATIONAL ELECTRICAL APPLIANCE COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at \$500,000. The incorporators are: C. L. Rimplinger, M. M. Clancy and F. A. Armstrong of Wilmington, Del.

THE OTISCO (N. Y.) LIGHT & POWER COMPANY has been incorporated by Earl T. Harter, Bessie L. Harter of Otisco and Maurice A. Phelps of Syracuse. The company is capitalized at \$10,000 and proposes to generate and distribute electricity for lamps, heaters and motors.

THE CYNTHIANA (KY.) PLUMBING & ELECTRICAL COMPANY has been organized for the purpose of doing a general electrical business, wiring, dealing in electrical supplies and also a general plumbing, heating and gas-fitting business. J. F. Nooe is interested in the company.

THE RUBES ELECTRIC LAMP WORKS of Brooklyn, N. Y., have filed articles of incorporation with a capital stock of \$10,000 for the purpose of manufacturing electric illuminating signals for trains. The incorporators are: Louis Rubes, Augusta Wegman and Nicholas Rubes of New York.

THE INTERCOUNTY ELECTRICAL COMPANY of Sidney, Ohio, has been incorporated with a capital stock of \$100,000 by Edward W. Kelsey, Jr., Charles Weirich, R. O. Holloway, Randolph P. Whitehead and Webb O. Schwenk. The company proposes to take over the municipal electric plant in De Graff and Quincy.

THE C. RAZMERE ACCESSORIES has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$20,000 to deal in electrical supplies of all kinds. The incorporators are: Norman E. John, Edwin J. Hardcastle of Edgemore, Del.; David W. Masters and Catherine G. Masters of Wilmington, Del.

THE DUPLEXALITE CORPORATION of New York, N. Y., has been chartered with a capital stock of \$275,000. The company proposes to manufacture gas and electric-light fixtures. The incorporators are: H. O. Walter, 60 Wall Street; L. C. Bunzl, 121 East Seventy-second Street, New York, N. Y., and L. Roche, Jersey City, N. J.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY of Chicago, Ill., has been incorporated with a capital stock of \$3,000,000. The company is a consolidation of the Benjamin Electric Company of Chicago and the Royal Enameling & Manufacturing Company of Des Plaines, Ill. The manufacture of electrical specialties and lighting systems will be continued. The plant of the new company will eventually be located on a site of 32 acres in Des Plaines, formerly owned by the Royal Enameling & Manufacturing Company.

New England States

BATH, ME.—The Bath Water District has entered into a contract with the Central Maine Power Company of Augusta and the Bath & Brunswick Light & Power Company to supply electricity for operating the pumping system for a period of three years. This is the first step, it is said, toward supplying the entire system for electrical operation, and eventually to have a storage basin on this side of the Kennebec River, as to do away entirely with the Nesquehoning pumping station and the crossing of the river mains.

CLAREMONT, N. H.—Preparations are being made by the Claremont Power Company for the installation of the necessary equipment in its new substation.

BROOKFIELD, MASS.—The power station of the Worcester & Warren Street Railway Company was practically destroyed by fire on March 4, causing a loss of about \$75,000. The road suspended service Jan. 16 and the power station has not been in use since Dec. 16.

SPRINGFIELD, MASS.—The Gilbert & Barker Manufacturing Company is erecting a large addition to its power house.

BRIDGEPORT, CONN.—Plans have been filed by the Fairbanks Storage Battery Company, 438 Atlantic Street, Stamford, for the construction of a new storage-battery station, 40 ft. by 120 ft., on Fairfield avenue, Bridgeport. Contract for building has been awarded to W. A. Smith & Son, 18 Cannon Street, Bridgeport, at \$20,000.

Middle Atlantic States

BROOKLYN, N. Y.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for alterations and improvements in the power plant at the Brooklyn Navy Yard to the Child & Scott Company, 112 Webster Street, New York City.

BUFFALO, N. Y.—A resolution has been introduced in the City Council by Commissioner Kreinheder providing for replacing all gas lamps in the city with electric lamps. There are now approximately 9000 gas lamps in use.

CHENANGO FORKS, N. Y.—Bids, it is understood, will soon be asked by the Binghamton Bridge Company, Press Building, Binghamton, for the construction of a power house at Chenango Forks. The equipment will include two 250-kw. water turbine-driven generators. A. L. Gilmore, Press Building, Binghamton, is engineer.

EAST AURORA, N. Y.—The plant and oldings of the East Aurora Electric Light Company are reported to have been purchased by Dr. George Stevenson, for \$50,000. The new owner, it is understood, will make improvements to the service.

LONG ISLAND CITY, N. Y.—The New York & Queens County Railway Company, 44 Jackson Avenue, it is reported, is considering extension to its plant on property recently acquired, consisting of nine and one-half acres at the intersection of the Long Island Railroad and Trotting Lane, Elmhurst.

NEW YORK, N. Y.—An amendment to the fire-alarm rules has been adopted by the Board of Standards and Appeals, permitting the installation of mechanical, non-coded closed circuit or coded closed-circuit fire-alarm signals in five-story factory buildings. The rule recently issued permitted these installations only in buildings up to four stories.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., for the construction of the United States assay office at New York City, the work to include deep foundations, safety vaults and certain mechanical equipment. Bids will also be received at the same time for the installation of one electric passenger elevator and three electric coin lifts in the United States assay office building, in accordance with drawings and specifications, copies of which may be obtained at the above office.

WAYNE, N. Y.—Three mills at the works of the Wayne Powder Company were recently destroyed by fire, including No. 1 and No. 2 wheel mills and the mixing mill, which was operated by electricity. The loss is estimated at about \$100,000.

BORDENTOWN, N. J.—The Borough Council is considering plans for the installation of a new electric fire-alarm system.

EDGEWOOD, N. J.—Plans have been prepared by the United States government for the erection of a large plant for the manufacture of gas in Edgewood. The cost of the entire project is estimated at about \$37,000,000.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ELIZABETH, N. J.—Plans have been prepared for the erection of a four-story building, 60 ft. by 300 ft., with a wing to cover an area of 180 ft. by 300 ft., at 810-50 Frelinghuysen Avenue, for the Diehl Manufacturing Company, Trumbull Street.

GLOUCESTER, N. J.—Plans are being considered by the City Council for extensions and improvements to the electric street-lighting system.

HALEDON, N. J.—A movement has been inaugurated for the installation of an electric-light and power plant at the overflow of the borough reservoir at North Haledon. Adolph Branch and Charles Banta are reported to be interested in the project. Haledon has not a post office.

NEWARK, N. J.—The Hay Foundry & Iron Works is building an extension to its plant, and, it is understood, will soon require cranes and machinery for fabricating steel.

NEWARK, N. J.—The construction of a series of power houses between its different shipways, consisting of three plants, between ways Nos. 1 and 2, Nos. 3 and 4, Nos. 5 and 6, respectively, for the Submarine Boat Company, Port Newark, Newark, is under way. The company has nearly completed the erection of two steel fabricating shops.

TRENTON, N. J.—The City Commission has issued instructions to the Public Electric Service Company to keep the electric street-lighting service in operation during darkness only, in order to aid in the conservation of coal. It is also proposed to make extensions and improvements in the lighting system.

ALLENTOWN, PA.—Contract has been awarded to L. M. Kratz & Son, Allentown, by the City Council for alterations and improvements to the power house at the local pumping station, to cost about \$15,000.

BELLEFONTE, PA.—Notice has been filed with the Public Service Commission by the State Centre (Pa.) Electric Company of an issue of \$7,000 in bonds, the proceeds to be used for improvements, etc.

CHESTER, PA.—Contracts have been awarded by the Chester Shipbuilding Company for the construction of five buildings, including a punch and mold shop department, 190 ft. by 500 ft., to cost about \$200,000; extensions to forge and blacksmith shop, \$30,000; new ship carpenter shop, \$30,000; general storehouse, \$30,000, and tank building.

COUDERSPORT, PA.—Notice has been filed by the Home Electric Company with the Public Service Commission of an issue of \$22,000 in bonds, the proceeds to be used for improvements to its plant and system.

ELLWOOD CITY, PA.—The Connoqueness-Lawrence Light & Power Company, recently organized, proposes to supply electricity for lamps and motors in Ellwood City and adjacent territory. The company is capitalized at \$10,000. The incorporators are: J. C. Chesnut, L. B. Round, H. N. Wood, M. Pendleton and C. H. Akins.

INDIAN CREEK, PA.—Plans have been prepared by King & Wightman, 1513 Walnut Street, Philadelphia, for the construction of a new power plant, 30 ft. by 70 ft., for the Mountain Water Supply Company, in Indian Creek.

LEMOYNE, PA.—Extensive improvements are being made to the local plant of the United Electric Company.

NEWPORT, PA.—The Juniata Public Service Company is erecting a new electric transmission line from Montgomery's Ferry to Liverpool, in connection with other improvements to its system.

WILLIAMSPORT, PA.—Plans have been prepared for the construction of a new power house near Rose Street and Erie Avenue for the Lycoming Rubber Company. The Lockwood Greene Company, 93 Federal Street, Mass., is engineer.

BALTIMORE, MD.—Contracts have been awarded by the Bartlett-Hayward Company, Scott and McHenry Streets, to Morrow Brothers, contractors, Fidelity Building, Baltimore, for the erection of a transformer house, about 28 ft. by 49 ft., at Columbia Avenue and Putnam Street; and for a heat-treating plant, 165 ft. by 62 ft., one story. Parker, Thomas & Rice, Union Trust Building, are architects.

ST. HELENA, MD.—Contracts have been awarded by the War Department, Wash-

ington, D. C., for construction of a plant at St. Helena for assembling and repairs of automobiles. A site on Colgate Creek of 100 acres has been acquired. The proposed plant will cost about \$2,500,000, and will consist of about 50 steel and concrete buildings.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company is planning to extend its car lines from Clarksburg to Salem, Philippi and Grafton; from Weston to Orlando and Fairmont to Morgantown. Work involving an expenditure of about \$3,000,000 is contemplated this year by the company.

WHEELING, W. VA.—Plans are being prepared by the Wheeling Traction Company for the reconstruction of its Bay Island carhouse, recently destroyed by fire.

FRONT ROYAL, VA.—The Old Virginia Orchard Company is contemplating extensions to its plant, including the erection of a two-story building 30 ft. by 70 ft., installation of steam water pump, smokestack, electric elevator, and other machinery connected with the canning industry.

RICHMOND, VA.—Contract has been awarded by the War Department, Washington, D. C., to the George A. Fuller Company, Fuller Building, New York, N. Y., for the construction of the aviation concentration camp on Bellwood Farm, near Richmond, to cost between \$3,000,000 and \$4,000,000.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded contract for the construction of two temporary office buildings, one for the army and the other for the navy, to the Turner Construction Company of New York, N. Y. The buildings are to be erected on government property, between the Washington Monument and the Lincoln Memorial, south of B Street and west of Seventeenth Street. The cost is estimated at about \$5,750,000.

North Central States

MUSKEGON, MICH.—The proposal to grant the Muskegon Traction & Lighting Company a 30-year franchise will be submitted to the voters at the April election.

AKRON, OHIO.—The Imperial Electric Company of Akron contemplates building an addition, 60 ft. by 100 ft., to its plant.

CINCINNATI, OHIO.—The Automatic Electrical Devices Company of Cincinnati has removed its offices from the Mercantile Library Building to 120 Opera Place, where its new shop will also be located. C. E. Ogden is president and general manager.

CINCINNATI, OHIO.—The Union Gas & Electric Company has petitioned the County Commissioners for permission to erect electric transmission lines along Anderson's Ferry Road, Cleves and Warsaw Pike, Lower River Road, Dugan Gap Road and Geist Road to the Ohio-Indiana state line to furnish electricity in Cleves, North Bend, Adyston and other villages below Cincinnati.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until March 15, for boiler ash hoppers for the division of light and heat. Specifications may be obtained at the office of the division of light and heat.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until March 15 for one two-ton auto truck for the Warrensville Infirmary, department of public welfare. Specifications may be obtained at the department of public welfare.

DEGRAFF, OHIO.—The Intercounty Electric Company, it is reported, has purchased the municipal electric-light plant in Degraff. Electricity to operate the local system will be secured from the Sidney Electric Company.

MARION, OHIO.—Contract, it is reported, has been placed by the Power Manufacturing Company of Marion for the erection of an addition, 82 ft. by 200 ft., one story high, to its plant.

OVERLIN, OHIO.—The high-tension line of the Lorain County Electric Company has been completed as far as Oberlin and is now supplying electricity to operate the local system. The plant of the Oberlin Gas & Electric Company, it is understood, will be closed down.

QUINCY, OHIO.—The municipal electric-light plant, it is reported, has been purchased by the Intercounty Electric Company. The local plant, it is understood, will be closed down, and electricity purchased from the Sidney Electric Company to operate the local system.

SIDNEY, OHIO.—The Intercounty Electric Company, recently incorporated with a capital stock of \$100,000, has purchased the municipal electric-light plants in Quincy and DeGraff. The company will transmit and distribute electricity in Quincy, DeGraff and Emberton and also to farmers along the route. Electricity to operate the system will be purchased from the Sidney Electric Company.

MIDDLESBORO, KY.—At a mass meeting held recently a committee was appointed to look into the matter of securing an electric street-railway service in Middlesboro. It is proposed to extend the car line to the mines to provide transportation to the laborers in that district. J. M. Rogan is chairman of the committee.

PADUCAH, KY.—W. A. Gardner, commissioner of public works, has petitioned the city commissioners for an appropriation of \$40,000 for extension to the municipal electric-light plant, including the erection of an addition to the power house, installation of two 300-hp. boilers, and raising the roof of the plant.

ROXANA, KY.—The Estill Coal Company, it is understood, will install a plant to be equipped for electrical operation this spring. C. H. Trimble of Memphis, Tenn., is interested in the company.

ELWOOD, IND.—The capital stock of the Indiana General Service Company has been increased from \$1,000,000 to \$3,500,000.

MONGO, IND.—Owing to the dam being carried away by the flood the local electric-light and power plant has been put out of commission. It is proposed to purchase a gasoline engine to operate the plant until a new dam is built.

MUNCIE, IND.—The Public Service Commission has authorized the Muncie Electric Light Company to sell its plant and holdings to the Indiana Public Service Company of Aurora for \$1,000,000.

CHICAGO, ILL.—The Public Service Company of Northern Illinois of Chicago has secured the consent of property owners on the "North Shore" of Chicago for a right-of-way for an extension of its electric transmission line between Evanston and Highland Park.

CHICAGO, ILL.—Contract has been awarded by the Inter Ocean Refining Company, 332 South Michigan Avenue, Chicago, Ill., for the construction of an oil refining plant and distributing station near Lyons consisting of a group of tanks, filter house, pump house, stills, boiler house, etc., to the Leonard Construction Company, 332 South Michigan Avenue.

GOOD HOPE, ILL.—The citizens of Good Hope have raised a subscription of \$1,000 to finance a proposed electric-lighting system for the town.

BRODHEAD, WIS.—Plans are being considered for remodeling the municipal electric power station and lighting system. K. Guelson is superintendent.

CAMP DOUGLAS, WIS.—The Orange Light & Power Company expects to increase its hydraulic head and extend its transmission line to the village of Hustler. A. M. Patterson is manager.

MINERAL POINT, WIS.—The Mineral Point Public Service Company has recently completed a transmission line from Dodgeville to Ridgeway and a distribution system in Ridgeway. Energy is supplied to the village of Ridgeway near the city limits of Dodgeville. The erection of a 33,000-volt transmission line from Reway to Platteville is now under way. The new line will connect with the lines of the Interstate Light & Power Company of Galena, Ill., for an interchange of service in case of emergency. John C. Meiners of Milwaukee is president.

SUPERIOR, WIS.—Edward Kaner, who has recently purchased a site in Superior, it is reported, will erect buildings, to be equipped with electrically operated cranes and other machinery.

LANESBORO, MINN.—At an election held recently the proposal to issue \$15,000 in bonds for the installation of an electric-lighting system was carried.

NASHWAUK, MINN.—Preparations are being made by the Water and Light Commission for extensive improvements to the municipal water and light plant. Since the power house was destroyed by fire the department has been handicapped in furnishing an adequate water supply. Orders have been placed for a new electrically driven well pump, to cost approximately \$7,000.

ST. CLOUD, MINN.—Surveys are being made of the contour of the river bed at Pike Rapids, a power site owned by the Pike Rapids Power Company, north of St. Cloud, about 6 miles south of Little Falls.

WACONIA, MINN.—Bids will be received by Joseph Fuchs, clerk of Independent school district No. 44, until March 28, for

the erection of a school building. Separate bids to be submitted on general construction work, heating and plumbing and electric work. Specifications may be seen at the office of Kirby T. Snyder, architect, Minneapolis, Minn., and at the Builders' Exchanges of Minneapolis and St. Paul, Minn.

EDDYVILLE, IOWA.—At an election to be held March 12 the proposal to issue \$8,000 in bonds for improvements to the municipal electric-light plant will be submitted to the voters.

KANSAS CITY, MO.—The Kansas City Light & Power Company has filed an application with the Public Service Commission for permission to increase its capital stock from \$4,977,300 to \$10,000,000.

KANSAS CITY, MO.—Plans are being prepared for the construction of a pumping plant at East Bottoms, a duplicate of the Turkey Creek plant. At the election to be held April 22 the proposal to issue \$1,250,000 for the proposed plant will be submitted to the voters. Burton Lowther is chief engineer.

ST. LOUIS, MO.—Contract has been awarded by the R. E. Burdeau Company, 2921 Locust Street, to the T. J. Ward Construction Company, 1519 Olive Street, St. Louis, for the erection of an automobile showroom, office and garage, 109 ft. by 125 ft., to cost about \$50,000 without mechanical equipment. The plans provide for an electric freight elevator, electric-lighting and steam heat, etc.

NEW ENGLAND, N. D.—The Asby Light & Power Company is contemplating the purchase of a 10-hp. or 100-hp. oil engine; would prefer a good second-hand machine; also a three-phase generator and exciter to go with the generator. The company would like to communicate with dealers and manufacturers in regard to the above equipment. J. A. Meyer is secretary.

BROOKINGS, S. D.—Bids will be received by the Regents of Education of the State of South Dakota, addressed to the president of the State College of Agriculture and Mechanic Arts, Brookings, until March 15 (extension of date from Feb. 15), for the installation of electric wiring in an armory building to be erected at the State College of Agriculture and Mechanic Arts. Plans and specifications are on file in the office of F. H. Ellerbe, architect, St. Paul, Minn., and the secretary, Brookings, and the Builders' Exchanges of St. Paul and Minneapolis, Minn.

BROOKINGS, S. D.—Bids will be received by the Regents of the Board of Education of the State of South Dakota, addressed to secretary of the State College of Agriculture and Mechanic Arts, Brookings, until March 15, for the following work: For electrical wiring in armory building to be erected according to plans and specifications prepared by F. H. Ellerbe, architect, St. Paul, Minn.; for steam heating and electric wiring in addition to administration building, and for electric wiring in stock-judging pavilion, according to plans and specifications prepared by Joseph Schwarz, architect, Sioux Falls, S. D. Plans may be seen at the offices of the architects, Builders' Exchanges, at St. Paul and Minneapolis, and at the office of the secretary of the college, Brookings. I. D. Aldrich is secretary.

NEWARK, S. D.—The local electric-light plant, it is reported, has been purchased by Louis Severson. The new owner, it is understood, will install a new engine in the spring and increase the capacity of the plant.

SCOTLAND, S. D.—The Council has decided to submit the proposal to issue \$35,000 in bonds for the installation of a municipal electric-light plant to the voters.

DAVIS CITY, NEB.—Bids, it is reported, are being taken by the Lincoln (Neb.) Telephone & Telegraph Company for the construction of a telephone exchange in Davis City.

FAIRBURY, NEB.—Plans are being prepared by the Lincoln (Neb.) Telephone & Telegraph Company for the construction of a telephone exchange in Fairbury, to cost about \$12,000.

JUNIATA, NEB.—At an election held recently bonds to the amount of \$6,800 were authorized for the installation of an electric-lighting system. The project includes the erection of an electric transmission line to Hastings.

LINCOLN, NEB.—The Lincoln Telephone & Telegraph Company has petitioned the Nebraska Railroad Commission for permission to increase its capital by \$50,000, the proceeds to be used for extensions to lines.

SIDNEY, NEB.—Bids will be received by the city clerk, Sidney, until March 12, it is reported, for machinery for the municipal electric-light plant and waterworks system as follows: One 250-hp. steam en-

gine, two 200-hp. boilers, one alternating-current generator for direct connection to engine, one steel smokestack, switchboard and instruments, feed-water pumps, and feed-water heater, auto-stokers, coal-handling machinery and enlarging coal bins, etc. Alternate bids will also be received on two 150-hp. internal-combustion oil engines, 10,000-gal. fuel-oil tank.

ATCHISON, KAN.—Contract has been awarded by the Blair Milling Company to the Missouri Valley Bridge & Iron Works of Leavenworth for the construction of a power house, 86 ft. by 102 ft., to cost about \$40,000.

DIGHTON, KAN.—Another election, it is understood, will be called to vote on the proposal to issue bonds for extensions to the municipal electric-light plant and water-works system. The amount (\$10,000) which was at first decided upon will not be sufficient to carry out the proposed plans.

EUREKA, KAN.—Bids will be received by J. W. Kenner, clerk, Eureka, until March 15 (extension of date from Feb. 27) for two 400-gal-per-minute, vertical centrifugal pumps and motors, pumping against a total head of 40 ft.; two 10-ft. by 10-in. gravity mechanical filters and all mechanical filters and necessary equipment; construction of coagulating basins, filter house and clear well. Black & Veatch, Inter-State Building, Kansas City, Mo., are engineers.

HUNTER, KAN.—The installation of an ornamental street-lighting system in Hunter is reported to be under consideration.

LAWRENCE, KAN.—Bids will be received by the Board of Administration, Topeka, Kan., until March 14 for the Administration and Liberal Arts Building at the University of Kansas, Lawrence, including plumbing, electric wiring and steam heating. The cost of the building is estimated at about \$225,000. R. L. Gamble of Topeka is architect.

WICHITA, KAN.—The Public Utilities Commission has granted the Wichita Walnut Valley Interurban Railway Company permission to issue \$1,000,000 in bonds and \$200,000 in capital stock, the proceeds to be used to acquire real estate for rights-of-way, terminal and station purposes and to construct and operate that portion of the line which connects Wichita, El Dorado and Augusta, about 40 miles long. Charles E. Payne is secretary.

Southern States

RALEIGH, N. C.—Bids will be received until March 14 for the installation of an elevator for building to be erected at the State Hospital for Insane. Drawings and specifications may be obtained from Harry Barton, architect, Greensboro. Albert Anderson, Dix Hill, Raleigh, is superintendent.

GREENWOOD, S. C.—Plans are being considered by the owners of the Panola Mill for the installation of street lamps and also for lighting residences.

ATLANTA, GA.—At an election to be held March 25 the proposal to issue \$75,000 in bonds for the installation of an electric generating plant will be submitted to the voters.

SANDERSVILLE, GA.—The City Council is planning to rebuild the municipal electric-light and water plant, recently damaged by fire, causing a loss of about \$10,000.

CHRISTINA, FLA.—The Phosphate Mining Company, it is reported, is planning to rebuild its electric power plant, recently destroyed by fire. P. H. Fuller of Nichols, Fla., is general manager.

DAYTONA, FLA.—The capital stock of the Daytona Public Company has been increased from \$300,000 to \$500,000.

MIAMI, FLA.—The City Council has decided to install arc lamps on Biscayne Drive and Avenue B from Twelfth Street to Buena Vista.

NASHVILLE, TENN.—The Nashville Railway & Light Company will soon begin surveys for an extension of its Gallatin turnpike line to near Hadleys Bend, and also for an extension of the Fairfield line along the Lebanon Road.

SEVIERVILLE, TENN.—The Tennessee Manganese Company is contemplating the installation of a steel furnace (25 tons daily capacity) to convert ore into ferro-manganese at Sevierville. D. C. Campbell of Knoxville is president.

MOBILE, ALA.—The Tennessee Coal, Iron & Railroad Company, it is reported, will construct an electric railway (1½ miles long) to connect with the tracks of the Mobile Light & Railroad Company, to pro-

street-car service to the new Chickaw. Shipbuilding plant. George Gordon Crawford of Birmingham is president.

MOBILE, ALA.—The Mobile & Ohio Railroad Company has awarded contract for the construction of conveyor for grain elevator to Hancock, Harbin & Hancock of Mobile, at \$15,000. The elevator will be equipped with electrically operated machinery and will have a capacity of 250,000 bushels. The elevator machinery will be installed under the direction of the R. C. Fine Engineering Company, Merchants' Exchange Building, St. Louis, Mo.

CORINTH, MISS.—The Supervisors of Corn County have awarded contract to G. Parish, Jackson, Tenn., for the construction of court house, to cost about \$10,000, without mechanical equipment.

CRYSTAL SPRINGS, MISS.—Arrangements have been completed by W. B. Lockwood, representing the town of Crystal Springs, for borrowing \$5,000, authorized by the Legislature for the purpose of installing new equipment in the municipal electric-light plant. The installation of the machinery, it is expected, will soon be completed.

HELENA, ARK.—The capital stock of the Helena Gas & Electric Company has been increased from \$300,000 to \$500,000. The company, it is said, contemplates extensions to its plant and the installation of new equipment.

ROGERS, ARK.—The City Council has adopted a resolution favoring the purchase of the electric plant of the Rogers Light & Power Company to be owned and operated by the municipality.

NEW ORLEANS, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 25 for a 10-ton electric traveling derrick crane, installed on existing runways the storage shed at the naval station at New Orleans. Specifications No. 2839 may be obtained on application to the above bureau or to the commandant of the naval station named.

ADA, OKLA.—The Oklahoma Power & Transmission Company, it is reported, contemplates the erection of transmission lines to furnish electricity to all the towns in the surrounding territory.

WATFON, OKLA.—The City Council is considering the question of selling the municipal electric-lighting plant. Owing to the high price of coal and the present charge for service the plant is not self-supporting.

BRISTOW, OKLA.—At an election to be held on March 12 the proposal to issue \$5,000 in bonds, the proceeds to be used for the purchase and improvement of the municipal electric-light plant, will be submitted to the voters.

COLLINSVILLE, OKLA.—The construction of an electric interurban railway from Collinsville to Nowata, Okla., Coffeyville, Kan., and other points is under consideration. D. H. Siggins of Coffeyville, Kan., is reported interested in the project.

HENRYETTA, OKLA.—The Henryetta Ice & Cold Storage Company is installing an ornamental street-lighting system, consisting of 42 standards. J. E. Meaders is purchasing agent.

HOMINY, OKLA.—The Hominy Ice, Light & Power Company has purchased an additional electric generating unit, consisting of a 150-hp. gas engine "Westinghouse," directly connected to a 100-kv. three-phase, 60-cycle, 2300-volt generator, to be delivered about April 1. G. J. Smallwood is secretary.

MCALISTER, OKLA.—The Missouri, Kansas & Texas Railway Company is planning to install a 300-ton mechanical chute at McAlester. F. Ringer of Dallas is chief engineer.

PRAGUE, OKLA.—The City Council has decided to call an election to submit the proposal to issue \$45,000 in bonds for improvements to the municipal electric-light and water-works system to the voters.

AUSTIN, TEX.—Plans are being prepared for the erection of a new telephone exchange building for the local telephone company.

GRANBURY, TEX.—The Granbury Cotton Oil Company, it is reported, is contemplating the purchase of a new or second-hand 150-hp. crude-oil engine, either direct-connected or belted to generator; also a 10-hp. to 300-hp. crude-oil engine, either belted or direct-connected type.

LOMETA, TEX.—F. C. Whittmire, it is reported, is planning to rebuild the local electric-light plant, recently destroyed by fire, causing a loss of about \$5,000.

McKINNEY, TEX.—The local electric plant of the Texas Light & Power Company was partially destroyed by fire recently, causing a loss of about \$8,000.

Pacific and Mountain States

CHEHALIS, WASH.—The Central Light & Manufacturing Company of Chehalis has filed a petition with the Commissioners of Lewis County asking for a franchise to construct and operate an electric transmission line from Walville at the Lewis-Pacific county line to Meskill, 12 miles west of Chehalis. If the franchise is granted, it is understood that the western Lewis County towns will be supplied with electricity from the transmission lines of the North Coast Power Company operating in this section.

TACOMA, WASH.—At the municipal election to be held April 2 the proposal to issue \$6,500,000 in bonds for the acquisition by condemnation or stipulation of the entire street railway system of the Tacoma Railway & Power Company will be submitted to the voters.

TACOMA, WASH.—A permit has been granted for the installation of underground conduits from the Nisqually substation at Twenty-third and C Streets to Winthrop Avenue. The new circuits (which will be the first underground conduits in Tacoma) will supply energy for the shipyards and the tideflats.

GARDINER, ORE.—Steps have been taken by Warren Reed of Gardiner and James R. Wheeler and Arthur Blanchard of Marshfield to organize a new electric company to be known as the Umpqua Power Company. The new company will take over the property of the Gardiner Light & Power Company and will furnish electrical service in this city and Reedsport, now without service.

FRESNO, CAL.—The Copper Mine substation of the San Joaquin Light & Power Company was recently destroyed by fire, causing a loss of about \$3,000.

REDDING, CAL.—At the annual election to be held April 8 the proposal to issue \$40,000 in bonds to build or acquire a municipal electric-light plant will be submitted to the voters.

BOISE, IDAHO.—The City Council is considering the installation of a new street-lighting system.

BOWIE, ARIZ.—The Southern Pacific Company has appropriated \$20,000 for remodeling its depot in Bowie and is also contemplating the installation of a power plant here.

BILLINGS, MONT.—The City Council has authorized the city clerk to call for bids for installing street lamps in special lighting district No. 3.

GREAT FALLS, MONT.—Work will start immediately by the Anaconda Copper Mining Company on the construction of a plant at the Boston & Montana Works at Great Falls for the electrolytic production of ferro-manganese. Five furnaces will be installed each with a daily capacity of 250 tons. Electric power will be supplied by the Montana Power Company.

DEMING, N. M.—Extensions and improvements involving an expenditure of at least \$300,000 will be made at Camp Cody, Deming. The proposed work will include another electric power plant of 185 hp., new headquarters building for nurses, new headquarters building for officers, operating pavilion, new hospital for treatment of eye, ear, nose and throat affections, new barracks, an inclined railway, another 100,000-gal. tank, etc.

Canada

FORT SASKATCHEWAN, ALTA.—Orders have been placed for equipment for the municipal electric-light plant, including one 125-hp. open-feed water heater, one steam main, consisting of 3-in. pipe, two non-return valves pipe bends and flangers. One boiler-tube rattler, one Lennox drive and one small motor-driven centrifugal vertical pump may possibly be purchased. E. Barnott is general superintendent.

NELSON, B. C.—Preliminary plans are being prepared by the Consolidated Mining & Smelting Company of Trail, B. C., for the construction of a concentrator plant in Nelson.

WOODSTOCK, N. B.—The Woodstock Electric Railway, Light & Power Company is contemplating improvements to its plant this summer, including the installation of a Hercules turbine type D of the Holyoke Manufacturing Company, developing 137½ hp. at 13 ft. head, belt-connected to a Westinghouse generator in synchronism with two other generators. A. Gordon Bailey is secretary and treasurer.

DARTMOUTH, N. S.—Tenders will soon be asked for electrical work for the new plant of the Canadian Carbonate Company, 132 Hollis Street, Halifax.

HALIFAX, N. S.—Tenders are being re-

ceived by Bate, McMahon & Company, Sparks Street, Ottawa, and Halifax Hotel, Halifax, for electrical work for the military huts for the Department of Public Works, Dominion Government.

SHELBURNE, N. S.—Frank J. Carter of Dartmouth, it is reported, is planning to erect and operate a cold-storage warehouse at Shelburne, to cost not less than \$40,000.

HAMILTON, ONT.—The rebuilding of the Central Market and the installation of a new refrigerating system, to cost about \$100,000, is under consideration by the City Council. E. R. Gray is city engineer.

LONDON, ONT.—The Public Utilities Commission is considering the purchase of two electrically-driven pumps, with a capacity of 600 gal. per minute, for the water works system. Philip Pocock is chairman.

LYNDHURST, ONT.—Improvements are contemplated to the local electric-light plant, owned by George E. Roddick, this coming summer, including the installation of 200-hp. waterwheels for the purpose of supplying electricity for lamps and motors to farmers and residents in the vicinity of Lyndhurst. It is also proposed to erect electric transmission lines (4 miles) through Oak Leaf and to connect up Suleys Bay.

SMITH'S FALLS, ONT.—The city of Smith's Falls has taken over the properties of the Citizens' Gas & Electric Company and the Smith's Falls Electric Power Company. Although the two plants are operating separately as yet, the intention is to reconstruct and unify the local distribution systems as speedily as possible and to operate them in parallel with the supply obtained from Merriekville through the transmission line of the Hydro-Electric Power Commission of Ontario. H. F. Shearer is manager.

STOUFFVILLE, ONT.—Plans are being considered to change the municipal electric-light plant from steam power to producer-gas fuel. R. O. Ward is superintendent.

TORONTO, ONT.—A permit has been granted to the Dominion Shipbuilding Company to erect a workshop and general machine plant at the foot of Bathurst Street, to cost about \$175,000.

UXBRIDGE, ONT.—Arrangements are being made by J. W. Gould, owner of the local electric-light plant, for the installation of a 70-kva. Bullock three-phase, 2300-volt generator this spring. Equipment has already been purchased.

WATERLOO, ONT.—The Waterloo Water and Light Commission is contemplating the installation of a regulator. C. W. Schiedle is secretary and manager.

ST. NARCISSE, QUE.—The North Shore Power Company, Power Building, Three Rivers, it is reported, will build a dam, to cost about \$15,000, at St. Narcisse.

SHERBROOKE, QUE.—The city of Sherbrooke is now installing in the Weedon plant (30 miles from Sherbrooke) a 1300-kva. generator and a 2000-kva. three-phase 2400/50,000-volt transformer, and is also building a general distributing station in Sherbrooke to receive power from all generating stations. Charles Desbaillets is manager and engineer.

MOOSE JAW, SASK.—Improvements are contemplated to the municipal electric-light plant this year, including the installation of an ash-handling plant, circulating pump and vacuum pump, steam-flow meters, CO₂ recorders, etc. J. D. Peters is manager.

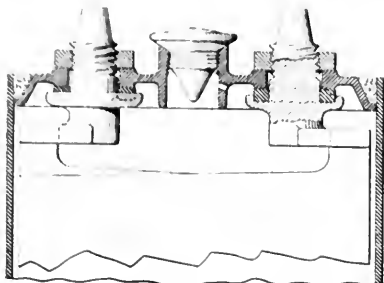
Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 23 for generator sets, switchboards, copper cable, end bells, transformers, connectors, terminals, receptacles, copper rod, busbar supports, pipe fittings and floor flanges. Blanks and information pertaining to this circular (No. 1203) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 27 for steel, iron or steel pipe, steel and copper cable, duplex and ignition cable, bronze copper, phosphor tin, motor-generator sets, transformers, starting compensator, end bells, busbar supports, electrical switches, split-T connectors, cable clips, speaking-tube mouthpieces, etc. Blanks and information relating to this circular (No. 1205) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

(Issued Feb. 5, 1918.)

- 1,255,597. INDUSTRIAL ELECTRICAL CAPACITY BATTERY; George Giles, Friburg, Switzerland. App. filed Oct. 16, 1916. Improvements.
- 1,255,598. SWITCH MACHINE; Gardner B. Gray, Pittsburgh, Pa. App. filed Feb. 5, 1916. Composed of two units.
- 1,255,607. DYNAMO-ELECTRIC MACHINE; William T. Hensley, Connorsville, Ind. App. filed June 8, 1912. Involving the use of sheet metal in the manufacture of generators and motors.
- 1,255,613. ELECTRIC FURNACE-CONTROL APPARATUS; Alvin D. Keene, Schenectady,



1,256,006—Secondary or Storage Battery

- N. Y. App. filed Sept. 5, 1917. Electrodes may be automatically moved into contact with a stationary conductor at the beginning of the furnace operation to strike the arcs.
- 1,255,637. ADJUSTABLE SPARK GAP; Albert E. Reade, Petersburg, Va. App. filed June 8, 1916. Mounted upon the outer end of a spark plug so that the spark plate, being carried upon the insulating strip, may be held in an adjusted position.
- 1,255,639. CHANDELIER CLUSTER HOOK; Alfred W. Keiser, Toledo, Ohio. App. filed July 27, 1917. Will greatly facilitate the installation of fixtures.
- 1,255,646. MAGNETIC AERIAL APPARATUS; Patrick J. Ruddy, Centralia, Pa. App. filed Feb. 24, 1916. Aerial telephone in which magnets are utilized to cause high oscillating currents and reproduce and magnify similar vibrations in the air and earth so that sounds may be received and sent.
- 1,255,651. COUPLER FOR MUSICAL INSTRUMENTS; Melvin L. Severy, Arlington Heights, Mass. App. filed March 31, 1913. Improvements.
- 1,255,667. HIGH-POTENTIAL INSULATOR; Elihu Thomson, Swampscott, Mass. App. filed Jan. 9, 1913. Utilizing the principle of the non-conducting and insulating character of a very high vacuum.
- 1,255,681. COMMUTATOR; Charles C. Zenk, Wilkesburg, Pa. App. filed July 8, 1912. Improvements.
- 1,255,712. ARMATURE-WINDING MACHINE; Newton Crane, Boston, Mass. App. filed June 3, 1914. Improvements.
- 1,255,713. ELECTRIC REGULATOR; John L. Creveling, New York, N. Y. App. filed March 16, 1910. Improvements.
- 1,255,721. SYNCHRONOUS ELECTRIC MOTOR; James K. Elderkin, Jr., Newark, N. J. App. filed Feb. 17, 1916. Improvements.
- 1,255,724. AUTOMOBILE; Roland S. Fend, Chicago, Ill. App. filed May 5, 1915. In which an internal-combustion engine and an electric motor and storage battery co-operate to form the prime mover for the vehicle.
- 1,255,771. ELECTRIC WAFFLE STOVE; Joseva Miller, Pasadena, Cal. App. filed Nov. 8, 1915. Improvements.
- 1,255,774. SWIVEL CONNECTION; Lambert H. Moulthrop, Philadelphia, Pa. App. filed Dec. 8, 1915. May be adjusted either to connect such parts movably so as to permit their relative rotation or to clamp them immovably together.
- 1,255,795. IGNITION TIMER; Ralph V. Sawyer, Sedalia, Mo. App. filed July 5, 1917. For regulating the time of the operation of the sparking plug.
- 1,255,814. ELECTRIC HEATER; Edmund N. Brown, San Francisco, Cal. App. filed Dec. 26, 1917. Improvements.
- 1,255,824. INSULATED TESTING-PLUG TERMINAL; San Francisco, Cal. App. filed Aug. 13, 1917. Adapted to be attached to the conducting cords connected to indicating or testing instruments.
- 1,255,838. DYNAMO-ELECTRIC MACHINERY; Rudolf Knoll, Enner-Baden, Switzerland. App. filed March 20, 1916. Relates to unipolar or homopolar dynamo-electric machines.

Record of Electrical Patents

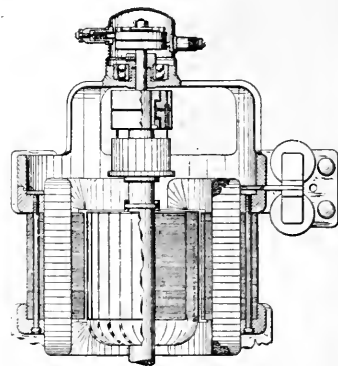
Notes on United States Patents

- 1,255,840. ELECTRIC RADIATOR; Richard G. Ledig, Philadelphia, Pa. App. filed Aug. 7, 1917. Heat waves generated by a resistance coil are directed by means of polished metal reflector.

(Issued Feb. 12, 1918.)

- 1,255,846. CIRCUIT-MAKE-AND-BREAK DEVICE; Walter D. Appel, Cleveland Heights Village, Ohio. App. filed Feb. 11, 1916. In connection with the electric ignition circuits of internal-combustion engines.
- 1,255,853. MEANS FOR LOCATING FAULTS ON ALTERNATING-CURRENT CIRCUITS; Karl H. Bausman, Dayton, Ohio. App. filed Feb. 7, 1917. Exploring coils.
- 1,255,861. DAMPING MATERIALS FOR TELEPHONES; Irving B. Crandall, New York, N. Y. App. filed Aug. 14, 1916. Of vibrating members.
- 1,255,863. OUTLET BOX OR FIXTURE; Lionel W. Compton and Earle N. Oliver, Tampa, Fla. App. filed May 1, 1915. For facilitating the connection and support of electric conductors or for supporting a chandelier or the like.
- 1,255,866. SIGNAL SYSTEM FOR ELEVATORS; Edward L. Dunn, Worcester, Mass. App. filed Nov. 13, 1913. For use in department stores.
- 1,255,874. MOTOR-CONTROL SYSTEM; Maurice M. Goldenstein, Milwaukee, Wis. App. filed Feb. 26, 1917. Relates to multi-unit printing presses and similar mechanisms.
- 1,255,887. ELECTRIC SWITCH; Charles J. Klein, Milwaukee, Wis. App. filed June 3, 1911. Multi-circuit.
- 1,255,895. ELECTRIC VIBRATOR MASSAGE MACHINE; William J. A. Kuehl, Chicago, Ill. App. filed March 2, 1917. Improvements.
- 1,255,905. ELECTRIC CLOCK; Edwin H. Messter, Brooklyn, N. Y. App. filed Dec. 5, 1914. Avoids the use of weights, springs and complicated gearing and operates with very small friction losses and wear.
- 1,255,943. ELECTRICAL CONNECTOR; Parke T. Snyder, Chicago, Ill. App. filed Aug. 14, 1916. Socket for receiving either a single or double contact Edison-Swan plug or lamp base.
- 1,255,947. TRANSFORMER AND LIKE COILS; Chester H. Thordarson, Chicago, Ill. App. filed Dec. 8, 1913. Provides means for maintaining the elements of the coil structure in proper position with relation to each other and to the insulation interposed between the elements.
- 1,255,948. COIL STRUCTURE FOR TRANSFORMERS AND THE LIKE; Chester H. Thordarson, Chicago, Ill. App. filed July 10, 1915. Novel winding-coil structure of the pancake or disk type.
- 1,255,959. SIGNAL; Frank T. Vanatta, Mill Valley, Cal. App. filed March 15, 1916. For use at grade crossings of railways.
- 1,255,964. TELEPHONE-EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed May 20, 1914. Applied particularly to such apparatus in connection with instruction circuits of telephone-exchange systems.
- 1,255,968. TIME CONTROLLING AND RECORDING MECHANISM; Walter Williamson, Everett, Mass. App. filed April 2, 1915. Particularly for use with a steam-whistle valve.
- 1,255,998. WINDMILL GENERATOR SET; Fred J. Fahle, Luckey, Ohio. App. filed July 22, 1915. The wheel of the mill moves at substantially a constant speed when the circuit of the generator is completed.
- 1,256,003. SANITARY ATTACHMENT FOR TELEPHONE TRANSMITTERS; Maries S. Federman, New York, N. Y. App. filed Feb. 19, 1917. Pad treated with an antiseptic solution.
- 1,256,006. SECONDARY OR STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed Dec. 22, 1916. Retaining the gasket employed to seal the terminal post to cell cover.
- 1,256,043. RENEWABLE CARTRIDGE FUSE; Emerich Sabina and Lester I. Cope, Sharpsburg, Pa. App. filed Oct. 29, 1915. Can be renewed without the use of tools.
- 1,256,063. ALTERNATING-CURRENT RECTIFIER; Howard A. Selah, Newark, N. J. App. filed March 29, 1915. Improvements.

- 1,256,066. FUSIBLE SERVICE PROTECTOR; Christopher H. Shoebridge, New York, N. Y. App. filed Dec. 15, 1915. Improvements.
- 1,256,067. ELECTROLYTIC APPARATUS; Harry T. Shriver, West Orange, N. J. App. filed Jan. 20, 1916. Improvements.
- 1,256,087. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr., and Edgar I. Clark, New York, N. Y. App. filed March 21, 1917. Improved organization for automatically controlling the distribution of calls in a telephone-call distribution system.
- 1,256,098. SIGNALING DEVICE; Berthold A. Baer, Philadelphia, Pa. App. filed Apr. 6, 1915. For use with moving vehicle.
- 1,256,123. TELEPHONE APPARATUS; George I. Galitzka, New York, N. Y. App. filed March 14, 1917. Adapted to notify and warn the subscriber that the local switchboard operator's set is connected in the line and the local operator is therefore able to listen in.
- 1,256,125. MASTER CONTROL AND LOCK FOR ELECTRIC CIRCUITS IN AUTOMOBILES; Leon Goldmerstein, New York, N. Y. App. filed Dec. 4, 1915. Improvements.
- 1,256,126. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodman, New York, N. Y. App. filed May 25, 1916. Means for segregating a desired class of calls.
- 1,256,134. AUTOMATIC SIGNALING DEVICE; Thomas D. Joeck, Asbury Park, N. J. App. filed Nov. 7, 1916. For automobile or other vehicle.
- 1,256,170. ELECTRICITY METERING; Edmund O. Schweitzer, Chicago, Ill. App. filed Dec. 31, 1915. Improved means for accurately metering the consumption of electricity, and more particularly means for affording a satisfactory basis for payment to the central-station company by the consumer for electrical energy furnished to and consumed by him.
- 1,256,195. ELECTRIC SWITCH; Winfield A. Atwood, Schenectady, N. Y. App. filed March 13, 1917. Magnetic blow-out type.
- 1,256,207. ELECTRICAL SYSTEM OF DISTRIBUTION; Gorham Crosby, Glen Ridge, N. J. App. filed Feb. 25, 1916. Adapted to a storage battery, and automatic means are provided for regulating the voltage to the generator.
- 1,256,210. ELECTRIC SWITCH; William W. Dean, Chicago, Ill. App. filed June 7, 1913. Improvements.
- 1,256,212. DYNAMO-ELECTRIC MACHINE; John V. Dobson, Wilkesburg, Pa. App. filed July 22, 1915. Railway.
- 1,256,223. ELECTRICAL SYSTEM; Hugo Grob, Zurich, Switzerland. App. filed Jan. 30, 1911. Electric lighting of railway trains or other vehicles.
- 1,256,228. APPARATUS FOR CHARGING STORAGE BATTERIES; William T. Hensley, Bound Brook, N. J. App. filed Nov. 9, 1914. Improvements.
- 1,256,234. MECHANISM FOR INTEGRATING POWER-CURRENT VALUES; Frank B. Innes,



1,256,063—Alternating-Current Rectifier

- Detroit, Mich. Volt-ampere-hour units may be registered directly and accurately without the necessity of taking cognizance of the angular separation of pressure and current.
- 1,256,258. POLARITY INDICATOR; Emil R. Richter, Chicago, Ill. App. filed Jan. 23, 1917. For battery circuits.
- 1,256,262. ELECTRIC SIGNAL DEVICE; John Roeder, Chicago, Ill. App. filed Nov. 6, 1914. Visual signal in the form of an electric lamp.
- 1,256,270. QUENCH-SPARK GAP; George Seibt, Schöneberg, Berlin, Germany. App. filed Dec. 1, 1911. Employed in connection with the oscillating systems of wireless-telegraph apparatus.

Electrical World

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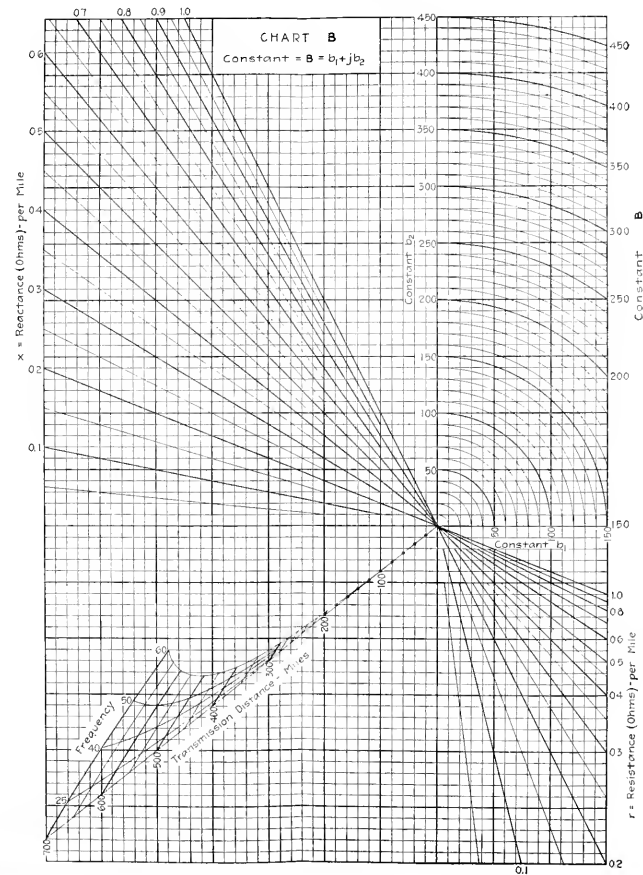
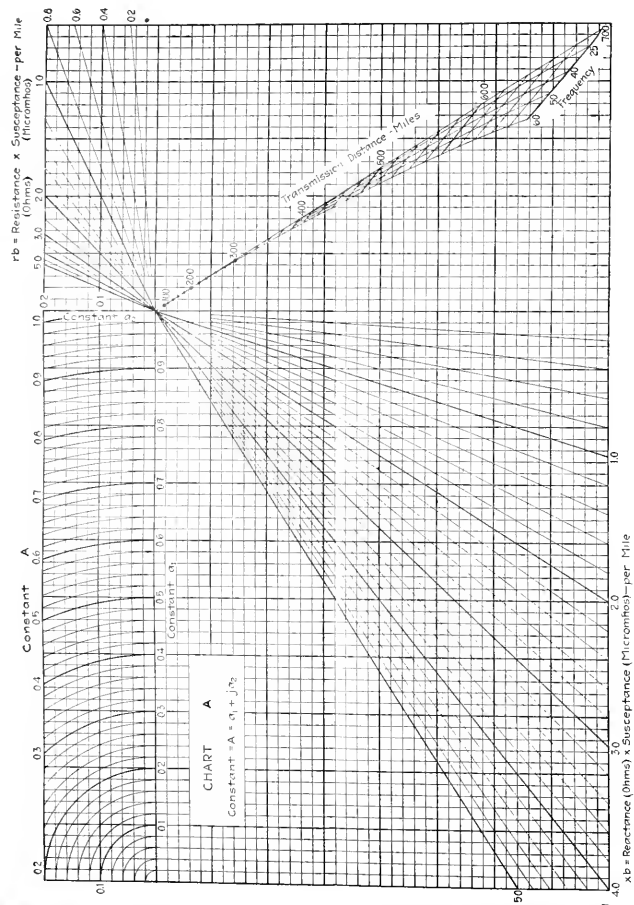
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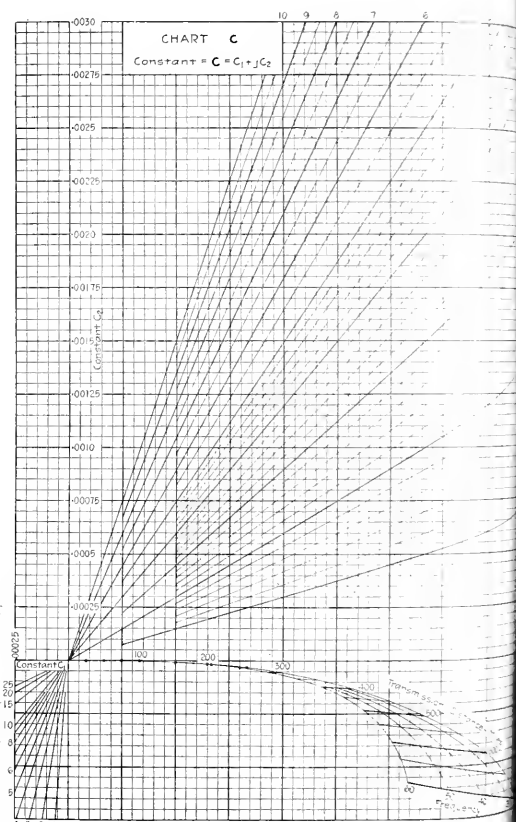
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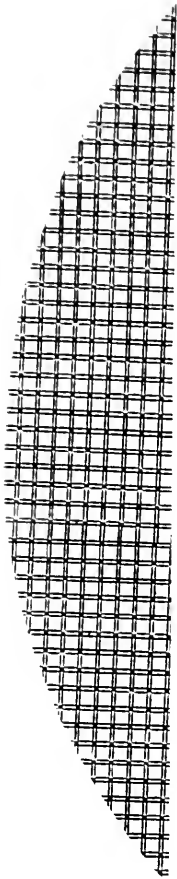
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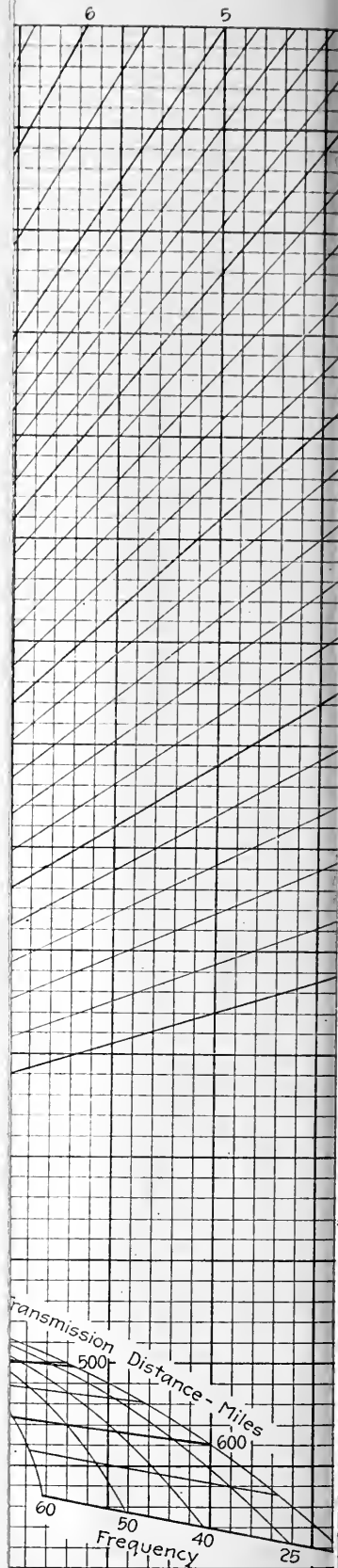
$rb = \text{Resistance (Ohms)} \times \text{Susceptance (Micromhos)} \text{ per Mile}$





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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Number 11

The Coal Pile Will Bear Continued Watching

SHORTAGE of bituminous coal stares the electrical industry in the face again this year unless the authorities in Washington find a way to increase production. Early in the present year the indicated output of coal for 1918 was 36,000,000 tons less than it was last year and 72,000,000 tons less than it was the year before. The cause assigned for this tremendous falling off in production is car shortage. In handling coal at the mines the procedure has always been to load the output directly from the mines to the cars. If cars are not available, the mines shut down and production ceases. To store coal at the tipples would mean re-handling of the fuel as well as added expense, and besides there is no storehouse comparable to the seams where the coal is found in the earth. It is therefore apparent that, if a shortage is to be avoided, the mines must be kept in operation and every effort made to increase the output. The country needs and must have coal. It is no longer interested in the skill by which the blame is shifted from the coal operator to the railroads and from the railroads to the weather. There is ample time between now and next winter for the Fuel Administration and the railroad director to co-ordinate their work, if they will, so that there shall be no recurrence of the coal famine of 1917. Public utility companies meanwhile should heed the warning which the present situation foreshadows and make every effort to get and to store coal.

Higher Salaries Needed by Engineering Profession

IN THESE days of increasing costs the engineering profession finds itself between the devil and the deep sea. Most engineers are under salary, and we have not discovered any acute symptoms of rising remuneration in this particular line of activity. The comparatively small number of engineers in independent practice can, of course, protect themselves by raising their fees on their own initiative; but they are too few to change the general situation with respect, let us say, to the average members of an engineering society. The long and short of the matter is that the salaried man, whether in a technical position or doing purely commercial work, finds himself "up against it." Perhaps, as Mr. Schwab intimates, the end of the war will find the country in the hands of the workmen. However this may be, the class of workmen who use instruments rather than ordinary tools seem likely to be left out of the reckoning. Undeniably the present situation is ex-

tremely hard on a large proportion of the engineering profession, and the general principles of fair play would seem to indicate that engineers should have a share in the upward movement of compensation demanded by carpenter, machinist, steamfitter and ditch digger. The engineering profession is not unionized, nor even well organized on an individualistic basis, as is the medical profession, in which there has been a very general increase of fees. Neither does it possess, through numbers and system, a powerful influence in the matter of votes. Nevertheless, the gospel of the square deal certainly calls for better compensation than at present rules. To meet the serious demands upon them engineers need larger financial recognition.

Make Your Plans for Third Liberty Loan Now

APRIL 6 is the date set for the campaign to place the third Liberty loan. Manufacturers, central stations and other employers of labor have a special opportunity to enlist their organizations in this army of investors for national service. The general purposes of the loan and the opportunity it offers for every stay-at-home to do his part in the establishment of new ideals for the world will be found in posters, magazines and newspapers. What is most needed, and this is what the practical business men of the industry can supply, is that every business organization form itself now into a branch collection agency for the government. The campaign will be short. Organization within each plant should be perfected now so that bonds can be sold to every one in the organization, from the company and its officials through to the least important member. In subsequent issues the ELECTRICAL WORLD will publish plans and methods successfully adopted by electrical companies. Later in March a special colored poster will be distributed with the paper in addition to an advertising insert contributed by the publisher and by the electrical manufacturers and devised in such a way that the posters that compose it may be placed on office and factory bulletins the country over. That the contributions of the industry may be recorded as completely as possible, the ELECTRICAL WORLD will be glad to receive at once accounts of plans that individual readers already have under way.

Graphical Determination of Line Constants

IN THE case of a simple alternating-current circuit containing in series a condenser and a resistive inductance the alternating current in the circuit may be taken as the same at any instant in all parts. That is, the amperes in the condenser are the same as the amperes in the inductance. The strength of the current is obtainable by Ohm's law, using impedance expressed in complex quantities. When, however, an alternating-current circuit comprises a line or lines possessing distributed resistance, inductance, capacitance and leakage, the current strength is not the same at the same instant in all parts of the circuit. In particular instances the current may be strong and flowing toward the generator at one point on the line, while at the same instant it may be very weak and flowing away from the generator at some other point in the line. In a long line, worked at a fairly high frequency, both the voltage and current may pass through a number of successive maxima and minima, and also through several reversals of direction, as we consider different parts of the line at one and the same instant. It is evident that Ohm's law ceases to be applicable to such a circuit in the ordinary sense. A new law, however, comes into application. In the steady state of alternating-current flow each and every point on the line possesses a certain complex hyperbolic position angle, which increases steadily and continuously with distance toward the generator end of the line, so long as the electrical constants of the line remain uniform, but which undergoes a simple sudden change when a transition occurs from one type of line to another, such as in changing from underground cable to overhead aerial line. The alternating-current strength at any point on the line is then directly proportional to the cosine of the position angle, and the alternating voltage to the sine of the position angle. Knowing the current and voltage at any one point in the circuit, such as the generator end, the current and voltage at any and all other points are immediately determinable by simple proportion, with the aid of existing tables or charts of hyperbolic sines and cosines. The impedance and the power are likewise simple hyperbolic functions of the position angle.

In his article this week T. A. Wilkinson describes an alternative method of deriving the voltage and current at the terminals of a transmission line, based on fundamental hyperbolic functions, but evaluated through the specially prepared charts which accompany the article. By using the vector formulas given at the beginning of the article, the six quantities a_1 , a_2 , b_1 , b_2 , c_1 and c_2 , appearing therein are easily obtainable from the charts, so that the solution follows without difficulty. Since these charts have been carefully drawn, they will be of permanent value, as affording one method of solving any such transmission-line problem.

In the particular arithmetical case presented in the article the length of line is taken as 250 miles (402 km.). This would be a long power transmission line, and yet the effect of taking the distributed capacitance into account by correct methods such as that offered is only a few per cent as compared with the result obtainable with the split-condenser method, in which half the capacitance of the line is assigned to a condenser applied at each end. At frequencies up to 60

cycles per second the effect of distributed capacitance is relatively unimportant on split-condenser computations up to transmission distances such as this. When, however, higher harmonic frequencies are considered, or in telephonic transmission problems, hyperbolic-function methods become absolutely indispensable to the engineer.

Good Practice in Cooling Transformers

IT WAS not so very many years ago that electrical apparatus was designed to run cool merely in virtue of abnormally low energy losses obtained at absurdly high costs of material. It took a long time to inculcate the lesson that the economics of the situation involved far more than I^2R losses. So, gradually, scientific cooling has rid us of more and more heat, and this gain is taken in the form of increased output for a standard rise of temperature rather than fruitlessly as low temperature at standard output.

We have seen no neater demonstration of practical conditions than in Claude H. Shepherd's description of the forced cooling of transformers in a Chicago substation, published in this issue. The starting point was an ordinary three-phase reducing transformer which, owing to heavy load in an abominably hot transformer room, increased in temperature enough to imperil the insulation. Oil at 75 deg. C. and a room at 60 deg. C. form a bad combination. Now, there are in more or less common use three types of transformers, air-cooled, self-cooled oil-filled and water-cooled oil-filled, of which the first is becoming rare, the second is extremely common, and the last, generally provided with cooling coils in the case, is not infrequent in heavy substation work. Mr. Shepherd's feat was to convert the second into the third type by tapping the case and pumping the oil through a cooling system, a simple enough thing to do, but rather better in its results than would at first be supposed.

The so-called self-cooled transformer is quite unexceptionable in small sizes or in the open air where the large cooling surface of the case can be well utilized. But in a superheated transformer room with the usual poor ventilation there is quite another story to tell. The net result in this instance of circulating the oil was to increase the practicable output by 60 per cent and to effect an actual saving in operation big enough to show about 37 per cent on the added investment. Obviously any fairly big transformer can be treated in this manner, the chief matter requiring attention being the arrangement of the intake in such wise as to keep all the hot oil moving. As Mr. Shepherd suggests, a copper cooling coil would be desirable as giving better results with less work in pumping and perhaps with increased output. At all events, the gain in practicable rating proved to be so great as to leave a large reserve capacity in other transformers likewise treated.

In these days of high costs and slow deliveries anything which can avert additions to the plant is worth while, particularly when simple and economical. In ordinary substation working there is no particular trouble in operating an oil-cooling system, and in out-of-doors substations there is generally little need of it. Cooling the oil by circulation through external coils is likely to be decidedly more efficient than the reverse

process of pumping cooling water through coils in the case, since in the first instance a large cooling surface is the more easily provided and the real condition of the oil is easier to ascertain.

Lessons from Steam-Turbine Accidents

ONE of the most serious accidents in the history of steam-turbine development so far as material damage is concerned occurred about a month ago in a generating station of the Boston Elevated Railways. It involved the wrecking of a 35,000-kw. machine with very large damage but fortunately no loss of life. Some of the circumstances of the occurrence are worth noting, as they throw a great amount of light on necessary lines of improvement in building turbo-generators of colossal output. In many lines of machine design mere size does not have to be very seriously considered as a factor in the problem. In case, however, of steam turbines and other fast-running mechanisms in which the factors of safety have to be very carefully considered the influence of dimensions sometimes turns up in unpleasant and unexpected ways. Trouble in the Boston turbine occurred at the low-pressure end in which cast-iron diaphragms were used. As nearly as can be learned from the data at hand, the eighteenth diaphragm buckled, fouling the blades on the corresponding runner and tearing them off. Immediately the next diaphragm gave way, involving the nineteenth wheel, and then the last diaphragm and wheel were affected, ending by tearing open the casing from the immense centrifugal force of the flying pieces.

The circumstances which led up to the accident give important hints as to causes and remedies. Exactly a year prior to the present accident the eighteenth diaphragm deflected in the trial runs, fouled the buckets of its runner and stripped them, likewise damaging the succeeding diaphragm and runner. The throttle was tripped when the buckets began to rub, but the mischief was already under way and promptly followed. Repairs were executed, and the machine did its duty up to the present catastrophe. In this instance the immediate cause of the trouble appears to have been a blow-out in another station which dropped its load of 10,000 kw. and threw it practically in its entirety on the fated turbine. This automatically opened its secondary valve and suddenly and greatly increased the steam pressure in the low-pressure stages, probably thereby causing the distortion of the eighteenth diaphragm which began the trouble. The first sign was rubbing and vibration. An at-

tempt was made to adjust the thrust bearing, but things began to happen inside the casing, the operators wisely took to cover, and in a very brief period the damage was done. How much power was actually thrown on the machine already carrying 32,000 kw. is uncertain, but whatever the load it came on like a battering ram.

The exact details and consequences of the smash-up may perhaps never be known, but some of the morals suggest themselves immediately. First, it seems reasonable that caution should be taken, as in any machine already subject to high strains, to avoid the shock of a sudden impulse. Less speed in the operation of the secondary valve would have dropped the frequency a little and perhaps would have averted the shock that wrecked the turbine. Attempts to force a heavy overload on a machine already close to its rating have to be made with great caution. A sudden short circuit is liable to occur on any system and it is better to yield in load than to run the risk of damage. Further, it looks very much as though cast iron cannot always be considered a suitable material for diaphragms in a machine of these dimensions. In principle it is amply strong—in fact, careful calculations in the case of this particular turbine showed as much—but it is at best a somewhat treacherous material, as many accidents have shown, particularly when subject to sudden and violent strains. A peripheral speed approaching 1000 ft. (328 m.) a second causes even the least rubbing to be serious and to add dangerously to the other strains on the system. Fortunately the throttle was tripped in the course of the proceedings, either semi-automatically by one of the retreating crew or by the vibration itself; otherwise more serious results might have occurred. It would not be impossible to provide for the automatic tripping of the throttle in case of a sudden increase in the differential pressure between the stages, but whether this precaution is desirable is a matter to be left to the turbine designer. Such accidents as this serve notice on the manufacturer and user that in the gradual development of very large sizes critical situations develop, as part of the necessary growth of the art, which eventually may call for material changes in practice.

Certain it is that in this case a serious accident occurred not because of physical faults in the material or incorrect general principles of design, but rather owing to the imposition of sudden strain under conditions which might conceivably have been better controlled and which developed a weakness not ordinarily to be expected in the operation of generating stations with the equipment of the one in question.

IN THE course of investigations to develop a method of increasing the carrying capacity of underground cables a Middle West company has studied the effect of filling the space between cables and their inclosing ducts with crude vaseline. Some very promising results have been obtained which will be presented in a coming issue of the ELECTRICAL WORLD. Since numerous improvements have been made in synchronous motors which make them suitable for many services to which they formerly were unadapted, an article in an

The Coming Issues

early issue will point out just what modern synchronous motors can and cannot do, giving some examples of actual installations. Among other subjects which will be discussed in the future will be important changes that have been made in factory-lighting legislation and the best methods of measuring the internal temperatures in generators. In next week's issue the presentation of the views of L. K. Comstock, advocating the payment of wages in the electrical contracting industry in accordance with index numbers indicating the cost of living, will be concluded.

Raising Wages with Cost of Living

A Plan for Paying Workers in the Electrical Contracting Industry on the Basis of Living Cost as That Cost Is Indicated by Index Numbers of Responsible Commercial Organizations

BY L. K. COMSTOCK

Mr. Comstock is in close contact with the practical problem of labor and is giving it thoughtful consideration so that wages may be made commensurate with living cost. He presented his advanced views recently before the Conference Club, an organization of the larger "interstate" electrical contracting organizations. They will be published in two articles in the *ELECTRICAL WORLD*. This one discusses generally the principles involved. The second one, to appear next week, will show the application.

NO PROBLEMS confront us oftener than those arising from the relation of employer and employee. In fact, this relationship is probably the most important one that engages the attention of the business and industrial world, and transcends in importance the problems now being solved on the battlefields of Europe, although perhaps inextricably mingled with those problems.

We as citizens of the United States, whether we belong to the ranks of labor or the employers of labor, have been derelict in our duty, because we have negligently or deliberately refused to look intelligently into this problem, to seek out the facts of human nature involved, and to be guided by what could have been found. The prejudices and traditions of the past still linger to make the employer look upon labor, not in the spirit of co-operation, but in the spirit of the master toward the servant.

On the other hand, centuries of tradition and prejudice have made the laboring man, the mechanic, look upon his employer as a man to be feared and hated. He has had perhaps a just cause for his servile attitude. But in these modern days of democracy and unions he has felt his strength and has endeavored to obtain by force what he thought he wanted and could get, because he knew no other way. There have been many exceptions, of course, to the general rule, and many employers for generations have had the best of relations with their employees.

OPPORTUNISM VERSUS LOGIC

I think it may be stated without fear of contradiction that these problems taken in the mass have drifted toward temporary or opportunist solution rather than yielded to the power of reason and logic. Most labor disputes in the past have been tinged with anger on one side or the other and generally on both sides, or they have been regarded as sporting events in which the contestants have played for the stakes for sheer love of the game. A labor dispute hardly rises to the dignity of the term unless accompanied by a strike or a lockout; in either of these cases both sides lose, a circumstance readily producing anger, and therefore usually an unjust settlement, divesting the game of its sporting character.

In discussing "war and human progress" Viscount Bryce points out the distinction between two schools of philosophical thinkers or historians. One of these schools emphasizes "the power of reason and of those

higher and gentler altruistic emotions which the development of reason as the guide of life tends to evoke and foster" and finds in these tendencies "the chief sources of human progress in the past and expects from them its further progress in the future." This school regards men "as capable of a continual advance through the increasing influence of reason and sympathy," and dwells upon "the idea of justice and right as the chief factors in the amelioration of society."

THE ARGUMENT BASED ON HUMAN SELFISHNESS

The other school, less optimistic, insists "on the power of selfishness and of passion, holding these to be elements in human action which can never be greatly refined or restrained, either by reason or by sympathy, that social order can be secured only by force—right itself can only be created by force," and that "it is past force that has made what men call right and law and government."

The tendency of this second school is "associated with the less rational element in man—with passion and the self-regarding impulses which naturally attain their ends by physical violence."

The conflict between these two philosophies which Bryce finds is the fundamental provocative of the great world war thoughtful persons find also is the fundamental provocative of industrial conflict.

Boiled down, these two schools of thought can be described as the forward-looking and the reactionary schools. The former builds on faith and the latter constructs its edifice out of the old materials of the past.

After incalculable losses to both employer and employee through many years by reason of strikes and lockouts, it would seem that the time had arrived for these two parties to apply to their differences some degree of intelligence, common sense and sympathy. The union mechanic cannot get along without his employer, nor can his employer get along without his mechanics. This being so, why is it not the part of common sense to admit it frankly and work peaceably in team harness? Let the employer study sympathetically the needs and requirements of his men and likewise let the union see to it that the men work faithfully and sympathetically for their employers.

One of the principal indications of an impending shift in the front of the labor movement in this country is found in the fact that many of labor's foremost spokesmen admit that in increased production lies one of the most hopeful routes to a higher social and economic status for those who work with their hands. In several recent reports—largely influenced by the American Federation of Labor—where this question of the effect of increased production was distinctly raised, labor's representatives refused to oppose increased production as such. This is a far step from the "soldiering" recently openly advocated and practiced.

It may be argued that trade union activity in the

ection of curtailing output, restrictions on apprenticeship and its successful demands for shorter hours made a real contribution toward increased cost of living. This argument is generally believed by certain classes of employers. Let us examine the available data on this subject. The federal bulletin on wholesale prices in 1913 cites twelve important food, fuel and

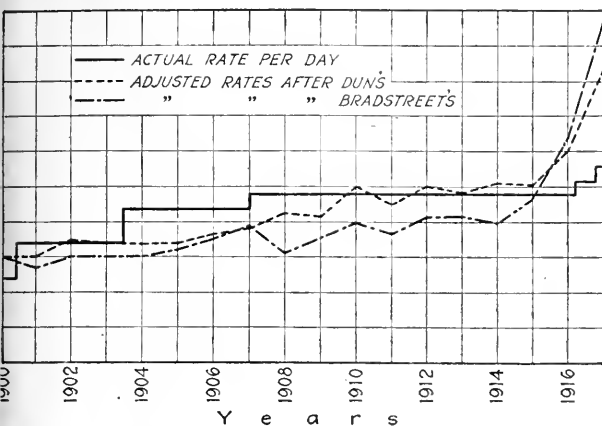


FIG. 1—RELATION OF ACTUAL RATE OF DAILY PAY TO RATES BASED ON RISING COST OF LIVING

other articles which on the average showed a price rise for the year 1913 more than 60 per cent higher than their price range for the period from 1890 to 1899. The whole 252 articles listed in the bureau's bulletin showed a price rise for the same period of only 35 per cent. It should be stated that eleven of the twelve articles above mentioned were produced by farmers, fishermen, timber men and oil workers. These groups of workers are not organized into unions and yet the commodities they produced show a price rise 70 per cent greater than that of average goods. Apparently organized labor exactions do not account for this great rise in eleven staples.

The great trouble seems to lie in the fact that collective bargaining is conceived in terms of unionism, closed shop and walking delegates, and there does not seem to be a comprehension of the fact that a compromise exists which will safeguard the rights of the employer and worker without injustice to either.

THE OLD METHOD OF BARGAINING NOT THE ONLY ONE
Union leaders have expended their energies in the past, ostensibly at least, to gain higher wages and better working conditions. Employers have with the greatest reluctance yielded in these two sets of demands when their intelligence should have dictated an early and willing acquiescence. By this statement I do not mean to imply a servile acceptance on the part of the employer of any demand, but I do wish to convey the idea that if the employer had earlier recognized the right of employees to unionize, had earlier perceived that the time had come or was at hand when public opinion would support the union demand for a larger and a fairer share in the fruits of his labor, then union labor would have naturally cultivated a more sympathetic attitude toward employers and the dishonest labor leaders would have been robbed of their opportunities for grafting. We talk of open shop and closed shop as though we are entitled to choose under which emblem we desire to conduct our operations. In a limited sense we have this right, but it is well to bear in mind that the right

of employees to strike for any cause or for no cause is sustained by the common law everywhere in the United States, and that agreements among strikers to take peaceable means to induce others to remain away from the works of an employer until he yields to the demands of the strikers are not held to be conspiracies under the common law, and the carrying out of such a purpose by peaceable persuasion and without violence, intimidation or threats is not unlawful. Many of the labor disputes which have reached the courts have been decided according to the common law, but twenty-three states and the federal government have laws or constitutional provisions for arbitration and conciliation, although the federal statute applies only to common carriers engaged in interstate commerce.

Much of our trouble with labor has arisen from that ever-recurring attempt to adjust the wage question. I think it within the limits of truth to say that this question is rarely if ever settled equitably. It is settled usually only after a strike and protracted negotiations, and then without any particular reference to the equities of the case. The side on which the ablest or most stubborn negotiators sit wins out. Such settlements are innocent of scientific considerations of adjustment, and the hidden designs of the negotiators cannot stand the test of daylight.

It can well be admitted that labor is constantly demanding higher wages; the employer as constantly resists; one or the other must give way or a deadlock ensues, and bitterness, perhaps violence, results, with loss to all concerned. A just and scientific consideration of the facts should point the way to any readjustment of wages. Is it not worth while and certainly expedient to inquire, when wage readjustment is demanded, whether or not the facts support such a readjustment?

Wage earners must receive something more than the cost of their support, because if this were not so it would be impossible for them to bring up families and the race of such workmen would not outlast a generation. It would appear, then, that the employer, from purely selfish motives, must take intelligent cognizance

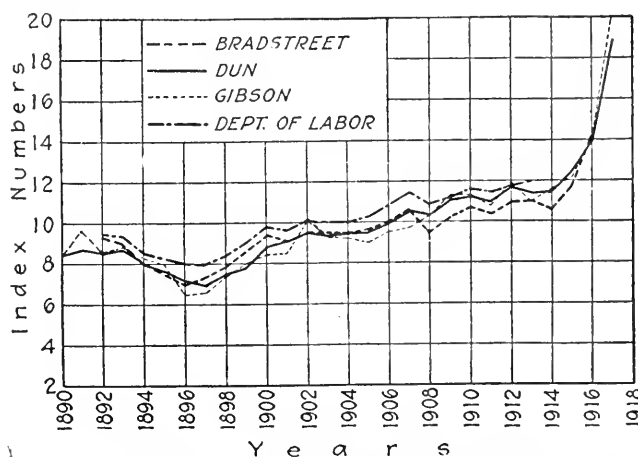


FIG. 2—INCREASES IN COST OF PRINCIPAL COMMODITIES FROM 1890 TO 1918
FIGURES COMPILED BY VARIOUS AUTHORITIES

of the relation between cost of living and rate of wages. As the cost of living rises the rate of wages must advance with equal increments, in order to maintain the relative position in the economic world of the wage earner. No one will deny the correctness of this theory—it remains, then, to find a practical method of its application.

Watch Your Radiation Losses to Help Save Coal

Heat Losses from Uninsulated Surfaces Great Enough to Demand Attention—
Principal Characteristics Needed in Heat Insulation—Thickness
Required and Other Practical Considerations

BY AUSTEN BOLAM

WHILE "bright lights" have been dispensed with, workless days tried, so-called unnecessary industries limited in their use of power or fuel, and such equipment as feed-water heaters, economizers, scale removers, soot blowers, CO₂ recorders, water and steam meters used more extensively than ever to conserve fuel and utilize it more efficiently, heat insulation and heat loss through radiation have not received the attention they deserve. Loss of heat from uncovered or poorly covered steam piping or equipment is more important than it seems on first thought, because the boiler and furnace efficiency must be taken into account. In other words, if condensation occurs it means that the equivalent loss is equal to the superheat plus the latent heat divided by the efficiency. If the condensate is not drained back into the boiler, the heat required to raise the water to the boiling point is also lost. If the efficiency of steam generation is low, say 50 per cent,

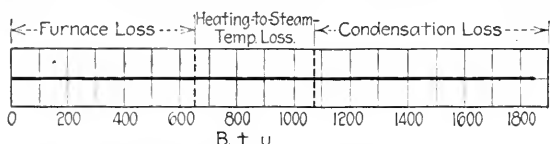


FIG. 1—COMPONENTS OF TOTAL LOSS RESULTING FROM UNCOVERED PIPES THROUGH CONDENSATION OF 1 LB. OF STEAM AT 150 LB. PRESSURE

it means that the actual loss is really twice the apparent loss.

Many steam plants have their main steam lines covered with insulation of some kind, but it is a very common practice to omit the coverings on valves, flanges, drips, feed pipes and other minor fittings, often because of a fancied difficulty in providing easily removable coverings. They are also great heat wasters, however. The amount of heat, for instance, wasted by one pair of uncovered 10-in. (25.4-cm.) flanges will probably amount to a ton of coal a year. Removable covers are easily made with a little fine chicken wire and some canvas, burlap or muslin, covered with plastic insulating material. They can be made in halves or sections and held in place by wire wrapping. Boiler tops, ends, drums, breechings and walls all need proper insulation. In the latter instance it will protect against air infiltration as well as from heat loss. A thickness of from 2 in. to 3 in. (5.1 cm. to 7.6 cm.) of covering is the least that should be used.

Writing¹ several years ago, Professor MacMillan said: "The saving due to the use of proper covering is so great that . . . the cost per year rather than the first cost should be the only consideration." In another place he said: "It is a deplorable fact that few steam lines at the present time are provided with thick enough coverings for the greatest net saving." Conditions have not changed appreciably since then, as lack of knowledge regarding the insulating values of different substances

and the extensive amount of guessing at the thickness of covering required indicate. Coal consumption is responsible for from 55 per cent to 75 per cent of the total operating expense of the average power plant or central

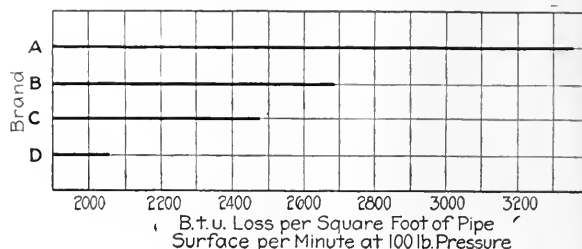


FIG. 2—RELATIVE EFFICIENCIES OF FOUR BRANDS OF PIPE COVERING

station. Therefore economizing in any portion of this enormous consumption is well worth the effort.

FALLACY OF RULE-OF-THUMB METHODS

In some cases engineers have decided on the thickness of pipe covering to use by feeling the covering after one thickness has been applied. If too hot, another layer is applied, and so on. Rule-of-thumb methods like this should be abandoned, since no two hands sense temperature alike and the hand can bear a temperature of 150 deg. Fahr. (65.60 C.) without discomfort. To illustrate the loss which can occur if only the touch test is applied for determining insulation efficiency suppose the steam pressure is 100 lb. (7 kg.). The temperature of the steam, without superheat, would be 327 deg. Fahr. (163.9 C.), so that with a temperature of 150 deg. (see above) at the outside surface of the covering the loss would be 40 per cent of the initial heat in the steam, most of it preventable by a covering of sufficient thickness.

Unfortunately there is extensive misinformation re-

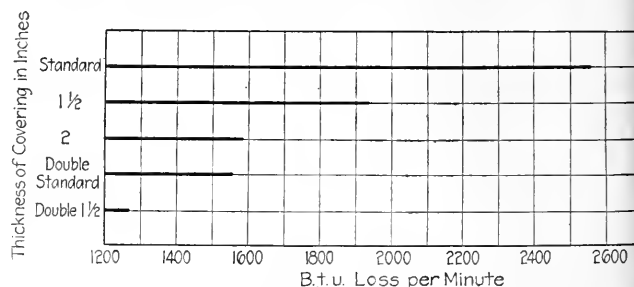


FIG. 3—RELATIVE LOSSES WITH DIFFERENT THICKNESSES OF COVERING

Temperature difference between air and steam, 300 deg. Fahr.; size of pipe, 3 in. Data from Armstrong Cork & Insulation Company.

garding the heat-insulating values of different materials, as a number of engineers seem to think that asbestos is a heat insulator, whereas it is a very poor material for this purpose except as a binder. There are many so-called pipe coverings on the market that are

¹Proceedings A. S. M. E., December, 1915.

worthless for anything more than the temperature used for ordinary house-heating, but they are being used in many large installations because they seem inexpensive and after they are on the pipes they look well. That there are no established standards of insulation practice is due largely to the fact that the coverings are commonly bought on a price-per-foot basis instead of on a cost-per-year basis. Competition between different makers is severe, and the temptation to unscrupulous competitors to cut prices at the expense of quality is obvious.

DURABILITY AND EFFICIENCY ESSENTIAL

On the other hand, the highest-priced insulation is by no means necessarily the most efficient. Without some knowledge of the theory of heat insulation comparison of different grades of material is impossible. The value of a heat-insulating material depends entirely on two co-essentials—efficiency and durability. Price is a minor consideration. If a covering will save its own cost in the first few years and will continue doing this as long as the plant lasts, it is a good investment. If

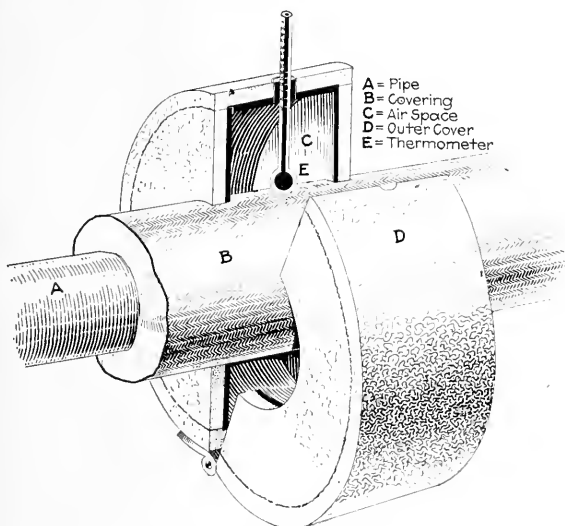


FIG. 4—SIMPLE OUTFIT FOR TESTING HEAT LOSSES FROM PIPES
Removable ends are provided to fit different-size pipes. The ends and periphery are covered with 85 per cent magnesia to prevent escape of heat. From the thermometer readings obtained the heat loss can be calculated.

it falls below this standard, it is dear at any price. There are some materials that will show great efficiency for a short period, but begin to deteriorate rapidly.

No pipe covering is 100 per cent efficient, but there are some that show an efficiency of from 80 to 90 per cent, the actual figures varying according to the thickness, etc. It is quite possible to reach and maintain the larger figure by proper selection and application. In order to set up a standard of comparison, what is perhaps the best-known and most universally used insulating material will be considered—85 per cent magnesia—because it complies almost entirely with all the requirements of a perfect heat resistant both in structure and in efficiency. This material consists of an almost pure crystalline carbonate of magnesia combined with a proportion of mineral fiber (asbestos) to give it the needful structural strength. Its structure is minutely porous, the crystals of magnesia embedding between their walls an extremely large percentage of dead air. In fact, these air cells comprise by far the greater part of the material, each one hermetically

sealed and so minute that millions of them are contained in a single square foot of the insulation.

A necessary consequence is that the substance itself is extremely light in weight relative to other substances. A heavy, dense material cannot possibly be a good insulation, nor on the contrary can one whose structure is so light that the air spaces visibly make up the greater part of the bulk. The general rule may be laid down that large air spaces permit circulation and therefore cannot have real insulation value.

Owing to the tremendous desiccating influence of the long-continued heat on the insulation, organic substances are necessarily barred. Otherwise there are many materials of this class that would make efficient insulating coverings.

Taking bare pipe as a standard for comparing radiation losses,² it can be easily calculated that from each square foot there is roughly a heat loss of 51.7 B.t.u. per degree difference of temperature per hour, or with a steam of 150 lb. (10.5 kg.) a net loss of at least 1½ lb. coal per square foot of pipe per hour, or 36 lb. per twenty-four hours. This loss is continuous as long as there is steam in the pipe and is equivalent to more than 7 tons per year per square foot of pipe. This is an extreme instance, but in so far as it is the practice to allow any kind of steam pipe or feed pipe to remain uncovered, so far do these extreme figures apply. A very few feet of uncovered or badly covered pipe will therefore waste considerable coal.

“Standard” thickness covering is intended for pressures up to 100 lb. (7 kg.) only. Above that point extra coverings are required up to the maximum temperature of about 600 deg. Fahr. (315 deg. C.), which represents the highest practical temperature in modern steam practice. Figures taken from the standard specifications of the Magnesia Association follow:

Steam Pressure (Lb.)	Thickness of Coating.
Up to 100	Standard.
100 to 150	Double standard.
Over 150	3 in.
With superheat	3½ in.

Any engineer can readily compare his own insulation with these standards. If it falls short of these thicknesses, he is probably wasting a good deal of valuable heat.

HEAT INSULATION FROM AN INVESTMENT POINT OF VIEW

When the late Henry G. Scott made what is perhaps the only series of actual tests ever conducted by a user of insulating materials, he pointed out that the following factors should be taken into consideration in selecting heat insulation if satisfactory service is to be expected:

(1) Investment in covering; (2) cost of coal required to supply lost heat; (3) 5 per cent interest on capital invested in boilers and stokers rendered idle through having to supply lost heat; (4) guaranteed life of covering, and (5) thickness of covering. He further says: “It is apparent that the covering which shows a minimum total cost under the first three headings is the best covering to adopt, for the loss of heat at the end of ten years may readily cost more than three times as

²Steam pressures and superheats such as are used in ordinary central-station and power-plant practice are considered. These remarks are only partly applicable to heating or other low-pressure work, or to the use of furnace or other forms of heat reaction.

much as the first cost of the covering." That his conclusions were justified is indicated by the fact that the original (85 per cent magnesia) coverings selected by him are still in use.

In considering the investment value of an insulation durability naturally assumes importance. It goes without saying that the most durable covering will pay best, provided that it is equal in initial efficiency to others under consideration. This point demands greater attention than it often receives, because once the pipes are covered it may be years before they are disturbed again. A poor covering may have lost its efficiency in a short while, but because there is nothing to show this externally it will continue to waste heat for many years or even until the pipes are worn out.

Following is a simple formula which will assist in determining the most economical covering for any given class of service, whether temporary or permanent $(c - a/b)b = d$. In this equation c is the value of the coal saved per year, a is the cost of the covering, b is its life in years, d is the gross return on the investment in the covering.

Thus taking the cost of 100 ft. (30.4 m.) of covering as \$80, assuming its life as fifteen years, and considering that during that time 25 tons of coal at \$4 per ton are saved per year owing to the covering, the gross return on the investment will be $(100 - 80/15)15 = \$1,420$ per 100 ft. of covering.

For comparison consider the cheapest kind of pipe covering, costing \$40, with an estimated life of five years. Assume that the coal saving is 60 per cent of that obtained with the better covering mentioned in the preceding paragraph. Then the gross return will be $(60 - 40/5)5 = \$260$, instead of \$1,420 with the better covering.

In applying this formula to actual practice it must be borne in mind that what is meant by "lifetime" is the efficient lifetime of the covering, during which it will give its maximum service—and not merely the time it will stay on the pipes without falling off.

ELECTROMAGNETIC CONDENSER FOR POWER-FACTOR REGULATION

One Winding of Dynamo Is Inserted in Alternating Current Circuit, the Other Is Excited from Source of Direct Current

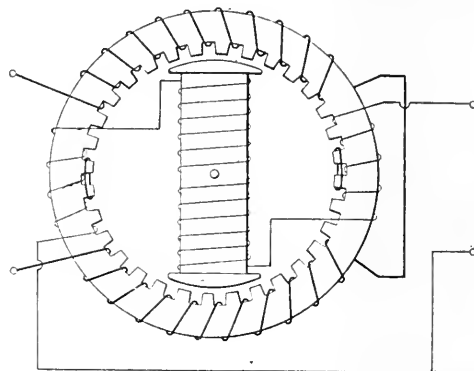
Prof. Gisbert Kapp of Birmingham, England, in patent No. 1,236,716, assigned to the Westinghouse company, suggests the use of an electromagnetic condenser to correct for the power factor of inductive apparatus in an alternating-current system. According to the inventor, a dynamo-electric machine wherein either the stator or the rotor winding is inserted in the alternating-current circuit in which it is desired to adjust the power factor is employed, and the remaining winding is excited from a source of direct current.

The rotor of the machine is therefore oscillated in synchronism with the frequency of the alternating current, absorbing energy from the latter portion of each current wave, storing the energy in the form of momentum, and recuperating the energy just before and upon the first portion of the succeeding wave. The phase of the resultant current wave may be made to

approximate that of the attendant voltage wave as closely as desired.

The stator winding is, for the sake of simplicity, shown as a ring winding, but a drum winding may be employed. The iron core of the stator carries an alternating current winding. A bar magnet is pivoted and provided with a direct-current winding, which latter may be put in series with the direct-current winding on the stator. The pole pieces of the magnet are so shaped as to sweep as closely as is mechanically possible in front of the stator winding. By this construction, with a given field excitation, a magnetic field of maximum strength is obtained. The object of the series winding is to secure to the magnet a zero position and to prevent it from vibrating through a greater angle than 90 deg. from the zero position.

So long as no alternating current is sent through the stator the vibrator will remain at rest in such position that its magnetic axis will coincide with the magnetic axis produced in the stator by its direct-current winding. If an alternating current of the low frequency of the slip is passed through the stator, the bar magnet is acted upon by mechanical forces that alternate in direction with the alternations of the current, and is thus set



PRINCIPLE OF ELECTROMAGNETIC CONDENSER

into vibration of the same frequency. Owing to the interaction between these electrodynamic forces and the mass inertia of the vibrator, the zero position is passed at the instant when the current passes through zero, while the reversal of motion takes place at the instants when the current has crest values. Since on passing zero position the vibrator has maximum speed, the emf. induced in the stator winding is at these instants also at maximum.

Thus the condition of quadrature between the current causing the vibration and the emf. produced by this vibration is brought about. That the emf. must be a leading emf. will be obvious from the following consideration: After passing zero position in either sense, the current opposes the motion, and thus brings the magnet to rest at the end of its swing. The energy stored kinetically in the vibrator is during this period transferred electrodynamicly to the alternating-current circuit. The circuit receives energy during the time that the current grows. On reversal, when the vibrator approaches its zero position, it must be accelerated by the dynamic force of the current. The vibrator takes energy from the circuit during the time that the current decreases from its crest value to zero. Thus the circuit receives energy while the current is growing, and must yield up energy while the current is waning.

voltage consumed through the line resistance. $XV = A$ is the no-load voltage at the generator end of the line and VH is the voltage rise at the receiver end due to the capacity effect.

Chart B represents the impedance triangle of the line, in which b_1 corresponds to the total resistance, b_2 to the total reactance and B to the total impedance, these constants being simply the values of R , X and Z as modified by their distributed nature.

Chart C represents the charging current of the line. c_1 is the equivalent total capacity of the line. C is the total charging current per volt, of which a small component c_1 is in phase with the voltage. As c_1 is always very small in comparison with C , its numerical effect on the value of C is negligible, and for all numerical values both C and c_1 can be disregarded, c_2 giving the charging current to a high degree of accuracy.

SOME RELATIONS SHOWN BY CHARTS

The charts show in a clear and interesting manner the effect on the line constants of the distributed nature of the resistance, inductance and capacity of the circuit. In Fig. 1 OL represents the values of the coefficients of $1 - a_1$ and a_2 for a given frequency, based on the exponential formula, in which the exponents of l vary with the distance. OM corresponds to the exponent 2 for all distances. The values of $1 - a_1$ and a_2 , therefore, as determined from points along OM , will be $(xb/2)^l$ and $(rb/2)^l$ respectively.

The difference between the constants as determined from points P and Q is, therefore, that due to the difference in the exponents. It was shown in the previous article that the integral exponents give values of the constants corresponding to the assumption of lumped capacity and that the difference between the integral and true exponents represents the distributed effect. This effect is shown by the separation of points P and Q , in Fig. 1. The projections of PQ on OY and OX show at P_1Q_1 and P_2Q_2 the effect on each component separately. OP_1/OQ_1 and OP_2/OQ_2 are the ratios of the true value of $1 - a_1$ and a_2 by the hyperbolic formula to their values based on the assumption of lumped capacity.

It is interesting to note that b_1 , corresponding to the ohmic resistance of the line, is the constant most affected by the distributed properties of the circuit. This constant reaches a maximum value at 60 cycles, for any value of r , at about 500 miles and decreases rapidly at greater distances. The ratio of b_1 to R at 500 miles is 0.67 and at 750 miles only 0.32. This brings out strikingly the fact that for a 60-cycle line the ohmic drop, with a given conductor, due to the load current, is a maximum at 500 miles, while in a line of quarter wave length it is less than one-third that of a short line of the same total resistance.

NUMERICAL EXAMPLE

The following example will illustrate the use of the charts in determining the line constants for a particular case:

Assume: Distance, 250 miles; frequency, 60 cycles; conductor, 300,000 circ. mil stranded copper; spacing, 15 ft.

From wire tables:

$$r = 0.189 \text{ ohm,}$$

$$x = 0.811 \text{ ohm,}$$

$$b = 5.30 \text{ micromhos.}$$

Calculate:

$$xb = 0.811 \times 5.30 = 4.30,$$

$$rb = 0.189 \times 5.30 = 1.00,$$

$$rb^2 = 0.189 \times 5.30^2 = 5.31.$$

From charts:

$$a_1 = 0.87, \quad a_2 = 0.030,$$

$$b_1 = 43, \quad b_2 = 193,$$

$$c_1 = -0.000013, \quad c_2 = 0.0013.$$

Conditions at the sending end when the above line is delivering 20,000 kw. at 110,000 volts, with power factor 0.95 lagging, are calculated as follows, for one phase, where P_0 and P_t are kilowatts at receiving and sending ends respectively:

$$E_0 = 110,000/\sqrt{3} = 63,500 \text{ volts.}$$

$$P_0 = 20,000/3 = 6667 \text{ kw.}$$

$$I_0 = 6667/(63.5 \times 0.95) = 110.5 \text{ amp.}$$

$$\begin{aligned} E_t &= 63,500 (0.87 + j0.030) + \\ &\quad 110.5(0.95 - j0.31)(43 + j193) \\ &= (55,200 + j1900) + (105 - j34.3)(43 + j193) \\ &= (55,200 + j1900) + (11,140 + j18,790) \\ &= (66,340 + j20,690) \\ &= 69,500 \text{ volts.} \end{aligned}$$

$$\begin{aligned} I_t &= 110.5(0.95 - j0.31)(0.87 + j0.030) + \\ &\quad 63,500(-0.000013 + j0.0013) \\ &= (105 - j34.3)(0.87 + j0.030) + (-0.83 + j83) \\ &= (92.4 - j26.7) + (-0.83 + j83) \\ &= (91.6 + j56.3) \\ &= 107.5 \text{ amp.} \end{aligned}$$

$$\begin{aligned} P_t &= 66.34 \times 91.6 + 20.69 \times 56.3 \\ &= 6076 + 1160 \\ &= 7236 \text{ kw.} \end{aligned}$$

At no load:

$$E_t = (55,200 + j1900) = 55,230 \text{ volts.}$$

$$I_t = (-0.83 + j83) = 83 \text{ amp.}$$

$$\begin{aligned} P_t &= 55.2 \times -0.83 + 1.9 \times 83 \\ &= -45.8 + 157.7 = 111.9 \text{ kw.} \end{aligned}$$

$$\text{Regulation} = (55,230 - 69,500)/63,500 = -22.5\%.$$

$$\text{Efficiency} = 6667/7236 = 92.1\%.$$

$$\text{Power factor} = 7236/69.5 \times 107.5 = 0.969.$$

As the current phase angle, $\tan^{-1} 56.3/91.6$, is greater than the voltage phase angle, $\tan^{-1} 20.69/66.34$, the power factor is leading.

Data from a Coal-Mining Company Supplying Public Utilities

The Eastern Utilities Coal Company, controlled by the Eastern Power & Light Corporation, which is under the management of W. S. Barstow & Company, New York, supplies part of the coal required by subsidiary public utility companies. With regard to the present outlook it reports that the mines with 9-ft. (2.7-m.) seams have a capacity of 10,000 tons monthly, which can be readily increased. The following data are taken from the company's report of operations:

In June, 1917, with 102 cars supplied, its output was 5390 tons, which represented a percentage of capacity amounting to 53.9. This was increased to 6890 tons in July, or 68.9 per cent of capacity, with a total of 151 cars. This ratio was well maintained through the summer and fall. In December there came a slump to 3610 tons, 36.1 per cent of capacity, only eighty cars being supplied, and in January, 1918, there was a further decline to 2490 tons and fifty-two cars. In February the output rose to 3380 tons, with seventy cars.

Simple Method of Measuring Emfs. Accurately

Description of a Means That Will Be Found Applicable to Determining Temperatures with Thermocouples, Potential Drops Across Resistance Standards and Shunts, and Other Objects

BY F. WENNER, PAUL D. FOOTE AND E. E. WEIBEL

HERE are two general methods for measuring the emf. of a thermocouple, one requiring the use of a potentiometer and the other involving the use of a galvanometer or millivoltmeter. The potentiometric method affords the most accurate means of measuring the emf., but the galvanometer method is also used extensively because the instruments are direct-reading and require no preliminary adjustment. However, unless the galvanometer is of very high resistance compared with that of the thermocouple and lead wires, the latter is a general being a quite variable factor, the instrument will not read correctly.

The object of the present note is to describe an instrument which combines several desirable features of each method, namely, cost of manufacture not much greater than that of a high-grade galvanometer, readings entirely independent of lead resistance, apparatus accurate and probably more robust than the best galvanometers of high sensitivity. Two methods have been devised which differ from the one devised by Northrup* mainly in that the balance is indicated by a zero change in the deflection of the millivoltmeter, on closing a key, rather than by a zero deflection. One of the methods also differs from Northrup's method in that the balance usually need not be made to so high an accuracy as that sought in the measurements.

The methods described here are not only applicable to the measurement of the emf. of thermocouples by means of a millivoltmeter (or galvanometer), but also to the measurement of the emf. in circuits of any resistance not large in comparison with the resistance of the measuring instrument. Examples are the measurement by means of a millivoltmeter of the drop in potential across resistance standards (or shunts) carrying a current, when the resistance of the leads is high and unknown, and the measurement by means of a millivoltmeter of the open-circuit voltage of a battery or the voltage of a battery so located that connection can be made to it only through a line of fairly high resistance.

ONE METHOD OF MEASURING THERMOCOUPLE EMF.

For one of the methods the arrangement of the circuits is as shown in Fig. 1. With the rheostat or slide wire adjusted so that the millivoltmeter gives the same indication both with the key open and with the key closed there is a balance between the emf. of the thermocouple and the potential drop across the millivoltmeter. Consequently the drop in potential between

the terminals of the thermocouple, which, with the key closed, is the reading of the millivoltmeter, is the same as its electromotive force.

Method of Balancing.—(1) The reading of the millivoltmeter or the position of its pointer is noted with the key closed; (2) the key is opened and this results in a change of the position of the pointer, depending on the lack of balance; (3) the contact on the slide wire is adjusted so as to bring the pointer back to or slightly past its first position. This brings about more nearly the condition for a balance. This process is, therefore, repeated until a balance is established to the accuracy required, which need not be high in case the resistance of the thermocouple is low in comparison with the resistance of the millivoltmeter.

In general the error resulting from a lack of balance is the same fraction of the lack of balance as the resistance of the thermocouple is of the resistance of the thermocouple and millivoltmeter. For example, if the resistance of the thermocouple is one-tenth the resistance of the millivoltmeter and the contact on the slide wire is adjusted so that, with the key open, the drop in potential across the millivoltmeter is 0.9 or 1.1 times the emf. of the thermocouple, the error in the reading, on closing the key, is only slightly in excess of 1 per cent. This for most industrial purposes is of little or no consequence. However, had there been no compensation—that is, had the electromotive force been measured directly with the millivoltmeter—the error would have been 9 per cent.

SECOND METHOD

For the other method the arrangement of the circuits is shown in Fig. 2. Here the millivoltmeter constitutes one arm, the slide wire R another arm, and the resistances P and Q the remaining two arms of a simple bridge. Since the bridge is balanced, the drop in potential across the slide wire R is the same as the reading of the millivoltmeter and the points G and G' of the bridge are at the same potential. Consequently, if the adjustments are such that there is no change in the reading of the millivoltmeter on closing the key, the emf. of the thermocouple is that indicated by the millivoltmeter multiplied by the ratio of the resistance between the sliding contact and G to the total resistance of the slide wire R . For example, if the millivoltmeter reading is 100 and the slide wire has 100 divisions, then each division between the sliding contact and G corresponds to a difference in potential of 1 millivolt.

Procedure in Making a Measurement.—First, with the key open, the contact on the slide wire S is adjusted so that the millivoltmeter reading corresponds to the full scale reading on the slide wire R ; then the key is closed and the contact on the slide wire R is adjusted so as to make the millivoltmeter reading the same as before closing the key. The emf. or temperature is then read from the scale of the slide wire R .

*At a meeting of the American Physical Society held at Washington in April, 1915, Dr. Northrup described a potentiometer method in which a single millivoltmeter is made to serve both in place of a galvanometer and of a standard cell. With this method the millivoltmeter is connected, first, in series with the thermocouple and indicating (by a zero deflection) when there is a balance—that is, when the potential drop in the potentiometer is equal to the electromotive force of the thermocouple—and, secondly, across the potential terminals of the potentiometer for measuring the potential drop. The arrangement is such that the potential drop is not changed as a result of the current through the millivoltmeter. A similar method is used in an instrument manufactured by the Westinghouse Electric & Manufacturing Company (see *Electrical Review and Western Electrician*, Vol. 70, p. 98, 1916.)

For either method provision should be made for easily opening the battery circuit when the apparatus is not in use. This may be accomplished by making it possible to move the sliding contact past the end of the

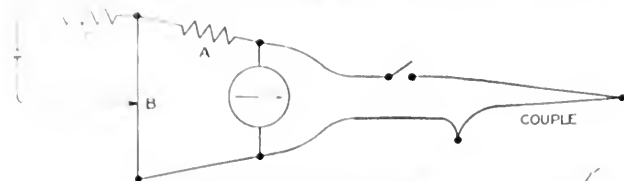


FIG. 1—ONE METHOD OF MEASURING THERMOCOUPLE EMF.

The resistances *A* and *C* and the slide wire *B* serve as means for adjusting this current so that the drop in potential in the millivoltmeter is equal to the electromotive force of the thermocouple. When this adjustment is made no current is drawn from the thermocouple on closing the key, consequently the resistance of the thermocouple does not affect the reading of the millivoltmeter.

slide wire *B* or slide wire *S*, or by means of a key, not shown in either diagram, in the battery circuit.

ACCURACY OBTAINABLE

While the resistance of the thermocouple does not affect the accuracy of the measurements when there is a balance, it does affect the accuracy with which the balance can be made. Still, with the resistance of the thermocouple in Fig. 1, or the thermocouple and slide wire *R* in Fig. 2, less than twice the resistance of the millivoltmeter, there should be little difficulty in making the balance with sufficient precision so that the electromotive force may be measured to an accuracy about the same as would be obtained if the thermocouple had no resistance and its emf. were measured directly with the millivoltmeter; that is, to the accuracy of the indications of the millivoltmeter.

In a particular case if the thermocouple gives an emf. of 15 millivolts at the maximum temperature at which it is to be used and has a resistance of less than 20 ohms, the millivoltmeter should have a range of 15 millivolts and 10 ohms is a satisfactory value for its resistance. In this case a single dry cell constitutes a very convenient source of current.

For the arrangement shown in Fig. 1 the millivoltmeter should be reliable at all points on its scale to an accuracy a little higher than that sought in the temperature measurements. Convenient values for the re-

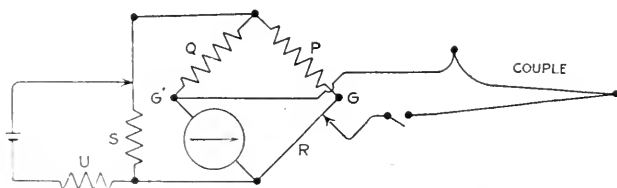


FIG. 2—ANOTHER METHOD OF MEASURING THERMOCOUPLE EMF.

The resistance *U* and the slide wire *S* serve as a means for adjusting the current through the bridge so that the drop in potential across the millivoltmeter has a desired value larger than the electromotive force of the thermocouple. When the contact on the slide wire *B* is adjusted so that there is no change in the reading of the millivoltmeter on closing the key no current flows in the thermocouple, consequently its emf. is equal to the drop in potential between the sliding contact and *G* (or *G'*) and may be read directly from the position of the sliding contact.

distances are: *A*, 50 ohms; *B*, 5 ohms; *C*, 50 ohms. As the results obtained do not depend upon accuracy in the adjustments of the resistances the apparatus aside from the millivoltmeter and thermocouple may be of very simple construction.

For the arrangement shown in Fig. 2 the millivoltmeter should be reliable at the reading used to an ac-

curacy a little higher than that sought in the temperature measurements. Convenient values for the resistances are: *P*, 25 ohms; *Q*, 50 ohms; *R*, 5 ohms; *S*, 5 ohms (variable from 4 ohms to 5.5 ohms); *U*, 60 ohms. The resistances *S* and *U* need not be adjusted to any definite values, but *P*, *Q* and *R* should be so adjusted that the bridge will be balanced to an accuracy a little higher than that sought in the temperature measurements.

With either method, if all the thermocouples to be used with any one equipment give the same emf. for the same temperature, a condition well satisfied by the rare metal couples now obtainable, the apparatus may be calibrated so that the temperature is read directly from the scale of the millivoltmeter in one case and from the scale of the slide wire in the other case.

INCREASING TRANSFORMER CAPACITY BY CIRCULATING OIL

Installation of Oil-Circulating System at Cost of \$700 Increased Permissible Loads on 200-Kva. and 450-Kva. Transformer Banks 60 per Cent

BY CLAUDE H. SHEPHERD

Electrical Engineer for the Lincoln Park Commissioners, Chicago

WHEN the main substation at Lincoln Park, Chicago, was built all multiple-circuit power was supplied by a bank of three 150-kva., 12,000/2300 volt, 60-cycle, single-phase, oil-filled, self-cooled, station-type transformers connected delta on the primary side and star on the secondary. These units were installed in an angle of the bus chamber as shown in the accompanying sketch. One spare transformer was provided but never used. Later a 200-kva., 12,000/2300-4000-volt, three-phase, oil-filled, self-cooled, station-type transformer was installed in the location shown and connected by means of double-throw disconnecting switches so it could be used in place of the 450-kva. bank. When this reserve equipment was put into service it was found that owing to the temperature of the bus chamber, which contains more than forty transformers, all of which are operated at night, the three-phase equipment became so hot as to be unsafe. The oil often attained a temperature of 75 deg. C.

To remedy this condition a ventilating system was installed and operated in such a way as to change the air about once in five minutes. This helped but did not eliminate the excessive heating of the transformers, and it was feared that the interior layers of insulation were beginning to carbonize. Sludge was rapidly forming in the oil so it was feared that unless drastic steps were taken immediately some of the three-phase equipment might be lost as the heat was actually unbearable in the immediate vicinity of either the three-phase bank or the single-phase transformer, the room temperature often attaining 140 deg. Fahr. (60 deg. C.).

Consequently oil-cooling apparatus was purchased and installed, practically no interruption of service being experienced, although the work was done under the most adverse conditions and in close proximity to both the 4000-volt and 12,000-volt buses.

By reference to the drawing it will be seen that the transformer oil is drawn by a direct-connected centrifugal pump directly from the transformer cases into an accumulator or settling tank and thence into the

pump, which discharges full volume into and through the cooling coils, the latter being immersed in constantly circulating water. From there the oil is discharged through a submerged outlet into the transformer. Two different suction systems were used. For the three-phase transformer the oil suction was taken

TABLE I—HEAT TEST ON 200-KW. TRANSFORMER MADE SEPT. 11, 1917

Time, A.M.	Temperature of Transformer, Deg. C.	Kw.	Pump On	Pump Off	Cooling-Water Temperature, Deg. Fahr.
8:00	23	140	.....	8:00 a.m.	48
8:30	28	150	.....	.....	48
9:00	26	150	.....	.....	48
9:30	26	160	.....	.....	48
10:00	26	175	.....	.....	48
10:10	36	175	10:10 a.m.	.....	48
10:20	37	175	.....	.....	48
10:30	37	175	.....	.....	48
10:40	37	175	.....	.....	48
10:50	36	175	.....	.....	48
11:00	35	175	.....	.....	48
11:10	35	175	.....	.....	48
11:20	35	175	.....	.....	48
11:30	34	175	.....	.....	48
11:40	34	175	.....	.....	48
11:50	34	175	.....	.....	48
12 m.	33	170	.....	12:00 m.	48

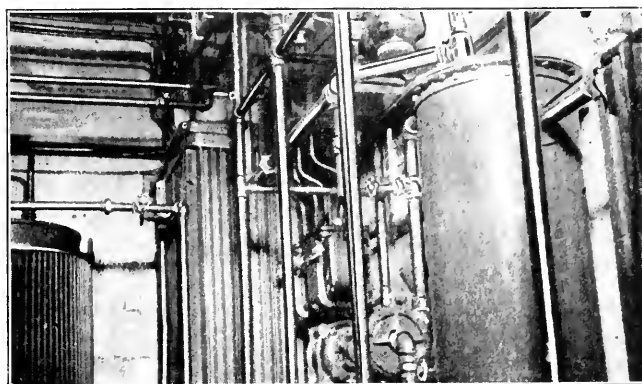


FIG. 2—THE 450-KVA. BANK IN THE FOREGROUND AND THE 200-KVA. BANK IN THE CORNER

through an already established connection at the bottom of the case, thus allowing automatic priming of the pump. In the case, however, of the three 150-kva., single-phase units it was found advisable to take the oil from the hottest part of the case, which was at the top next to the wall, the individual sections being brought forward through the thermometer wells to regulator valves discharging into the main suction pipe or line. The discharge in each case was submerged and additional safety was assured by the use of fiber discharge nozzles.

It will be noted from the drawing that section valves are placed in the two main suction lines and that individual regulator valves have been placed in each individual suction and discharge line, and that a pump

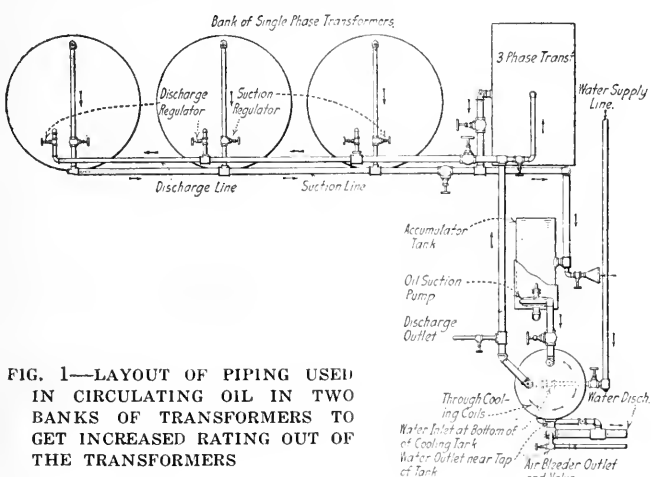


FIG. 1—LAYOUT OF PIPING USED IN CIRCULATING OIL IN TWO BANKS OF TRANSFORMERS TO GET INCREASED RATING OUT OF THE TRANSFORMERS

throttle was also installed, giving absolute control of the oil flow and allowing perfect adjustment under all conditions. A separate make-up funnel and valve were connected to the accumulator tank, and a T-connection and valve were placed in the discharge line, allowing oil to be either added to or taken away from the system at any time. With this arrangement it is obvious that the four transformer cases with oil at the proper level act as a reservoir system for each other, allowing levels

to be adjusted or oil to be completely shifted from one case to another at any time. This plan gives assurance of great flexibility.

A thermometer is installed in the individual section for each transformer and at the suction and discharge of the cooling coils, giving complete data on the temperatures. An oil gage is installed on each transformer

to show the oil level and an air-bleeder valve is installed on the accumulator tank. The cooling water is supplied by the city system and is piped into the bottom of the coil tank. The overflow is installed near the top of the tank at such a level as to keep the coils always submerged. The supply connection is made through a T at the bottom of the tank, the continuation of the supply line being connected through a stopcock into

TABLE II—COST OF OIL-COOLING INSTALLATION

LABOR	
Machinist, 79 hours at 55 cents.....	\$43.45
Steamfitter, 92 hours at 48 cents.....	44.16
Helper, 79 hours at 38 and 40 cents.....	30.50
Class A electrician, 99 hours at 75 cents.....	74.25
Engineering and overhead.....	\$192.36
MATERIAL	
Fittings	\$8.59
One 14-in. by 30-in. galvanized-iron expansion tank	9.38
One 18-in. by 45-in. galvanized-iron tank with cooling coils	71.50
162 ft. 2-in. black pipe at 39 cents.....	6.42
Six 0-110 deg. C. thermometers.....	57.38
One 1/2-in. by 6-in. water glass.....	.10
Miscellaneous screws, bolts, etc.....	9.31
Electrical conduit fittings.....	17.91
Piping and fittings for water supply.....	55.79
Transil oil .....	.80
24-ft. No. 8 fine stranded wire.....	.10
One oil pump driven by 1700-r.p.m. three-phase, 3-hp., 220-volt, 60-cycle motor, 50 g.p.m., 30-ft. head	165.00
Four transformer oil gages.....	6.28
Grand total	\$700.61

the overflow line. Hence by closing the supply valve and opening the stopcock the tank may be quickly drained, a special air-bleeder line being provided to facilitate this operation. Three-phase energy is supplied to the pump motor from 220-volt taps on the secondary side of the main transformers. As the system is self-priming, no attention is paid to the pump during a shutdown as it will automatically come into operation again when the power supply is re-established.

For about six weeks during last summer the 200-kva.,

three-phase transformer carried in actual operation a maximum day load of 325 kw. for about five hours per day with a maximum oil temperature of 41 deg. C. (105.8 deg. Fahr.), and a cooling water temperature of 44 deg. Fahr. (6.7 deg. C.). The cooling system, it is apparent, has increased the capacity of the 200-kva. transformer over 60 per cent. As this has been the maximum multiple circuit load so far, the 200-kva. transformer should have ample capacity when operated with the cooling system to "pull" the entire multiple-circuit load. In fact, since the installation of the cooling system it has never been necessary to operate the 450-kva. bank. Assuming the same relative percentage of core losses on both the 450-kva. bank and the 200-kva. transformers and allowing for the 1 kw. necessary to operate the cooling system, it is estimated that a net energy saving of \$0.72 per day is obtained with the cooling system in operation, energy costing 0.0075 cent per kilowatt-hour. Assuming a percentage increase in the capacity of the 450-kva. bank on the basis of 60 per cent, it will be possible to pull a load of 720 kw. on this bank. The only doubtful point is whether or not the interior layers of insulation are beginning to carbonize. This question will be investigated during the winter,

but judging from the quality of the oil now in the transformers no damage from this cause has appeared so far.

The test data in Table 1 show that in spite of the fact that the load was increased when the pump was started and remained at 175 kw. all night, the temperature of the circulating oil was steadily reduced from 37 deg. C. to 34 deg. C.

It will be noted that the temperature jumped from 26 deg. C. to 36 deg. C. when the pump was started, but this is due to the thermometer being in the suction riser. It indicates the riser temperature until the pump is started, thereafter the case temperature.

One change is necessary before the efficiency of the cooling system will be considered entirely satisfactory, and that is to substitute copper coils for iron pipe. The latter was used in place of copper because of the high initial cost of the copper. However, it has been found that for each passage of the oil through the cooler the temperature drop is from 2 deg. C. to 5 deg. C., whereas with copper coils it is expected that the temperature drop will be much greater. It is estimated that the investment in the present oil-cooling equipment earns about 37.3 per cent annually.

War-Time Methods of Bill Delivery

The Experience of Many Central Stations in Adjusting Themselves to Higher Postage Rates and Scarcity of Labor, Together with Comparative Statistics of Cost on the Different Methods

WITH the thought and energy of every central station concentrated as never before on measures of economy, a great many companies have turned a searching eye on their methods of delivering the monthly statement. The increase in the postal rates has brought a considerable additional cost in many cases, and the loss of men into the national service has generally reduced the organization available for carrying on routine work of this kind.

When the postage rate went up, of course, the idea of discontinuing the mailing of the monthly service bills and delivering them instead naturally suggested itself. There is more than the question of cost involved, however, for the mailing of a bill is generally conceded to be satisfactory proof of its delivery. Moreover, if delivered by hand, should this be done by meter readers, high-school boys, old men, girls or women? Or, if mailed, which is the better—post-card or regular bill inclosed in envelope? These questions are particularly pertinent right now and worth consideration by every central station.

Not long ago—but before the postal rates went up—the Cleveland Electric Illuminating Company made an analysis of the cost of its bill delivery, which includes 60,000 bills delivered by hand and 40,000 by mail, to find out how much could be saved by using a post-card bill. The figures were found to be as shown in the table on the next page.

With the 1-cent postage rate the post-card proved to be the cheaper method, but the doubling of this cost made the hand-delivery system far more economical. The system in Cleveland has been to place the delivered

bill in the consumer's mail box, or if there is no box to hand it to a member of the family. Failing this, the distributor brings back the bill and it is mailed. For this delivery the Cleveland company first tried boys sixteen or eighteen years old, but did not find them satisfactory. It then employed elderly men of from fifty to sixty-five years and has practically eliminated all complaints.

In Sandusky, Ohio, however, the Sandusky Gas & Electric Company has had most satisfactory results from high-school boys, who both read the meters and deliver the bills. The boys receive 1 cent per meter read. Before the postal rate went up the company used government post cards, but since then it has devised a card of the same size, of which a six months' supply can be printed in advance. These are stamped and mailed to customers beyond the convenient reach of the delivery routes, but the bulk of them the boys deliver at a cost so far of approximately a half cent per bill. This the company finds is effecting a saving of \$18 per 1000 customers per month on postage alone and is bringing additional economy by reducing the operating force to a minimum during the winter. Because of the limited number of hours that the students have available for this work, it is necessary to employ a much larger number than if the regular employees were handling it, but this has not proved an objection. About 9000 bills are delivered in Sandusky between the twentieth and the last of each month.

In Mobile, Ala., the company now delivers by hand at a cost of about 1½ cents per bill, a saving of about \$37.50 a month since the postal increase. In Traverse

City, Mich., the company delivers to about 1400 consumers at a cost of 1 cent, and this also includes collecting about one-third of the accounts. In Pine Bluff, Ark., the company delivers 4500 bills, using the regular meter readers after the readings are completed. It requires from four to five days and costs in all, it is figured, from \$10.50 to \$12.50. In Kokomo, Ind., the company has also changed from mailing to delivery and is distributing 6000 bills by meter readers at a cost of \$35. In Kingston, N. Y., the meter readers now deliver 5800 gas and electric bills, all except about 300 which are mailed to outlying territory, and the company finds the

COMPARISON OF COST OF PRESENT SYSTEM OF HANDLING 100,000 CONSUMERS' BILLS PER MONTH WITH PROPOSED SPECIAL CARD OR GOVERNMENT 1-CENT POST-CARD SYSTEM, AT CLEVELAND, OHIO.

Present system, printed bill in outlook envelope; 60,000 delivered by company distributors, 40,000 mailed with 2-cent stamps.

PRESENT SYSTEM:	
100,000 bills, at \$1.50 per 1000.....	\$150.00
100,000 outlook envelopes, at \$1.65 per 1000...	165.00
40,000 2-cent stamps in rolls.....	802.40
Inclosing bills in envelopes—2 boys one month at \$40 each.....	80.00
Sealing 100,000 envelopes and affixing 40,000 stamps, one boy one month.....	45.00
/Sorting 60,000 bills for delivery, one boy one month	40.00
/Delivering 60,000 bills, five men at \$70 per month	350.00
Supervising delivery, half time of one man at \$100	50.00
Total	\$1,682.40
PROPOSED SYSTEM:	
<i>Special Cards, 1-Cent Post Stamp Affixed:</i>	
100,000 cards, printed.....	\$116.00
Affixing stamps, one boy one month.....	45.00
100,000, 1-cent stamps, in rolls.....	1,006.00
Total	1,167.00
Amount saved by using special cards and affixing stamps	\$515.40
<i>Government 1-Cent Post Cards:</i>	
100,000 cards	\$1,000.00
Printing	25.84
Total	\$1,025.84
Additional saving with government cards.....	141.16
Amount saved by using government stamped cards	\$656.56
Items checked ✓ indicate expense of delivering 60,000 bills per month. To find total delivery expense on 100,000 bills, add item No. 3, 40,000 2-cent stamps, \$802.40.	

system quite as dependable as by mail. It saves approximately \$50 every month. In Indianapolis the metermen of the Merchants' Heat & Light Company read meters every morning and deliver bills in the afternoon, and they have proved much more responsible than schoolboys, though boys were tried. The cost per bill now figures about 1 cent. In Denver the bills are mailed to the suburbs but delivered in the city by boys and young men on bicycles at a cost of one-third of a cent per bill.

In Wilkes-Barre, Pa., 19,500 bills—gas, electric and steam heat—are delivered by two men, who receive \$65 per month, delivering continuously, which means a cost of about one-half cent per bill. These men collect when possible as they deliver. In Terre Haute, Ind., the company formerly had mailed all bills at a total cost of \$125 monthly, but with the higher postal rate began delivering all bills within the city by one man, who is paid \$45. The remaining postage cost for

bills still mailed is also \$45, so that in spite of higher postage the company is saving \$35 monthly.

The consensus of opinion, therefore, judged from the experience of these and a large number of other cities heard from, would clearly recommend the delivery of bills within the centers of dense population. One Pennsylvania company, moreover, which operates through an extensive rural territory serving about 75,000 population, is delivering all bills in spite of distances, and claims a delivery cost of 0.92 cent per bill on a total of 7016 bills. This company lays much stress at the same time on the value of the collectors in maintaining good relations with the consumer, a point which is echoed by a number of other companies. Men are picked who do their work in a friendly spirit, and much good comes of it.

On the other hand, in many outlying towns in Indiana the Indiana Railways & Light Company began with this year to try the plan of not sending any bills at all to some 2000 customers, who are asked to call at the local offices to pay their bills, though delinquency notices are still mailed when necessary. In line with this, in Brattleboro, Vt.; in Franklin, Ind., and in Seymour, Ind., the local utilities have been furnishing many customers with cards on which to make their own meter readings. This method has met with considerable success. In Fort Madison, Iowa, the meter reader in certain residence districts carries with him bills already partly made out, on which he enters the reading, making out the bill and presenting it for collection at the one call. The company's other bills go out on post cards, and, in short, since the rates went up there has been a decided movement in the industry toward the post-card bill as offering an appropriate war-time economy.

FEW COMPANIES USING WOMEN

All in all, however, the trend is toward delivery, if not by meter reader, then by boys or old men. One New England central station has found a practical solution by making use of the services of the substitute postmen, who, though on waiting orders, are familiar with the town and have received instructions in delivering. Everywhere the possible expedient of utilizing women for delivering has been considered, but apparently it has not been adopted very largely. However, El Reno, Okla., reports the bill delivery in charge of two young women, who are taking care of it well and at a saving of \$30 monthly on postage. At Binghamton, N. Y., girls are used to read meters and deliver bills.

Of course, the many cities where bills have always been mailed at the 2-cent rate are not affected by the postal increase. Buffalo and Wilmington, Del., state that they have no intention of changing, for they consider mailing less trouble and more sure. In Detroit, on the other hand, the company has been delivering bills by messenger for years at a cost much less than postage, the meter readers delivering the bills. In Providence, R. I., the method is optional with the consumer in most districts. He may have it by mail or messenger, as he prefers, and bills for suburban towns are delivered to the suburban post offices and mailed there under the local rate. There is plainly enough diversity, therefore, to suggest the advisability of every man looking well to his own conditions locally; but in the majority of cases delivery seems to be the preferred method.

Getting the Most Out of Turbo-Generators

Cleaning and Cooling Ventilating Air Not Only Increases the Rating and Reduces the Possibility of Burn-Out but Also Obviates Overhauling of Generator for Cleaning, with the Attending Disadvantages

BY L. H. PARKER AND J. J. PREBLE
Spray Engineering Company

WITH the advent of the modern horizontal-shaft steam-turbine generator, the ratio of the total kilowatt capacity to the cubical contents of power-plant engine rooms has increased at least two-fold or threefold. The necessity for adequate ventilation must, therefore, be recognized in order that a safe operating temperature for the electrical apparatus may be maintained and extreme engine-room temperatures avoided for the comfort of the attendants.

The enormous quantity of air required for ventilating large generators is perhaps better understood when the actual weights are considered. Assume, for example, a 20,000-kva. machine requiring 65,000 cu. ft. (1840 cu. m.) of air per minute. As this amount of air weighs about 2½ tons, the generator will handle an amount of air equal in weight to its own weight in from one-half to three-quarters of an hour.

While no one questions the necessity of supplying a generator with a sufficient amount of ventilating air, there are many who do not give the temperature and quality of the air sufficient consideration. The turbine manufacturers equip their machines with fans designed for handling the proper volume of air, but upon the consulting engineer, manager or superintendent of the plant falls the duty of seeing that adequate air-conditioning apparatus is installed, so that the machines will also receive cool and clean air. One effective device that can be used for this purpose is a properly designed water-spray type of air washer and cooler.

CLEANLINESS AND TEMPERATURE

Air in almost any locality contains considerable dust and dirt. In the vicinity of power plants it may be assumed that roughly one-hundred-millionth of the volume of the air consists of dust, dirt and other foreign particles. This would mean that with a machine handling 65,000 cu. ft. (1840 cu. m.) of air per minute, as mentioned heretofore, a total of 93,600,000 cu. ft. (2,650,000 cu. m.) would be handled in twenty-four hours. On this basis the amount of dirt passing through the machine in this period would be 0.936 cu. ft. (0.026 cu. m.), or 86 cu. ft. (2.4 cu. m.) in three months.

A certain proportion of this, because of air swirls and eddies, will necessarily be deposited in the air passages. Such deposits of dirt become a serious handicap to the ventilation. The air passages become partly clogged, causing a decrease in the quantity of air handled, and the cooling effect is greatly diminished owing to the fact that air cannot come in direct contact with the heat-radiating surfaces. Air taken from the inside of a power plant usually contains oily vapors, which make accumulations on the air passages rapid.

Unwashed air means dirty generators and excessive heating, which not only reduces the electrical efficiency but shortens the life of the insulation. Unless the machines are taken apart and cleaned periodically, grounds

and even burn-outs are liable to occur. The cost of thoroughly cleaning a generator amounts to considerable, and under average conditions this has to be done about twice a year. The expense of dismantling and cleaning a 10,000-kw. unit would be about \$500 for each operation, without taking into consideration the revenue lost owing to the machine being out of commission.

Since a generator which receives clean air is comparatively free from all such troubles, it is apparent that an air washer will practically eliminate any danger of a serious accident, with a resulting loss that might exceed many times the cost of the installation.

As all modern units are designed for a certain allowable maximum temperature in the armature and field windings, the temperature of a generator with a given load will be a fixed amount above the temperature of

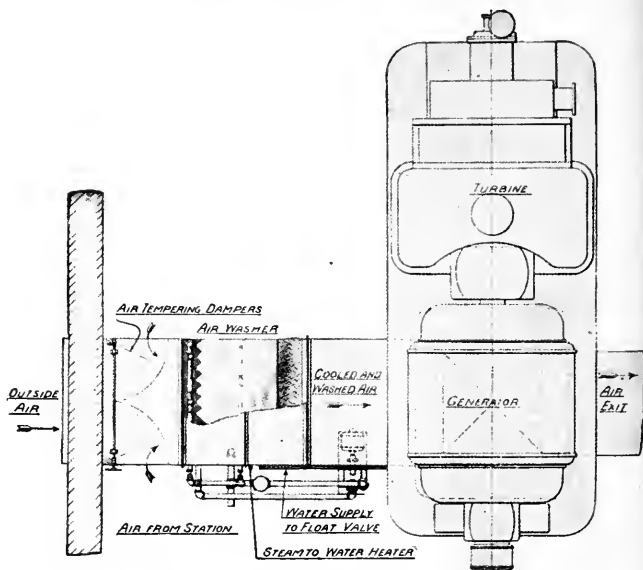


FIG. 1—TYPICAL ARRANGEMENT OF AIR WASHER WITH RESPECT TO GENERATOR

the ingoing ventilating air, which must be well below the critical temperature of the insulation. The cooler the air delivered to a generator, therefore, the greater will be its load-carrying capacity.

The permissible load on a turbo-alternator may, therefore, be expressed as a function of the temperature of the ingoing air. This relation* is given in the accompanying table based on representative 25-cycle and 60-cycle machines. The load is based on a fixed maximum temperature attained by any part of the windings. Since 25 deg. C. (77 deg. Fahr.) is a standard air temperature for electrical machinery, the load at this temperature is taken at 100 per cent.

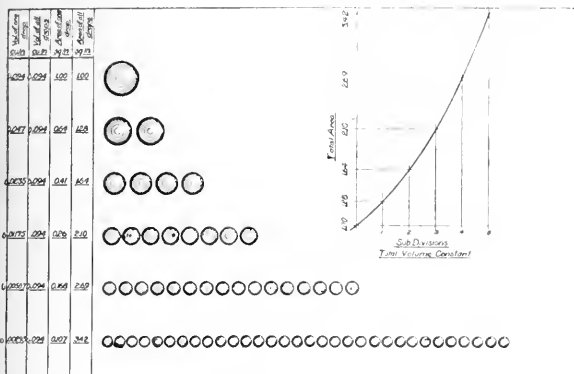
The cooling which can be obtained by the use of air washing and cooling equipment varies with the make

*Curve given in *General Electric Review*, September, 1913.

type of washer. For use with electrical equipment washer should be capable of reducing the temperature of the entering air at least 85 per cent of the initial wet-bulb depression. Table II shows the cooling effect with washer of this class, using some of the higher temperatures given above, with different humidities. It is possible, therefore, with this class of washer

hot months it would, therefore, be necessary to do one of three things, (1) install air washers; (2) increase the size of the electrical end of the units, or (3) install a spare unit. For illustration it is sufficient to compare the first two.

Each of the 10,000-kw. machines would require a washer of 40,000-cu.-ft.-per-minute (1120 cu.-m.-per minute) capacity, and the total cost of the three wash-



When about to purchase an air washing and cooling apparatus for this service, there are several items which, from an engineering standpoint, should not be overlooked. Merely to ask for a quotation on a washer of a certain capacity is comparable to asking for a quotation on a pump capable of handling a definite quantity of water, without regard to type, efficiency, speed or materials of construction.

CHARACTERISTICS WHICH SHOULD BE REQUIRED IN AIR WASHERS

In order to be efficient as regards both cleansing and cooling, and properly constructed, it is of prime importance that:

(1) The washer be provided with nozzles or other means of spraying the water, so that it will be finely atomized. The smaller the individual drops composing the spray, the greater will be the exposed surface for a given quantity of water. Therefore, both the cooling, due to evaporation, and the cleansing, due to the larger number of falling water particles, will be greatly increased.

(2) High pressures should be avoided, and the centrifugal pumps used for recirculating the spray water

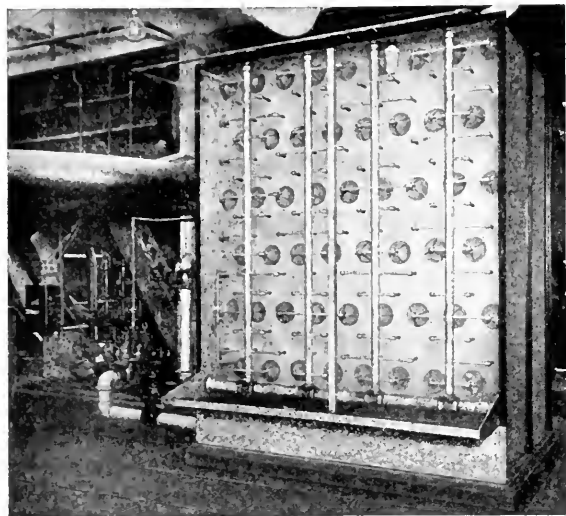


FIG. 4—ACTUAL INSTALLATION OF AIR WASHER USED IN CONNECTION WITH TURBO-GENERATOR

should be designed for high efficiency, so that the expenditure of power will not be excessive.

(3) The spray chamber should be completely filled with a dense mass of fine spray. Water curtains, or contrivances producing sheets of water, should be avoided, as, in order to pass, the air must necessarily punch holes in the sheet, which means that a considerable proportion of the air will not be properly cleaned or cooled.

(4) Means should be provided for completely eliminating all free moisture from the air before it leaves the washer. This should be accomplished without the use of heater coils.

(5) The materials used in the construction of the washer, as well as the workmanship, should assure long life. This requirement is met in one type of washer by using nozzles of bronze, screens of copper, casing and water box of heavy galvanized iron; eliminator plates, galvanized after fabrication; piping, galvanized; pump, bronze-fitted with inclosed impeller.

(6) The drop in air pressure through the washer should not be excessive. The allowable resistance measured at the inlet end of most generators is $\frac{1}{2}$ -in. (1.27-cm.) water gage, and the drop through the washer should therefore not exceed this, or the amount of air which can be handled will be diminished. The exact air requirements are usually given in the generator contract specifications or can be obtained from the manufacturers.

By way of further explanation, it may be added that the spray chamber should be of proper depth and the velocity of the air low enough to allow sufficient time for contact between the air and water spray. Obviously, the more efficient the nozzle, the higher the permissible air velocity, and consequently the more compact the air washer. Economy of space is of great importance in power plant work. Nozzles which produce a full conical spray of finely divided particles of water at medium operating pressures are well adapted for this class of work. Spray-atomizing screens are used advantageously on one of the well-known makes of washers in order to increase the atomization of the water.

Not long ago there were very few, if any, water-spray-type air-conditioning outfits used in connection with the ventilation of electrical machinery. To-day there are several hundred power plants in this country equipped with air washing and cooling apparatus, including practically all of the large well-known stations. The resulting gain in efficiency and capacity, the saving in maintenance and the longer life of the machines to which they are attached make the installation of air washers inevitable in all progressive and up-to-date power plants.

NEW ELECTRIC FURNACES FOR MAKING FERRO-ALLOYS

One Rated at 3000 Kw. Is Being Tested on San Francisco Bay, and Another One Is to Be Placed in Operation Very Soon

A 3000-kw. furnace is being tested out at the Pacific Electro-Metals Company plant, completed recently at Bay Point, near San Francisco. It is expected that another furnace of equal capacity will be added within a few weeks, so that together with the incidental load a total of about 7000 kw. will be utilized when the work is in full blast. Pending decision of a suit for lower rates which is being heard before the California Railroad Commission, the Great Western Power Company is supplying service on a rate amounting to \$40 per horsepower-year. This is based on a guarantee of 90 per cent power factor and subject to readjustment on a kilovolt-ampere basis if the power factor falls lower. Energy is measured at 22,000 volts and the rate of \$4.44½ per kilowatt-hour per month is charged on the basis of the average power consumption for the fifteen-minute period in which the demand is the maximum. The contract also restricts the conditions under which the load shall be used. There is to be a 10 per cent limit on the load between phases. The plant is supplied by a 22,000-volt, three-phase line about 14 miles (22.5 km.) long from the Clayton substation, which is supplied by the 100,000-volt line from the Big Bend generating plant, 125 miles (201 km.) distant.

ELECTRICITY FACILITATES COAL HANDLING AT CAMP

Description of Machinery That Not Only Saves \$100 per Day, but Takes Care of Bigger Load with Less Help

Electrically operated machinery saves over \$100 per day in coal handling at Camp Devens, Ayer, Mass., one of the cantonments of the National Army. During the recent severe weather the daily coal consumption of the cantonment was about 800 tons, and the problem of distributing the fuel through the camp is no small one. Camp Devens was designed to accommodate about 42,000 troops.

Coal is brought to the camp by rail and discharged upon the ground by gravity from a trestle of the Boston & Maine Railroad about 450 ft. (137 m.) long at the easterly side of the cantonment. A general view of this trestle and of three electric loading machines is shown in Fig. 1. A fourth machine, of the electric shovel type, is at present behind the trestle, on the other side of the storage pile, and is shown in Fig. 2. The coal-

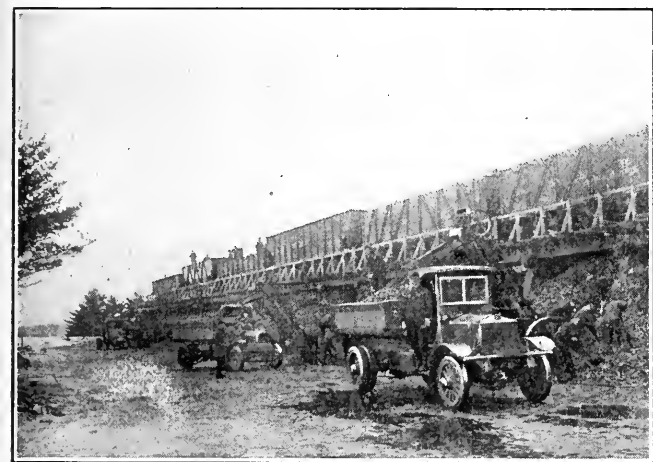


FIG. 1—GENERAL VIEW OF MACHINES

handling contract within the cantonment is held by C. E. Hall & Sons, Inc., of Revere, Mass., who schedule the movement of fuel from the ground storage pile to the fourteen boiler plants in camp, using fifteen 5-ton and 6-ton gasoline motor trucks for delivery. The average round trip of each truck is 3 miles (4.8 km.), and about fourteen round trips are made daily per truck. Normally trucks are in service from 7 a. m. to 10 p. m.

A "close-up" view of one of the electric loading machines grouped in Fig. 1 and discharging into a 6-ton Hurlburt truck is reproduced in Fig. 3. These loaders were built by the Conant Machine Company, Concord Junction, Mass., and each has a capacity of about 30 tons per hour. Energy is supplied at 220 volts from a bank of transformers connected with the cantonment supply circuits, these being fed through a substation connected with a 66,000-volt line of the New England Power Company. Each loader is gear-driven by a 5-hp. Westinghouse three-phase induction motor mounted on a frame and housed in a sheet-iron box providing easy access for inspection. The motor speed is 1750 r.p.m., and a reduction to about 350 r.p.m. is obtained through the pinion and gear to the main driving shaft, from which a Griplock chain drive is provided to a wheel and shaft that provides the drive for the buckets.

The buckets are 8 in. (20.3 cm.) deep, 8½ in. (21.6 cm.) wide and from 16 in. to 18 in. (40.6 cm. to 45.7 cm.) long, depending on the size of the machine. About twenty buckets are required per machine. The machines weigh from 2800 lb. to 2 tons (1270 kg. to 1840 kg.), according to size, and are easily moved about to



FIG. 2—ELECTRIC SHOVEL AT WORK

different portions of the coal pile. A flexible cable connects the motor in each machine with an appropriate terminal box or outlet on the trestle.

The electric shovel shown in Fig. 2 is of the Thew type and handles about one-fourth of the daily tonnage. It is designed for revolving service and is self-propelled. Energy is supplied through a flexible cable, the machine being operated by a 20-hp. Westinghouse induction motor. A 6-ton truck can be loaded in about five minutes with this equipment. The best day's work of the four electrically driven machines at the Camp Devens coal-reclaiming yard to date is 1056 tons. Formerly 150 men were required for this work and the maximum tonnage handled in one day was 750 tons by hand, and with motor truck distribution. At present three men are used on the shovel, one being an operator, who receives

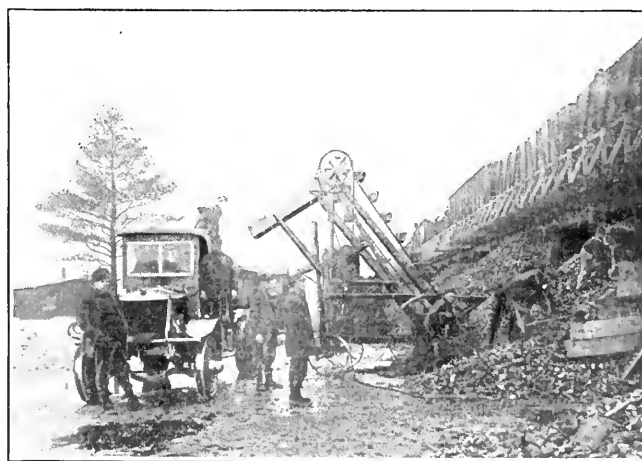


FIG. 3—"CLOSE-UP" VIEW OF LOADING MACHINE

91 cents per hour for forty-four hours per week and double rates for overtime. The loaders require one, two or three men each for the most rapid feeding, and the whole force now is composed of only about twenty men. The capacity of the ground storage is about 50,000 tons.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

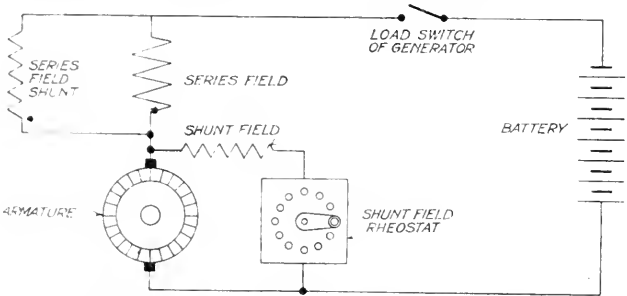
LOCATING TROUBLE IN MOTOR-GENERATOR SET

Generator Was Being Motored Owing to the Clamp of Two Bottom Series-Field Coil Interconnections Working Loose

BY E. C. PARHAM

That all battery-charging circuits should include a reverse-current circuit breaker to prevent the cells from motoring the generator should the generator voltage fall below that of the cells is shown by the following incident: A motor-generator set after being connected to some batteries all night appeared to be unable to charge the batteries. The set was found to be running at a reduced speed with circuit breaker open. The accompanying diagram indicates the connections.

The set was shut down by pulling the knife switch and the generator was carefully inspected. The series field-coil interconnections were of the clamp type and the clamp of the two bottom coils had worked off, there-



CONNECTIONS OF MOTOR-GENERATOR CIRCUIT

by opening the series winding and making it necessary for the series-field shunt to carry the total current. Had there been no series-field shunt, the loosening of the clamp would have opened the circuit between the generator and the battery and there could have been no motoring action.

As it was, however, the cutting out of the series winding lowered the voltage of the generator to a value that was below that of the battery and the shunt held intact the circuit that was necessary for the motoring. Up to the time of the opening of the motor breaker the driving motor and the battery had been operating the set in the same direction.

Emergency Temporary Repair for Plain Grate

Recently in a small Middle West power house where it was not possible to secure plain grates owing to delays in deliveries, etc., temporary grates were constructed of 2-in. (5-cm.) and 3-in. (7.5-cm.) pipe sawed to the proper length. This makeshift repair tided the plant over the period of railroad congestion and maintained steam-heating and electric service until the repair parts which were in transit arrived.

A MOTOR-DATA SHEET FOR INDUSTRIAL PLANTS

All the Important Data Concerning the Installation of Each Motor Are Included in This Comprehensive Record

To avoid the usual lack of complete data bearing upon motor applications in industrial plants, a Massachusetts factory uses the form reproduced herewith. On a sheet 8½ in. by 10¾ in. (21.5 cm. by 27.3 cm.) in size all the more essential data are listed, including the factory section, department and floor on which the

MOTOR	
For	Date.....191
Dept.....	Blgd.....Sect.....Floor.....Size H.P.....
Voltage - 230 D. O.....	Duplicate of Shunt Similar to Drive on Mach.No.....Compound Wound Series
Constant	By Armature.....
Variable Speed	Normal Speed.....By Field.....
Direct	
Clutch Connected.	Back Geared.....Ratio.....Reversible.....
Pulley Diam.....	Face.....Teeth in Gear.....Sliding Rail Base.....
Arranged for Floor Mounting	Enclosing Covers
Ceiling Suspension	Mesh Enclosed
Make Recommended by Drafting Dept.....	Type.....
Catalogue.....	Page.....
Plain heavy Duty Starter with Renewable Segments	
Armature Controller with Renewable Segments - Fan Duty.	
Compound Controlled With Renewable Segments - Machine Duty	
Starting Resistance and Field Control with Renewable Segments.	
Overload Release	
Printing Press Type	
Self Starter - Lock and Key	
Panel with Knife Switch and Fuses	
Circuit Breaker	
Reverse Switch.....	Dynamic Brake.....
.....Single	Number Steps Armature
.....Double Push Button Stations	Field.....
Ship to.....	
Wanted.....Appropriation received.....	
Ordered.....From.....	
Remarks:	
Our Number.....	

COMBINED MOTOR ORDER AND DATA SHEET FOR USE IN INDUSTRIAL PLANT

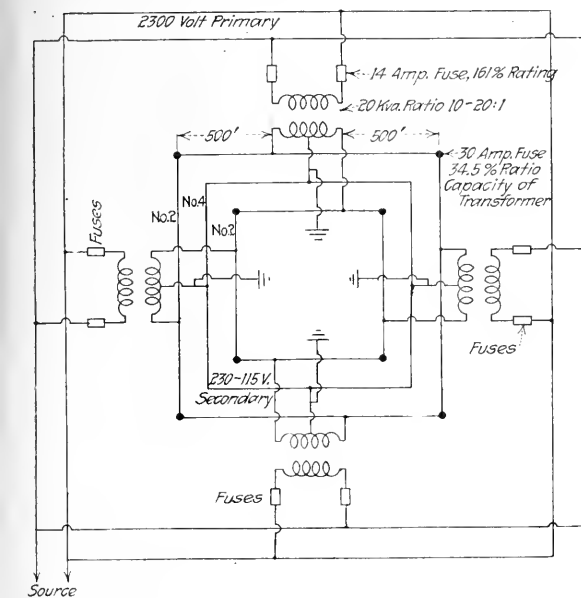
motor is going, speed, pulley and suspension or mounting details, type of covers, make recommended by drafting department, type of controller and shipping directions.

On the original order it has not been customary to fill in more than the necessary information for the motor maker and control manufacturer, but the complete information desired by the plant is kept on the filed sheet, which is convenient in its provision for all the important facts.

ECONOMICAL PLAN OF FUSING INTERCONNECTED SECONDARIES

Placing Fuse at Neutral Point Between Transformers and Choosing Fuse Rated at 30 per Cent of Transformer Is Recommended

In discussing the advisability of fusing interconnected transformer secondaries on a single-phase distribution system, M. E. Grah of the Toledo (Ohio) Railways & Light Company expressed the opinion before a meeting of the distribution committee of the Ohio Electric Light Association that fuses should be



BANK OF FOUR TRANSFORMERS WITH INTERCONNECTED SECONDARIES FUSED AT NEUTRAL POINTS

used. If the secondary is not fused, said he, the primary fuses of all transformers will probably blow in case any transformer fails. When this happens it will be impossible to energize the bank again until the secondaries are sectionalized. Moreover, if a primary fuse is blown and the secondary network is alive from other transformers, the transformer which is in trouble is "alive" and should not be inspected until its secondary has been disconnected. These have been the great objections to banking transformers.

Having decided to fuse the transformer secondaries, the next question to settle is the location of the secondary fuses. If the secondary fuses are placed at the transformers, some saving in time is made in getting at the transformer for inspection in case of trouble. It is Mr. Grah's opinion, however, that this method of fusing does not obtain the results desired from fusing and requires the use of fuses of such size as to be too costly for the benefits derived. A better arrangement can be secured by fusing the primary of the transformer for about 150 per cent of its rating and placing a fuse rated at about 30 per cent of the rating of one transformer at the neutral point between the transformers of the bank.

For an example consider the layout shown in the accompanying diagram. Here are shown four 20-kva., 2300/220/110-volt transformers with interconnected secondaries. In the primary 14-amp. fuses are used as the standard size, giving nearly 150 per cent of the transformer rating. In reality the 14-amp. fuse gives

161 per cent of rating. This permits the 80-kva. transformer bank to deliver a total maximum rating of 128.8 kva., or 32.2 kva. per 20-kva. unit, or 140 amp. at 230 volts. The full-load rating of each transformer is 87 amp. at 230 volts, and with the load divided equally at the transformer this allows 43.5 amp. each way from the transformer. By assuming the transformers to be 1000 ft. (304.8 m.) apart and that the neutral point is just half way between them, it can be decided to install these fuses in the outside wires rated at 30 per cent of the rated capacity of the transformers. This will permit an interchange between transformers of 30 amp. or 6.9 kva. Such an interchange may appear small, but in case of failure of one of the transformers this fuse is designed to blow before permitting either of the adjoining units to become overloaded more than 134 per cent.

To prevent trouble from accidental grounds, Mr. Grah recommends grounding the neutral of the secondary on poles adjacent to transformer poles if primary lightning arresters are installed on transformer poles, or on the transformer poles themselves, if possible.

EMERGENCY SWITCHING AND COMMUNICATING SCHEME

Used to Advantage in the Repair or Rebuilding of Transmission Lines Which Cannot Be Worked on While Alive

A switching and communication scheme which may be used to advantage during line repairs or rebuilding is illustrated herewith. It is particularly applicable to the reinsulating of loop lines of from 11 kv. to 22 kv. which cannot be worked on while "alive" and which have such characteristics that, while one arm of the loop is adequate to carrying the day load, both branches must be placed in operation each evening.

As will be seen from the diagram, a small transformer with indicating lamps is placed just inside of each of the switches which cut out the section to be worked on. Two lamps are used to insure against failure, and the transformers are not fused, to eliminate incorrect signals due to a blown fuse. In addition, a branch line switch is installed at each point. Two terminals of this switch are used to short-circuit and ground one phase of the line; the other cuts a telephone into the circuit.

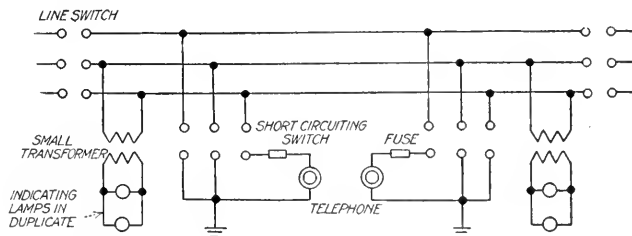


DIAGRAM OF CONNECTIONS FOR COMMUNICATING SCHEME

In the morning the foreman of the repair crew proceeds to one switch and a patrolman or the foreman of a second crew to the other. Each opens his line switch on arrival, and when the second has been opened the lamps at both points go out. Each then throws in the short-circuiting switch and after waiting two minutes they communicate by telephone and the fore-

man receives a definite report that the other switch is open. At night the procedure is reversed; at an appointed time the men communicate by telephone and each reports all men clear. They then hang up, open the short-circuiting switches, wait two minutes and then close the line switches. Even should an incorrect lamp signal be given by the coincidence of failure of energy on the line while one man is waiting in the morning, no accident beyond the shutting down of the line will occur, since the line is not worked on unless short-circuited and grounded. This system is obviously unnecessary where commercial telephones are available near each switch point.

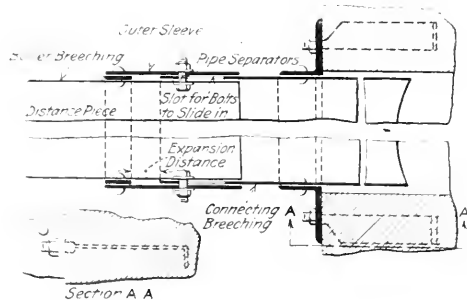
EXPANSION JOINT USED IN SMOKE BREECHING

Reasons Why This Type of Joint Is Best in a Long Breeching Which Is Designed to Serve a Number of Boilers

BY T. W. REYNOLDS

Without some provision for expansion and contraction, the breeching will in course of time leak at joints and uptakes with detriment to the proper draft. More particularly is this true of its connection to the chimney opening, at which point the breeching is riveted to angles which are in turn secured by anchor bolts to the brickwork of the chimney. Intermittent operation, forcing of boilers and the extremes of temperature changes will soon force an opening at this point and draw the anchor bolts from their fastenings. Therefore a long breeching serving a number of boilers should have an expansion joint next to the brick chimney, particularly when the connecting portion to the chimney is exposed to the weather and not covered.

In the construction illustrated the breeching, usually of No. 10 gage, is terminated at a point near the chimney and provided at this end with an outer sleeve of $\frac{1}{4}$ -in. (0.6-cm.) iron, $10\frac{1}{2}$ in. (26.7 cm.) in length. At the boiler end of the sleeve a continuous-distance piece of 2-in. by $\frac{5}{16}$ -in. (5-cm. by 0.7-cm.) iron is riveted on 4-in. (10-cm.) centers to and between the breeching and sleeve. This forms a space entirely around the breeching, $\frac{5}{16}$ in. by $8\frac{1}{2}$ in. (0.7 cm. by 22 cm.) in length, into which space is fitted a breeching of $\frac{1}{4}$ -in. (0.6-cm.) thickness connected at its other end through



DETAILS OF JOINT FOR EXPANSION AND CONTRACTION

the chimney opening. The boiler breeching, being free to move, slides as a hollow piston inside of this latter breeching for a maximum distance of $2\frac{1}{2}$ in. (6.5 cm.), this being the distance fixed by the construction as shown herewith.

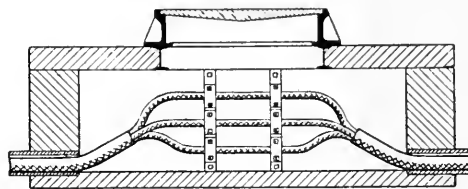
The connecting breeching and outer sleeve are se-

cured together by bolts with washers under the head and with pipe separators as distance pieces around the bolts. The bolts slide in the slots cut out in the connecting breeching, their movement being equal to and dependent upon that of the boiler breeching.

CABLE RACKS DESIGNED FOR UNDERGROUND SERVICE HOLES

Eliminates the Use of Junction Boxes—Cables Are Fanned Out and Passed Through Insulators—Cost Saving

Hand-holes have been provided between manholes on the underground system of the Knoxville (Tenn.) Railway & Light Company to facilitate service taps and inspection. Ordinarily expensive junction boxes are



RACK WHICH ELIMINATES USE OF JUNCTION BOX

provided in all hand-holes, but in the Knoxville system these junction boxes are eliminated, the cables being fanned out and passed through insulators, as shown in the accompanying diagram. All service connections are made by soldering directly on to the cables and taping the joints. This construction reduced the cost one-eighth and has proved thoroughly satisfactory in operation.

INTERESTING POLE-SETTING RECORD OF WESTERN COMPANY

1503 Poles Set Over 35.5 Miles of Line and Three Villages at an Average Expense of 26.5 Cents per Pole

The Dakota Engineering & Construction Company, which is at present engaged in the erection of a high-tension transmission line from Valley City, N. D., to supply a group of small outlying villages, claims that during the last season its men set seven 60-ft. (18.3-m.), thirty 40-ft. (12.2-m.), 124 35-ft. (10.7-m.), 1222 30-ft. (9.1-m.) and 120 25-ft. (7.6-m.) creosoted Western cedar poles, a total of 1503 pieces, over 35½ miles (57 km.) of line and three villages, at a total cost of \$398.85, an average of 26½ cents per pole. The crew consisted of six men including the foreman. The foreman received \$4.50 per day and the laborers \$3. On the high-tension lines in the country it was common for this crew to set from eighty-five to ninety 30-ft. poles per day, an average in spite of the high wages of only 21 2/3 to 23 cents each.

The poles were set, lined and tamped, having been placed near the holes previously. All 40-ft. (12.2-m.) poles and lighter ones were set with four pikes, larger poles by means of block and tackle. In no case were more than six men used on the pole-setting crew. It might be mentioned, in addition to the above, that each pole carried a 25-lb. (11.3-kg.) iron wishbone arm when raised.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

RATES FOR THAWING

FROZEN WATER PIPES

New York Company Has Derived a Revenue of \$895
During the Past Winter from
This Work

H. K. Stein, superintendent of the Genesee Light & Power Company of Batavia, N. Y., commenting upon the article on rates for thawing frozen water pipes in the Feb. 16 issue of the ELECTRICAL WORLD, page 363, writes as follows:

"The Genesee Light & Power Company has been thawing pipes by electricity for some time past and has charged for its service on a different basis from that noted in the article concerning the practice of the company at Binghamton, N. Y. The Genesee Light & Power Company makes a charge of \$5 for an 0.75-in. (1.9-cm.) pipe and an additional charge of \$5 for each 0.25-in. (0.63-cm.) increase in size. Up to the present date the company has thawed 152 water services varying in size from 0.75 in. (1.9 cm.) to 3 in. (7.6 cm.), with a resultant revenue of \$895. This shows an average revenue per service thawed of \$5.88 per service." [See also ELECTRICAL WORLD for March 2, page 467.—EDS.]

ELECTRIC RANGE BUSINESS

GROWING IN SMALL CITIES

An Analysis of the Range Situation Shows the
Smaller Towns to Be Taking Up This Load
Actively with Good Success

While in the large cities central stations may not expect to push ranges this year, they will in the great majority of cases continue to sell them. The usual amount of publicity will probably not be given to the range business, but sales will be made quietly as a matter of routine. This, in fact, is going on at the present time. But in the small towns and cities there is a different outlook on the range business.

For purposes of analysis these smaller communities can be placed in two classes—first, those owned and operated by holding companies; second, those owned and operated by local capital. It seems probable that there will be less activity in the former group than in the latter. This is a natural consequence of the present financial situation, in which borrowing capital is a difficult process. The companies owned locally do not encounter so much of this trouble as others because their sources of capital have not yet been subject to such severe drains as have the central markets. Moreover, some locally owned companies have in general been less forward in making rates for electric cooking and in establishing twenty-four-hour service than other companies. The backward companies, seeing an opportunity on account of the high cost of domestic fuel to get range business easily, are making cooking rates. It

is true that in some cases they are looking at the revenue from cooking as an additional source that need not necessarily bear so much of the fixed cost as business already existing. But nevertheless the rates are being inaugurated, and these newly opened towns are providing this virgin territory for the range salesman to work. If it is found that time payments are essential to the success of any of these small-town campaigns, it is felt that there will be little difficulty in getting the money to carry the accounts. The operations of the Morris plan banks have opened the eyes of nearly every small-town banker to the possibilities of making money out of handling accounts of this nature.

Tangible evidence of the correctness of this analysis has been secured by the Hughes division of the Edison Electric Appliance Company. A circular letter was sent to a large mailing list of central stations, and inclosed therewith were a small envelope stuffer on ranges and a return post-card order blank for ordering either ranges or advertising helps. It was expected that there would hardly be any range orders, but it was thought that there would be calls for advertising helps from the cards. At the end of eight days after the letter had gone out the company had replies from eighteen companies in different states, and the replies included actual orders for \$985 worth of ranges. But the most interesting fact about the results of the letter is that the replies came mostly from communities that had never before been known as range markets. As indicating the character of the communities to which the letter and the range business appealed, a list of some of the towns is given: Zionsville, Ind.; Great Barrington, Mass.; Kalispell, Mont.; Albany, Ga.; Elma, Iowa; Deansboro, N. Y.; Froid, Mont.; Williamsburg, Ky.; Bloomville, Ohio; Earling, Iowa; Liberty, Mo.; Intercourse, Pa.; Oak, Neb.; Norton, Kan.; Clinton, N. C.; Salt Lake City, Utah; St. George, Utah; Armstrong, Iowa; Clearwater, Fla.; Boonville, Ind.; Portland, Me.; Portsmouth, Ohio; Lamon, Iowa; Gillespie, Ill.; Midland, Tex.; Huntington, Mass.

THE DIFFICULTY IN HANDLING APPLIANCE PAYMENTS OVERCOME

A Special Colored Coupon Is Attached to the
Monthly Bills of Customers Having an Open
Account for Appliances, Thus Saving Work

Trouble has been found by cashiers of utility companies in taking care of payments on account for special campaigns where these payments were included with the regular bill for meter service. In order to eliminate this difficulty, the Rochester (N. Y.) Railway & Light Company, in one of its special appliance campaigns recently, issued a special colored coupon which is attached to the regular monthly bill of any person who bought one of the appliances in that campaign. When the cus-

Consumer pays his bill for service and also for the appliance the cashier stamps both bills paid in one operation, tears off the special colored slip and places it on a separate file.

RUBBER STAMPS SAVE EXPENSE IN BILLING

Company with Sliding-Scale Rate Does Billing Now in One-third Time Required for Industrial Calculations

The Consumers' Electric Light & Power Company of New Orleans has just introduced a system of rubber stamps to save some of the clerical work entailed in making out its several thousand monthly bills. Under the company's rate lighting service is figured on a sliding scale and a great deal of calculating is required in figuring the bill totals each month. To make out a bill for 300 kw.-hr., for instance, it has been necessary to list five amounts and the total, including, first, the service charge of 25 cents; second, the first 20 kw.-hr. at 8 cents; then the next 30 kw.-hr. at 7 cents; then the

allowed for prompt payment, a simple matter as 1 cent is allowed for each kilowatt-hour consumed during the month.

It has been found that the use of these stamps makes it possible to do the billing in one-third of the time formerly required, and with considerable more neatness, besides minimizing the element of incorrectness in totaling. General Manager Aicklen recommends this system to other managers and offers to send a full set of impressions from these stamps to any one who desires them.

SUCCESS WITH GIRLS HIRED AS METER READERS

Colorado Utility Finds that They Are More Accurate than Men, Besides Making a Better Impression Upon Housewives

While there has been some hesitation about employing girls or women as meter readers owing to the inaccessibility of some meters and the condition in which cellars are frequently kept, some companies are finding the employment of women in this connection very satisfactory.

The Arkansas Valley Railway, Light & Power Company of Pueblo, Col., has during the last few months been employing young girls in the meter department as meter readers and has found them to be fully as competent and dependable as men in the number of meters read, and, according to Superintendent E. F. Stone, "if anything, more accurate."

Approximately 90 per cent of the meters in Pueblo are in the residence district, which enables girls to read a great percentage of the meters. The girls are limited to this district. The company employs one young man as a reader who handles the commercial and industrial districts and also acts as a relief reader.

The girls are furnished with a leather case in which to carry book and flashlight. They are also furnished with an identification card, as shown. They receive the same compensation as the men formerly employed at this work. They are reading on an average twenty-five meters per hour, work from four to five hours in the morning and read "strays" or are employed in the shop in the afternoon cleaning and repairing meters.

By reading the meters in the morning and using the girls in the shop in the afternoons the company finds the number of "strays" greatly reduced, as a greater percentage of the people are away from their residences in the afternoon.

When a girl is employed as a meter reader she is first required to serve at least a week or ten days in the

The image shows two examples of utility bills from the Consumers' Electric Light & Power Company of New Orleans. Both bills are for the same company, located at 116 BARONNE STREET. The top bill is for J. L. BAPTISTE, 4220 CLARA ST., and the bottom bill is for MRS. A. MOOS, 2420 GEN. TAYLOR. Both bills show a service charge of 25 cents and a total gross bill of 33 cents. The bills include a 'WE SELL' stamp and a 'W.S.S. WAR SAVINGS STAMPS' stamp. The bottom bill also includes a 'CASH DISCOUNT' section with a table of rates for different amounts of gross bill.

AMOUNT OF GROSS BILL	DISCOUNT
100	1%
200	2%
300	3%
400	4%
500	5%
600	6%
700	7%
800	8%
900	9%
1000	10%

HOW PUBLIC UTILITY USES RUBBER STAMPS TO SAVE BILLING EXPENSE

next 150 kw.-hr. at 6 cents, and the final 100 kw.-hr. at 5 cents. These extensions must then be totaled.

A careful analysis of the bills developed the fact that 80 per cent of the customers were using somewhere from 1 kw.-hr. to 300 kw.-hr. per month, and a series of rubber stamps were secured numbered from 1 to 300, each of which bears the necessary calculation to cover that consumption. So that by merely stamping the bill the fixed service charge of 25 cents, which is added to all retail bills, and all the items on the sliding scale are covered in one operation. The billing clerk has these 300 stamps before him arranged in a handy rack, from which he can easily pick the proper stamp with far less risk of error than in hasty figuring. The only figuring now necessary on the bill in pen and ink is the discount

shops cleaning and reading the shop meters. She must become efficient in reading shop meters before she is allowed to take a route.

The girls have met with little difficulty in obtaining admission to the homes to read meters. From com-

Form 214 3-15 500

Pueblo, Colo. Jan. 1st. 1918

To Our Customers:

This is to Certify, That the bearer of this Card

Miss Ruth Barr

is employed by this Company as **Meter Reader**

Customers will please admit him to their premises at reasonable hours for the purpose of reading, testing or inspecting meters or making necessary repairs.

This Card becomes void after **Feb. 1st. 1918.**

The Arkansas Valley Railway Light and Power Co.
(SGD) **E. F. STONE**
Supt. Lighting and Power

IDENTIFICATION CARD OF GIRL METER READER

ments that the company has received from the housewives, they prefer to have girls read the meters, and the results attained make it very likely that the company will continue to use girls in this work.

TEMPORARY RECEIPTS FOR GUARANTEE DEPOSITS

Brooklyn (N. Y.) Company Institutes New Method for Handling Customers' Deposits Collected by Salesmen

A new method of handling customers' guarantee deposits paid to collectors has recently been instituted by the Edison Electric Illuminating Company of Brooklyn, N. Y. Formerly it had been the custom for the collector to issue to the customer merely a memorandum receipt, very similar in character to the memorandum receipts which are commonly issued by banks in return for stock certificates left for transfer. It did not constitute a specific receipt for the amount of cash paid or cover the full details, but was followed by a formal receipt in detail which was forwarded to the customer from the office. The result was that salesmen, collectors and branch office cashiers experienced more or less difficulty with any customer who did not feel that he was properly secured for the money paid down and was unwilling to wait for the formal receipt to come by mail.

The new plan has put in force a system of temporary receipts which are issued to the representatives in books of a convenient pocket size containing fifty individual receipts serially numbered, each receipt providing a temporary customer's receipt, a cashier's coupon and a permanent carbon which remains in the book. Whenever a deposit is now paid to a representative of the company a temporary receipt is given, and this receipt states plainly that a regular deposit certificate will be mailed within five days from the treasurer's office.

A cashier's coupon is also made out, and it accompanies the money when turned in. The supply of books is under the control of the cashier, who secures the employee's signature when the book is issued and signs for the empty book when the receipts are used up. An

additional numerical control of individual coupons is secured by a system of tally sheets maintained by the cashier, on which he notes after each number the date the coupon was put through the records. It is a very simple method, requiring very little labor, and provides an absolute check against the proper receipt of every deposit which is paid to a representative of the company. The records of these deposits are kept on a series of cards that are operated by a tabulating machine.

Each book bears the name of the employee to which it has been issued on a special label which provides space for the transfer of the book to other employees. Careful instructions for the handling of these guarantee deposits are pasted on the cover of the book, as follows:

"Coupons and receipts should be written in ink. It is important that names, initials and addresses be correctly given. Legible carbon copies should be made on the duplicate (stub). Deposits turned over to branch office cashiers by agents should be receipted for on the duplicate. Deposits must be turned in to the company daily, accompanied by a correct copy of order. The space provided on the coupon for mailing address is to cover cases where party from whom deposit is received does not yet or will not reside at premises at which service is to be supplied. Consumers' deposit coupons are to be treated the same as cash coupons attached to electric bills. They are to be listed on the reverse side of collectors' 'daily collection sheets' under the heading of consumers' deposits, listing the number of the coupon as well as the amount of the total. This will constitute a permanent record of deposits turned in to the company and the receipt form attached to the collectors' 'daily collection sheet' should be properly made out by collectors and signed by person authorized to receive the money for the company. Collectors and branch office cashiers should carefully preserve all such receipts."

The new plan discontinues the practice of giving a self-addressed stamped envelope to customers paying deposits and provides a serially numbered temporary receipt to be held by customer until the permanent re-

<input type="radio"/> CASHIER'S COUPON No. 6571 CONSUMER'S DEPOSIT RECEIVED FROM NAME _____ TO BE APPLIED TO _____ PREMISES _____ AMOUNT \$ _____ DEPOSIT NO. _____ MAIL DEPOSIT CERTIFICATE TO _____ _____ _____	TEMPORARY RECEIPT No. _____ FOR DEPOSIT AMOUNTING TO \$ _____ _____ DOLLARS REGULAR DEPOSIT CERTIFICATE WILL BE MAILED IF NOT RECEIVED WITHIN FIVE DAYS NOTIFY TREASURER'S OFFICE EDISON ELECTRIC ILL'G CO OF BKLYN, 360 PEARL STREET BROOKLYN N. Y. FOR THE COMPANY _____
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LEAF TORN FROM BOOK SHOWING TEMPORARY RECEIPT AND CASHIER'S COUPON

ceipt is received, thereby saving a great deal of time formerly used in explaining why no receipt was issued for the money received.

Not only that, but it minimizes the opportunity of customers suspecting the company of trying to defraud them of their money. It is always easier to prevent trouble than to make explanations later to an irritated customer.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Notes on the Design of Electromagnetic Machines, Part III.—STANLEY PARKER SMITH.—In Part I of the article the author dealt with some of the main principles underlying the design of alternating-current generators. In Part II these principles were applied to the design of a low-speed, three-phase alternator, giving 750 kw. at 2200 volts when running at a speed of 250 r.p.m. In Part III the principles are applied to the design of a three-phase turbo-alternator to give 2000 kw. at 3000 r.p.m. at a line pressure of 5000 volts, and the mechanical stresses in the rotor are discussed.—*London Electrician*, Feb. 8, 1918.

Factors That Determine Maximum Rating.—F. T. HAGUE.—Commutation and temperature are the principal limitations to the ratings of direct-current machines, but the method of rating must be determined partly by the characteristics of the unit and partly by the service requirements. The limitations to rating may be considered as shifting, being extended as the knowledge of the theory involved is enlarged and as the skill in design and construction is improved. Most of the article is taken up with commutation limitations. Among the subjects discussed are commutator construction, maximum voltage, voltage per bar, flashing, maximum current, brush width, brush-current density, division of current between brushes, quality of brushes, armature reactance voltage, number of poles, and kw. versus speed.—*Electric Journal*, February, 1918.

Lamps and Lighting

Effect of Artificial Light on the Growth and Ripening of Plants.—J. L. R. HAYDEN and C. P. STEINMETZ.—A hitherto unpublished investigation of the application of electric light to stimulation of plant growth and fruition appears in the article. A description is given of the procedure, and the results are presented in the form of progressive photographs, tabulations and curves. Based upon these facts, the conclusions of the investigation show that under certain conditions electric light may be used with commercial success to accelerate the growth and development of plants.—*General Electric Review*, March, 1918.

Generation, Transmission and Distribution

The Unification of Frequencies.—ULISSO DEL BUONO.—The first installment of an extended study into this question, which the author purposes to discuss under four divisions: (1) Influence exerted by the alteration of frequency upon generating plants, prime movers and electrical machinery, and the modifications which ought to be made to enable machines to operate at a frequency different from that for which they were built; (2) influence of the alteration of frequency upon the lines, network and receiving stations and modifications necessary with a change in frequency; (3) general considerations upon cost and conditions of performance in

the case of new machinery constructed for a given frequency; (4) methods of bringing about parallel operation of networks with different frequencies and examples of plants which have changed the frequency.—*L'Elettrotecnica*, Feb. 5, 1918.

Design of Underground Distribution for Electric Light and Power Systems.—G. J. NEWTON.—The object of this article is to show each step necessary in the design of an underground distribution system such as is usually required in a medium-size city. The operating conditions and municipal requirements are different in every locality; it is impossible, therefore, to make any definite rules that will apply under all conditions. By assuming the average conditions met with in the smaller cities it is possible to show the fundamental principles of handling this work in a systematic manner. While systems may and do differ, still it is possible to design a system for any type of distribution if these principles are followed. Where costs are given they are based on normal conditions and should not be taken as being the present costs. They are used simply for comparison, however, and will be of value in that manner only, and if treated as percentage difference will apply under any reasonable conditions. Owing to lack of space, no tables have been printed in this article as they can be found in electrical handbooks.—*A. I. E. E. Proceedings*, March, 1918.

Water Power Our Electrochemical Salvation.—C. A. WINDER.—The author undertakes to show that at least 50 per cent of the water now passing over Niagara Falls could be quickly and cheaply diverted for power purposes without in any way detracting from their natural beauties. In view of the serious coal shortage and the urgent need of electrochemical products, he contends that it is the duty of Congress to enact legislation at once which will make available the great quantity of energy now being wasted.—*General Electric Review*, February, 1918.

Installations, Systems and Appliances

Advantages of Electric Cooking.—Facts culled from the *Bulletin* of the Swiss Association of Electricians concerning the report of a commission on heating and cooking apparatus. Holding that the higher price of electric ranges as compared with gas ranges is counterbalanced by their superior safety and cleanliness, it follows that the essential condition of electric service is a charge not greater than that for gas. The daily consumption of gas for cooking is from 0.3 cu. m. to 0.5 cu. m. a person and that of electricity from 0.80 kw.-hr. to 1.04 kw.-hr. a person, the higher figure including the heating of water. Therefore it is necessary to sell 2.4 kw.-hr. at the same price as 1 cu. m. of gas. Since with the war the price of gas has risen from 18 to 20 centimes to 30 centimes (6 cents) a cubic meter, electric energy should therefore sell for 10 to 15 centimes (2 to 3 cents)

per kilowatt-hour—a price at which it is already sold by some central stations. It is objected that in many cases the existing electric installations are not able to take on the increased load that a general adoption of the electric range would cause. Much, however, can be done by tariffs adjusted to encourage the use of off-peak energy for cooking purposes.—*Revue Générale de l'Electricité*, Jan. 19, 1918.

Electricity in Beet-Sugar Factories.—E. M. ELLIS.—The article gives a readily intelligible description of the processes involved in the production of beet sugar and explains how greater reliability and economy can be secured by electrification. The many illustrations show the simplicity and flexibility of electric drive.—*General Electric Review*, March, 1918.

Testing Electric Ignition Apparatus.—J. D. MORGAN.—In connection with the testing of electric apparatus—namely, magnetos and induction coils—it is required to measure the current in the high-tension spark circuit. Owing to the complex character of the current, the problem of measurement is a difficult one. At the present, the author points out, the problem appears to be incapable of complete solution, and the task of producing a practical instrument resolves itself into devising means which will give useful indications when subjected to the actions of different currents having the same general characteristics. Different types of thermal instruments and varieties of the same type give very different accounts of the same piece of ignition apparatus.—*London Engineering*, Feb. 8, 1918.

Electrophysics and Magnetism

Aluminum Bronzes.—An exhaustive study of these alloys, both ordinary and complex, with regard to their electrical and mechanical properties, fabrication and industrial use. The electric resistivity of the ordinary alloy grows according to the content of aluminum until $7\frac{1}{2}$ per cent is reached, after which it decreases. With 90 per cent of aluminum the resistivity approaches that of the pure metal. The temperature coefficient diminishes when the content of aluminum reaches 10 per cent. At 94 per cent it is virtually the same as with pure metal. The addition of minute quantities of aluminum to copper augments very sensibly the resistivity of that metal, but the addition of similar quantities of copper to aluminum hardly affects the resistivity of the latter.—*Revue Générale de l'Electricité*, Jan. 19, 1918.

Suppression of Hysteresis in Iron-Carbon Alloys by a Longitudinal Alternating Magnetic Field.—C. W. MAGGONER and H. M. FREEMAN.—Some remarkable experiments are described in which the disappearance of hysteresis was brought about by the action of an alternating magnetic field. It is possible, say the authors, that the explanation is to be found in the action of the eddy currents induced in the samples during magnetization. This point is being investigated further.—*General Electric Review*, February, 1918.

Units, Measurements and Instruments

A Recording Thermometer.—At the last meeting of the Physical Society Prof. C. V. Boys described a recording thermometer which is constructed to go into the case of a regulator clock. The thermometric element consists of a rod of ebonite within a glass tube. The differential expansion is determined by a pair of levers giving a movement of 1 in. for 10 deg. Fahr.

(2.54 cm. for 5.5 deg. C.). The drum carries an ordinary barometer chart and is driven at such a speed that a two-hour interval of $\frac{1}{8}$ in. (0.3 cm.) is passed in twenty-four hours. The drum is driven by friction by means of a cord. An alternative design on the same lines to go into a recording barograph was also given.—*London Electrician*, Feb. 22, 1918.

Some Factors Affecting Determination of Maximum Demand.—CHESTER I. HALL.—A concise review of the development of maximum-demand rate systems is given in the introduction. Following this is a discussion of the four general methods of measuring maximum demand. Meters for this purpose are segregated into two subdivided classifications, the corresponding types being named. What constitutes an equitable time interval over which to integrate demand values is given consideration. A companion article is to follow.—*General Electric Review*, February, 1918.

Telegraphy, Telephony and Signals

The Mechanics of the Pole Line.—WARD H. SNOOK.—The determination of the forces acting on pole lines by use of graphics, deductions which may be made and applied to practical pole-line construction, and drop-wire construction and sags are discussed.—*Telephony*, Feb. 28, 1918.

The Telephone in the World War.—H. T. CARROLL.—The author describes the important part the telephone performs in the operations of the various armies. The war-time use of the telephone in the United States is also described.—*American Exporter*, March, 1918.

Miscellaneous

Turbo-Rotor Cap-Rings.—R. ROBERTS.—Conclusion of article from previous issue. The author shows how the stresses in turbo-rotor cap-rings may be calculated for some commonly used designs and summarizes the points that should be considered when designing the cap-rings.—*London Electrician*, Jan. 25, 1918.

Rolling Mills and the Electric Drive.—L. ROTHERA.—The power installed in British steel and metal works for driving rolling mills is now well in excess of 300,000 hp. This represents only a very small percentage of the total power employed in these industries, however. The advantages which can be claimed for the electric drive are, the author points out, the economy of working, reduced space taken up, ease of control, constant check on the power consumed, increased output from a given plant, more uniform drive and smaller initial cost. In applying electrical methods to large reversing mills several engineering problems have had to be solved. One arises in connection with the design of the flywheel, which acts as a reservoir of energy and flattens out the constantly recurring peaks experienced in rolling-mill practice. In order to keep the weight of the wheel down to a minimum very high peripheral speeds have been employed, and to avoid the risk arising from internal strains it has been necessary to design a special type of built-up wheel to insure good balancing.—*London Electrical Review*, Feb. 15, 1918.

Switch-Gear Standardization.—C. C. GARRARD.—The author considers the various parts of switch gear which can, in the present state of the art, be standardized with advantage and suggests adoption of the American standard test pressures for switch gear, giving specifications for brass and gunmetal. The article is to be concluded.—*London Electrician*, Feb. 22, 1918.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

CO-OPERATIVE RESEARCH BY WIRE AND CABLE MAKERS

They Purpose Investigation of Fundamental Nature of Dielectric Phenomena as a Foundation for Future Progress

At a recent committee meeting of the American Institute of Electrical Engineers Prof. Comfort A. Adams proposed a comprehensive system of co-operative research by manufacturers and others interested in the properties of insulating materials. He suggested that a committee be appointed consisting of representative experts in this field throughout the country who have facilities for carrying on research. This committee would lay out a plan of research, dividing the work between the various laboratories, and would meet periodically to compare results. In this way it is hoped that the fundamental nature of dielectric phenomena may be successfully investigated and a foundation laid for progress by all of the manufacturers participating.

The object of this committee would be to economize the efforts of the industry and to obtain results which are more thorough-going, comprehensive and commercially useful to them. Professor Adams said that he thought that this kind of co-operation will be necessary if we expect to compete with an organized nation like Germany after the war is over and that the organization of this committee will be the first step in one of the biggest movements for industrial supremacy. This plan has met with the approval of many manufacturers, and it is likely that the committee will be organized in the near future.

NEW RESEARCH LABORATORY IS ORGANIZED IN JAPAN

Provisions Made for Private Research, Dissemination of Information, Co-operation with Other Bodies and Training of Researchers

A new physics and chemistry research laboratory has been recently organized in Japan. It is a semi-governmental institution, part of the foundation being furnished by the government and the rest by private subscribers.

Several young scientists have been nominated as members of the staff, and some of them are at present in the United States studying laboratory methods. The noted physicist, Dr. Nagaoka, is the head of the physics department, and Dr. Ikeda is the head of the chemistry department. The object of the institution is to conduct original investigations in physics and chemistry and to apply the results for the promotion of industry. To accomplish these objects and to make the institution more closely related to the outsiders, the articles of in-

corporation contain the following provisions: (1) Private parties may apply for research to be done on specific subjects. (2) Outsiders may obtain permission to utilize the equipment of the institution. (3) Outside investigators may obtain assistance for completing their investigations or inventions. (4) The institution will publish the results of researches conducted in it. (5) The institution will provide public lectures for the dissemination of the results of its research. (6) The institution may confer honorary degrees upon those who have accomplished original research of merit. (7) The institution will conduct correspondence with other similar institutions of the world and co-operate with them. (8) The institute will undertake training of research men.

Investigations Under Way or Completed

(RESEARCH WORK REPORTED SINCE FEB. 16)*

CELLS, PRIMARY.

Investigations are being conducted to develop a primary cell that is light and practicable for use in connection with flash-lamps.—*E. J. Berg, Union College, Schenectady, N. Y.*

CORE LOSS.

An investigation and comparison of various methods for measuring the core losses in 2000-cycle transformers. Several methods were used for measuring the losses and the results compared.—*William B. Kouwenhoven, Johns Hopkins University, Baltimore, Md.*

CORONA, DIRECT-CURRENT.

An extensive study of direct-current corona has been made. Rectification of alternating current up to 45,000 volts effective has been accomplished with the corona tube in hydrogen. The effect of a hot wire on the corona discharge has been studied, and some very interesting facts have been observed. As soon as time allows, the research will be continued.—*Jacob Kunz, University of Illinois, Urbana.*

MAGNETIC HYSTERESIS CURVE.

Steinmetz's formula for hysteresis loss gives the integral value of the loop, but does not indicate the value of the hysteresis proper as a function of field strength or of induced magnetization. An attempt is being made to separate the three forces acting in magnetized iron, namely, field strength, magnetic tension and hysteresis. For any value of field strength their resultant determines the total magnetic flux density B . The hysteresis h for the upper branch of the loop seems to satisfy the following equation (similar equation holds for the lower branch): $h = A / \cosh(\phi - u)$, where $u = c(f + H)$, and $\cosh \phi = (1/\epsilon) \cosh \sqrt{a(b + u^2)}$. In these equations H is the field strength and A, c, f, a, b and ϵ are constants.—*Hans Lippelt, Brooklyn, N. Y.*

RESISTANCE TO THE GROUND.

With the usual methods of measuring the resistance between the ground and the earthing plates the result is vitiated by stray currents and by the emf. of polarization. The author has devised a method with which an ordinary Wheatstone bridge can be used with the addition of an adjustable emf. in the plate circuit. This latter emf. is set to compensate for that which exists between the plates and is due to the earth currents, electrolysis, etc., so that the bridge measures the true ohmic resistance of the ground connection.—*Shiro Sano, Tokyo, Japan.*

TRANSIENT VOLTAGES, SPARK GAP IN AIR.

Experiments were performed on the behavior of a needle gap and of a sphere gap connected across the high-tension terminals of a testing transformer. Instantaneous voltages up to 35 kv. were applied by suddenly exciting the low-tension side with direct current, and it was found that under these conditions a needle gap can stand considerably higher transitory voltages than are shown in the A. I. E. E. table for continuous application.—*P. H. Felker, St. Louis, Mo.*

Suggestions for Research

INDUCED EMF., THE NATURE OF.

If a cylindrical condenser moves parallel to its plates in a field with its induction parallel to the plates and perpendicular to the motion, it becomes charged; but if the magnetic field between the plates is given the same relative motion while the condenser remains fixed, the condenser receives no charge. The experiments are of necessity more complicated than the corresponding experiments on rotation, especially in requiring the use of a magnetic arrangement analogous to the electric guard ring.—*S. J. Barnett, Ohio State University, Columbus.*

RECTIFIERS, COMMUTATOR-TYPE.

Theoretical and experimental investigation of a commutator-type rectifier driven by a synchronous motor. It is desired to improve the commutation by means of choke coils, condensers, etc., and to reduce the brush friction and energy loss. Such rectifiers are now being placed on the market for garages and for electrolytic work. Further development for heavier currents is desired, having in mind the electrification of steam railroads.—*Editorial Suggestion.*

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

Preventable Waste of Coal

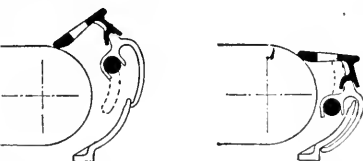
To the Editor of ELECTRICAL WORLD:

SIR: With reference to the abstract from D. M. Myers' interesting paper on the above subject contained in your issue of Dec. 8 I think it may be of interest to your readers if I give some particulars of two devices which we have had at work for some time at the Deptford power station, London, and which have proved to contain great possibilities in the way of coal saving when applied to chain-grate stokers on which it is necessary that many and



FIGS. 1 AND 2—FIXED CLINKER DAMS NOT SUITABLE WHEN WIDELY DIFFERING COALS ARE USED

graded grades of fuel should be burned. Users of these coals will have noted their widely different burning characteristics on the grate. While, on the one hand, many classes of coal yield close-lying, compact coke, many others, on the contrary, tend to "spread" on the grate in more or less open formation with isolated patches and intervening bare spaces, the latter condition making necessary some form of clinker dam or dumping bar at the rear end in order to hold the coal back and maintain a compact fuel bed until combustion is completed. The dam or dumping bar in general use has hitherto been of the fixed type, two well-known forms of which are illustrated in Figs. 1 and 2. We have found, however, that these fixed bars have very considerable limitations, as made sufficiently high to bank up and retain efficiently the "spreading" masses of coal, the ash and clinker frequently as much as 30 per cent in the poor qualities of coal we are having to burn under present war conditions will not pass over but effect a segment on and in quite a short time choke up the grate, causing a serious loss in efficiency due to excess air admission and lowering of the furnace temperature. On the other hand, if



FIGS. 3 AND 4—ADJUSTABLE DUMPING BAR SET FOR SPREADING COAL AND CLOSE-LYING COAL

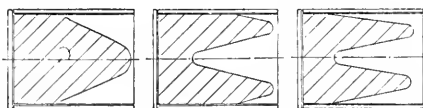
made sufficiently low to clear the ash refuse, the grate fails to retain the "spreading" coal, not only allowing large quantities of unburned fuel to pass over the rear end but also resulting in a large amount of excess air admission due to the open formation of the fuel bed.

To overcome this difficulty one of the devices referred to above has been adopted. It consists of an adjustable dumping bar, one design of which is illustrated diagrammatically in Figs.

Readers' Views and Comments

3 and 4. The dumping bars, of sectional type, pivot on supporting plates which make an air seal with a fixed "former" plate, this plate constituting the front side of the ash pit. The bearer bar carrying the sealing plate and dumping bar can be raised or lowered by hand, or preferably by means of a small hydraulic cylinder connected to the feed-water mains, the operating cocks being placed adjacent to the sight door at the rear end of the furnace. These dumping bars can therefore be set at the most suitable height for the particular fuel that is being burned, and should the accumulation of clinker require, it can be readily operated by merely lowering the bars for a few minutes until the debris has passed over, when they can be reset at the original or any suitable height. The main features of this apparatus are:

1. Flexibility of parts.



FIGS. 5, 6 AND 7—UNEVEN DISTRIBUTION OF COAL SOMETIMES OBTAINED ON GRATINGS

2. Wide angular rotation of the ash-receiving face.
3. Quick and ready renewal of parts.
4. Rocking or pushing back avoided.
5. Complete air seal in all positions.
6. Ease of operation.

The second device referred to above applies to the furnace door. One essential condition for good furnace ef-

Figs. 5 to 7. These irregularities or "legs," as the stokers call them, may be due to various causes, such as size and constitution of the coal, design of the chute feeding the coal hopper, or some feature in the design of the arch or furnace setting. It is also found that distortion and collapse of the type of guillotine door generally in use is not infrequent, more especially when burning fierce or highly volatile coals on a furnace setting which has been designed to give good front-end ignition with low volatile or low-grade fuels. We have found these difficulties almost entirely overcome by the use of the sectional adjustable door illustrated in Fig. 8, which it will be seen consists of a series of narrow doors suitably lined with firebrick and fitted with renewable shoes, each one separately and pivotally hung from a common bearer girder and individually adjustable, and so arranged that they may be collectively raised or lowered as required. Advantages of this design are, briefly:

1. Control of the fuel thickness and therefore of the distribution of the fire over the grate area.
2. Durability of parts.
3. Quick and ready renewal of burnt parts.
4. Freedom of working.
5. Effective air sealing.

The advantage of having the adjustment and flexibility of these two devices will, I think, be obvious to all users of chain or other traveling-grate stokers under any conditions of working with high or low grade fuels, but we have found them to be more particularly effective in greatly improving the efficiency of our boiler plant with the poor-quality coals we are at the present time having to handle. All who have had the experience of the unsatisfactory furnace conditions and poor efficiencies which usually are inseparable from a 25 to 30 per cent ash coal will, I think, realize the impor-

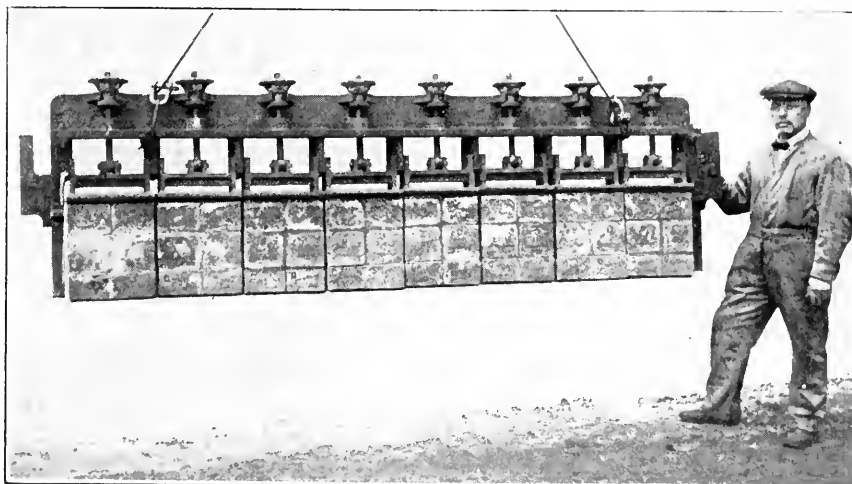


FIG. 8—SECTIONAL ADJUSTABLE GATE FOR INSURING UNIFORM FUEL BED

iciency is, of course, that the whole area of the grate up to the dumping bars should be equally covered by the fuel. Frequently, however, and more particularly in the case of the wider 8-ft. or 9-ft. stokers, the fire fringe assumes forms such as are indicated in

tance of an apparatus which can not only enable normally good efficiencies to be obtained but also show a marked improvement in steaming capacity.

G. W. PARTRIDGE.

Engineer and Manager, London Electric Supply Corporation, Ltd.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

TIME TO PREPARE FOR THIRD LIBERTY LOAN

But Three Weeks in April Allowed—Speed Necessary to Make a Perfect Record—100 per Cent Subscription the Goal Set

With a definite date now set for starting the national campaign on the third Liberty loan—April 6—the campaign will be short and furious, only three weeks being allotted in which to obtain the required subscriptions.

Speed, therefore, is necessary, and it behooves every one to keep this factor in mind. Careful plans must be laid and every effort made to go well beyond the mark set.

In the first two loans the individual subscriptions, while large, were by no means so great as they might have been. The subscriptions in large blocks from the financial centers were the predominant features.

The third loan, however, demands a much wider distribution than either of the other two. The fifty-dollar and hundred-dollar subscriptions must far exceed their number in either of the two previous loans.

Consequently there is a direct obligation on the part of every employer to see that his employees have the opportunity to subscribe 100 per cent. Those in the electrical industry have backed the other two loans magnificently. Their efforts on these occasions, however, must fade into insignificance compared with what they are to do in the three allotted weeks in April.

To sell every employee a bond is the task set the industry. To help the industry in this work by the suggestion of how it can be done is the task of the ELECTRICAL WORLD. In these pages each week until the loan is pronounced a success will be found details of schemes that have proved their worth in previous campaigns, as well as cartoons, posters and other helpful material.

In order to make the third Liberty loan another thorn in the Kaiser's side manufacturers, central stations, jobbers, dealers, contractors, engineers, agents, etc., must begin *now* to lay the foundation for their campaign in their own shops, offices and plants.

PERSONAL SOLICITATION NECESSARY

First and foremost the first two loans taught one great lesson. Personal solicitation of employees is necessary—without it the maximum results cannot be had.

Bearing this in mind, therefore, the first thing to do is to organize the shop or plant or office into a committee or committees—preferably the foremen or department heads. They should be told exactly how it is proposed to sell to the employees, namely, whether the company will carry the account and, if so, on what basis. They should be educated, if they are not already so educated, on the fundamental idea back of the Liberty loans and their enthusiasm aroused. Enthusiasm is the keynote. Without it the solicitor will not be successful.

Other preliminary work will include procuring, if it

is not already at hand, a bulletin board at least 9 in. by 12 in. in size. Naturally this should be placed where the men are in the habit of gathering.

Subscription blanks and any other stationery also should be prepared ahead of time. Posters for hanging up in all the places that the men work or gather can be procured from the local Liberty loan committee and should be on hand and hung up when the campaign opens.

The ELECTRICAL WORLD is preparing two posters which will appear prior to the beginning of the national campaign and which will serve as original posters for bulletin boards. Besides, the ELECTRICAL WORLD is laying in a supply of stickers for letterheads, printed in three colors, which may be had for \$3 a thousand. These stickers are free from all except Liberty loan advertising.

Lastly, let the local committee help. Let no stone remain unturned. The goal set is 100 per cent subscription.

For several reasons the desire for greater distribution of the loan seems likely to be fulfilled. First, America is now very much in the war—*our* soldiers are holding long stretches of first-line trenches and consequently the national realization of the war is now much more acute. Second, the education on the first two loans will serve as a foundation for the third. Third, wage earners are in a better position than ever to save.

USE OF TRADE ACCEPTANCES URGED BY MANUFACTURERS

Committee of Associated Manufacturers of Electrical Supplies Shows that They Will Be of Great Value, and Governors Act

At a recent meeting of the board of governors of the Associated Manufacturers of Electrical Supplies the following resolution on trade acceptances was passed:

Whereas the board of governors of the Associated Manufacturers of Electrical Supplies has investigated by committee the general question of the employment of trade acceptances; and

Whereas the reports of such committee indicate that the general use of trade acceptances would be of exceeding value to the electrical manufacturing industry,

Resolved, first, that the board urge upon the membership of the Associated Manufacturers of Electrical Supplies the desirability of the immediate adoption in their respective businesses of the trade acceptance; second, that members not fully acquainted with the methods and processes employed be urged to communicate at once with the committee on trade acceptances and obtain the information necessary to a thorough understanding and ultimate adoption; third, that the committee consisting of Messrs. Eidlitz, Trumbull and Dustin be continued and instructed to extend by all proper methods throughout the electrical manufacturing industry the use of the trade acceptance; fourth, that a copy of this resolution be mailed to all members of the Associated Manufacturers of Electrical Supplies.

MINNESOTA ASSOCIATION IN WAR-TIME CONVENTION

Members Meet at Minneapolis Because They Feel
Need of a Conference to Consider Problems
Growing Out of the War

The first war-time convention of the Minnesota Electrical Association was held at Minneapolis on March 11, 12 and 13. The registered attendance was larger than it had been at any time before in the association's history. The members had expressed a desire for a convention as a war-time necessity and came to the meeting to learn how other companies are solving the new problems presented by war conditions. The keynote of the convention was conservation. Keen interest was displayed in papers and discussions on all plans for effecting true economies.

President F. A. Otto of Albert Lea departed from the usual type of presidential address and made several definite recommendations. He said in part:

Considering the question of holding a meeting this year, the board of directors of the association was unanimously of the opinion that the abnormal conditions caused by the war made it more necessary than ever to get members together for their mutual co-operation in maintaining the central-station industry at maximum efficiency.

The work of operating a public utility is becoming more and more difficult and the end is not yet in sight. Delays and inability to get fuel and the increasing cost of coal, as well as the rising cost of labor, have added materially to the operating expenses.

Difficulty in financing new extensions and securing new capital have added to the troubles; shortage of material, transportation delays, curtailment in lighting and power have all tended to reduce revenues of central stations. For these reasons and many others it seemed necessary to call members together.

The president then recommended that a fuel committee be appointed with the following objects:

1. To make a survey of the coal situation in the State as it affects public utilities. By this is meant to ascertain the amount of coal consumed annually by the public utilities and the monthly consumption, and to ascertain how much coal can be stored by each utility. This will show how much coal must be transported.

2. To co-operate with the State Fuel Administrator to secure the necessary supply of coal and to co-operate with railroad operators to keep coal moving regularly.

3. To give special assistance to association members who have difficulty in getting a sufficient supply of fuel.

Mr. Otto further urged emphatically that since the central stations are of first importance as a national asset in war time no effort should be spared to maintain them at maximum efficiency in spite of all difficulties. To this end he recommended that the work of the technical committee be enlarged so that any association member could secure assistance in maintenance.

S. B. Hood, superintendent of construction Northern States Power Company, presented a paper on proper grouping of transformers in an interconnected secondary network. This paper was a résumé of two articles on the same subject presented in earlier issues of the *ELECTRICAL WORLD*. Mr. Hood stated that the fuses which are essential to the success of his plan will be marketed soon by a well-known manufacturer.

The discussion indicated interest in this plan as a method of increasing the possible load a given distribution system can carry.

George A. Hughes, president Edison Electric Appli-

ance Company, delivered an inspiring address on how electricity can be used to conserve people and materials. He pointed to the wide difference between the two words "conservation" and "conservatism," the meanings of which are sometimes confused. "Conservatism" means "do not do anything new," while "conservation" means "hasten to do the new things to be constructive."

Mr. Hughes' paper was discussed by H. E. Young and George D. Shepardson, Minneapolis, and Leonard Peterson, Thief River Falls.

Other papers presented, of which more will be published in later issues, were: "Maintenance of Electric Meters," by George Hewitt, Minneapolis; "Iron Wire Transmission Lines," Prof. W. T. Ryan, Minneapolis, and "Minnesota Water Powers," R. D. Thomas, St. Anthony Water Power Company, St. Anthony Falls.

Officers for the ensuing year were elected as follows: President, B. W. Cowperthwait, Faribault; vice-president, H. E. Swanson, Rochester; secretary, Fred C. Hoffmann, St. Paul; directors, Emil Avelsdson, Litchfield, and H. E. Young, Minneapolis.

TENTATIVE A. I. E. E. PROGRAM FOR ATLANTIC CITY CONVENTION

Five Technical Sessions to Be Held at Annual Convention—Tentative Program Prepared for
the June Meeting

It has been decided to hold an annual convention of the American Institute of Electrical Engineers in Atlantic City, N. J., on June 26, 27 and 28, 1918. Five technical sessions are contemplated.

The tentative program for the annual convention was decided upon by the committee on meetings and papers at the regular meeting in Cleveland last week. The following papers are considered as convention possibilities and will be presented in the order named if they are submitted and accepted by the committee on April 25:

Wednesday, June 26, 2.30 P. M.—W. H. Cole, "Split-Conductor Cables—Balanced Protection"; E. B. Meyer, "Overhead Cables"; H. H. Cochrane, "Wood-Stick Insulators"; G. I. Gilchrist, "The Applications of Theory and Practice of Transmission Systems."

Thursday, June 27, 10.30 A. M.—C. T. Allcutt, "Lightning-Arrester Spark Gaps"; C. P. Steinmetz, "Oxide-Film Lightning Arrester."

Thursday, June 27, 8.30 P. M.—E. Kilburne Scott, "Nitrogen Fixation"; C. P. Steinmetz, "America's Power Supply"; D. C. Jackson and N. W. Alexander, "Education."

Friday, June 28, 10.30 A. M.—V. Karapetoff, "Charged Condensers"; C. L. Fortescue, "Method of Symmetrical Coordinates Applied to the Solution of Polyphase Network"; N. S. Diamant, "Flux Distribution in Alternators Under Sustained Short-Circuit Conditions and Different Loads."

Friday, June 28, 2.30 P. M.—J. J. Linebaugh and J. L. Burnham, "Protection from Flashing for Direct-Current Apparatus"; H. S. Osborne, "The Design of Transformers for Parallel Telephone and Power Circuits."

The meeting will open at 10.30 a. m. on Wednesday, June 26, with an address by the president, and an informal reception will be held at the Marlborough-Blenheim Hotel at 8.30 the same evening.

The committee on meetings and papers has decided to recommend to the board of directors to hold a joint technical session with the American Physical Society at the annual fall meeting at Philadelphia in October.

CLEVELAND A. I. E. E. MEETING WITH THE STEEL ENGINEERS

Standardization of Motors Evokes Lively Discussion
in Joint Meeting with Association of Iron and
Steel Electrical Engineers

The important topics discussed at the intersection meeting of the American Institute of Electrical Engineers at Cleveland, March 8, 1918, were "Motor Standardization for Steel Mills," "Selection and Control of Steel-Mill Auxiliary Motors," "Capacity of Rolling-Mill Motors" and "Underground Distribution for Electric Light and Power Systems."

At the evening technical session President E. W. Rice, Jr., of the A. I. E. E. and President C. A. Menk of the Association of Iron and Steel Electrical Engineers presided jointly. Both manufacturer and consumer were given the opportunity to discuss the problem of motor standardization in steel mills.

W. L. Snyder, chairman standards committee of the Association of Iron and Steel Electrical Engineers, made a plea to the electrical engineers to help standardize electric motors for the steel industry. Lantern slides showed the labor and expense involved in changing the type of motor on various machines. Size of bases of motors and distances between bolt holes vary widely, and new frame castings had to be placed on the machines shown on the screen to hold the motors in position. Mr. Snyder mentioned several reasons for the need of standardization. He quoted a letter from the Midvale Steel & Ordnance Company which stated:

"Of approximately 800 crane motors now in use in this plant, 400 are of one type, which we have chosen as a standard, the other 400 being of miscellaneous makes and types. For the 400 standard-type motors we require twenty-eight duplicates to keep them in operation, whereas for the 400 miscellaneous motors 116 duplicates are necessary. If all 800 motors were of the standard type, only forty duplicates would be necessary and a saving of 73 per cent in duplicates would be effected."

"There are approximately 1,000,000 motors in the allied steel industries to-day," said Mr. Snyder, "which require 200,000 spares, costing \$8,000,000. If the motors were standardized, only 50,000 spares would be needed and an investment of \$6,000,000 avoided."

The paper was discussed by T. E. Tynes, B. J. Beck, D. M. Petty, H. C. Cronk, E. Friedlaender, A. D. Nye, A. W. Cowles and President E. W. Rice, Jr. Mr. Tyne said that when crane motors are to be replaced, which is bound to happen in time, it is usually impossible to procure the same type of motor. Therefore the trolley systems on the cranes would have to be redesigned.

Mr. Becker told of the troubles he had experienced from a manufacturer changing two types of motors twice in ten years. There were several questions upon such points as the advantages of straight or tapered shafts and interpole or straight series motors that Mr. Becker thought ought to be settled before standardization was effected.

Mr. Petty pointed out that the engineers should thoroughly consider what standardization meant to the manufacturers as well as to the consumers, because additional expenditures would be necessary to enable the manufacturers to discard their present-type motors and adopt the standard.

Mr. Hess said that the Youngstown (Ohio) Sheet & Tube Company carries a stock of 244 different-size brushes for the 2500 motors in the plant, which involves an investment of \$50,000. If these brushes were of one type, a saving of \$32,000 to \$38,000 could be made.

Mr. Friedlaender startled the convention by asking "How are you going to do it? Who makes the best motors?" He pointed out that standardization would retard future improvement in design and said that it would be best for the engineers to standardize their opinions before trying to standardize motors.

Mr. Nye said that if the demand were great enough the manufacturer would have to supply a standard motor and that a motor should be designed and submitted to the manufacturers.

President Rice pointed out that the manufacturer is in favor of standardization methods because the producing cost is greatly reduced. But he thought that standardization should come by evolution and not by revolution. He suggested that a committee of engineers be appointed to develop a standard and that manufacturers should be allowed to attend these meetings and advise concerning the design.

SELECTION OF STEEL MILL AUXILIARY MOTORS

In a paper entitled "Selection of Steel-Mill Auxiliary Motors and Control as Affected by Mechanical Features of the Drive," J. D. Wright showed illustrations of complete electrically equipped steel mills. He explained the function and operation of manipulators for blooming mills, which consist of side guards and lifting fingers. Traveling tilting tables were shown, and Mr. Wright pointed out the necessity of having motors reversible and with solenoid control for inching work.

In the discussion that followed the presentation of the paper it was generally held that rolling-mill motors should be of the high-speed series type instead of the special low-speed machine, because the series motor is more easily controlled. It was pointed out that more clearance was needed on the side guards in the mill housing of rolling tables. That a buffer resistance instead of a jam relay should be used on the side guards, because the jam relay does not have time to act, was contended by several speakers, but Mr. Wright, in closing the discussion, stated that the machine in question had been originally equipped with a jam relay which had to be discarded as being unsatisfactory.

CAPACITY OF ROLLING-MILL MOTORS

"Some Considerations in Determining the Capacity of Rolling-Mill Motors," by R. F. Hamilton, was presented by W. Sykes somewhat briefly because of the mathematical calculations involved in the paper, which held that classification of motors, mathematical determinations of energy required for rolling, relation of speed to tonnage, motor capacity and flywheel application should be thoroughly studied in the application of electric drive to rolling mills.

In closing the discussion Mr. Sykes stated that the designer should start with the idea of what he wants to roll. He emphasized the fact that the motor should be used in the type of mill for which it is designed and that all calculations for capacity should be made with ultimate needs in view.

That rolling-mill motors should be designed for reliability as the chief consideration was the main thought

the discussion. If a steel mill is shut down for an hour, a large loss is entailed, and therefore continuous operation should be considered first. It is not the manufacturer's duty to design the correct type of motor, but the industrial engineer should tell exactly what is wanted because he knows the conditions of the plant.

UNDERGROUND ELECTRIC DISTRIBUTION SYSTEMS

The complete design of an underground system was described in a paper by G. J. Newton entitled "Design of Underground Distribution for Electric Light and Power Systems." The author realized that all systems differ and that it would be impossible to make definite rules that would apply under all conditions. He made clear, however, what information is necessary and told how, after getting that information, the design should be made.

The paper was discussed by A. A. Myer, G. N. Rakestraw, H. T. Wallau and E. Friedlaender.

Mr. Myer told of the direct-current underground system used in Detroit and pointed out that the load density was an important factor involved in the design of an underground system.

Mr. Rakestraw recommended the use of varnished fabric insulation for underground cables instead of paper in spite of the fact that paper is more economical. He also advised against the use of a bare-wire neutral connection to ground in an underground system. Mr. Friedlaender told of the troubles of an underground system in steel mills because of maintenance. If a break occurs, it can be more easily and quickly remedied on an overhead line than on the underground system.

ANNUAL MEETING PLANS OF ASSOCIATED MANUFACTURERS

Convention on March 21 in New York Will Include Afternoon Business Session and Banquet in the Evening

As stated in last week's issue of the ELECTRICAL WORLD, the annual meeting and banquet of the Associated Manufacturers of Electrical Supplies will be held at Delmonico's, New York, on Thursday, March 21.

The business session is called for 2 p. m., for election of governors, presentation of reports, etc., and for consideration of international trade conditions after the war, trade acceptances and their advantages, the work of the war service committees and many other matters of interest.

The evening session, with a banquet, to which members may invite guests, will be a social session, in the ballroom of Delmonico's, at 7.30 p. m., and will be strictly in keeping with the condition of the times and the war situation.

A most interesting program has been arranged, with entertaining speakers, excellent music and other attractive features. Major Donald Guthrie of the British Army, who has been in a number of battles in France and was wounded severely, will speak at the banquet. The entertainment committee is Le Roy Clark, J. W. Perry and Charles E. Dustin.

A revised schedule of the section and committee and their meetings to be held in the association rooms, 30 East Forty-second Street, New York, during the week of the annual meeting follows:

Monday, March 18, 1918.—Interlocking standardization committee, 2 p. m.

Tuesday, March 19.—Inclosed fuse committee, 10 a. m.; Snap Switch Section, 10 a. m.; Molded or Formed Insulation Section, 10 a. m.; Lamp Receptacle and Socket Section, 2 p. m.; Outlet Box Section, 2 p. m.; Industrial and Street-Lighting Fixture Section, 2 p. m.; Attachment Plug Section, 4 p. m.; Insulating Materials Section, 4 p. m.

Wednesday, March 20.—Panelboard and Switchboard Section, 10 a. m.; Fuse Section, 10 a. m.; Fan Motor Section, 10 a. m.; Knife Switch Section, 2 p. m.; Non-metallic Conduit Section, 2 p. m.; Metallic Flexible Conduit and Armored Conductor Section, 4 p. m.; inclosed externally operated switches, immediately following Knife Switch Section meeting.

Thursday, March 21.—Annual meeting of the association, 2 p. m., at Delmonico's, New York; social session and banquet, 7:30 p. m., at Delmonico's.

Friday, March 22.—Magnet wire committee, Wire and Cable Section, 10 a. m.

HEARINGS ON ADMINISTRATION BILL TO GOVERN WATER POWER

Special Committee Has Set Aside Whole Week to Hear Testimony of Investment Bankers, Engineers and Utility Operators

The special committee of fifteen having in hand a so-called "administration" water-power bill, which creates a federal power commission to provide for the improvement of navigation, for the development of water power, for the use of land in the United States in relation thereto and for other purposes, has set aside the week beginning March 18 for hearings on the measure. The bill, which is the proposed House substitute for Senate bill 1419, has been modified to include recent suggestions made by the Secretary of War, Secretary of the Interior and Secretary of Agriculture. These three will constitute the water-power commission. The measure, as has been previously pointed out, also provides for an executive officer of the commission, appointed by the President for five years, for the payment of rentals and for licenses for water power on public lands as well as public streams for fifty years.

At the end of the license period the licensee will be allowed to renew the license and remain in undisturbed possession until the proposed commission shall have done one of three things:

1. Issued new licenses under laws then applicable.
2. Given licenses to new licensees who shall pay for the net investment of the licensee in the project.
3. Taken the property over upon paying the net investment of the licensee in the project plus reasonable damages for all property not taken over and damaged by reason of severance.

"Net investment" is given as the actual legitimate original cost as defined and interpreted in the "Classification of Investment in Road and Equipment of Steam Roads," issue of 1914, Interstate Commerce Commission, plus similar costs of additions thereto and betterments thereof, minus the sum of the following items properly allocated thereto, if and to the extent that such items have been accumulated during the period of the license from earnings in excess of a fair return on such investment: (a) unappropriated surplus, (b) aggregate credit balances of current depreciation accounts, and (c) aggregate appropriations of surplus or income held in amortization, sinking fund or similar reserves, or expended for extensions or betterments.

Closing Inefficient Plants to Save Fuel

CONTINUING further its investigation into isolated plant and central-station conditions in New York City, the Public Service Commission, First District, held a hearing on March 11. C. E. Stuart, of the utilities section of the conservation division of the Fuel Administration, was present again as a representative of the Washington authorities.

Mr. Stuart had placed in the record of the proceedings a full statement of the purposes of the federal Fuel Administration in concerning itself with the case.

Supplementing this statement, Mr. Stuart said later to a representative of the ELECTRICAL WORLD that the investigation in which the Fuel Administration is interested is proceeding not only in New York, but also in different ways in other sections of the country. It is possible that one of these investigations will furnish a basis for a broad general solution.

It is proposed to treat every case on its merits, and Mr. Stuart said that the Fuel Administration is anxious that this shall be understood thoroughly. There is no intention, for instance, of issuing a broad, sweeping order condemning inefficient plants.

Some plants can be diverted to central-station service with economy; in others remoteness of location, necessary interior or exterior construction or other considerations would make it inexpedient.

CASES INVOLVING DUPLICATE SERVICE

In addition to the issue affecting isolated plants, Mr. Stuart said that the Fuel Administration is also looking into cases where private and municipal plants are duplicating service. In one Indiana community where this condition existed the local authorities combined, without the influence of the Fuel Administration, to close the inefficient plant.

In his formal statement to the commission Mr. Stuart said in part:

The experience of the past winter has shown that on account of the transportation congestion and other conditions caused by the war some curtailment of the previous rate of fuel consumption by the community is necessary. This curtailment was effected during the past winter by cutting off light, reducing heat, shutting down factories, etc. These methods cause serious inconvenience and loss to many, and it is therefore obviously desirable to secure the necessary economies in the future in less drastic ways, if this is at all possible.

The individualistic way in which fuel is now consumed in cities is not efficient. A ton of coal burned in a large central station will produce at least four times as much electric power as if burned in the average small plant, and if centralized burning could be introduced to a greater extent, the amount of fuel required could be largely reduced without reducing in any way the ultimate production of light and power.

It may be generally stated that in buildings where electric plants are located and where exhaust steam from engines is utilized in the heating of the building, furnishing hot-water requirements and possibly providing a very small amount of steam for industrial and other processes, such a building can readily adopt central-station service without a loss of money and at a large percentage of saving in fuel.

In many other cases it might be more economical from the standpoint of fuel saving to utilize isolated electric plants in conjunction with central-station service. The ideal arrangement would then be to use the combination of services in such a way that no exhaust steam would be sent to the atmosphere to be lost.

It is the duty of the Fuel Administration to devise means for securing a curtailment in the use of fuel in ways which will impose a minimum of hardship. It is believed that there are many plants not only in New York but throughout the entire country which could, at least temporarily, shut down their own electrical machinery and purchase power from others at a financial advantage to both parties and with a considerable saving in fuel.

The subject considered more broadly will affect even the question of whether or not certain central stations now in operation can be economically continued in operation.

There are localities in the country where there is an excess of hydroelectric energy and where at the same time coal-burning central stations are in operation. The saving that could be effected by shutting down the coal-consuming plant, provided it is practicable to do this, is evident. If it be possible to make necessary connections, enabling the shutdown of the coal-consuming plant, it would simply mean that the hydroelectric plant would carry the load of the coal-consuming plant, and it would become a question of an adjustment of rates so as to conserve the interests of the public and of the coal-consuming plant through the period of shutdown.

While it may appear that the interests of the central station are being benefited to a large degree, such is not of necessity the case. In some cases central stations may be shut down. In any event, any connection between a central station and a building or a manufacturing plant that is affected will of necessity be for the period of the war only or through the period where the coal situation is critical. The machinery of the isolated plant can be readily preserved through this period of necessity. Under these circumstances the heavy expense attendant upon the making of the connection by the central station may completely or even more than offset any profit which could be expected of such a load through a short period.

In those cases where small electric plants are closed down entirely there will be a larger number of men available than in cases where a partial closing down is brought about. In any event these skilled men are vitally needed in many of the war industries of this country.

Again, the conservation efforts of the Fuel Administration are being directed in order to conserve the interests of all with the least inconvenience and cost and with the object of making the coal supply that is available go just as far as possible and to prevent the necessity of further drastic measures such as were necessary in January.

The administration at this time has no idea of attempting to bring about any such result by means of orders, or even of suggestions that fuel be saved by the closing of isolated plants, where this would cause hardship to the owners not commensurate with the benefit derived by the public. It is interested in the present hearings, however, in the hope that they will set forth the facts and also the savings which are possible in certain cases in so convincing a way that each plant owner will consider himself a volunteer member of the administration, charged with the duty of investigating his own condition in a non-partisan way and where circumstances warrant it of taking the necessary steps to secure the saving.

J. W. Lieb, vice-president and general manager New York Edison Company, made an extended statement before the commission bearing on the main and collateral questions raised in the investigation. The Fuel Administration is interested in the possible coal economies, and the Public Service Commission is raising also the question of rates.

Mr. Lieb read a statement, in part as follows:

The company had no knowledge whatsoever as to the purpose of the commission in issuing its order calling for these hearings, and it has taken no steps whatsoever with the commission or elsewhere in the direction of agitating or promoting any movement having in view the shutting

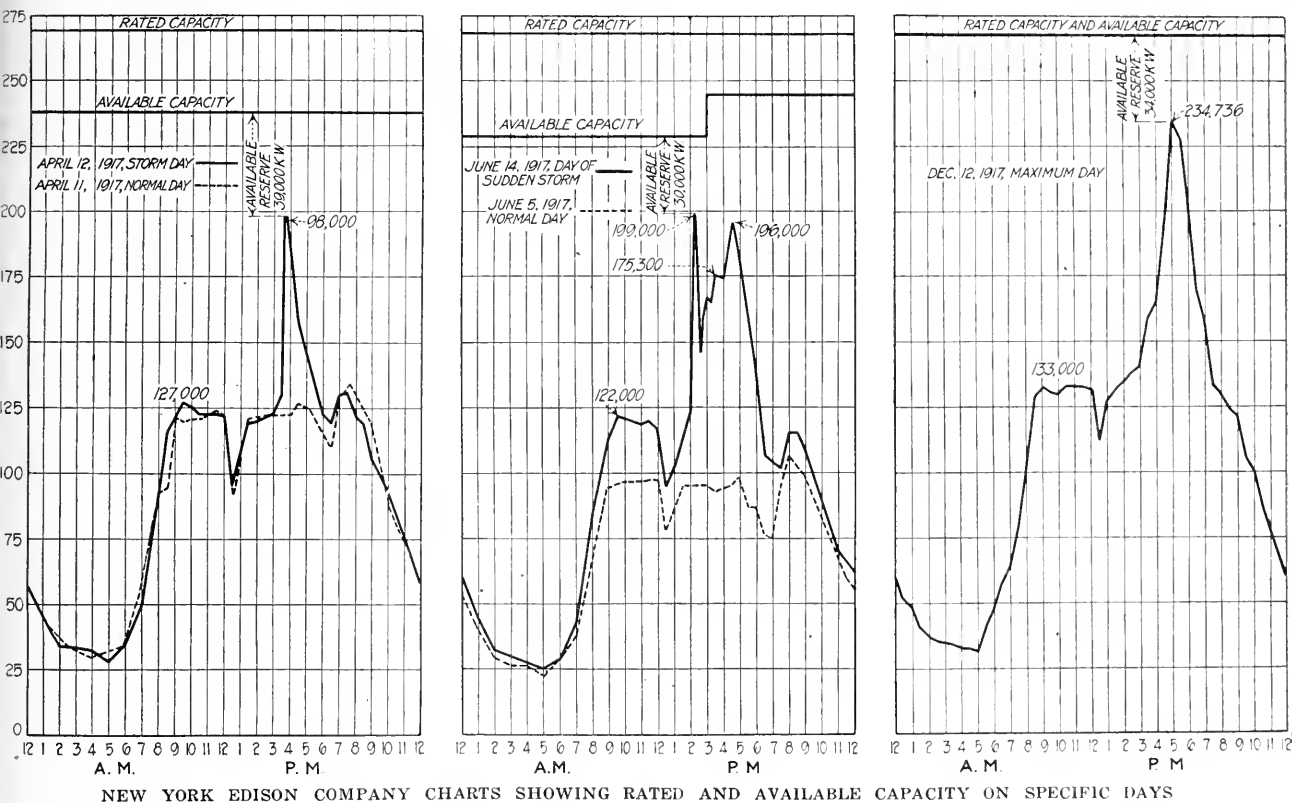
own of isolated plants and the substitution therefor of central-station service. It has not attempted in any way to take any advantage of the present situation to urge upon any public authorities, national or local, the desirability of closing down isolated plants as a measure of fuel conservation, nor has it initiated or prompted any action whatsoever ward enlisting their interest or support in such a movement.

It would appear from the opening remarks of the presiding commissioner that this was to be a hearing on fuel conservation; we find it to be in reality a rate hearing, the commission's order making no reference whatever to the subject of fuel conservation.

We are prepared to give "segregated" service as an auxiliary to private plants at our regular rates without any limitations whatsoever. We are also prepared to give peakdown and auxiliary service to isolated plants at the standard rates for this service provided for in our rate schedule. We are not, however, prepared to furnish breakdown service to a so-called block lighting plant, which is not customer's own plant furnishing service for himself alone, it is in effect a small central station supplying energy to

is the endeavor of operators of isolated plants to obtain a special reduced so-called "off-peak" rate for this class of service, notwithstanding the fact that the present rate was arranged for with the approval of the commission to cover just such service under normal conditions and not under such extraordinary conditions as exist at the present time. We shall show by the incontrovertible facts of our experience that under the conditions prevailing on Manhattan Island this service is not an "off-the-peak" service. We are put in the position of presenting testimony now and at this of all times for what seems to be to all intents and purposes a rate hearing having for its primary object not primarily the elucidation of facts in regard to the conservation of fuel but an endeavor to obtain a reduced rate for a special temporary service amply and reasonably provided for, in character of service and rate, by our standard rate schedule.

We may be called upon to present such data as we may be able to prepare on the question of the rate for this service in relation to its cost, but we wish now to place on record our emphatic protest against being required to participate in a rate hearing at this time. It appears to us most unrea-



number of customers outside of the building in which the plant is located, making it an actual competitor of the lighting companies, one over which the commission has not, however, assumed jurisdiction, these block lighting plants paying no franchise taxes and escaping the regulatory obligations and control as to rates, standards and conditions of service, etc., that are imposed on lighting and power companies by the Public Service Commission law and the statutes of the State.

The company in 1908, at the request of the commission and with its co-operation, established a rate which met its full approval, mistakenly, however, called a "breakdown" rate, providing at the same time and under one rate for breakdown, insurance, emergency, auxiliary and supplementary service to buildings obtaining their service normally from private plants installed on the premises. That this service and the rate and conditions under which it is given have been satisfactory and to their advantage would seem to be attested by the fact that over one-half of all the isolated plants on Manhattan Island have availed themselves of it, and the number is increasing, particularly during the last few months.

We now learn from the testimony so far adduced that it

sonable and unfair to consider what in effect is the question of the lowering of rates under conditions when no man can foretell what the morrow may bring forth and under circumstances of such uncertainty, precariousness and dismal outlook that, as the commission well knows, the company is even now seriously considering the necessity of coming before it and asking for a general increase of rates.

In submitting the accompanying curves Mr. Lieb said that it should be noted that this diagram is not strictly correct, it does not show conditions as they really are.

The April and June loads are not on the same basis as the December load. As a matter of fact there was a larger connected load in December than in April or June owing to the fact that many new installations were added to the system between these dates.

If this additional load had been on the system on the dates shown in the April-June curves, the actual peak loads on these dates would have been considerably larger and the reserve capacity as compared with winter conditions would have been still smaller.

CONSTRUCTION OUTLAYS LARGE FOR TELEPHONES

Capital Expenditures in 1917 for Bell System Reach
\$118,600,000—Maximum Requirement for 1918
Estimated at \$90,000,000

Heavy capital expenditures for plant additions made necessary by the war are an outstanding feature of the annual report of the American Telephone & Telegraph Company for 1917. The net amount added to plant and real estate by all companies, excluding connecting companies, constituting the system in the United States was \$118,599,462. This compared with \$66,224,700 in 1916 and was larger than for any previous year by nearly 50 per cent.

Concerning the results of the policy adopted and outlining the probable construction requirements of 1918, Theodore N. Vail, the president, says in the annual report to stockholders:

The continued policy of the Bell system of constructing in advance of requirements, partly to provide for emergencies, and for economical reasons, has again justified itself many times over during the year.

It is difficult to estimate what additions will be made to the plant during 1918. Plans have been made aggregating \$90,000,000. This is believed to be the maximum requirement; the probabilities are that much less will be expended. The government's desire for the conservation of men, material and money for direct-war requirements and the difficulties of transportation because of priority orders and freight embargoes make the exact determination of the program impossible.

The net capital addition of \$118,599,462 was distributed as follows: Real estate, \$13,770,614; equipment, \$28,029,466; exchange lines, \$41,565,583; toll lines, \$25,834,824; construction work in progress, etc., \$9,398,975.

TOTAL OPERATING REVENUES NEARLY \$300,000,000

In round figures the total operating revenues of the Bell system were \$294,900,000, an increase of \$30,300,000, or 11.5 per cent, over last year. Of these revenues depreciation and maintenance consumed \$94,071,000, an increase of \$9,515,000 over 1916, or 11.3 per cent; traffic expenses consumed \$68,122,000, an increase of \$14,373,000, or 26.7 per cent; commercial expenses, \$28,364,000, an increase of \$2,665,000, or 10.4 per cent; general and miscellaneous expense, \$13,850,000, an increase of \$1,947,000, or 16.4 per cent; taxes assignable to operations, in which provision is made for the estimated amount of federal income and excess profits taxes payable in 1918, \$20,711,000, an increase of \$5,795,000, or 38.9 per cent.

During the year \$94,071,000 was applied out of revenue to current maintenance and depreciation, an increase of \$9,515,000 as compared with 1916. Current maintenance increased \$6,227,000, averaging 4.3 per cent on the average plant in service, which compares with 3.9 per cent in 1916.

The provision for depreciation of plant during the year was \$52,919,000, an average of 5.5 per cent of the cost of plant, an increase over 1916 of \$3,288,000.

Mr. Vail says that during the year there was a very general readjustment of salaries and increase in the number of operators to meet the necessary demands.

Regarding the value of the property, A. K. Vail assures security holders by stating: "The minimum replacement value of our property, exclusive of intangibles, is far in excess of the book value, and intan-

gibles represent expenditure and have value. Actual appraisals are continually being made by boards of control, municipal and other rate-making bodies for rate-fixing purposes. They are made by independent appraisers who certainly have no interest in over-valuation. In every case the appraisals have demonstrated the conservatism of the book value."

At the end of the year the number of employees on leave of absence for military, naval and other government war service was 7002.

SUMMARY OF ACTIVITIES FOR GOVERNMENT

In a summary of activities of the system in connection with government matters, Mr. Vail says in part:

Precedence was established throughout the system for all government service, and at Washington and over the entire country for the maintenance of existing government facilities and the construction of the numerous additional ones required.

In other sections it has been necessary to provide telephone facilities and toll connections for the National Army cantonments, National Guard camps, division headquarters of the army and navy, army posts, navy yards, aviation fields, supply, quartermasters' and training camps, munition manufactures, shipbuilding yards, and various federal and state camps and headquarters in different parts of the country. Many of them are far from existing facilities and in sections heretofore not requiring extensive telephone facilities, and some of them are the equivalent telephonically of cities of 30,000 to 40,000 inhabitants.

Several pages in the report deal with the engineering department. Part of this section follows:

During the past ten years there has been a great increase in the number, extent, voltage and current of power and lighting circuits in all parts of the country. Therefore telephone engineers have been confronted by the difficult and constantly growing problems of disturbances in neighboring telephone circuits producing noise, interference with signaling and, in extreme cases, hazard. The electrification of trunk-line railroads, which has been largely a development of the last ten years, has brought up peculiarly difficult problems of this kind. Plans have been worked out as far as practicable for minimizing such disturbances by rearrangements of our wires and modifications in the apparatus associated with them. But in many cases the disturbances have been such that a solution was not to be found by treating only the telephone system. It has been necessary, therefore, to work with many electric light, power and railway interests and manufacturers of electrical power apparatus, and to arrange with them to design and operate their systems so as to reduce the disturbances at the source.

On Jan. 1, 1918, there was one Bell telephone station to each ten of the total population of the United States.

A section of the report dealing with the Western Electric Company, Inc., says in part:

When it became probable that this country would become involved in the great war, the Bell system, in preparation for extraordinary service demands which would come in such a contingency, directly and indirectly, from the various departments of the government, commenced a systematic restraint of station growth. That naturally affected adversely a certain portion of the Western Electric business. Later (in July) it appeared to us that we should do our part to conserve the resources of the country which would be required for war purposes, and we decided to limit construction and reconstruction which would use lead, copper and other materials, and likewise man power, to such work as would further military preparations. This cut down materially another part of the Western Electric product.

With this came the setting aside of its program on central office work and a substitution in its place of emergency requirements for camps, cantonments, etc., so that during the past year the company has been meeting a variety of changes in its requirements which will probably affect its earnings.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Northern California Power Company Elects Officers.—All retiring directors of the Northern California Power Company were re-elected at the annual meeting held recently, W. F. Detert remaining as president, A. S. Carman as vice-president and F. Reese, Jr., as second vice-president. Edward Whaley, former secretary and general manager, was made general manager, and W. H. Pearce, formerly assistant secretary, was elected secretary.

Violators of Light Regulations Considered Slackers.—Secretary H. G. Wilson of the Lucas County (Ohio) Fuel Administration states that violators of the regulations requiring lightless Sunday and Thursday nights and those who keep signs lighted at times not permitted will be branded as slackers and their names will be published as such. Energy was withdrawn from twelve signs in Toledo whose owners had kept them lighted on one recent evening, and it is proposed to continue the campaign against such persons.

Community Facilities in Housing Bill.—The committee on public buildings and grounds has favorably reported to the House of Representatives a bill authorizing the expenditure of \$50,000,000 through the Secretary of Labor for housing local transportation and other community facilities for war needs. This is an administration measure and is likely to be enacted. The report on the bill calls attention to the fact that it "gives to the Secretary of Labor the power to acquire by purchase or otherwise such local transportation and other community facilities, or parts thereof, and equipment as in his judgment may become necessary for the proper execution of the trust created."

Ohio Commission Authorizes Utility Merger.—The Ohio Public Utilities Commission has authorized a merger of four public utility companies operating in Mansfield and the surrounding territory. The companies coming under the merger are the Mansfield Railway, Light & Power Company, the Mansfield Gas Light Company, the Mansfield Electric Light & Power Company and the Ashland Gas & Electric Company. The name of the merged company will be the Richland Public Service Company, and while it will control all of the above-mentioned properties, the Ashland Gas & Electric Company will be operated separately. The Richland Public Service Company is controlled by H. L. Doherty & Company, New York. The commission also authorized the issuance of \$2,942,000 5 per cent bonds, to be marketed at 80. It further authorized the issuance of \$3,200,000 common stock, which will be

placed at 70. Both the bonds and the stock will probably be taken by H. L. Doherty & Company. R. E. Burger will continue as general manager of the Richland Public Service Company.

Relieving Coal Shortage.—A statement has been made by the Commissioner of Agriculture of Montana in regard to the use of electric power by the Chicago, Milwaukee & St. Paul Railway, which awarded recently a contract to the Westinghouse Electric & Manufacturing Company for ten electric locomotives. The railroad is now obtaining 160,000 kw. of electric energy from the hydraulic plant of the Montana Power Company and the saving in fuel effected by this use of water power instead of coal has been very gratifying to the State officials. The commissioner states: "To give an idea of the value of the power which is being generated by these plants it may be stated that to produce 160,000 kw. from coal would require the yearly consumption of 2,500,000 tons, which at the average price of \$4, which would apply at the points where the power is used, would amount to \$10,000,000. When it is considered that the value of this coal is by means of water power being saved each year for future generations, and that during the next ten years this saving will, in all probability, be increased seven or eight times, it is not difficult to understand that true conservation consists in encouraging the rapid development of water power, which unless developed and utilized becomes lost for all time."

Construction to Get Gas Fuel in California.—A. Emory Wishon, assistant general manager San Joaquin Light & Power Corporation, Fresno, Cal., writes to the ELECTRICAL WORLD in answer to an inquiry about its new pipe line: "In the past the San Joaquin Light & Power Corporation has used as fuel for electric generation a certain amount of gas in Bakersfield that has been obtained from the Valley Natural Gas Company. The capacity of the Valley Natural Gas Company's line has been used up, however, in supplying gas for domestic and other consumption, with the result that during the year 1917 practically no gas was used for steam generation in the Bakersfield steam plant. At present the San Joaquin has on order 26.5 miles of 6-in. pipe that is to be delivered in April and May and will connect the Bakersfield steam plant with the main gas transmission line of the Midway Gas Company, 26.5 miles due south of the city of Bakersfield. Last year the Bakersfield steam plant could have used 600,000,000 cu. ft. of gas. This year, unless the wet season starts pretty promptly, we shall use several times as much. The pipe line is to be a welded line and is capable of carrying sufficient gas to allow us to carry a peak of 10,000 kw. without calling on our oil reserve for peak operation. The San Joaquin also has a steam plant at Betteravia, Cal., that is connected to the Santa Maria oil fields with a gas line, and gas at this plant is being made available just as fast as we can deliver electric motors to replace crude boiler plants now operating the oil wells."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Louisiana Engineering Society.—A. M. Lockett presented a paper entitled "The New Orleans Industrial Canal" before the Louisiana Engineering Society on March 11.

New York Jovian League.—Richard E. Enright, Police Commissioner of New York City, told the story of the New York Police Department at the Jovian luncheon held March 13.

Synchronous Club, Los Angeles.—Lecture No. 10 of the Synchronous electrical course, on "Electric Furnaces and Welding," was given March 7 by J. H. Cunningham of the General Electric Company.

Electrolysis Mitigation.—James A. McKenna of the Providence city engineer's department addressed a meeting of the Providence Engineering Society recently on the subject of "Electrolysis Mitigation."

Arkansas Association of Public Utility Operators.—The State convention of the Arkansas Association of Public Utility Operators will be held at Hot Springs, Ark., on May 21 to 23, with headquarters established at the Arlington Hotel.

Jovian Electric League, Los Angeles.—At the last regular meeting of the league the speaker of the day was August F. Knudsen. The subject of his talk was "Hawaii." T. C. Carr of the General Electric Company was chairman of the day.

The Esthetics of Street Lighting.—S. E. Doane, chief engineer National Lamp Works of the General Electric Company, presented a paper on "The Esthetics of Street Lighting" before the Philadelphia Section of the Illuminating Engineering Society at a meeting on March 15.

New York Chapter, A. A. E.—E. W. McKnight of the First Canadian Expeditionary Forces spoke on "War-Time Experiences" at a meeting of the New York Chapter of the American Association of Engineers on March 13. I. L. Birner, 220 West Forty-second Street, is the secretary of the New York Chapter, A. A. E.

Gear Makers to Meet.—"Gear Standardization" will be the principal subject of discussion at the second annual convention of the American Gear Manufacturers' Association, to be held at Green Brier Hotel, White Sulphur Springs, W. Va., on April 18, 19 and 20. An address by a representative of the United States Chamber of Commerce, of which the association has just become a member, will bring other matters of timely interest before the association.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Refusal to Give Service.—In a decision regarding discontinuance of electric service affecting Max Huhn as complainant and the Richmond Light & Railroad Company as defendant, the New York Public Service Commission, First District, holds that refusal of service by an electrical corporation except upon the payment of a penalty because the service connection has been tampered with is unauthorized under the law; but in view of the fact that complainant may obtain redress by a penalty action under the transportation corporations law and because of the uncertainty as to the commission's power herein, no order was adopted. It was recommended, however, that upon payment by the complainant of \$1.80 for each of the three months during which the meter failed to register service be renewed by the electric company.

Provision for Increasing Service Demands.—Approving plans of the Public Service Company of Northern Illinois for extension, the Illinois Public Utilities Commission declares that it has jurisdiction to enter an order finding the necessity for, and authorizing and directing the construction of, additions, extensions, repairs or improvements to, or changes in, the existing plant, equipment, apparatus, facilities or other physical property of any public utility, if the facts and conditions warrant, irrespective of whether or not property owners are made defendants to the proceeding, or make objections to such extensions or other changes. "It appeared from the evidence," says the commission, "that at the present time the Waukegan plant is normally capable of generating about 8000 kw. of electrical energy and at times has been overloaded to 9000 kw.; that, because of the excessive demands upon said plant and the increasing growth of petitioner's business and of the load carried by said plant, in order to meet properly the demands of the public it is necessary to install without delay in said plant an additional unit of not less than 10,000 kw., and that within four or five years it will, judging from the present rapid rate of growth of petitioner's business, be necessary to install a second additional unit of 10,000 kw. It further appeared that good operating practice, in case of an electric generating plant of this kind, requires that the plant have, adjacent to it, coal-yard storage capacity for at least sixty days' supply of coal; that such a supply of coal is, in good engineering and operating practice, considered the minimum coal supply which such a public utility plant should have on hand at all times in

order properly to protect the public from interruption of service by reason of coal shortage, which is likely to, and very often does, occur as the result of one or more of the following causes: Labor difficulties at the mines, congestion of traffic on the railroads, car shortage, or unfavorable weather conditions interfering with transportation. It further appeared that in order to accommodate such a coal supply and to make a proper railroad track layout to handle such a coal supply, and to insure the continuous and proper operation and maintenance of the enlarged generating station it will be necessary to acquire, and petitioner has sought but without success to purchase, the property adjacent to its present plant hereinafter specifically described."

"When Costs Go Up Rates Should Do Likewise."—In allowing increased electric railways to the Portland Railway, Light & Power Company, the Oregon Public Service Commission made a number of statements touching utilities in general. Some of these are mentioned briefly below: "It is time for the public to realize that the powers conferred upon public service commissions, thoroughly tested and upheld by the courts, are ample for the protection of the public against all the evils from which they have suffered in the past. It is time also to realize that good service can be obtained only by just and equitable treatment. No starved horse ever pulled a heavy load. The utilities have been deprived of the power to make unjust profits. They must also be protected against unjust losses. . . . In spite of all that has been said, there still lingers a popular impression that the difficulties of the street railway company are fictitious and are merely used as a cover for an attempt to extort a profit on watered stock. We therefore wish to repeat with the utmost emphasis that if the stocks and bonds of the company were one hundred times the real value it would have no effect on this case. The appeal of the applicant and the decision of this commission are based on the commission's own valuation of the property. . . . The cost of service would not be less if the city should take over the street-car system and operate it. With the present service and equal efficiency of management, the operating expenses would be the same as at present, while power, instead of being furnished as now at cost, would have to be paid for at commercial rates. Under condemnation, it is not likely that the property could be bought for any less than the commission's valuation, and if the courts took account of the present scale of prices of materials and labor, the cost would be increased at least 25 per cent. . . . Under state regulation of rates no utility is permitted to earn a surplus during good times by which to carry itself over the lean years which may lie ahead of it. Rates must at all times be kept down in conformity with the value and the cost of the service rendered. Justice, therefore, requires that when costs go up rates for service should do likewise."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Notice of Line Defect.—In action for death of child from contact with a wire of a fence electrified by defendant's live wire, which had fallen upon it, it was held in *Drimel versus Union Power Company* (165 N.W. 1058) that whether defendant was negligent in failing sooner to find break and repair it was a question for the jury.

Anticipation of Danger from Wires Thrown Across Lines.—The Supreme Court of Kansas in *Storm versus Leavenworth Light, Heat & Power Company* (169 P. 556) followed the decision in *Snyder versus Light Company* (98 Kan. 157; 157 P. 442) in holding that a company should by maintaining sufficient insulation provide against dangers from a loose wire being thrown across its lines.

Electricity Deposit Does Not Apply to Gas Bills.—Where a consumer contracted separately for electric energy for lighting and for gas for heating with the same company, depositing \$20 on the electric light contract, the company was not required to apply the deposit to the consumer's arrears on his gas bill before shutting off his supply, the company having no right to divert the deposit without the consumer's consent and apply it to an indebtedness accruing under a contract for gas made some months later than the contract for energy, the Court of Appeals of Maryland held (102 A. 465), *Annapolis Public Utilities Company versus Martin*.

Height of Wires.—While telegraph and telephone wires crossing a highway must be high enough for the usual and ordinary travel, they need not be high enough for extraordinary travel, in which case the traveler must keep a lookout, the Supreme Court of Iowa held (165 N. W. 449). The law authorizes telephone companies to construct their lines along the highways, but one section declares that the line shall not be constructed so as to incommode the public. The owner of a telephone line strung along a country highway constructed the line at a sufficient height at the ordinary points of ingress and egress to clear ordinary vehicles. It was held that, as a landowner is not entitled as against the public to access to his land at all points along the boundary between it and the highway, an abutting landowner could not require the owner of the telephone line to maintain it at a height along the entire boundary of his property sufficient to permit an unobstructed passageway from the highway into his fields, and hence could not assume in passing out of the field into the highway at a place not ordinarily used that the line was high enough to clear his vehicle.

George Oates has resigned from the district managership of the Utah Power & Light Company at Rexburg, Idaho.

Charles B. Hill, Buffalo, N. Y., has been appointed chairman of the Public Service Commission for the Second District.

Carl A. Wolf from has been promoted from assisting operating manager to district manager for the Utah Power & Light Company at Rexburg, Idaho.

C. I. Weaver of Jackson, Mich., has been appointed general manager of the Springfield (Ohio) Light, Heat & Power Company, to succeed Weare Parsons.

E. E. Sanford of the Northern States Power Company of St. Paul, Minn., has been elected a director of the local Y. M. C. A. for the next three years.

George W. Smidt, power-station engineer for the Dubuque (Iowa) Electric Company, has been appointed to a similar position with the Northern Ohio Traction & Light Company, Akron, Ohio.

C. B. Hudson, formerly superintendent of the power plant of the Ithaca (N. Y.) Traction Corporation, has been placed in charge of the power plant of the Strathmore Paper Company, Woburn, Mass.

Major Peter Junkersfield, assistant vice-president of the Commonwealth Edison Company, Chicago, and who was in charge of the electrical construction of the cantonments, has been advanced to the rank of lieutenant-colonel.

Joseph Bamberger, who has been connected with the Northern Indiana Gas Electric Company, Lafayette, Ind., for the last ten years, has been appointed assistant engineer of the Elkhart Valley Electric Company of Elkhart, Ind.

F. C. Adams, St. Louis, Mo., has been chosen chairman of the committee representing the electrical interests of that city on the board of a permanent organization which has been formed to secure the advantages that St. Louis possesses as a center for the manufacture of construction materials for the government.

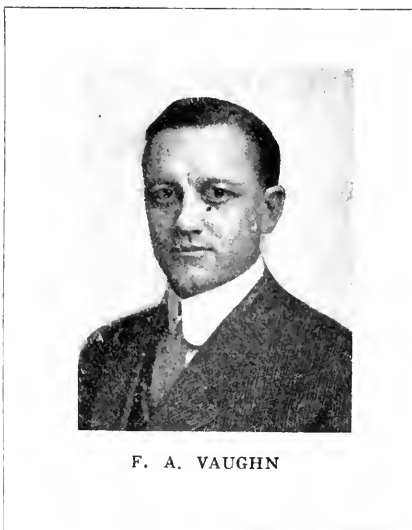
J. L. Kent, formerly with the Consumers' Power Company, Grand Rapids, Mich., has been appointed commercial manager of the Springfield (Ohio) Light, Heat & Power Company, succeeding J. E. North, resigned. Mr. Kent is a graduate of the Ferris Institute and has been connected with the Godenpyl-Hardy interests for about ten years.

A. N. Richardson, who has been connected with the Union Electric Light & Power Company during the past year in construction work, has been appointed operating superintendent by the Illinois Northern Utilities Company, Dixon, Ill. Mr. Richardson was formerly general superintendent of the Kansas City Electric Light Company. Prior to that he was for a number of years connected with the Washtenaw Light Power Company, later the Washtenaw division of the Eastern Michigan Edison Company.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Francis A. Vaughn, senior member of the firms of Vaughn & Meyer, consulting engineers, Milwaukee, and Charles L. Pillsbury Company, consulting engineers, Minneapolis and St. Paul, has been engaged by the School of Engineering of Milwaukee as business manager and director of engineering and industrial relations. Mr. Vaughn is a graduate of the University of Wisconsin in electrical engineering, class of 1895. He was in the testing depart-



F. A. VAUGHN

ment of the Standard Telephone Manufacturing Company, later in the Gibbs Electric Company and then for fourteen years with the Milwaukee Electric Railway & Light Company in the operating, engineering, meter-testing and distributing departments. Mr. Vaughn has had a very intimate connection with national engineering societies and is a fellow of the A. I. E. E. He has been president of the Milwaukee Electrical League and trustee of the Engineering Society of Wisconsin, besides having been chairman of the Wisconsin Electrical Association committee on revision of the Wisconsin Railroad Commission's electric service rules.

Joe E. King has been transferred from the post of local superintendent for the Southern Sierras Power Company at Corona, Cal., to a similar position at San Bernardino.

Robert C. Lamphier, secretary and general manager of the Sangamo Electric Company, Springfield, Ill., has been elected president of the Springfield Commercial Association to succeed John M. McCreery, manager of the St. Nicholas Hotel. Mr. Lamphier has been active in the Red Cross work in Springfield and has taken a prominent place in civic affairs.

Frank B. Jewett, chief engineer of the Western Electric Company, who received the commission of major last spring, has been promoted to the rank of lieutenant-colonel.

J. I. Matthias, manager of the Leominster (Mass.) Electric Light & Gas Company plants, has resigned to go into business for himself in Worcester. Mr. Matthias has recently been elected chairman of the mercantile bureau of the Chamber of Commerce of Worcester.

S. E. Hutton, for several years head of the mechanical and electrical engineering departments at the University of Idaho, recently enlisted in the United States Army, at Spokane, Wash., as a private in the aviation section of the Signal Corps. Mr. Hutton was formerly consulting engineer of the Idaho State Public Utilities Commission and on the faculties of Highland Park College at Des Moines, Iowa, and the University of Kansas.

James B. Black, formerly assistant general agent of the Great Western Power Company at San Francisco, has taken over the duties formerly discharged by W. W. Briggs, resigned, and has been given the title of general sales manager of the Great Western System. Three distinct systems are operated jointly in the Great Western System. These are the properties of the Great Western Power Company, the Great Western Power Company of California and the City Electric Company.

W. C. Austin, auditor of the Eastern Pennsylvania Railways Company, Pottsville, Pa., has been elected assistant secretary and assistant treasurer of that company. In 1917 Mr. Austin was transferred from the staff of traveling auditors of the J. G. White Management Corporation, New York, N. Y., to the accounting department of the Eastern Pennsylvania Railways Company, which company is being operated by the management corporation. For a number of years Mr. Austin was treasurer and auditor of the Otsego & Herkimer Railroad Company (now Southern New York Power & Railway Corporation), Cooperstown, N. Y.

Obituary

W. J. Macy, formerly secretary to the president of the Birmingham Railway, Light & Power Company, has died of pneumonia in France, where he was serving as a member of the motor-truck department of the quartermaster's service.

A. W. Sharp, Jr., of the Fort Wayne department of the General Electric Company, Chicago office, died, at the age of twenty-eight years, on March 4. Mr. Sharp was a graduate of Lewis Institute, Chicago, and immediately upon leaving school entered the Fort Wayne Electric Works. After that company was taken over by the General Electric Company in 1913 he was employed in the Fort Wayne department, specializing mainly on battery-charging apparatus.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

SUPPLY OF RAW MATERIAL NOW IN FAIR CONDITION

Current Needs Difficult to Satisfy—Anticipating
Requirements the Only Solution—Shipments
and Deliveries Vexing

Broadly speaking, manufacturers appear to be in a fairly satisfactory position respecting the supply of raw material. Interviews with leading concerns in the various branches of the trade confirm this impression. Moreover, there is no indication of uneasiness regarding future requirements, despite the governmental restrictions on certain metals and other basic material. Deliveries, of course, are the bane of the industry, so much so that they are mentioned as affecting the ultimate selling price of the finished product. On the matter of prices generally an authority said that the most important factor contributing to the increases are the intensification of demand for material, the disruption of distributing processes, a shortage of labor and the decrease in the production of various products. Manufacturers with expanding programs are obliged to buy material when the opportunity presents itself for the certain delivery of the goods, preparing against periods when cars are unavailable for shipments. In other words, manufacturers have to stock requirements for future operations on a far greater scale than they would if they could depend on deliveries when the supplies are needed.

As one producer stated, the demand for raw material in the steel, iron and copper lines appears to have no limit. To be sure, it was explained, the situation is badly mixed, but the supply of metal and other material entering into the manufacture of machinery, generators, motors, transformers and apparatus of every description is easing up and deliveries are slightly better. Concerning wire and cables it was learned that copper seems to be plentiful for other than government work and can easily be had if the producers have it, and they are not yet being reported as short of the metal. Prices remain at the official standards. Shipments from the smelters can be made, but the embargoes hold up the deliveries. Unless priority orders, to which all shipments of this kind are subject, are obtained from the freight traffic committee by the consignee, the delay may be indefinite. Cotton and rubber, indispensable in the production of certain wire, cable and other electrical products, are practically in the same class as copper.

In other lines where not only copper is an essential but brass, slate, steel castings and sheets are basic materials a representative of one of the largest manufacturers in either East or West said that his company had anticipated its requirements for the last two years and was therefore fully provided to meet every demand. In the fall of 1915 this concern carefully went over its inventories for the preceding year, and it based its requirements for 1916 on the aggregate plus 100 per cent. It was figured that this would represent the probable increase in the business, and material was placed on order on this basis. Of this stock of raw material 92 per cent was worked up into its finished products, representing only 8 per cent of overbuying. For 1917 the same plan was adopted, with a still further increase of 30 to 35 per cent, which will carry the plant up to September of this year.

By placing its orders far in advance this manufacturer—and there appear to be others following the same plan—provided against future inconvenience or shortage of material. The first question to be considered is the one of delivery, with price secondary, a rule which seems to prevail in every transaction. According to this concern, no contracts on copper can be made for future requirements. It is bought at the market—base price plus the cost of rolling

or drawing. In order to be sure of a shipment of copper a manufacturer had three cars of the metal forwarded by express from Connecticut to a Western city at a cost of \$6,000. The company in question, like three-fourths or more of the manufacturers, has government contracts, and therefore shipments of either raw material or the finished goods are granted the advantages of priority certificates otherwise the embargoes interfere with deliveries to the regular trade.

An advance in steel castings is considered a probability by a number of manufacturers, although it is intimated that the official price, which remains in force until March 31, will remain at the present figure. The American Iron and Steel Institute, acting in conjunction with the War Industries Board on this question, declines to state its position one way or the other. As regards gears and pinions, a manufacturer of prominence said, shipments have been held up since Jan 1, which has resulted in the delivery of only a quarter of the quantity usually sent out. All export business has been suspended for the time being. While government control is not affecting gear steel, forged gear blanks are almost impossible to obtain on reasonable delivery. Pinion material is costing more than ever before, but prices have not advanced recently. Malleable iron is easier. In plants of this description and those on parallel lines in the electrical field labor is the most trying problem. Skilled workmen are required, and they are scarce and of uncertain tenure on account of the abnormal wages.

Quotations on nearly if not quite all raw material for electrical goods are made f.o.b. plant, with shipment at convenience of mill or factory. As one of several manufacturers who volunteered the information said, shipments in the immediate neighborhood can be accomplished, but to reach points in the Middle West with either material or finished goods is difficult, often taking two or three months.

CO-OPERATIVE BUYING BY CENTRAL STATIONS Inexpensive Portable Lamp of Standardized Design Is Produced as the Result of Conference

Thirty thousand portable lamps of a standardized design are to be placed on the market next fall as the result of a recent conference in New England between a group of central-station men and a fixture manufacturer who is handling this order on an off-season basis. This co-operative buying plan includes central stations from some of the largest cities in the country, whose representatives met informally to develop the program of securing a fixture at low cost for multiple production and wide distribution. The movement promises far-reaching results in the large-scale merchandising of electrical appliances. Those behind the plan believe that individualism has been overplayed in many lines of electrical selling to the general public; they believe that certain standardizations of design can be accomplished to appeal to a very wide market, and that through the concentration of orders and through intensive production along repetitive lines costs can be lowered to a point which will mark a new stage in the popularization of electrical merchandise.

When these central-station men assembled they met at a Connecticut fixture factory where an enormous yearly output of kerosene lamps of a simple design is produced for the Chinese trade. They recognized, of course, that no standard design of portable lamp will suit the entire market, but they believe that a large buying power exists among the public for a low-cost standard product of general

application. It is believed that a great many persons will be glad to purchase a portable lamp of uniform design, wholly regardless of the fact that other people may be using the same product, provided that the price is low enough.

The matter was discussed with the manufacturer, and a design of portable lamp has been prepared which is expected to meet an extremely wide range of service conditions, applicable to business and home surroundings. The central-station men present represented the sales departments of their several companies, and it is noteworthy that some of the smaller cities represented were among the heaviest underwriters of the plan.

Owing to its being the dull season in fixture production, it was possible for the manufacturer to take the order upon a very satisfactory basis of cost. The raw material for these lamps has been purchased on a more satisfactory basis of price and delivery than applies to small and individualistic orders for scattering shipment at odd times. The manufacturer has been enabled to plan his production on steady output during the off-season, and the various central stations will receive these lamps at a price which will enable them to market them at about the former factory cost level.

As a result of these negotiations and because of the optimism felt by the central stations concerned, a standardized desk lamp is now in process of development for handling in the same way. One of those attending the conference informed the representative of the **ELECTRICAL WORLD** that the co-operative purchasing plan will probably be extended into other lines of appliances and that the movement marks the beginning of what may prove to be a new era in electrical merchandising.

METAL MARKET SITUATION

Copper in Easy Supply, but Restrictions Are Imposed—Position of Platinum and Aluminum in Question

No trouble is being experienced in obtaining a sufficient supply of copper for "essential commercial purposes," but no commitments on the metal will be accepted by producers or jobbers on contract. The market is the base price, which is a shade lower this week, plus rolling or drawing, subject to the scrutiny of the copper committee in making the allotment of supplies.

One of the elements of interest in the metal market is the position of platinum, now under government control. Germany is now reported to have purchased the entire available supply of platinum in Russia, the world's principal platinum market, and to have made this purchase at her own figure.

Buyers and sellers of aluminum are awaiting the government ruling in transactions on the 32-cent base price at shipping point in lots of 50 tons and over.

Old metals remain at practically the same prices that have been quoted for several weeks, and no unusual demand for them is reported in existence at this time.

NEW YORK METAL MARKET PRICES

	March 4	March 11
	£ s d	£ s d
Copper:		
London, standard spot.....	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	*27.00	26.25 to 26.75
Lead, trust price	7.25	7.25
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter.....	†15.00	†15.00
Copper, spot	7.77½ to 7.82½	7.67½ to 7.72½
tin, Straits	*85.00	*85.00
Aluminum, 98 to 99 per cent. .	†Govt. price 32.00	†Govt. price 32.00

OLD METALS

Heavy copper and wire.....	21.50 to 22.00	21.50 to 22.00
Brass, heavy	14.00 to 15.25	14.00 to 15.25
Brass, light	10.00 to 10.50	10.00 to 11.00
Lead, heavy	6.25 to 6.50	6.25 to 6.50
Zinc, old scrap.....	5.50 to 5.75	5.50 to 5.75

*Nominal. †F.o.b. producer's plants.

THE WEEK IN TRADE

JUDGING from the reports received from the cardinal points of the country, electrical business is in excellent shape. An official deliverance that the sale of electrical merchandise was running behind last year's record appears to have been made without the facts. At any rate, the buying of large equipment by shipbuilders and the government continues apace. The aggregate is on an enormous scale; in fact, it dominates the industry.

Freight congestions and troublesome deliveries are more acute than ever in all parts of the country. Some price changes have occurred. On the part of the regular trade there is a steady and increasing demand for staples. In some instances jobbers are having all they can handle in the way of business.

Financially the trade appears to be on a sound basis, with collections from tight to easy. Credit lines have narrowed, ironclad provisions are inserted in contracts, and payment terms are shortened.

NEW YORK

Very little complaint is heard concerning the general average of business in all electrical lines. Occasionally a pessimist is encountered whose selling methods may be responsible for his hypercritical attitude. The large majority of jobbers, distributors and dealers, as well as manufacturers, report an active demand for electrical staples and specialties. The volume of trade is greatly in excess of the same period last year. With a shortage in certain lines a demand for second-hand equipment is in evidence, and this class of goods is said to be moving out as rapidly as acquired. Some changes in prices have occurred, but no recessions are recorded. Shipments and deliveries which are still restrictive, are troublesome factors and will probably not be wholly eliminated under current conditions.

Differences exist respecting financial obligations, but collections, on the whole, are fairly prompt. Credits receive close attention, and trade acceptances are being strongly urged by jobbers as the best solution in the sale of merchandise as against open-book accounts.

FUSES.—An active market is the majority opinion of distributors and jobbers, with dealers keeping representative stocks and reporting a brisk movement.

LAMPS.—The situation is very much improved with the elimination of the slow sellers and the distribution of stocks on a more equitable basis. An ample supply is reported with the exception of some standard sizes, which are being taken over by the government in large quantities.

PANEL SLATE.—An advance of from 20 to 25 per cent was made within a few weeks. The best grades, free from flaws or metallic veins, are none too plentiful. The difficulty of retaining labor at the quarries is also adding to the cost, as well as deliveries, which are not infrequently made by express. The express carriers are becoming more exacting in their acceptance of shipments, and this is becoming likewise bothersome.

HEATING APPLIANCES.—Trade of a very satisfactory nature is a current condition in every branch of the business. Jobbers and dealers are also stocking up on a generous basis with the regular lines of household appliances, including washing and sewing machines, flatirons, toasters, percolators and chafing dishes, in anticipation of heavy sales during the warm weather.

PORCELAIN.—The market is short in all goods of this kind, and stocks in the hands of distributors, jobbers and retailers generally are low. This is to be accounted for by the extraordinary buying for government needs. It is believed that the situation will not ease off appreciably until these requirements are satisfied.

COLLECTIONS AND CREDITS.—A few reports are to the effect that collections are falling behind, but the greater number bear a favorable aspect. It appears that when financial obligations receive unremitting care the results are proportionate to the effort. The lack of building operations and erratic deliveries of goods are cited as primary causes for the slowing up of payments by contractor-dealers. Credits have not eased off so far as can be noticed.

SOCKETS.—Every variety of the line is spoken of as in steady sale, with no complaint of a present or anticipated shortage.

CONDUIT.—Prices have receded about $5\frac{1}{2}$ per cent—4 points. On all sizes this staple is extremely short in supply. A few jobbers who are yet receiving shipments under old contracts—which are being carried out by the producers most reluctantly, reports say, on account of the price—have a small stock. This is tenaciously reserved for the highest selling figure obtainable. Delivery is the primary consideration, with price a secondary matter.

DRY BATTERIES.—No advance has been made in several months, despite statements to the contrary. Fair stocks in the hands of primary distributors and manufacturers are reported.

CHICAGO

The tone everywhere in the trade during the last week has been more optimistic. The fact that more sales were made in February than in January and increased activity that comes with spring in part are responsible for the general tone. Central stations are not buying much, but the retail trade is better. Moreover, the conditions seem to be improving even in the building field. The record of building permits and electrical permits, which had reached a very low mark early in 1918, is now climbing slowly but steadily.

In the week ended March 6 permits aggregating \$422,800 were issued. In the previous week there were thirty-four permits aggregating \$505,800, and in the same week last year there were 139 permits, aggregating \$1,281,850. In the week ended March 6 558 electrical permits were issued, totaling 5961 incandescent lamps and 578 hp. in motors. In the week previous there were 452 permits, aggregating 5794 lamps and 469 hp. in motors. In the same week in 1917 there were 781 electrical permits.

HEATING APPLIANCES.—Shipments of hollow ware from the East that have been en route for five weeks have not yet arrived in Chicago.

CONDUIT.—The delivery situation is improving. It is now possible to get shipments through on priority orders in fairly good time, whereas it formerly seemed impossible to get shipments on any kind of an order. The price of conduit has taken a four-point drop, which amounts to about 5 per cent. This was done to put the finished-product price more nearly in line with the government's fixed price on raw material. The price change is said to have no relation whatever to conditions of supply and demand in the market.

LAMPS.—Demand is strong and steady. Deliveries are getting better.

ELECTRIC TRUCKS.—Thirty-five trucks have been sold in Chicago in the last winter. Prospects for more sales this spring are bright.

FLOODLAMPS.—Business, which was stimulated to an unexpected degree by plants with war orders, has continued unabated. It is now characterized as "better than ever."

FARM LIGHTING SETS.—Business is improving steadily and at a fairly rapid pace, although there can hardly be said to be a boom in progress. There is an increasing tendency to distribute these goods through the electrical trade.

INCANDESCENT LAMPS.—A one-year contract to provide electric bulbs to all Indiana State institutions has been let to the Indianapolis Belting & Supply Company. To the same company was awarded a contract to provide other electric lighting supplies. The contract for electric bulbs provides that \$10,000 worth shall be used in a year.

BOSTON

War industry dominates the electrical trade as the spring approaches. The volume of business continues very heavy. Prices show little change, barring an advance of \$5 in electric valve grinders scheduled for last Monday. Central stations with few exceptions are maintaining an extraordinarily conservative policy regarding new work, but the easing of the fuel situation and restoration of normal lighting five nights a week are stimulating earnings and to some extent will be reflected in the future sales of supplies. Collections are tight, for the most part. Trade acceptances are coming into more general use in jobbing circles.

It is announced that the government will expend a total of about \$18,000,000 on the great army base to be built at Boston for transatlantic forwarding. Jobbers expect to obtain heavy orders of equipment and supplies in connection with this terminal. The large army and naval stations continue substantial buyers of supplies. Military and naval hospitals are buying electric centrifuges in quite large volume. It seems impossible to get any one to say a good word for the railroad service, deliveries showing little if any improvement as yet. A decided boom in the sale of electric road trucks is noted in the Boston district. Labor is quiet.

MOTOR-DRIVEN VALVE GRINDERS.—These are in great demand, and factory stocks are reported to be low. An advance in price from \$30 to \$35 was scheduled for Monday in the case of the Stenman electric valve grinder made at Worcester, Mass.

IGNITION BATTERIES.—Stocks are in good shape. One dealer has just received two carloads of batteries, and the outlook is excellent for spring business.

ELECTRIC TRUCKS.—A decided increase in the demand at Boston is noted for electric road trucks. One dealer has sold sixty-eight trucks in the last three months. Deliveries are being made in one to two weeks.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are increasing. The government was reported to be in the market for forty-eight units at the end of last week. Prices remain steady and deliveries fair.

ELECTRIC PASSENGER CARS.—Interest is increasing and is reflected in good sales. A prominent dealer sold all the cars he exhibited last week at the Automobile Show.

LAMPS.—Consumption is increasing, with the abandonment of lightless nights. Production is in good volume and railroad delays are the chief obstacle to local stock building.

WIRE AND CABLE.—Government orders in heavy volume predominate, with firm prices and poor delivery conditions due to railroad difficulties.

FIBER CONDUIT.—Although business is quiet and inquiries have not matured to any great extent, one large central-station order covering the year's requirements has been booked by a Boston agency, following a proposition by the latter to carry the completed product at the factory pending service demands. Prices are steady and deliveries can be made along satisfactory lines.

ASBESTOS INSULATION.—Business is very active, with no change in prices. It is difficult to accumulate factory stocks at present.

ELECTRIC RADIATORS.—Jobbers report a remarkably good season, which is still continued. One wholesaler has distributed 6500 radiators of a single make since Jan. 1, and looks for an attractive business in connection with summer cottages and camps this year.

MOTORS.—A heavy demand is noted for sizes of 10 hp. upward, with fair deliveries. A representative quotation is from two to three months on standard types of alternating-current and direct-current motors, four months being promised on special equipment. Government orders are well maintained and constitute the backbone of the motor business to-day.

CONDUIT.—Spasmodic deliveries continue to disturb the market. Jobbers appear to be well stocked in smaller sizes, and here and there larger diameters are in the bins. Last week's four-point drop in price means little to New England under existing delivery conditions. Some goods ordered a year ago are still to be received.

ATLANTA

As a rule reports agree that trade in general is running well ahead of the same period last year. Whether the increase is based on monetary value or volume is debatable, but opinion appears to favor actual gains in physical volume as accountable for the excess. The congestion in transportation has measurably subsided, and shipments from points west of Pittsburgh consigned south are moving freely; but, on the other hand, freight movements from Eastern points to this section are very slow. The aggregate value of building permits for February was greater than for any month since last September. Industrial construction continues to expand, with a large volume under way. The Saxon and Spartan Mills, Spartanburg, S. C., have closed contracts for approximately \$110,000 worth of electrical equipment. Individual motor drive will be used practically throughout both mills. Energy will be secured from the Blue Ridge Power Company, Spartanburg, an affiliated corporation.

STREET LIGHTING.—There is no noticeable activity in new equipment, but jobbers state that a number of municipalities are buying freely of replacement material, such as reflectors and miscellaneous goods, to handle much-needed repairs. Deliveries on all classes of this material are good, and jobbers experience no difficulty in taking care of the volume of business from local stocks.

FANS.—Jobbers report a substantial number of inquiries for early delivery. Some sales have been made on the basis of 15 to 25 per cent above 1917 prices.

ATTACHMENT PLUGS.—While the call for these has been good, the demand has been further stimulated by anticipated fan business. Local stocks are in good shape.

DRY BATTERIES.—The demand has been phenomenal and it is merely a question of having them on hand for delivery. Shipments to this section have been spotty, but on the whole carload-lot deliveries are pretty fair considering the Eastern freight congestion.

FLASHLAMPS.—Demand is very steady, with about the same volume of sales as registered during the last six months. Batteries and casings for the dollar and two-dollar sizes are very hard to get, and stocks are low.

PIPE FITTINGS.—This line follows closely the call for steel products, which has been strong. A slight improvement is noted in deliveries.

PORCELAIN PRODUCTS.—There is no cessation in the demand for knobs, cleats and tubes. Local stocks are pretty well cleaned out, and replacement orders are not coming in.

SOCKETS.—Stocks are very low, and more or less trouble is experienced by the jobbers in handling the large demand.

LAMPS.—There appears to be no let-up in the volume of business being done. All standard sizes are popular. Stocks are holding up well under the pressure, and deliveries are prompt. There is no evidence at this time of the shortage which was predicted some time back.

SEATTLE

The usual heavy volume of sales to shipyards and industrial plants was maintained during the week. There is considerable big business in prospect. The contract will be let shortly for the power apparatus for a new shipbuilding plant to be among the largest in the Northwest. Several new plants will soon let contracts for the larger sizes of wire and cable. As regards inquiries and prospective business, last week exceeded the record for several months. Stocks of sewing and washing machines are running low but heavy shipments are en route. Sales of these and other domestic appliances are maintaining the levels of several weeks past.

The condition of car shortage is reported equal in seriousness to that of the fall of 1916. The shingle-mill owners in the West coast territory have voluntarily brought the industry under an eight-hour day, as have the lumber mills in the Western Pine Association in eastern Washington and Idaho.

Bulk handling of wheat is gaining in favor to such an extent that the authorities state that more than 200 grain elevators will be erected in the Northwest this year. One Port-

land firm alone has a contract for twenty-five, ranging in price from \$25,000 to \$35,000 each. Electrical jobbers in the Portland and Spokane fields particularly report increasing inquiries and orders for both large and small motors and lighting equipment for elevators under construction. Thirty thousand acres of land will be devoted to the sugar-beet industry in Yakima County, Washington, this year, instead of 10,000 as last year.

Seattle faces spring with its available supply of rented houses exhausted. The problem of housing Eastern mechanics and families employed in the shipyards is serious. New residence building continues increasing. Tacoma shipyards plan asking the government for \$1,500,000 to meet the housing problem. The principal activity in building lines in the Northwest cities is in residences, and this, in Sound cities especially, is heavy.

Retailers report that the lighting fixture business is daily increasing as the result of residence building and remodeling. In new residences fixtures are not installed until the houses are sold, builders leaving the selection of the class to the option of the purchaser. Sales of drop cords, switches and buzzers are heavy, and March business is expected to be exceptionally heavy. Floodlamps are selling as fast as they can be obtained. Portland and Gray's Harbor fields are buying heavily. Stocks are low, but it is believed will be in good shape in three weeks with shipments en route.

SAN FRANCISCO

The past week has been unmarked by any striking developments. Jobbers report the arrival of several long-expected carloads, covering such necessities as rubber-covered wire and schedule material and such articles of popular demand as sewing machines and washing machines. The rainfall continues, guaranteeing a very prosperous year to the coast. Governmental and State contracts are helping to ballast building conditions. In the past week the government awarded two contracts, amounting to \$1,000,000 each, for the construction of two aviation schools and camps, one to be built at Mills, near Folsom, Cal., and the other at Riverside, Cal. Buildings to house various war activities are to be erected by Red Cross chapters. The Rolph Shipbuilding Company at Eureka will erect the first unit of fifty community cottages for employees of its plant, and a number of fruit-drying stations, to accommodate a million-dollar contract from the government, will be built by E. C. Horst.

Oakland building permits for February were 172 in number and aggregated \$408,000. San Francisco building permits were 340, to cost \$538,000. Government work is censored and is not included in this report. The San Francisco comparative report for 1917 was \$1,166,000. This is about the average decrease in private construction. Reports from southern California make light of the strike of electrical workers on the lines of the Southern California Edison Company.

MOTORS.—The demand for motors is good and well distributed. For small-size motors stocks and deliveries are excellent, the greatest demand being for pumping plant sizes of 1 hp. to 5 hp. inclusive. For larger sizes, 15 hp. and over, the demand exceeds the supply. Dealers in second-hand motors are doing a good business and find a market for every old motor that they can refurbish and put back.

FARM PLANTS.—The prosperity of farmers in general and the influence of several large advertising campaigns on farm plants are producing a good demand. Deliveries are poor. In the opinion of shrewd observers this demand will continue to increase, one decided factor being the influence of the automobile and the realization of farmers, through its use, that gasoline engines and storage batteries are not too technical and complicated to be handled by them.

INSULATING MATERIAL.—Deliveries, stocks and sales are all good, with the solitary exception of linen tape, which requires six months for shipment. The products of factories making this tape are absorbed by the Red Cross. The demand for second-hand motors, referred to above, is responsible for a big demand for insulating material to be used in repairing them, also for second-hand transformers. The shipbuilding industry requires a considerable amount of fiber to be used in pipe gaskets.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List per 1000 Ft.
No. 14 solid.....	No. 14 Solid	\$61.00
No. 12 solid.....	No. 12 Solid	71.00
No. 10 solid.....	No. 10 Solid	90.00
No. 8 solid.....	No. 8 Solid	106.00
No. 6 solid.....	No. 6 Solid	145.00
No. 10 stranded.....	No. 10 Solid	95.00
No. 8 stranded.....	No. 8 Solid	115.00
No. 6 stranded.....	No. 6 Solid	160.00
No. 4 stranded.....	No. 4 Solid	205.00
No. 2 stranded.....	No. 2 Solid	266.00
No. 1 stranded.....	No. 1 Solid	315.00
Twain-Conductor		
No. 14 solid.....	No. 14 Solid	104.00
No. 12 solid.....	No. 12 Solid	135.00
No. 10 solid.....	No. 10 Solid	185.00
No. 8 stranded.....	No. 8 Solid	235.00
No. 6 stranded.....	No. 6 Solid	370.00
No. 4 stranded.....	No. 4 Solid	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor		No. 14 Solid
Less than coll.....	List to \$61.00	
Coll to 1000 ft.....	10% to 59.17	
Twain-Conductor		No. 12 Solid
Less than coll.....	List to \$71.00	
Coll to 1000 ft.....	10% to 63.87	
Twain-Conductor		No. 14 Solid
Less than coll.....	List to \$105.00	
Coll to 1000 ft.....	\$70.00 to 10%	
Twain-Conductor		No. 12 Solid
Less than coll.....	List to \$135	
Coll to 1000 ft.....	10% to \$130.95	

DISCOUNT—CHICAGO

Single-Conductor		No. 14 Solid
Less than coll.....	+ 15% to 20%	
Coll to 1000 ft.....	5% to 20%	
Twain-Conductor		No. 12 Solid
Less than coll.....	+ 15% to + 20%	
Coll to 1000 ft.....	10% to 20%	
Twain-Conductor		No. 14 Solid
Less than coll.....	15% to \$115	
Coll to 1000 ft.....	20% to \$80	
Twain-Conductor		No. 12 Solid
Less than coll.....	+ 15% to + 20%	
Coll to 1000 ft.....	20% to 5%	

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to \$24.00
1/5 to std. pkg.....	20% to 19.80
Std. pkg.....	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+ 20% to 12%
1/5 to std. pkg.....	20% to List
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175-.3195	.3215-.3295
Barrel lots.....	.2875-.2895	.2915-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List Per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than	Coil to 1000 Ft.
3/8-in. s. stp....	Net to \$75.00—15% to \$69.75
3/8-in. d. stp....	15% to 75.00 15% to 72.00
1/2-in. s. stp....	List to 100.00—15% to 93.00
1/2-in. d. stp....	+ 15% to 100.00 List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than	Coil to 1000 Ft.
3/8-in. single strip....	\$75.00 \$63.75
3/8-in. double strip....	78.25-78.75 71.25-71.75
1/2-in. single strip....	100.00 85.00
1/2-in. double strip....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than	\$15 to \$60	\$60 to \$150
\$15 List	List	List
7/32-in.....	\$25.00-\$55.00	\$20.50-\$24.50
1/4-in.....	\$28.00-\$60.00	\$22.50-\$27.00
		\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than	\$15 to \$60	\$60 to \$150
\$15 List	List	List
7/32-in.....	\$36.00-\$55.00	\$25.00
1/4-in.....	\$40.00-\$66.00	\$27.00
		\$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.11 1/2
3/4.....	.17
1.....	.23
1 1/4.....	.27 1/2
1 1/2.....	.37
2.....	.58 1/2
2 1/2.....	.76 1/2
3.....	

Couplings, List Elbows, List

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	4% to 10%	3/4 in. to 3 in.
2500-5000 lb....	7% to 9%	6% to 12%
		12% to 15%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	1.3% to 4.7%	4.3% to 7.7%
2500-5000 lb. . .	3.3% to 6.7%	6.3% to 9.7%
(For galvanized deduct six points from above discounts.)		

FLAT IRONS

NEW YORK

List price.....	\$6.00
Discount.....	30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28%
1/5 to std. pkg.....	38%

FUSE PLUGS		
3-Amp. to 30-Amp.		
NEW YORK		
Less than 1/5 std. pkg.	Per 100 Net	
5 to std. pkg.	\$5.00 to \$5.75	
Standard package, 500.	List, each, \$0.07.	
CHICAGO		
Less than 1/5 std. pkg.	Per 100 Net	
5 to std. pkg.	\$6.25 to 5.25	
Standard package, 500.	List, each, \$0.07.	

LAMPS, MAZDA		
105 to 125 Volts		
Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt-B	100	\$0.30
60-watt-B	100	.35
100-watt-B	24	.70
75-watt-C	50	.70
100-watt-C	24	1.10
200-watt-C	24	2.20
300-watt-C	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt-G 25	50	.53
25-watt-G 25	50	.55
40-watt-G 25	50	.55
Round bulbs, 3 3/4 in., frosted:		
60-watt-G 30	24	.77
Round bulbs, 4 3/4 in., frosted:		
100-watt-G 35	24	1.10

DISCOUNT—NEW YORK	
Less than std. pkg.	Net
std. pkg.	10%

DISCOUNT—CHICAGO	
Less than std. pkg.	Net
std. pkg.	10%

LAMP CORD		
Cotton-Covered, Type C, No. 18		
NEW YORK		
Less than coil (250 ft.)	Per 1000 Ft. Net	
coil to 1000 ft.	\$24.90 to \$31.00	
coil to 1000 ft.	22.72 to 27.90	
CHICAGO		
Less than coil (250 ft.)	Per 1000 Ft. Net	
coil to 1000 ft.	\$29.00 to \$30.00	
coil to 1000 ft.	21.50 to 33.50	

LAMP GUARDS, WIRE		
Standard packages from 50 to 150		
NEW YORK		
et per 100	\$20.00 to \$29.00	
CHICAGO		
et per 100	\$19.17 to \$24.00	

OUTLET BOXES		
os.	List,	per 100
01—A, A1 1/2, 4 S.C., 6200, 320.		\$30.00
02—B.A., 6200 S.E., 300, AX, 1 1/2,		30.00
03—C.A., 9, 4R, B 1 1/2		25.00
06—F.A., 7, C.S., 1 1/2, 3 R.		20.00

DISCOUNT—NEW YORK		
Less than \$10.00 list.	Black	Galvanized
10.00 to \$50.00 list.	25%-37%	20%-32%
	42%-45%	37%-40%

DISCOUNT—CHICAGO		
Less than \$10.00 list.	Black	Galvanized
10.00 to \$50.00 list.	40%	35%
	50%	45%

PIPE FITTINGS		
DISCOUNT—NEW YORK		
Less than 1/5 std. pkg.	10%	
1/5 to std. pkg.	20%	
std. pkg.	30%	
DISCOUNT—CHICAGO		
Less than 1/5 std. pkg.	10%	
1/5 to std. pkg.	20%	
std. pkg.	30%	

PORCELAIN CLEATS—UNGLAZED		
2 and 3 Wire		
NEW YORK		
Less than 1/5 std. pkg.	Per 1000 Net	
1/5 to std. pkg.	\$20.00 to \$38.00	
Standard package, 2200.	List per 1000,	
\$20.		
CHICAGO		
Less than 1/5 std. pkg.	Per 1000 Net	
1/5 to std. pkg.	\$15.80 to 14.80	
Standard package, 2200.	List per 1000,	
\$20.		

PORCELAIN KNOBS		
NEW YORK		
Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N. C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.		
1/5 to std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20
CHICAGO		
Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N. C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.		
1/5 to std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES		
	Std. Pkg.	List
1/2-in. cap key and push		
1/2-in. cap key and push sockets, 500		\$0.33
1/2-in. cap keyless socket, 500		.30
1/2-in. cap pull socket, 250		.60
DISCOUNT—NEW YORK		
Less than 1/5 std. pkg.	Net to \$23.00	
1/5 to std. pkg.	20% to 21.00	
NET PER 100—CHICAGO		
Less than 1/5 std. pkg.	24% to \$25.00	
1/5 std. pkg.	30% to 23.00	

SWITCHES, KNIFE		
250-Volt, Front Connections, No Fuse		
High Grade:		
30-amp. S. P. S. T.		\$0.80
60-amp. S. P. S. T.		1.20
100-amp. S. P. S. T.		2.25
200-amp. S. P. S. T.		3.48
300-amp. S. P. S. T.		5.34
30-amp. D. P. S. T.		1.20
60-amp. D. P. S. T.		1.78
100-amp. D. P. S. T.		3.38
200-amp. D. P. S. T.		5.20
300-amp. D. P. S. T.		8.00
30-amp. 3 P. S. T.		1.80
60-amp. 3 P. S. T.		2.68
100-amp. 3 P. S. T.		5.08
200-amp. 3 P. S. T.		7.80
300-amp. 3 P. S. T.		12.00
Low Grade:		
30-amp. S. P. S. T.		0.42
60-amp. S. P. S. T.		0.74
100-amp. S. P. S. T.		1.50
200-amp. S. P. S. T.		2.70
30-amp. D. P. S. T.		0.68
60-amp. D. P. S. T.		1.22
100-amp. D. P. S. T.		2.50
200-amp. D. P. S. T.		4.02
30-amp. 3 P. S. T.		1.02
60-amp. 3 P. S. T.		1.84
100-amp. 3 P. S. T.		3.76
200-amp. 3 P. S. T.		6.76

DISCOUNT—NEW YORK		
Less than \$10 list.	High Grade	List to + 5%
\$10 to \$25 list.		11%
\$25 to \$50 net.		14% to 15%
Less than \$10 list.	Low Grade	5% to 10%
\$10 to \$25 list.		16%
\$25 to \$50 list.		24% to 25%
DISCOUNT—CHICAGO		
Less than \$10 list.	High Grade	List to + 5%
\$10 to \$25 list.		10% to 11%
\$25 to \$50 list.		14%
Less than \$10 list.	Low Grade	5%
\$10 to \$25 list.		16%
\$25 to \$50 list.		24%

SWITCHES, SNAP AND FLUSH		
5-Amp. and 10-Amp. 125-Volt Snap Switches		
	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd		
10-Amp. 250-Volt Push-Button Switches		
	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK	
Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%
DISCOUNT—CHICAGO	
Less than 1/5 std. pkg.	+ 20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT		
Union and Similar—		List
No. 155		Each
No. 160		\$0.34
		.60

DISCOUNT—NEW YORK		
	Black	Galvanized
Less than \$2.00 list.		Net
\$2.00 to \$10.00 list.	10% to 20%	5%
\$10.00 to \$50.00 list.	20% to 30%	15%

DISCOUNT—CHICAGO		
	Black	Galvanized
Less than \$2.00 list.		
\$2.00 to \$10.00 list.	25%	15% to 20%
\$10.00 to \$50.00 list.	25%	20%
	25% to 35%	20% to 25%

TOASTERS, UPRIGHT	
NEW YORK	
List price	\$6.00
Discount	30%

CHICAGO	
List price	\$1.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR		
NET PRICE—NEW YORK		
	Per Lb. Net	
No. 18, less than full spools.		\$0.44 1/4
No. 18, full spools.		0.43 1/4

CHICAGO		
	Per Lb. Net	
No. 18, less than full spools.	\$0.57 to \$0.65	
No. 18, full spools.	0.47 to 0.55	

WIRE, RUBBER-COVERED, N. C.		
Solid-Conductor, Single-Braid		
NEW YORK		
	Price per 1000 Ft. Net	
	Less than 500 Ft.	500 to 1000 Ft.
No.	500 Ft.	1000 Ft.
11..	\$15.00-\$18.00	\$13.00
12..	23.25-25.41	21.30-21.78
10..	32.40-35.21	29.70-30.18
8..	45.70-49.12	41.90-42.12
6..	72.40-77.84	66.35-66.72

CHICAGO		
	Price per 1000 Ft. Net	
	Less than 500 Ft.	500 to 2500 Ft.
No.	500 Ft.	2500 Ft.
14..	\$18.00	\$13.00
12..	25.33-26.28	22.02-25.33
10..	36.48-36.54	27.94-31.26
8..	42.54-51.57	38.99-41.13
6..	67.38-88.38	56.15-75.61

WIRE, WEATHERPROOF		
Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.		
NEW YORK		
	Per 100 Lb. Net	
Less than 25 lb.	\$33.25 to \$35.25	
25 to 50 lb.	31.25	
50 to 100 lb.	28.25 to 34.25	

CHICAGO		
	Per 100 Lb. Net	
Less than 25 lb.	\$35.42 to \$40.35	
25 to 50 lb.	34.42 to 39.35	
50 to 100 lb.	33.42 to 38.35	

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Shade Holders

Harvey Hubbell, Inc., of Bridgeport, Conn., has placed on the market a line of brass shade holders of the three-screw type for use with medium and mogul base weatherproof and porcelain



FOR USE WITH MEDIUM AND MOGUL
BASE SOCKETS

sockets. The attachment to the socket is accomplished by means of a clamp and screw arrangement which guarantees a firm grip. The holders are given a bright dip and lacquered finish, making an attractive as well as useful device.

Floodlighting Projector

A floodlighting projector designed for use of 300-watt to 1000-watt standard Mazda "C" lamps has been placed on the market by the George Cutter Company, South Bend, Ind. It is called the "Standard" floodlighting projector.

The new unit has the same general construction features as the Cutter "Universal" projector for floodlighting lamps, features which have made the latter unit popular because of its adaptability for the many purposes for which floodlighting projectors can be used. They include weather-proof and fume-proof body or housing cast of aluminum or gray iron and forming absolute protection for the lamp and reflector, a method of mounting that permits of the projection of light in



FOR STANDARD MAZDA "C" LAMPS

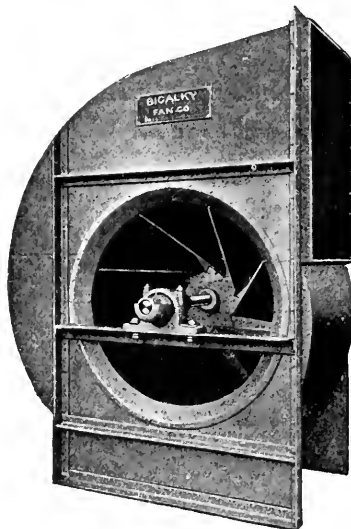
any direction in any plane, construction of the housing that permits of the interchange of narrow or wide angle-beam reflectors, and sectional wireglass doors to minimize breakage.

In this projector the socket is ad-

justable both horizontally and vertically for focusing the lamp or changing the width of the beam. When adjustment is made the socket is locked in position. Reflectors are made of copper, heavily silver-plated and finished with a coat of water and fume-proof lacquer. The narrow-beam reflector has a divergence of 10 deg. and the wide-angle-beam reflector a divergence of 30 deg. They are designed to redirect the maximum amount of light from the lamp.

Disk Fans

The Bicalky Fan Company of Buffalo, N. Y., has developed a disk fan that is constructed entirely of steel. The hub is conical in shape, thereby offering the least resistance to the air, it is pointed out. This fan is equipped



CONSTRUCTED ENTIRELY OF STEEL

with ball bearings running in oil. The center shaft is stationary and the steel hub revolves in the shaft. The wheel shaft is hollow, thus providing a large oil chamber, so that the fan requires oiling only occasionally. The fan is equipped with self-oiling babbit bearings.

Electric Heating Pad

The Wirt Company of Philadelphia has developed an electric heating pad in which the heat-producing element is inclosed between two sheets of rubberized fabric, permanently vulcanized together. The wire is laid in parallel strands 1/16 in. (0.16 cm.) apart.

The manufacturers point out that many pads are equipped with a thermostat. A thermostat in this pad is unnecessary. The wire that is used is

such that as the heat increases the resistance increases, automatically reducing the watts consumed. Hence, it is pointed out, the wire in the pad is itself a thermostat, which will always work, providing absolute protection against excessive heat. The pad itself may be washed or scrubbed with soap and water as often as necessary or may be sterilized by dipping in boiling water for a minute or two. The rubberized fabric will not permit the water to come in contact with the resistance wires. The slip-on cover furnished with the pads is easily removed. It is furnished with 8 ft. (2.4 m.) of cord and attachment plug. Close to the pad is a slip connector, which enables the user to shut off the heat.

Plastic Refractory for Baffles

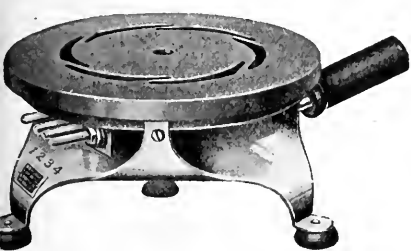
Jointless and gas-tight baffles can be made by the use of a refractory known under the trade name of plastic firebrick and manufactured by the Betson Plastic Fire Brick Company of Rome, N. Y. This material was originally introduced for lining boiler furnaces and is compounded of refractory materials so prepared as practically to eliminate expansion and contraction with changes in temperature.

Where this material is used there is no restriction upon the shape or size of the baffle, and the latter can therefore be arranged in any form desired. In cross-baffled boilers, for example, it is becoming the practice to slope or incline the baffles, so that the gas passage will contract progressively from the point where the gases enter the tube to the point where they leave, in order to maintain a uniform gas velocity, in spite of the shrinkage of gas volume with cooling. This is easily accomplished with the plastic material, whereas with the solid bricks or blocks a special block is required which can be inserted and maintained in place only with difficulty, if at all.

This material also finds use as a substitute for special forms of bricks or blocks, as, for example, where the front headers of horizontal water-tube boilers rest upon the front arch. Its use for lining furnace and combustion chambers, including front arch, side walls, bridge wall, rear arch, etc., has been described previously. The exacting tests to which it has been put in direct contact with the fuel bed and with the gases of combustion before they have been cooled by the boiler surfaces proves its ability to withstand high temperature gases and stresses such as are encountered in furnace construction for long periods without crumbling or otherwise deteriorating.

Disk Stoves

A four-heat disk stove is being manufactured by Landers, Frary & Clark of New Britain, Conn. A disk 3 in. (7.6 cm.) in diameter is surrounded by a ring 6 in. (15.2 cm.) in diameter. Each has a heating unit which can be



FOUR-HEAT STOVE

operated independently or in conjunction with the other. Two single stoves are thus combined in one and at a cost less than that of the regular two-heat disk stove, it is said.

The nichrome wire heating unit is incased in a polished and blued cast-iron top. The stand is nickel-plated. The wattage of each unit is 300 and the total wattage 600. A neat convenient handle is provided. This device has a wide field in homes, laboratories, schools, shops, drug stores, prescription counters and hospitals.

Automatic Starting Switch for Squirrel-Cage Motors

The control from a remote point of the starting and stopping of single-phase and standard polyphase motors, as well as high-torque polyphase motors, is often desirable, if not essential. Such installations in connection with pumps for railroad water tanks and various other pump and compressor applications, coal and ash conveyor installations, etc., are at once called to mind. The control may be a float switch closing and opening the control circuit with changes in the water level of a tank, or a pressure regulator performing similar service in a closed system, or control may be had by push-button stations, one button being normally open and one normally closed. In any case some form of automatic device must be used, unless the motor is very small, to handle the motor current. An automatic starting switch which is of the double-pole clapper type is made for single-phase and standard polyphase motors up to 15 hp. and for high-torque polyphase motors up to 50 hp. Besides the double-pole switch, two inverse-time-element overload relays are mounted on the same slate panel, which is supported on a pressed-steel frame.

When used with a float switch, pressure regulators or a snap switch, the overload relays are arranged for manual reset; hence when an overload occurs the operator is required to go to the starting panel before the motor can again be started, a feature which results in more careful attention to operating conditions and less motor abuse.

When used with three-wire controlling apparatus, such as two push-buttons, one normally open and one normally closed, the overload relays can operate with a self-resetting feature.

The wiring diagram below shows the advantages of this feature and why depressing the start button will immediately restart the motor after a shut-down from overload trip, voltage failure or intentional stopping with stop button.

Except on some of the smaller sizes, both poles of the main contactor are equipped with powerful magnetic blow-outs. The clapper switch fingers are standard C-H butt contact construction with hard-drawn copper tips. By the use of shading coils these contactors gain great holding power and there is a total absence of magnetic hum.

The relays used on these panels are of that type in which the length of time between the instant the overloading condition arises and the instant of opening the control circuit is inversely pro-

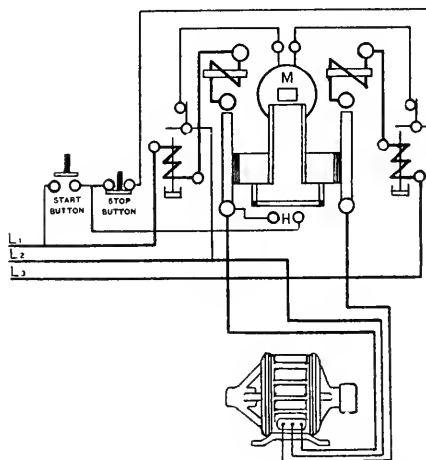


DIAGRAM OF CONNECTIONS FOR STARTING SWITCH WITH OVERLOAD RELAYS HAVING SELF-RESETTING FEATURE

portional to the amount of the overload. They give adequate protection to polyphase induction motors against excessive continued overloads and yet permit a large inrush of starting current.

The complete panel is known as an "across-the-line type self-starter" and is manufactured by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Safety Switch

The Metropolitan Electric Manufacturing Company, Boulevard and Fourteenth Street, Long Island City, New York, is manufacturing a safety switch for the W. A. McCombs Company of Pittsburgh, Pa. This is a quick-break switch mounted in a box said to be unusually strong. The cover is in three pieces. The upper and lower doors each move on separate hinges and the middle section is attached to the box by two screws. The top door over the switch compartment may be opened by means of a lock which permits ready inspection. The lower door over the fuse compartment is held by a snap catch. No live parts are exposed. The safety

switch rated at 30 amp. is a 60-amp. switch with 30-amp. fuse spacings to give mechanical strength.

Combination Air Compressor and Grinder Outfit

The United States Air Compressor Company, Cleveland, Ohio, has recently announced a combination air compressor and grinder outfit which is especially suitable for service in garages and similar places where compressed air is required.

The outfit consists of a self-oiling air compressor with filtering trap, check valve and safety valve, buffing head, 30-gal. (113.6-l.) tank, air-pressure gage, needle-point valve, pipe and fittings, armored hose, automatic air chuck, 6 ft. (1.8 m.) of armored cable with plug, all mounted on a metal base to form a compact unit which requires but little floor space.

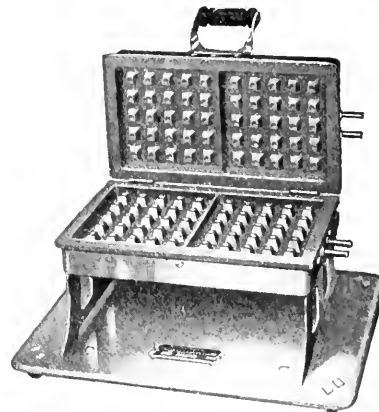
The outfit is equipped with an extra tank, the function of which is to permit the motor to start against no pressure and attain full momentum before assuming its full load, thereby eliminating the cause of burned-out motors and other motor trouble.

The outfit is equipped with a 1-hp. Robbins & Myers motor which permits the compressor and buffing head to operate at the same time. Outfits without this buffing head are equipped with a 0.5-hp. Robbins & Myers motor.

Waffle Iron

Waffle irons for lamp sockets are now being manufactured by Landers, Frary & Clark of New Britain, Conn. Highly polished nickel finish gives them a pleasing appearance. This, combined with aluminum grids which require no grease and are smokeless, makes the iron desirable for dining-table use.

The waffles are 3½ in. by 3½ in. (8.9 cm. by 8.9 cm.), and two are prepared simultaneously. Only a minute and a



CAN BE USED ON THE DINING TABLE

half is required for cooking. These irons are available in standard voltage ranges, wattage 600. Gift shops, tea rooms, confectionery shops and soda counters will find ready sale for waffles prepared in this way.

Trade Notes

P. B. ZIMMERMAN has been appointed publicity manager of the National Lamp Works, succeeding N. H. Boynton. Mr. Zimmerman was editor of the *Mazda Stimulator*.

THE GENERAL STORAGE BATTERY & REPAIR COMPANY, Jersey City, N. J., is planning to increase its present capacity and is making improvements and additions to its plant.

THE NATIONAL LAMP WORKS OF THE GENERAL ELECTRIC COMPANY have opened at Detroit, Mich., a new, completely equipped factory for the production of National Mazda miniature lamps.

THE WEEHAWKEN TUNGSTEN LAMP COMPANY of Weehawken, N. J., has plans under consideration for the reconstruction of its tungsten-lamp plant, recently destroyed by fire with a cost of \$25,000.

THE PERMITT COMPANY of New York City, manufacturer of water-softening and rectification apparatus, has removed from 30 East Forty-second Street to 410 Fourth Avenue, where the entire top floor will be occupied by its offices.

THE WESTINGHOUSE ENGINEERING & MANUFACTURING COMPANY, East Pittsburgh, Pa., has leased for a period of years the Baxter Stove Company at Mansfield, Ohio, with the intention of consolidating at this point the manufacturing of heating appliances now being carried on at some of the other Westinghouse plants.

THE NATIONAL CONDUIT & CABLE COMPANY of New York City at a meeting of the directors last week elected George J. Jackson president, to succeed Edward S. Perot, and Norton A. Howard, formerly secretary, was chosen vice-president, to take the place of Edward S. Perot, Jr. H. J. Pritchard, formerly treasurer, was elected secretary and treasurer to succeed Mr. Howard.

THE BUCKEYE DIVISION OF THE NATIONAL LAMP WORKS OF THE GENERAL ELECTRIC COMPANY has moved its Chicago offices from 54 West Lake Street to larger quarters in the Le Moyne Building, at Wabash and Lake Streets. N. H. Boynton has been appointed general manager of the company, succeeding Leroy P. Sawyer, who goes to Cleveland to take up executive work with the National Lamp Works.

THE UNO-LITE COMPANY OF AMERICA, which was originally organized as a partnership to sell reading lamps, has been incorporated under the laws of the State of Indiana. The capitalization consists of 300 shares of common stock at \$50 par value and 400 shares of preferred stock at \$50 par value, making a total capitalization of \$35,000. The preferred stock is cumulative 7 per cent and shares in addition proportionately with common stock in all profits of the company after 20 per cent has been paid on the latter. The officers of the Uno-Lite Company include H. H. Harrison and R. A. MacGregor of the Merchants' Heat & Light Company, Indianapolis, Ind.

BENJAMIN F. CHASE, United States Consul at Santa Rosa, Costa Rica, informs the State Department that in the fire which on Dec. 28 last destroyed the American consulate with many other buildings all catalogs, directories and year books of chambers of commerce, and trade journals were lost. A permanent new office has now been secured and occupied, where such publications can be properly displayed. It is requested that firms seeking sales in that market send copies of their latest catalogs and that chambers of commerce send their year books and directories for the files of the consulate. It is well to note that the cost of receiving parcel-post packages is 75 centavos (about 16 cents at present rate) per package and that only the small catalogs need be sent.

THE AMERICAN GEAR MANUFACTURERS' ASSOCIATION will hold its second annual convention at Green Brier Hotel, White Sulphur Springs, W. Va., on April 18, 19 and 20. An address by a representative of the United States Chamber of Commerce, of which the association has just become a member, will bring matters of timely interest before the association. The convention will begin with meetings of committees on the morning of April 18. At 1:30 p. m. the first session will open with an address by President F. W. Sinram on "The A. G. M. A. Past, Present and Future." Following the address by the Chamber of Commerce representative, C. R. Poole will talk on the "Hardening and Heat Treating of Gears" and B. F. Waterman will present the report of the standardiza-

tion committee. The following morning's session will include reports of officers and committees. An informal banquet will be held in the evening. The next morning a paper on "Uniform Cost Accounting" will be presented by J. H. Dunn, and one on "Hobs and Hobbing Machines" by a representative of the Barber-Coleman company. A program of sports and amusements has also been arranged.

Trade Publications

FANS AND BLOWERS.—The Healey Fan Company of Buffalo, N. Y., has prepared a circular descriptive of its fans and blowers.

LIGHTING UNIT.—The Reflectolyte Company, 914 Pine Street, St. Louis, Mo., has prepared a folder descriptive of its "Reflectolyte."

SOCKETS AND RECEPTACLES.—Pass & Seymour of Solway, N. Y., are distributing leaflet 42-A, descriptive of their key and keyless sockets and receptacles.

CENTRIFUGAL PUMPS.—The Manistee Iron Works Company of Manistee, Mich., has prepared its bulletin No. 54, descriptive of its multi-stage centrifugal pumps.

AUTOMATIC STARTERS.—The General Electric Company of Schenectady, N. Y., has prepared a circular descriptive of its automatic starters for direct-current motors.

FLOODLIGHTING PROJECTORS.—Bulletin 338, descriptive of Cutter "Universal" and "Standard" floodlighting projectors, is being distributed by the George Cutter Company of South Bend, Ind.

REDUCTION GEARS.—Marine application of reduction gears of floating-frame type is the subject of reprint No. 62, now being distributed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

SMALL-GEARED TURBINE-GENERATOR UNIT.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared a leaflet descriptive of its geared turbine-generator units in sizes from 15 kw. to 50 kw.

HEATING PAD.—The Wirt Company of Philadelphia has prepared a folder descriptive of its electric heating pad. The heat-producing element of this pad is inclosed between two sheets of rubberized fabric permanently vulcanized together.

ELECTRIC HEATING DEVICES.—The Simplex Electric Heating Company, 85 Sidney Street, Cambridge, Mass., is distributing a folder containing bulletins descriptive of its electric heating devices. A revised list and index, dated Feb. 1, 1918, is included.

JOBBER'S CATALOG.—The Monarch Electric & Wire Company, Adams and Desplaines Streets, Chicago, has ready for distribution its catalog No. 20, which contains over 1100 pages. This catalog has a wire list which is said to be the most complete published up to the present time. The book contains over 100 pages of information such as the Fire Underwriters' rules, illuminating data, industrial motor application and useful data covering storage batteries. It also catalogs a complete line of electrical supplies and construction material, well illustrated.

FLATIRONS.—Landers, Frary & Clark of New Britain, Conn., have prepared a handsome life-sized window-display cut-out in nine colors, showing an attractive girl using a real Universal iron. It measures about 34 in. high by 24 in. wide. This will be ready for distribution about April 30. Dealers may arrange with their jobbing houses for these displays. The spring national advertising of Universal electric home needs will feature this cut-out, and this affords the dealer an excellent opportunity to identify his store with the Universal trade name and national advertising.

ELECTRICAL EQUIPMENT FOR BREWERIES.—The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has just issued publication No. 220, a four-page pamphlet illustrating and describing C-H electric beer-vat dryers and stating some advantages of drying beer vats by electricity. The C-H beer-vat dryers are made with two and three heats and in three sizes, ranging from 750 watts to 1250 watts on low heats and from 3000 watts to 5000 watts on high heats. The pamphlet also illustrates a direct-current motor starter, a porcelain push socket and a porcelain push switch especially adapted for use in breweries and other damp places.

ELECTRICAL HEATING.—Of interest to everybody connected with the heating of baking, drying and jappanning ovens is

reprint No. 66, just issued by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This includes an article on "Electrically Heated Jappanning Ovens" by C. F. Hirschfeld, reprinted from the *N. E. L. A. Bulletin*, and "Heat Calculation for Baking and Drying Ovens," by W. S. Scott, reprinted from the *Electric Journal*. Thus there are grouped under a single cover an article giving general considerations in favor of electrical heating for this purpose and an article giving the detailed method of calculation for the amount of heat required to raise the temperature of the work, of the supporting and carrying parts, such as trucks, and of the ventilating air. How to compute the losses from the external surface of the oven and the heat required to raise the temperature of the oven walls, etc., are also told. This publication should be of much value to central-station solicitors who are endeavoring to interest their customers in the electrical heating of ovens, as well as to present and prospective users of such equipment.

New Incorporations

THE UNITED STATES TURBINE MANUFACTURING COMPANY of Quincy, Mass., has been incorporated with a capital stock of \$50,000. George A. Weaver is president.

THE ELK PARK (N. C.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of \$25,000 by A. P. Brinkley, A. P. Brinkley, Jr., and Hall H. Brinkley.

THE WOODWARD-WIGGINS ELECTRIC COMPANY of Orangeburg, S. C., has been incorporated with a capital stock of \$9,000 by J. L. Woodward and J. C. Wiggins, both of Orangeburg.

THE ROCK CITY ELECTRIC COMPANY of Nashville, Tenn., has been incorporated by J. C. Campbell, W. C. Campbell, H. S. Sumner and others. The company is capitalized at \$50,000.

THE D. & F. ELECTRICAL ENGINEERING COMPANY of Ogdensburg, N. Y., has been incorporated by S. J. Delaney, F. J. Francis and A. T. Whalen of Ogdensburg, N. Y. The company is capitalized at \$10,000.

THE AMERICAN AUTOMATIC SIGNAL COMPANY of New York, N. Y., has been incorporated with a capital stock of \$350,000 by S. B. Howard, G. V. Reilly and A. W. Britton, 28 Nassau Street, New York City.

THE NATIONAL GAS & POWER COMPANY of Indianapolis, Ind., has been incorporated by E. C. Lewis, W. W. Wiswell and J. B. Detwiler. The company is capitalized at \$100,000 and proposes to generate and distribute electricity.

THE GRAFTON (ILL.) ELECTRIC LIGHT & POWER COMPANY has been chartered with a capital stock of \$10,000 by William J. Brower, Robert L. Mayensburg, August Miller, D. C. Slaten, John N. Eastman, E. P. Edsall and H. A. Patton.

THE SANTO DOMINGO ELECTRIC LIGHT & POWER CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$300,000 to generate and distribute electricity. The incorporators are: Alex. A. Oldrini, Jose A. Losada and Zachary M. Delman.

THE UNITED STATES ELECTRICAL SUPPLY COMPANY of Peoria, Ill., has been organized with a capital stock of \$100,000 to do a general electrical contracting business. Walter O. Ireland is to be president of the new company and B. P. Crawley vice-president.

THE OHIO TUEC VACUUM CLEANER COMPANY of Toronto, Ont., Can., has been chartered with a capital stock of \$50,000 to manufacture vacuum cleaners, machinery, etc. The incorporators are: Joseph M. Bullen, 44 King Street West; Harold L. Steele, Wendell Osborne and others.

THE ACME ENGINEERING COMPANY of Toronto, Ont., has been incorporated by Ewart Lynch, Traders' Bank Building; D. B. Coleman, F. A. D. Campbell and others. The company is capitalized at \$125,000 and proposes to manufacture machinery, tools, electrical equipment, etc.

THE CHICKASAW (ALA.) UTILITIES COMPANY has been incorporated with a capital stock of \$50,000 as a subsidiary of the Tennessee Coal, Iron & Railroad Company. The officers are: George G. Crawford, president; H. C. Ryding, vice-president; L. T. Beecher, secretary and treasurer, all of Birmingham.

New England States

DENMARK, ME.—A joint petition has been made to the Public Utilities Commission by the Denmark (Me.) Light & Power Company and the Western Maine Power Company of Limerick, asking authority for the latter to purchase the property and holdings of the former.

PORTSMOUTH, N. H.—Bids will be received at the Bureau of Yards and Dock, Navy Department, Washington, D. C., until March 25 for furnishing and supervising the installation of two 700-gal. per minute electrically driven centrifugal booster pumps and equipment at the navy yard, Portsmouth. Drawings and specifications No. 2846 may be obtained on application to the above bureau or to the commandant of the navy yard named.

BOSTON, MASS.—The Tileston & Holingsworth Company, paper manufacturers, 49 Federal Street, is changing the motive power of its plant at 892 River Street, Hyde Park, from steam to electricity. The work consists of a new transformer house, new reinforced concrete motor and other machinery foundations. The Aberthaw Construction Company, 27 School Street, Boston, has the contract.

IPSWICH, MASS.—At the annual town meeting held recently the Water and Light Commissioners were authorized to extend both the water and electric systems.

NEW BEDFORD, MASS.—The Union Street Railway Company has awarded contract to the J. W. Bishop Company of Worcester for the construction of the superstructure of a building to be used as a boiler house and turbine room. The building will be 98 ft. by 126 ft., and will cost about \$135,000.

NEWBURYPORT, MASS.—Application has been made by the New England Telephone & Telegraph Company to the Council or permission to construct an underground conduit and erect pole lines for distributing purposes on State Street from High Street to the Newbury line and on intersecting streets.

PAWTUCKET, R. I.—Preparations are being made for the construction of a new power plant in the rear of Park Place to furnish light and heat for the large business blocks of the Taylor Estate in Main and Broad Streets. The new power plant is made a necessity owing to the decision of the Blackstone Valley Gas & Electric Company to abandon its heating plant next fall.

GROTON, CONN.—The Public Utilities Commission has granted the petition of the Shore Line Electric Railway Company to supply electricity to the Croton Iron Works for its shipbuilding plant. The borough municipal plant is not able to furnish an adequate supply.

Middle Atlantic States

BINGHAMTON, N. Y.—The Public Service Commission has granted the Binghamton Light, Heat & Power Company permission to sell \$100,000 refunding and improvement bonds.

BUFFALO, N. Y.—Plans are being prepared by the Lackawanna Steel Company for the construction of a central turbo-generator power plant, 100 ft. by 190 ft., one story high, to cost about \$200,000.

BUFFALO, N. Y.—Contracts have been awarded by the Transmission Ball Bearing Company, 1050 Military Road, Buffalo, for a one and two-story addition, 175 ft. by 350 ft., to its plant at Military Road and the Central Railroad, to cost about \$150,000.

BUFFALO, N. Y.—Plans are under consideration by the City Council for equipping the Buffalo Belt Line for electrical operation in order to increase the efficiency of the system for the transportation of workmen to the various plants engaged upon war contracts.

BUFFALO, N. Y.—Plans have been completed by the New York Telephone Company for the acquirement and operation of the systems of the Federal Telephone & Telegraph Company, the Niagara County Home Telephone Company and the Chautauqua County Telephone Company of Buffalo.

NEW YORK, N. Y.—Permit has been taken out by the New York Edison Company for the erection of a repair shop, 50 ft. by 70 ft., at 720 First Avenue.

NEW YORK, N. Y.—The Long Island Lighting Company has petitioned the Public Service Commission for permission to purchase the properties of the Sag Harbor (N. Y.) Light & Power Company and the Riverhead (N. Y.) Electric Light Company.

NEW YORK, N. Y.—The Emergency Fleet Corporation has awarded the Lord Construction Company, 105 West Fortieth

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

Street, New York, N. Y., a contract for fitting out twenty wooden hulls being built at various shipyards. The work will include the installation of engines, boilers and all similar equipment and supplies.

NORWICH, N. Y.—The Public Service Commission has granted the Norwich Gas & Electric Company permission to issue \$80,000 in bonds and \$38,500 in capital stock.

UTICA, N. Y.—A committee has been appointed by Mayor Smith to investigate the proposal that the city of Utica develop the water powers in nearby streams and erect an electric transmission line to the city. The plan contemplates using the power developed to operate war industries here.

AMPERE, N. J.—A permit has been taken out by the Crocker-Wheeler company for the construction of an extension to its power house.

CAMDEN, N. J.—A permit has recently been taken out by the New York Shipbuilding Company for the erection of an addition, 110 ft. by 115 ft., to the power house at its plant.

HACKENSACK, N. J.—The Gas & Electric Company of Bergen County has petitioned the Board of Public Utility Commissioners for permission to issue \$700,000 in bonds, the proceeds to be used for extensions, improvements, etc., in its plant and system.

HOBOKEN, N. J.—Plans are being prepared for the erection of a building near Fourteenth Street, Hoboken, for the United States government, to cost about \$1,000,000. It will be used for the manufacture of army equipment, as well as for storing, handling and shipping of materials, and will be known as the Expeditionary Depot.

NEWARK, N. J.—Plans are under consideration by the City Commission for the installation of a new heating plant in the City Hall at once. The proposed plant will furnish heat for the police headquarters soon to be formally opened.

PERTH AMBOY, N. J.—Plans have been filed by the American Smelting & Refining Company for the construction of an addition, about 60 ft. by 70 ft., to the power house at its plant at Maurer. Contract for construction of building has been awarded to Ira Crouse, 495 State Street, Perth Amboy.

FITMAN, N. J.—The Board of Public Utility Commissioners has given its approval to the application of the Electric Company of New Jersey for a bond issue of \$197,000, the proceeds to be used for extensions, improvements, etc.

TRENTON, N. J.—The City Commissioners are considering plans for operating under municipal ownership the system of the Trenton & Mercer County Traction Corporation.

BRADFORD, PA.—A portion of the power plant of the Boviard & Seyfang Manufacturing Company was recently destroyed by fire, causing a loss of about \$10,000.

COALDALE, PA.—Plans are being prepared by Louis Stockton, architect, 35 West Thirty-ninth Street, New York City, for an addition, 40 ft. by 60 ft., to the power house of the Panther Creek Valley Hospital.

COLLEGEVILLE, PA.—The entire electrical equipment of the power house of the Reading Transit & Light Company at Collegeville has been purchased by Henry Potts & Company, 650 Real Estate Trust Building, Philadelphia, Pa.

EASTON, PA.—The Pennsylvania Utilities Company has completed the erection of a new tie line between its system and that of the Lehigh Valley Transit Company at Allentown. A section of the new line, which will provide for an interchange of about 1200 kw., facilitating operation in event of a breakdown in either system, has been equipped for 13,200 volts, and the remainder for 33,000 volts.

HARRISBURG, PA.—The Harrisburg Railways Company in connection with other improvements to its plant will begin work on the installation of automatic stokers in its main power plant and substation at Reily and Marion Streets.

HARRISBURG, PA.—Application has been filed with the Public Service Commission by the Penn Mills Light, Heat & Power Company, the Bernville Light, Heat & Power Company and the Jefferson Light,

Heat & Power Company, all of Berks County, to consolidate.

HARRISBURG, PA.—Application has been filed with the Public Service Commission for permission to consolidate the following companies: The Port Allegheny Power Company, the Liberty Township Power Company, the Smithport Power Company, the Lafayette Township Power Company, the Bradford Township Power Company and the Keating Power Company, all of McKean County.

PHILADELPHIA, PA.—Contract has been awarded by the Philadelphia & Reading Railway Company for the construction of a power house, one and two story, at Tulio and Somerset Streets, to the F. W. Mark Construction Company.

WAYNESBORO, PA.—The Chambersburg, Greencastle & Waynesboro Railway Company has taken out a permit for the construction of a new substation, 10 ft. by 50 ft., two stories high. The cost is estimated at about \$10,000.

WILMINGTON, DEL.—Notice has been filed with the People's Heat, Light & Power Company of a change in name to the Seaboard Electric Company.

WILMINGTON, DEL.—Preparations are being made by the Sugar Refining Company for the erection of a large power house in connection with its proposed new sugar refinery on the Delaware River, for which preliminary plans are being prepared. The cost of the entire project is estimated at about \$10,000,000.

PRINCETON, W. VA.—The City Council is considering replacing the arc lamps now in use with incandescent electric (three-lamp clusters) lamps.

HAMPTON ROADS, VA.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of a new fire alarm system at the local yards.

NORFOLK, VA.—Plans have been prepared for additions to the Norfolk Navy Yard, consisting of a new pattern shop, to cost about \$600,000, and a power plant, to cost \$575,000, and auxiliary structures.

PETERSBURG, VA.—The Virginia Railway & Power Company is planning to erect an electric transmission line from Petersburg to Norfolk to supply electricity in Petersburg and Norfolk and to the towns between the two cities. The cost of the work is estimated at about \$750,000. Contracts, it is understood, will soon be awarded for the proposed work. The proposed line will provide connections with the three power plants in the cities of Richmond, Norfolk and Petersburg. In case of accidents to any of the plants service can be supplied by the two other stations.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 1724—50,700 ft. lead-covered wire, 400,000 ft. twisted lamp cord, 37,000 lb. weatherproof wire, and 202,500 ft. rubber-covered wire; Schedule 1725—140,000 ft. double, duplex armored wire, 800,000 ft. double duplex leaded wire, 70,000 ft. double duplex plain wire, 158,000 ft. leaded and armored single conductor wire, 262,000 ft. single conductor wire, 21,000 ft. interior communication wire, and 113,000 ft. interior communication leaded and armored cable. Philadelphia, Pa., Schedule 1725—a quantity of magnet wire. Application for proposal blanks should designate the schedule desired by number.

North Central States

ASHTABULA, OHIO.—The residents on Bancroft Street have petitioned the City Council for sidewalks, grading and electric lamps for that thoroughfare.

BUCYRUS, OHIO.—Preparations are being made by the Bucyrus Light & Power Company to increase the output of its plant. Work will begin at once on the installation of machinery capable of developing 2500 kw., which will increase the capacity of the plant by 150 per cent. The present output of the plant is 1750 kw.

CANTON, OHIO.—A tentative site, it is announced, has been selected for the new roundhouse and power plant to be erected in connection with the freight yards under construction by the Wheeling & Lake Erie Railway Company, to cost about \$500,000. The cost of the power plant and roundhouse is estimated at about \$250,000.

CINCINNATI, OHIO.—Plans are being prepared by the United States Electrical Tool Company for an addition to its factory, 60 ft. by 100 ft.

CINCINNATI, OHIO.—Two 30,000-kva. units of the new 125,000-kva. generating

plant of the Union Gas & Electric Company, now under construction, will be placed in operation this summer. Work on the new 13,200 volt transmission system is nearly completed. C. W. De Forest is manager of the electrical department.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until March 22, for electric meters. Specifications may be obtained at the office of the division of light and heat.

COLUMBIA, OHIO.—The Columbia Gas & Electric Company has been awarded the contract to furnish electricity to operate the motor-driven pumps to be installed at the auxiliary water-works pumping station.

FREMONT, OHIO.—The Ohio State Power Company is building a large addition to its Ballville plant, which when completed will increase the output to 24,000 hp.

GERMANTOWN, OHIO.—The Town Council, it is reported, has asked the Dayton Power & Light Company to prepare plans showing how the company would light the town, and to submit a schedule of prices for both municipal and private lighting service. Thomas F. Keely is representative of the company.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Company has secured a contract from the Brightman Nut & Manufacturing Company to supply electricity (125 hp.) to operate the plant of the latter.

WATERVILLE, OHIO.—The Defiance (Ohio) Gas & Electric Company is contemplating extending its service to the village of Waterville. Application has been made by the company to the Commissioners of Lucas and Wood Counties for permission to place lamps on the Waterville bridge.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Railway & Light Company is considering plans for the reconstruction of its line between Sharon and the Wheatland Borough limits, to cost about \$150,000.

MAYFIELD, KY.—The city of Mayfield has taken over the water and light plants of the Mayfield Water & Light Company to be owned and operated by the municipality.

ANDERSON, IND.—Improvements to be completed by the Union Traction Company of Indiana during 1918 include the erection of a transmission line and other apparatus for operating the Muncie-Portland line with energy from the central power plant at North Anderson.

COLUMBUS, IND.—Work is now under way for replacing the street arc lamps now in use with electric incandescent street lamps.

ELKHART, IND.—The St. Joseph Valley Railway Company, it is reported, is contemplating the construction of an extension of its line from Elkhart to Toledo.

INDIANAPOLIS, IND.—The contract for furnishing and erecting eight bronze standards of special design for the Dewey Memorial Fountain has been awarded to the Hatfield Electric Company of Indianapolis, at \$4,476.

CHICAGO, ILL.—The Public Utilities Commission has authorized the Public Service Company of Northern Illinois to issue \$1,334,000 refunding mortgage bonds.

CHICAGO, ILL.—The Ilg Electric Ventilating Company has purchased a site at Elston Avenue and Snow Street, Chicago, on which it will erect a group of manufacturing buildings, to cost about \$750,000. Plans are being prepared by Lehenbaum, Marx & Vigeant, architects, 175 West Jackson Boulevard, for the proposed buildings, which will be built in units 60 ft. by 300 ft., connected by passageways.

HARRISBURG, ILL.—The Public Utilities Commission has granted the Southern Illinois Light & Power Company permission to issue \$279,000 in bonds and \$402,100 in capital stock. The company was also given a certificate of convenience and necessity to operate a plant.

BUTTERNUT, WIS.—The Butternut Electric Light & Power Company is planning to install an additional 3-wire generator of about 15 kw. capacity and a kerosene oil engine with a rating of from 20 to 25 hp. this year. W. J. Schulz is manager.

MILWAUKEE, WIS.—Plans are being prepared by the A. C. Electric & Novelty Company, 224 Fourth Street, Milwaukee, for rebuilding its plant and warehouse, which was recently damaged by fire, causing a loss of about \$25,000. Much of the equipment was badly injured and will have to be replaced.

NEENAH, WIS.—The City Council is considering the purchase of electrical equipment for the city stone quarry.

PINE CITY, MINN.—Improvements are contemplated by the Eastern Minnesota Power Company, consisting of the installation of a 500-kw. steam turbine, also de-

veloping a water power and the erection of a 10-mile electric transmission line to connect with its present plant.

ST. PAUL, MINN.—Contracts have been closed by the Northern States Power Company for furnishing electricity (22,000 hp.) for industrial motors. With the exception of two munition plants, it is stated that the new business is of a permanent character.

TROMMALL, MINN.—The installation of an electric-lighting system in the new town of Trommald is reported to be under consideration.

VIRGINIA, MINN.—Plans are being considered by the Virginia Board of Education for the installation of an electric light and power plant in connection with the new school building.

DEBUIQUE, IOWA.—The power plant of the Farley & Loetscher Company was recently damaged by fire, causing a loss of about \$20,000.

DUNLAP, IOWA.—Bids will be received by the Board of Education of Dunlap until April 10 for the construction of a high school building, including electric wiring, vapor steam heating, plumbing, etc. The cost of the building is estimated at about \$75,000. J. H. Craddock & Company, 504 Farnum Building, Omaha, Neb., are architects.

SCOTLAND, S. D.—At an election held recently the proposal to issue \$35,000 in bonds for the installation of a municipal electric light plant was defeated. Electrical service is now furnished by the South Dakota Light & Power Company of Armour. Improvements, it is understood, will now be made to the local system.

KANSAS CITY, MO.—The Interurban Central Station Company has filed a bond of \$50,000, thus assuring the erection of the new interurban union station at Tenth and McGee Streets.

KANSAS CITY, MO.—A permit has been taken out by the Kansas City Light & Power Company for the construction of its proposed new plant at Front Street and Park Avenue. The new building will be 244 ft. by 185 ft., four stories high. The cost of the first unit is estimated at \$1,700,000.

ST. JOSEPH, MO.—The Lawhon, Stamey Construction Company, 905 Edmond Street, St. Joseph, has been awarded the general contract for construction of a department store, to be erected at the corner of Sixth and Francis Streets, to cost about \$200,000. Contract for electric wiring and elevators has not yet been awarded.

BUNKER HILL, KAN.—The installation of a municipal electric-light plant in Bunker Hill is under consideration.

YATES CENTER, KAN.—The City Council has adopted ordinances providing for submitting the question of municipal ownership of the water works, electric-light plant and ice plant to the voters at the coming election.

Southern States

BADEN, N. C.—The Tallassee Power Company, it is reported, will erect 300 additional buildings at its plant this spring.

BLADENBORO, N. C.—The Town Commissioners have made arrangements with the Bladenboro Cotton Mills for furnishing electricity for lighting the streets of the town. Electric wires have been erected, and it is understood that contract has been placed for lamps.

PINE LEVEL, N. C.—The Citizens' Power & Light Company will erect 13 miles of electric transmission line, connecting up two towns, one having a population of 2500 and the other 5000. A substation will be erected in each town. C. I. Goodwin is owner.

SUMTER, S. C.—The City Council has authorized Mayor Jennings to engage an engineer to make investigations and estimates of the cost of establishing a municipal electric-light plant with a view of calling an election to submit the proposal to establish a municipal electric plant to the voters.

JACKSONVILLE, FLA.—The City Commission has adopted the resolution providing for the extension of the electric transmission lines of the municipal electric-light plant to the shops of the Seaboard Airline Railroad Company to furnish electricity. The railroad agrees to pay the cost of erecting the transmission line, which is estimated at about \$15,000.

COLUMBIA, TENN.—Options on sites and land on Duck River have been obtained by M. R. Stern, engineer of Nashville, representing capitalists who have developed water power in a number of towns in middle and east Tennessee. The proposed

plant will be located on the site now known as the Ashton Mills, on the north edge of Columbia. The dam, which is 6 ft. high, will be raised 6 ft.

HADLEY'S BEND, TENN.—The contract for the electrical equipment for the power plant to be erected for the United States government at Hadley's Bend has been awarded to the Western Electric Company. The total cost of the electrical equipment is estimated at \$5,000,000.

KNOXVILLE, TENN.—The installation of new electric lamps in the newly acquired territory of Greater Knoxville will soon be completed. Since the work was started last August 446 lamps have been erected.

SEWANEE, TENN.—The telephone exchange building of the Sewanee Telephone Company was recently damaged by fire.

BIRMINGHAM, ALA.—A. T. Newell & Brothers, it is reported, have been awarded the contract for the construction of the Alabama Interurban Railway from Birmingham to the Warrior River, a distance of about 20 miles. Thomas L. Cannon of Birmingham is president of the railway.

KOSCIUSKO, MISS.—The Planters' Oil Mill & Gin Company is contemplating the purchase of coal-handling and unloading machinery.

SHREVEPORT, LA.—The installation of additional equipment is reported to be under consideration by the Elliott Electric Company of Shreveport.

BROKEN ARROW, OKLA.—The Oklahoma Public Service Corporation has applied for a franchise to install an electric light and power plant in Broken Arrow. The granting of the proposed franchise will be submitted to the voters on March 26.

SHATTUCK, OKLA.—Plans are being considered for rebuilding the municipal electric-light plant and water-works system for which bids will soon be asked. The proposed work consists of the installation of either oil fuel or steam plant for lighting system and rebuilding all water mains. The cost is estimated at \$75,000.

DALLAS, TEX.—The erection of a new telephone exchange building is under consideration by the consolidated telephone companies. The plans provide for an 18-story building.

EAGLE PASS, TEX.—The Eagle Pass Ice Manufacturing Company is contemplating the installation of additional machinery to cost about \$20,000.

HOUSTON, TEX.—Contract has been awarded by the City Council for the construction of the first unit of the proposed municipal street railway from a connection with the International & Great Northern Railroad north of Harrisburg Boulevard to the plant of the Sinclair Gulf & Refinery Company east of Simms Bayou (4 miles), to the Houston Construction Company, at \$59,000.

LUBBOCK, TEX.—Extensions are contemplated to the municipal electric light plant, including the installation of an additional 200-hp. oil engine and generator, bids for which will be called for early in April. C. E. Parks is Mayor.

MCALLEN, TEX.—The Mutual Irrigation Company contemplates the construction of an irrigation system in this vicinity and also the installation of a pumping plant, to cost about \$50,000.

Pacific and Mountain States

KELSO, WASH.—The district office of the North Coast Power Company, formerly at Kalama, will be transferred to Kelso. F. A. Peterson will assume the management of the Kalama office.

RITZVILLE, WASH.—The Intermountain Power Company has petitioned the Commissioners of Adams County for a franchise to erect and operate electric transmission lines over certain highways in Adams County.

SEATTLE, WASH.—The Lighting Department of the city of Seattle has secured a contract to supply 2500 hp. to the shipyards of the Erickson Engineering Company. This company will construct steel ships.

SEATTLE, WASH.—Bids will be received by the purchasing agent of the Alaskan Engineering Commission, 422 Bell Street Dock, until March 25 for furnishing electrical supplies as follows: For 6600 ft. conduit, 40,000 insulators, 25,000 ft. 5/8-in. cable, and approximately 100,000 ft. of wire.

SNOHOMISH, WASH.—Mayor J. W. Hall has publicly announced that he is in favor of a movement to utilize water power of the county for municipal electric-light plants, asserting that Snohomish can obtain 5000 hp. from the dam of the city

avity pipe line. The Commercial Club also back of the project.

VANCOUVER, WASH.—The Portland Railway, Light & Power Company contemplates an extension of its 11,000-volt commercial feeder line to pick up 2000 hp. steel shipbuilding load. F. H. Gay is division manager.

WALLA WALLA, WASH.—Further improvements are contemplated by the Pacific Power & Light Company to its local system. The company is building a new switching station at Pasco, which when completed will improve the service in Walla Walla.

MORO, ORE.—The Farmers' Elevator Supply Company of Moro is contemplating the construction of two elevators at Moro, to cost about \$70,000. The cost of the equipment is estimated at about \$12,000.

PORTLAND, ORE.—What may become the first unit of a municipal power plant now under construction by the Water Bureau at the headworks of the Bull Run water system. Plans have been prepared for the installation of a 4-kw. electric plant for lighting the buildings at the headworks. L. M. Kaiser, superintendent of the water bureau, has charge of the work.

BISHOP, CAL.—A mill will be built at the camp at the Pine Creek tungsten claims, recently secured by the Cooper Lumber Co. of the Round Valley Tungsten Company. Two Marcy mills with a combined capacity of 150 tons daily will be installed. Arrangements, it is understood, have been made with the Southern Sierras Power Company for furnishing electricity to operate the proposed mills. To furnish a service a transmission line 12 miles long will be erected.

FRESNO, CAL.—Application has been made by the San Joaquin Light & Power Company with the State Water Commission for 250 second-feet of water in addition to that already used by the company from the Kern River. A new plant to increase its present output by 20,000 hp. is to be erected at the mouth of Kern River Canyon, to cost about \$1,500,000.

FRESNO, CAL.—Application has been made with the State Railroad Commission by the San Joaquin Light & Power Company for authority to issue \$1,000,000 in bonds, the proceeds to be used to complete additional facilities upon which work has already started. Among them is plant No. 2, near North Fork.

KNIGHTS FERRY, CAL.—Plans are being considered to reopen the old power plant at Knights Ferry, which was closed down over 12 years ago. The Railroad Commission has asked that this plant be reopened, as it will be a means of conserving water. The plant is owned by the Sierra and San Francisco Power Company. H. F. Jackson, 58 Sutter Street, San Francisco, is general manager.

LOS ANGELES, CAL.—Twenty-three ordinances providing for the installation of ornamental lamps on as many thoroughfares have been adopted by the City Council.

LOS ANGELES, CAL.—The Public Service Commission has authorized the leasing from the Harbor Commission of a tract of land on the east side of the Harbor boulevard, adjoining the Los Angeles Dry Dock & Shipbuilding Company on the west side, to be used as a site for a substation for the municipal power system. This station will furnish power service to industries around the west basin and to the No. 1 and across the channel in the Wilmington district.

OAKLAND, CAL.—All wires in the Lake district between Wesley Avenue and Cottage Street are being placed underground.

RIVERSIDE, CAL.—The Southern Sierras Power Company has petitioned the State Railroad Commission for permission to purchase and incorporate under its management the Corona (Cal.) Gas & Electric Company, the Rialto (Cal.) Light & Power Company and the Bishop (Cal.) Light & Power Company.

VENICE, CAL.—The City Council will advertise the sale of a ten-year franchise to operate an electric railway on the ocean front.

BONNERS FERRY, IDAHO.—John E. Rice & Company of Seattle, Wash., have taken an option on the holdings of the Bonner Water & Light Company of Bonners Ferry, the price being placed at \$135,000.

TWIN FALLS, IDAHO.—Plans are being considered by the citizens of Twin Falls, Idaho, and Filer for establishing a mutually owned electric light and power plant to serve this district. It is proposed to take over the plans and plants of the Mutual Light, Heat & Power Company, recently organized to develop and furnish electricity to its stockholders at cost of production; also taking over the partially developed power site at Clear Lake on Snake

river north of Buhl, owned by W. C. Hazzard. A committee has been appointed to enter into negotiations with Mr. Hazzard for the purchase of the property.

BRIGHAM, UTAH.—The electric light committee is contemplating removing the lamp poles from the center of the street to the curb line in the business section of the city. C. O. Roskelly is manager of the municipal electric-light plant.

TOOELE, UTAH.—The Utah Lime & Stone Company is negotiating with the Clark Electric Power Company of Tooele to extend its electric transmission lines to Flux and Dolomite to furnish electricity to operate its factories at those places. The lines of the Clark company now extend within 7 miles of the property of the Utah Lime & Stone Company.

KINGMAN, ARIZ.—Surveys are being made by the Desert Power & Water Company for the proposed extension of its electric transmission lines from the generating station in Kingston to the Hackberry mining district, a distance of 33 miles.

CHESTER, MONT.—A petition is being circulated by the residents of Chester and Joplin to be presented to the Montana Power Company, asking that the electric transmission line of the company be extended from Havre to Shelby, taking in Chester and Joplin. Both towns have electric generating plants, but are unable to meet the demands made upon them.

CASPER, WYO.—The Natrona County Electric Company and the Wyoming Electric Company, both of Casper, have been consolidated under the name of the Natrona Power Company. The concern is capitalized at \$1,000,000 and furnishes electricity to the Casper district. Patrick Sullivan of Casper is president; E. P. Bacon of Logan is vice-president and manager.

WHEATLAND, WYO.—Bonds have recently been voted for the installation of a municipal electric-light plant in Wheatland.

YERINGTON, NEV.—Application has been made to the State Water Commission by A. M. Wishart, Alexander Cameron and James Herrin of Yerington to impound 20 second-ft. of the waters of Sweetwater Creek in Mono County. They propose to build a dam 10 ft. high and 43 ft. long, and running from the pool so formed is to be a metallic flume 3 1/2 miles long. It is estimated that 2575 hp. will be developed.

GALLUP, N. M.—The Town Board is considering calling an election to vote on the proposal to establish a municipal electric-lighting plant. An engineer will be employed by the town to estimate cost of plant and other necessary data.

Canada

KASLO, B. C.—The question of establishing a 24-hr. service in connection with the municipal electric-light plant is under consideration. Fred D. Emory is chief engineer.

MURRAYVILLE, B. C.—The Laking Mills, destroyed by fire some time ago, are being rebuilt and will be equipped for electrical operations.

REVELSTOKE, B. C.—The city of Revelstoke is considering putting in new sluiceways and new head racks at dam. Correspondence is invited from contractors and dealers interested in this work. C. North is manager.

TRAIL, B. C.—The West Kootenay Power & Light Company is contemplating the construction of new lines and improvements to its system in Trail and vicinity, involving an expenditure of about \$30,000.

VICTORIA, B. C.—Bids are being received by City Purchasing Agent Galt for a supply of globes for arc lamps and nitrogen lamps for the light and power department.

FREDERICTON, N. B.—Application will be made for a charter for the construction of a new car line from the St. John Valley Road at a point near Pokioik to a connection with the proposed Eastern Maine Railway at a point near the international boundary at North Lake in Orient, Aroostook County, a distance of 24 miles. The plans provide for generating and distribution of hydroelectric power. The Eastern Maine Railway Company of Bangor, Me., is reported interested in the project.

HALIFAX, N. S.—The intention of the Dominion government to establish a steel shipbuilding plant at Halifax has been announced by the Department of Public Works. Extensions to drydock and repairs will be made to Piers Nos. 3 and 4, for which contract has been awarded to the Cook Construction Company.

CORNWALL, ONT.—The Board of Trade has sent a resolution to the Hydro-Electric Power Commission of Ontario, the Dominion and Ontario Premiers and Frank

Carvell, minister of Public Works, asking that action be taken as soon as possible with reference to the development of Longue Sault Rapids for power purposes.

OTTAWA, ONT.—Tenders will be received by John A. Pearson, architect, and J. O. Marchand, associate architect, Parliament Buildings, Ottawa, Ont., Can., until March 25 for switchboards, panelboards and transformers required in the reconstruction of the Parliament Buildings. Plans and specifications and other information may be obtained at the office of the general contractor, P. Lyall & Sons Construction Company, Ottawa.

PORT DOVER, ONT.—The installation of an electric system (Hydro-Electric power) is reported to be under consideration by the Town Council.

TILSONBURG, ONT.—The main building of the plant of the Huntley Manufacturing Company in Tilsonburg was recently destroyed by fire, including machinery, tools and completed elevator machinery, causing a loss of several hundred thousand dollars. The main plant of the company is located at Silver Springs, N. Y.

TORONTO, ONT.—The Alloy Steel Works are reported to be considering the installation of a six-ton electric furnace in the near future.

TORONTO, ONT.—The government of Ontario has appropriated \$9,054,000 for hydroelectric development in this Province. Of this \$4,175,000 is for Niagara Falls development, including the Chippewa-Queenston project, and \$2,896,000 for extensions to the Niagara Falls system, which includes the radial railway from Welland to Port Colborne, to Port Erie and Bridgeburg. The Hydro-Electric Commission, it is expected, will not require all this amount in 1918. The Chippewa-Queenston power canal, it is hoped, will be completed by 1921. The radial lines, it is understood, will not be built during the war.

TORONTO, ONT.—Plans have been prepared by the Imperial Oil Company, 56 Church Street, Toronto, for the erection of a pump house, to cost about \$5,000, and a boiler house, to cost \$10,000.

MONTAGUE, P. E. I.—The Montague Electric Company is being reorganized. The capital stock has been increased from \$10,000 to \$25,000 and new machinery installed in the plant. Work on improvements has not yet been fully completed and considerable house wiring is yet to be done.

MONTREAL, QUE.—The Southern Canada Power Company is contemplating the purchase of a 150-kw. and a 300-kw. motor-generator set (second hand), the generator end 250 volts, direct current, motor end three phase, 60 cycles, 220 volts, synchronous motor, or separate machines of identical capacities and characteristics. L. C. Haskell is purchasing agent.

ST. LAMBERT, QUE.—Work, it is understood, will be started this summer on the new plant of the Dominion Textile Company. The cost of the building is estimated at \$3,000,000.

THREE RIVERS, QUE.—Prices are being asked by the city of Three Rivers on a 3000-gal. centrifugal pump, split case, one-stage, and a 200-hp. gasoline engine.

VERDUN, QUE.—Improvements are contemplated to the municipal electric-light plant and waterworks system to cost about \$50,000, for which, it is understood, bids will soon be asked.

MELFORT, SASK.—The purchase of a Diesel engine is under consideration by the Town Council.

MOOSE JAW, SASK.—The Council has appropriated \$20,400 for extensions to the municipal electric power plant as recommended by J. D. Peters, manager.

MOOSE JAW, SASK.—The Canadian Pacific Railway Company contemplates the erection of a mechanical coaling plant (400 tons capacity) in Moose Jaw, rebuilding and adding to the local stock yards; building new section houses, tool houses, stations, wells, and the grading of siding and road crossings in the yards west of the city.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 1 for lighting fixtures, bronze wire, annunciators, signal bells, connectors, push-button plates, reflectors, switches, conduits and covers, shades, fans, bends, cleats, conduits, elbows, oil heaters, oil pump, etc. Blanks and information relating to this circular (No. 1207) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

(Issued Feb. 12, 1918.)

1,256,319. **ELECTROLYTIC CELL**; Thomas G. Hill, Seattle, Wash. App. filed Oct. 26, 1916. Transforms chlorides into perchlorates.

1,256,317. **SEMI-AUTOMATIC TELEPHONE EXCHANGE**; Carl A. W. Hultman, Stockholm, Sweden. App. filed March 18, 1916. Simplifies circuits and switching means so as to obtain reliable operation and a quick connection of the register with the junction.

1,256,332. **SWITCH MECHANISM**; Hubert P. Keantz, Brooklyn, N. Y. App. filed May 2, 1914. For use with either a push-button, lever throw or pull switch, particularly of the quick-make and quick-break type.

1,256,313. **ELEVATOR SIGNAL SYSTEM**; Alvin C. McNabb, Dallas, Tex. App. filed Oct. 23, 1915. Improvements.

1,256,362. **AUTOMATIC HEADLIGHT DIMMER FOR AUTOMOBILES**; Victor Olson, Naugatuck, Conn. App. filed March 21, 1916. Improved.

1,256,380. **MERCURY SWITCH**; Frederick W. Schmidt, Chicago, Ill. App. filed Oct. 19, 1914. Improvement.

1,256,105. **ROTARY - BLOWER SPARK GAP**; Harlan S. Webster, Canton, Ohio. App. filed March 3, 1917. Means for cooling the electrodes.

1,256,447. **TYPEWRITER ATTACHMENT**; David E. Dunkle, Norwich, Pa. App. filed April 28, 1916. Electrically operated carriage shifters for typewriters.

1,256,500. **TELEPHONE-EXCHANGE SYSTEM**; Henry P. Clausen, Mount Vernon, N. Y. App. filed April 27, 1916. Operation of a line-finder switch in hunting for a calling line will be inaudible to busy lines multiplied to the same group.

(Issued Feb. 19, 1918.)

1,256,511. **AUTOMATIC TELEPHONE SWITCH**; John G. Blessing and Bernard D. Willis, Chicago, Ill. App. filed March 16, 1912. Improved automatic switch and circuits for operating the same.

1,256,512. **SUBSTATION SWITCH HOOK**; John G. Blessing, Chicago, Ill. App. filed March 20, 1916. For automatic telephone systems.

1,256,545. **DOOR-LOCK-CONTROLLED ELECTRIC SWITCH**; John R. Folger, Detroit, Mich. App. filed Feb. 26, 1916. Designed to cut out the lights in a room when the door is locked.

1,256,546. **WALL SWITCH**; Charles Forth, Ottawa, Ontario, Canada. App. filed Feb. 2, 1916. Improvements.

1,256,554. **SYSTEM OF WIRELESS TELEPHONY**; Walton Harrison, New York, N. Y. App. filed Oct. 30, 1914. Improvements.

1,256,558. **MOTOR VEHICLE**; Frederic Hild, Denver, Col. App. filed Oct. 2, 1916. Improvements in various features of construction, including novel mountings for the wheel trucks, wheels and motors.

1,256,567. **INCANDESCENT LAMP WITH CONCENTRATED METALLIC FILAMENT**; Herman J. Jaeger, Weehawken, N. J. App. filed March 16, 1915. Improvements.

1,256,568. **METALLIC-FILAMENT LAMP FILLED WITH NITROGEN**; Herman J. Jaeger, Weehawken, N. J. App. filed March 17, 1916. Improvements.

1,256,571. **ELECTRIC HEATING DEVICE**; William K. Kearsley, Jr., Newark, N. J. App. filed Aug. 17, 1916. Cigar lighter.

1,256,587. **TELEPHONE SYSTEM**; Earl R. Neir and Bernard C. Groh, Chicago, Ill. App. filed March 20, 1916. Improvements.

1,256,591. **MEANS FOR INDICATING THE DISPLAY OF MOTION PICTURES**; Robert D. Pike, San Francisco, Cal. App. filed July 17, 1916. Improvements.

1,256,616. **ELECTROPNEUMATIC BRAKE**; Walter V. Turner, Wilkesburg, Pa. App. filed July 27, 1915. Relates to fluid-pressure brakes.

1,256,618. **FLUID-PRESSURE BRAKE DEVICE**; Walter V. Turner, Wilkesburg, Pa. App. filed March 28, 1917. Electrically controlled.

1,256,623. **REDUCTION OF ORES**; Sigurd Westberg and Emil Edwin, Christiania, Norway. App. filed Aug. 26, 1916. Relates to the reduction of oxide ores by means of reducing gases.

1,256,628. **ELECTRICAL SYSTEM OF DISTRIBUTION**; Joseph Woodbridge, Philadelphia, Pa. App. filed June 9, 1914. Storage battery is employed for supplying current to the circuit when the dynamo is shut down.

1,256,643. **HIGH-TENSION SUSPENSION INSULATOR**; Svend Barford, Oakland, Cal. App. filed July 26, 1915. Provides an insulator in which fracture from shearing strain is entirely eliminated.

Record of Electrical Patents

Notes on United States Patents

1,256,665. **CIRCUIT COUPLING**; Harry A. Douglas, Bronson, Mich. App. filed March 17, 1916. Improved union between a coupler or connector and the lug or member which is desirably provided therefor.

1,256,691. **ELECTRIC LIGHTING APPARATUS**; William H. Honsberger, Welland, Ontario, Canada. App. filed July 30, 1917. Switch-controlled headlight circuit.

1,256,692. **ELECTRIC SWITCH**; William H. Honsberger, Welland, Ontario, Canada. App. filed July 30, 1917. Vehicles.

1,256,698. **TELEPHONE-EXCHANGE SYSTEM**; Lewis H. Johnson, Bloomfield, N. J. App. filed May 25, 1917. Improved signaling means.

1,256,705. **INDUCTION MOTOR**; Justin Lebovitz, Oakley, Ohio. App. filed June 2, 1916. Self-starting type.

1,256,708. **TRANSMITTER**; Eugene H. Lowe, Modesto, Cal. App. filed Jan. 23, 1917. Resistance-varying elements are disposed in a vacuum chamber.

1,256,732. **RECORDING MECHANISM FOR RAILWAY - TRAFFIC - CONTROLLING APPARATUS**; Frank H. Nicholson, Wilkinsburg, Pa. App. filed Aug. 27, 1914. Improvements.

1,256,740. **FIRE ALARM**; Eugen Steiger, Zürich, Switzerland. App. filed April 22, 1916. Consists of the light box, sources of electricity, an electrically controlled switch or relay, and the audible or visible alarm device proper, or an extinguisher, such as a water-sprinkler system or the like.

1,256,749. **INCANDESCENT LAMP FIXTURE**; William C. H. Wefel, Denver, Col. App. filed Dec. 14, 1916. Designed for use in a circuit in which a number of lamps are connected in series.

1,256,758. **PROCESS OF REFINING SUGAR**; Robert R. Williams, Manila, Philippine Islands. App. filed Jan. 26, 1914. Pertains to an electrolytic process for the removal of any acids, bases or salts (electrolytes) from solutions of sugar for the purpose of increasing the purity of the sugar solution and facilitating further utilization.

1,256,795. **MULTIPOLAR MAGNETO**; Otto Heins, New York, N. Y. App. filed Dec. 24, 1915. Improvements.

1,256,796. **MULTIPOLAR MAGNETO**; Otto Heins, New York, N. Y. Improvements.

1,256,800. **CIRCUIT CONTROLLER**; Albert J. Horton, White Plains, N. Y. App. filed Feb. 5, 1912. Controlled by a common electromagnet.

1,256,802. **PROCESS OF EXTRACTING ZINC FROM ITS ORES**; Edvin A. Johansson, Trollhättan, Sweden. Improvements.

1,256,804. **MAGNET-GROUPING DEVICE FOR ELECTRICAL MUSICAL INSTRUMENTS**; John F. Kelly, Pittsfield, Mass. App. filed Sept. 24, 1912. Type in which a perforated note or music sheet is employed to control the operation of the electromagnets.

1,256,813. **CONNECTING MEMBER FOR ELECTRICAL CONDUCTORS**; Harry T. Martin, Milwaukee, Wis. App. filed Oct. 27, 1916. Improvements.

1,256,814. **PERMUTATION ELECTRIC SWITCH**; Sigurd O. Mattison, Eau Claire, Wis. App. filed Dec. 4, 1916. May be actuated to connect two of a series of contact members selectively.

1,256,817. **AUTOMATIC TELEPHONE SYSTEM**; Frank Newforth, Jr., Chicago, Ill. App. filed Sept. 18, 1914. Improvements.

1,256,832. **FLUID RHEOSTAT**; Michael N. Schonwitz, Milwaukee, Wis. App. filed June 26, 1916. Fluid or electrolytic type.

1,256,842. **SYSTEM OF CONTROL**; Norman W. Storer, Pittsburgh, Pa. App. filed Nov. 12, 1915. Regenerative.

1,256,863. **ELECTRIC CONDUCTOR**; Charles J. Beaver and Ernest A. Claremont, High Leigh, England. App. filed July 19, 1915. Saves the waste of copper involved in enlarging the cross-section area of the cable and at the same time secures, on the one hand, the necessary flexibility

and, on the other hand, the security from distortion necessary in a high-voltage cable.

1,256,864. **COMPOSITION OF MATTER**; Julius Becker, Chicago, Ill. App. filed Nov. 27, 1915. Well adapted for use as a separation material for plates in electric secondary cells and the like.

1,256,875. **PROCESS FOR PRODUCING AMMONIA**; Alexander Classen, Aix la Chapelle, Germany. App. filed Oct. 8, 1915. Operates by the action of electric discharges.

1,256,889. **WIRELESS DUPLEX SIGNALING SYSTEM**; Lloyd Espenschied, Hollis, N. Y. App. filed May 15, 1916. Provides a system for the simultaneous transmission and reception of signals and in particular to afford means for duplex communication between two stations.

1,256,912. **CONTINUOUS CURRENT GENERATOR**; Frans G. Liljenroth, Westera, Sweden. App. filed May 20, 1916. Applies particularly to shunt or separately excited generators of that type.

1,256,929. **PROCESS OF PRODUCING METALLIC WIRES, FILAMENTS AND THE LIKE**; Otto Schaller, Berlin, Germany. App. filed May 16, 1914. Improved.

1,256,930. **FILAMENT OF WIRE FORMED OF A SINGLE CRYSTAL**; Otto Schaller, Berlin, Germany. App. filed May 16, 1914. Produced in passing a crystalline or a fibrous structure, through a short zone of intense heat, at a certain speed.

1,256,935. **PROCESS OF PRODUCING NITROGEN COMPOUNDS OF METALS**; Mathias Sem. Christiania, Norway. App. filed Nov. 21, 1916. Operates by the action of gaseous nitrogen upon carbides and has for its object a continuous process of producing such compounds by producing a suspension or cloud of pulverulent carbide in a current of gaseous nitrogen.

1,256,950. **ACCELERATOR**; John E. Thompson and Clarence W. Jameson, Chicago, Ill. App. filed Oct. 7, 1915. Used in connection with the control of elevator motors and the like.

1,256,951. **COOLING SPOT - WELDING ELECTRODE**; Elihu Thomson, Swampscott, Mass. App. filed May 29, 1917. Improvements.

1,256,958. **ELECTRIC HEATING FURNACE**; Edward E. Walker and John W. Cox, Erie, Pa. App. filed Jan. 2, 1917. A liquid electrode is utilized which diffuses the intense heat of the arc, thus prolonging the life of the electrode and so extending the heat area as to make it effective as a heating unit.

1,256,959. **METHOD OF HEATING**; Edward E. Walker and John W. Cox, Erie, Pa. App. filed Feb. 15, 1917. Utilizes an electric arc.

1,256,960. **PROTECTIVE ARRANGEMENT FOR ELECTRICAL SYSTEMS**; John F. Watson, Blackheath, England. App. filed Nov. 24, 1915. Consists of an arrangement of pilot or protective conductors and relays so interconnected or associated with one another that, while normally there is no complete circuit through any of the protective conductors, current derived by one conductor from the system through leakage which virtually establishes the circuit of a companion relay controlling a switch at one place will, through such relay, cause current to be conducted to the conductor or conductors of other relay or relays controlling a switch or switches at a distance.

1,256,969. **TEMPERATURE-CONTROL SYSTEM**; Frank Ahlburg, San Francisco, Cal. App. filed Nov. 4, 1915. Particularly adapted for use in an apparatus for marking fruit.

1,256,972. **SEPARATION OF MAGNETIC IRON ORE FROM THE ASSOCIATED NON-MAGNETIC OR FEELBY MAGNETIC MINERALS**; App. filed May 10, 1911. Improvements.

1,256,983. **WIRELESS TELEGRAPHY AND TELEPHONY**; Edwin H. Colpitts, East Orange, N. J. App. filed Jan. 27, 1916. Improved method for the simultaneous transmission of telephone and telegraph signals and for their reception.

1,257,015. **ELECTRIC LIGHTING SYSTEM FOR AUTOMOBILES**; Bernice J. Noyes, Boston, Mass. App. filed April 9, 1913. Improvements.

1,257,021. **RELOADABLE FUSE**; Ralph C. Patton, Providence, R. I. App. filed June 20, 1917. Strong enough to operate safely without filling material.

1,257,054. **ELECTRIC-WIRE COUPLING**; Courtland W. Weaver, Toronto, Ontario, Canada. App. filed June 19, 1917. Improvements.

1,257,075. **REPRODUCTION OF SOUND CHARACTERISTICS**; Percy W. Fuller, Boston, Mass. App. filed Sept. 30, 1910. Operates somewhat after the manner of a condenser.

Electrical World

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Output of Large Generating Systems

WE PUBLISH in this issue very interesting statistics on the outputs of the large generating systems of this country and Canada, representing approximately two-thirds of all of the central-station energy manufactured in 1917. The lessons to be drawn from the figures are many and varied. One in particular cannot be over-emphasized at this critical time when fuel conservation and important water-power legislation are under consideration at Washington. From time to time the central-station industry has been charged with grabbing all the water power in sight and playing the hog. Certain government officials have maintained that further water-power development was unnecessary because in some sections, particularly on the Pacific Coast and in the Northwest, overdevelopment of water-power resources could be shown. On this point the statistics published throw an interesting light. Facts are stubborn things, and how the facts in this case can be controverted we do not know. We do know that they belie the statements of the water-power obstructionists and that next year more fuel will have to be burned by hydroelectric companies because of the shortage of rainfall this winter on the Pacific Coast. Therefore any relief measures contemplated must be acted on quickly. As indicative of the immense saving of coal possible through the development of water powers, the statistics show an aggregate output of electricity from that source equivalent to the consumption of 25,000,000 tons of coal.

The Wages of Labor and Living Cost

IN THE discussion by L. K. Comstock, published in part in last week's issue and concluded in this issue, we have an earnest effort to perfect a reasonable solution of the labor problem in the electrical contracting industry. It is commended to our readers for the important lesson which it carries. The war is bringing momentous changes to the world. They touch for long-lasting good or ill the relation of massed capital and massed labor and also of individual labor and smaller units of capital. Mr. Comstock admits the issue frankly. His proposition is that it must be solved by intelligent, fair, logical methods, just to labor. Labor's standpoint is like that of the manufacturer whose production cost rises. Living cost of the workman has advanced, and if he cannot bridge the chasm between that cost and his earning power he faces a bankruptcy that is as perilous to him and to

the nation as the bankruptcy of the capital of the manufacturer. Either one threatens a catastrophe which it is our highest interest to avert. Sometimes business men of real integrity voluntarily increase payments under a contract price because they know that higher costs made the performance of the contract impossible at the stipulated figure without damaging loss. Many voluntary advances have been made; more will have to be made if present abnormal living costs and labor scarcity continue. The future will be made easier in the relations of labor and capital if capital, seeing clearly the needs of the hour, shows labor that it proposes to meet them fairly.

The Water-Power Bill

HEARINGS on this important measure are now under way, and we earnestly hope that the facts presented will lead to the rapid passage of the reasonable legislation which can well spring from the bill now under discussion. It would perhaps be impossible to draft a bill to satisfy everybody. Indeed, one of the best criteria of a really equitable decision of any kind is that all of the parties thereto should consider that they had been favored with only a partial victory. In the long run sound compromises can be made which will produce good results, even if not wholly pleasing to everybody concerned. The main thing now is to enact such a statute as shall encourage the speediest possible development of the hydraulic resources of the country. The nation has had a hard time during the past winter in obtaining its necessary supply of fuel; and it is not likely to have an easy time next winter in view of the heavy strain that may be expected on our already burdened transportation systems. Everything that can be obtained from hydroelectric plants is badly needed, and this is no time to temporize concerning the situation or to split hairs over the form of requirements to be embodied in the bill.

The main thing is to give those who would be glad to develop water powers a fair enough chance to hold their interest in the work and to encourage them to go at it immediately. Before the end of the current year it will be possible to put a very large amount of hydraulic power into service provided that the chance is given without further exasperating delays. The fuel situation is not likely to become much easier to meet before the close of the war, whenever that may be, and it certainly is a gross neglect of national resources to permit the continuing loss of valuable power. The obstructionists are in chief those who are attempting to force the government at once into the water-

power business as a national enterprise. The government has already enough on its hands in the necessary assumption of business more immediately concerned with the war to keep any reasonable official body busy to its heart's content. It might with great profit to the country take into its own hands temporarily still other affairs in which it is suffering from scandalous profiteering. In view of all this, and of the fact that the government will have control in the broadest sense of the operations of hydroelectric plants established on its domain, it seems scarcely wise to undertake in its own behalf their full financing and administration. We do not believe that the government is looking for trouble to this extent, and we most earnestly hope that it will give some reasonable encouragement to the conservation of fuel by passing promptly a workable water-power bill.

The Use of Synchronous Motors

THE synchronous motor, although at present used in a somewhat limited way, has certain virtues which commend it to the engineer quite apart from its very useful function in power-factor correction and as a voltage regulator. Its practical field of operations is well described in Will Brown's paper in the current issue, which will be rather an eye-opener to many engineers who do not fully realize in how many instances the synchronous motor has found application. On broad principles the synchronous motor has for its weakest points the need of an exciter for the field and a somewhat limited starting torque. Its strong points are its beautiful uniformity of speed, its power to carry stiff overloads and its generally useful effect on the power factor of the system. In addition, it is a general rule that a synchronous motor has a higher efficiency than an induction motor of the same output, particularly when the rotative speed is low. Hence it is that Mr. Brown shows that synchronous motors are likely to pay for their somewhat higher first cost after a short period of use, simply by reason of higher efficiency. The cause of this higher efficiency is obvious enough in the lessened hysteretic losses and in the lessened I^2R loss when the synchronous machine is used anywhere near unity power factor.

It is on account of the general requirement of an exciter and of a construction which adds considerably to the cost of the machine that it is not usual, as Mr. Brown correctly states, to find synchronous machines used, save for motor-generator sets, for outputs of less than about 100 hp. Above that output the lessened running losses score pretty heavily in its favor. Looking over the list of applications in the paper before us, one is immediately struck with the ready applicability of the synchronous machines to large pumps, either piston or centrifugal. These are quite universally started at light load by the use of by-passes or analogous means, thus overcoming one of the inherent failings of synchronous motors. With recent designs the starting torque has been materially improved, but it is still too low for picking up anything near the rated load. The torque per kva. is also relatively low, but so indeed it is in many induction motors of the squirrel-cage type. There is a general feeling that it is somewhat difficult to start up a synchronous

machine. In point of fact this difficulty is popularly rather exaggerated, since with the proper starting arrangements the rotor is quickly brought to speed and very readily synchronized, with only an insignificant chance of anything going wrong. There are, too, a great many kinds of work in which the load can be assumed by a clutch after the machine is at speed.

Air compressors and ammonia compressors in ice plants furnish admirable loads for the use of synchronous machines, particularly on account of the very material gain in efficiency to be secured by their use. In fact, one of the earliest applications of the polyphase synchronous motor was in driving the compressors of an ice plant. It is particularly well suited to this use because these compressors have not infrequently to work at part load and the efficiency curve of the motor can be kept considerably flatter than the normal efficiency curve of an induction motor. When direct-connected drive at low speed is desirable the induction motor is somewhat at a disadvantage, particularly in the matter of power factor. In all cases where a synchronous motor can be used under fairly steady load it stands a chance of getting a power rate bettered by the obviously useful effect on the power factor of the load, and even of the plant. The average power factor of a central station carrying a heavy load of induction motors is none too good even in these days of improved design, and the question of proper charges for the kva. demand required is one that is continually coming to the front. Mr. Brown's paper, with its comprehensive study of various applications, should prove a useful guide in planning for a combined load which will tend to keep up both the power factor and the working efficiency of the system as a whole.

A Simple Method of Measuring Emfs. Accurately

IN MEASURING the emf. generated by a thermocouple, so as to determine the temperature of the same, there is probably no apparatus so reliable as the potentiometer, provided that there is a suitable range for small voltages. In some potentiometers the range of precision in the first few microvolts is too narrow. A disadvantage of the potentiometer is that, being a zero-reading instrument, it takes some little time to adjust the potential for galvanometer zero. When a number of such thermocouples have to be tested in succession this process becomes slow and tedious. A more convenient measuring device in such cases is a millivoltmeter, which on being connected to the thermocouple under test speedily indicates the terminal voltage. If the thermocouple and its leads have appreciable resistance, the drop of potential therein may cause the millivoltmeter to indicate appreciably less than the true emf. It would be desirable to combine the convenience and rapidity of the millivoltmeter with the freedom from drop error of the potentiometer.

Two suggestions toward this object were offered by F. Wenner, P. D. Foote and E. E. Weibel in an article printed in our last issue. These methods lack the precision of a good potentiometer, but they are swift and convenient in operation. The precision available is probably in most cases satisfactory, and there should be no drop error. As adjuncts to the testing laboratory these methods are well worth noting.

Standardizing Factory Lighting

THE considerable increase in night work which has resulted from the war lays particular emphasis on the importance of the artificial lighting of factories. Prof. C. E. Clewell's discussion of the efforts to standardize suitable lighting for industrial establishments therefore has direct value at the present moment. The I. E. S. code of 1915 was a long step in advance and served as a basis for some important legislation. The experience of the last three years, together with the greater amount and severer requirements of factory lighting, has rendered changes desirable. These were undertaken last year by the I. E. S., and their importance has been emphasized by the recent legislation which Professor Clewell mentions. Changes in the original code have been in considerable degree due to the greater importance now attached to artificial illumination and to a considerable degree have been in the direction of a more complete classification of the work to be done. Another very important change has been to direct more specifically attention to the question of glare, always recognized as a very important factor in successful industrial lighting, but hard to reduce to workable definitions. Indeed, whether it is possible to draft a regulation of a kind practicably enforceable which will properly cover the subject of glare is a question which does not yet admit of a definite answer.

A longer step forward is made in the strong recommendation of actual measurements of the lighting by a portable photometer. At the present time instruments of this kind, of sufficient accuracy for the purpose and convenient for use, are readily attainable, and there is no reason why legislation as to industrial requirements cannot be worked to a successful result. The four desiderata in industrial lighting suggested by the committee on labor of the Advisory Commission—to wit, conservation of eyesight, safety, increased labor efficiency and better quantity and quality of output—are the obvious things to be borne in mind in codes and statutes. As regards the general conditions of lighting, those which satisfy the last two requirements will also satisfy the first two, with due attention to the lighting of stairways and other areas of that kind.

If the minimum lighting requirements are specified in accordance with the suggestions of the I. E. S. and can be enforced, as is comparatively easy by the use of portable photometers, the whole situation will be effectively cleared up. Heretofore it has been far easier to say whether lighting was or was not good than to pin it down to definite intensities of illumination. Now, with the problem of photometry somewhat simplified, the necessity of training state factory inspectors in the use of instruments and in the fundamental principles of industrial lighting becomes obvi-

ous. At present they will have much less difficulty than was the case a very few years ago, since manufacturers are compelled to do much work by artificial light and have come rather generally to realize at last the importance of good illumination as a factor in the general success of the plant. Very little pressure intelligently applied by legislation and its judicious enforcement will work wonders.

Increasing the Carrying Capacity of Underground Cables

IN THE electric circuit it is well understood that the difference of electric potential E produced by a direct current I in traversing an electric resistance R is expressed by Ohm's law according to the equation $E=IR$. In a similar way, there is a thermal law like Ohm's law, which states that the difference of temperature, or thermal potential, θ deg. C. produced by a thermal current F traversing a thermal resistance R is given by the corresponding equation $\theta=FR$. In the case of an underground cable the thermal current is determined by the loss of electrical energy in heat, so that F may be regarded as fixed by the electric current carried over the conductor. The temperature elevation which this F can develop depends entirely upon the thermal resistance in the path of its escape to surrounding bodies at normal temperature.

The thermal resistance between the conductor of an underground cable and the remote normal-temperature environment resides in the dielectric envelope, the air space between the cable and the conduit, the conduit walls and the soil in their immediate vicinity, all taken in series. A considerable share lies in the air space within the duct. The resistance in the dielectric and in the conduit walls may not be susceptible of change. What these offer in any given case may have to be accepted. If, however, the duct containing the cable be filled up with some cheap electrically insulating material of better thermal conductivity than air, the total thermal resistance R may be appreciably reduced, thereby reducing the temperature elevation θ of the cable; or, if the cable is thereby kept unnecessarily cool, the original temperature elevation may be retained, with a correspondingly larger electric current and thermal current F .

The article this week by E. O. Schweitzer describes an experiment in which the substitution of crude vaseline for air in a cable duct was found materially to diminish the thermal resistance and corresponding temperature elevation. It remains to be seen whether on a larger scale vaseline is a suitable substance for use in this way; but it is only reasonable to expect that some economical substance should be thus available for replacing air in underground-cable ducts, so as to increase the safe electric carrying capacity of the cable.

AMONG subjects which will be discussed in early issues of the ELECTRICAL WORLD will be the relative effectiveness of different methods of measuring internal temperatures in large generators, changing aspects of factory lighting legislation, relative costs of furnishing hydroelectric and steam generator power, increasing economy in boiler rooms, and improving the

The Coming Issues

starting characteristics of synchronous motors. An article will also be published presenting in systematic form, for the convenience of designing engineers, information on different safety features which have been developed for use in connection with switching installations. Lessons arising from the curtailment of lighting will be discussed.

What Synchronous Motors Can and Cannot Do

Discussion of Industrial Applications as Viewed from the Standpoint of Performance Alone—Power-Factor Improvement a Secondary Advantage

BY WILL BROWN
Electric Machinery Company

IN MANY discussions of synchronous motors the subject of power-factor correction and condenser capacity is mixed up with and allowed to overshadow the characteristics of motor performance. A motor should be judged, however, by its ability to perform a certain duty and should stand or fall upon this performance alone. If it is able to improve the power factor of the system, this characteristic may then be considered as an additional point in its favor.

SERVICE THAT SYNCHRONOUS MOTORS CANNOT GIVE

While synchronous motors as now designed are quite different from the modified alternators of older days, and can develop 30 to 50 per cent full-load torque at starting, there are certain duties they cannot perform. So as to clear up any misunderstandings that may exist concerning synchronous motors in regard to either their limitations or advantages, some of the purposes to which they cannot be adapted will be outlined first.

(1) They cannot be used profitably on small loads. This generally means anything under 100 hp. An exception should be made in the case of small synchronous motor-generator sets, however.

(2) They cannot be used on intermittent loads involving frequent starting and stopping, such as crane motors, reversible hoist motors, etc.

(3) They cannot be used where variable speed or adjustable speed is demanded unless some mechanical means of regulating the speed change is provided.

(4) They cannot be used where it is necessary to start up the full load from rest unless a clutch or some other mechanical method of easing the starting condition is supplied.

USES TO WHICH SYNCHRONOUS MOTORS ARE ADAPTED

In answer to the question which now probably arises in the reader's mind, "Where are synchronous motors now in use?" Table I is presented. It does not by any means cover the full field of possible applications, but it does indicate the already wide range of these motors and the promise of a much greater use in the future.

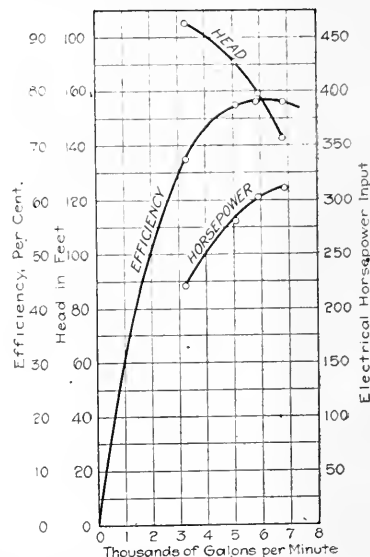
Where a heavy and fairly continuous load can be driven at a constant speed, there is generally an opportunity to install a synchronous motor. High efficiency and reliability of service are the two great essentials in such work. It is safe to say that a synchronous motor is always higher in efficiency than an induction motor of corresponding rating. At low speeds the advantage in favor of the synchronous motor is even greater than at high speeds.

There are many heavy-duty machines which must be run at low speeds. Formerly, if these machines were to be driven by motors it was necessary to install some form of belt or gear drive. They can now be

directly connected to synchronous motors and operate efficiently at speeds as low as 72 r.p.m.

Starting Ability.—The old handicap of synchronous motors was their inability to start up from rest while carrying a mechanical load. This handicap has been overcome to a greater extent than most engineers realize. There are practical examples of large synchronous motors developing a starting torque as high as 50 per cent of full-load torque obtained without a prohibitively large kva. input. The future will probably bring even more remarkable results.

It is a fundamental fact that a low-speed synchronous motor cannot develop as high an initial starting torque with the same starting voltage as the high-speed motor,



OVER-ALL EFFICIENCY OF DIRECT-CONNECTED CENTRIFUGAL PUMP

it being understood that horsepower ratings of the two motors are the same. For example, a certain motor with a synchronous speed of 200 r.p.m. can develop a starting torque of 35 per cent of full-load torque on the 40 per cent voltage tap with an input of 130 per cent of the full-load kva., whereas a 600-r.p.m. motor can develop a starting torque of 40 per cent of full-load torque on the 40 per cent voltage tap with an input of 115 per cent of full-load kva.

Variable Loads.—Many types of heavy-duty machines requiring variable output are now designed so that they can be started and driven by synchronous motors. For instance, in a certain reciprocating pump installation a variable stroke is automatically obtained by means of bell cranks and by shifting the cylinder. This permits varying the delivery from zero up to 4200 gal. (15,900 l.) per minute.

Mechanical methods for changing the inlet or outlet passages for fans and blowers permit the use of constant-speed motors where formerly only adjustable-

speed motors could be used. There are already a number of such installations—for instance, large exhaust fans such as are used on mine shafts, etc.—and it seems quite likely there will be many more in the future.

Line-Shaft Drive.—In cases where manufacturing processes are so correlated that a line-shaft drive is preferable to individual motor drive, the synchronous motor is finding wide applications. The motors may be either direct-coupled or belted. For this service it is nearly always necessary to use a clutch, either mechanical or magnetic, to permit starting and bringing the motor up to speed before the load is thrown on. The writer knows of a number of installations of this type in flour mills, also in rubber mills, all of them operating very satisfactorily and handling heavy loads, in which there are at times considerable fluctuations.

Efficiency and Ruggedness.—The high efficiency which can be secured with a synchronous motor is well

and the bearing repaired. Very frequently the windings of the armature are damaged also. The synchronous motor, owing to its comparatively large air gap, is much more rugged and dependable for operation on low-speed, direct-connected loads.

Air-Compressor Drive.—Air compressors, especially those of sufficiently large capacity to require 100 brake horsepower or more, can be economically and efficiently driven by a synchronous motor. The old idea that it was necessary to change the piston speed with change in air demand has been abandoned. Mechanical methods of regulation on the compressors now permit the driving motor to operate at a uniform speed.

In practice synchronous motors are used both belted and direct-connected to the compressor. On direct-connected units the speeds required are generally within the range of 260 r.p.m. down to 120 r.p.m. Probably the greatest number of direct-connected synchronous-motor-driven compressors operate at a speed in the neighborhood of 200 r.p.m. This speed is very much higher than was ever thought advisable by compressor builders a few years ago. The increased speed has been made possible by the adoption of a light plate valve with a low lift. The time required to open and close such a valve is so small that it permits operating the piston at much higher speeds.

In starting an air compressor the pressure can be relieved by a by-pass so that the motor has only the friction load and inertia to overcome in breaking the compressor from rest. This is very easily taken care of without drawing excessive kva. from the line, and the motor can pull into synchronism without causing objectionable fluctuation of the line voltage.

Since the load factor of a compressor is generally high, and since the power factor of a synchronous motor can be maintained at unity, a favorable rate can usually be secured when energy is purchased from a central station. The fact that these motors operate at unity power factor or slightly leading (at part loads) should appeal with even greater force to plants generating their own energy. The power factor and efficiency obtained with a typical direct-connected synchronous-motor-driven air compressor are shown in Table II.

Recently there has been an enormous demand for large synchronous-motor-driven air compressors among the shipyards of the country. They range in size from 150 hp. to 1200 hp. Among other lines of industries using synchronous-motor-driven air compressors might be mentioned mines, foundries, automobile factories, structural steel works; in fact, any industry where a large quantity of compressed air is used. In driving tunnels the air pressure can be maintained in the headings by means of a battery of low-pressure compressors driven by synchronous motors.

Ammonia-Compressor Drive.—The large ammonia compressors used in ice plants (50-ton or over) are driven in exactly the same way as air compressors, by either belted or direct-connected synchronous motors. The starting duty required is somewhat more severe than in the case of air compressors, however. In order to obtain the required starting torque it is sometimes necessary to use a higher voltage tap on the starting compensator than would be necessary with the corresponding air-compressor installation. The large flywheel combined with the inertia and friction

TABLE I—APPLICATIONS TO WHICH SYNCHRONOUS MOTORS ARE ADAPTED

TYPES OF PLANTS USING SYNCHRONOUS MOTORS AND THE MACHINES WHICH ARE DRIVEN												
	AIR COMPRESSORS	AMMONIA COMPRESSORS	CENTRIFUGAL PUMPS	CONVEYORS	CRUSHERS	FANS	FREQUENCY CHANGERS	GRINDERS	JORDANS	LINE SHAFTS	MIXERS	MOTOR GENERATOR SETS
AUTOMOBILE PLANTS												
BRICK AND CLAY PLANTS												
DRAINAGE PLANTS												
ELECTRIC LIGHT AND POWER PLANTS												
FLOUR MILLS												
FOUNDRIES												
ICE AND REFRIGERATING PLANTS												
IRON WORKS												
IRRIGATION PROJECTS												
MINES												
MARBLE AND STONE CUTTING PLANTS												
METAL WORKING PLANTS												
OIL REFINING PLANTS												
PAPER MILLS												
QUARRIES												
RUBBER MILLS												
RAILROAD SHOPS												
SHIPYARDS												
STEEL PLANTS												
SUCTION DREDGES												
SEWAGE DISPOSAL PLANTS												
STONE CRUSHING PLANTS												
TEXTILE MILLS												
WATER WORKS												
MISCELLANEOUS												

illustrated in the following installations: One marble-working concern has been operating a 150-hp. synchronous motor driving a line shaft for nearly four years. The choice originally lay between an induction motor and a synchronous motor. The higher efficiency obtained by the synchronous motor brought a saving in the first two years of operation which more than made up for the higher original cost of the synchronous motor.

There is a rather interesting installation in a paper mill where a 1150-hp. synchronous motor is driving two direct-coupled pulp grinders. No difficulty has been experienced either in starting or running. An induction motor of similar horsepower driving a similar load was caused more or less trouble, which is generally traced to the very small air gap. The slightest wear of the bearings alters the air gap sufficiently so that a very heavy magnetic pull is set up on one side of the motor and quickly wears the bearings down still more until the time arrives when the motor must be stopped

of other moving parts requires that the motor be specially designed to produce maximum starting torque.

The preference for direct-connected synchronous-motor-driven ammonia compressors is very markedly shown in the ice and refrigerating plants recently constructed or now in course of construction. It may be said safely that the energy cost with direct-con-

TABLE II—EFFICIENCY AND POWER-FACTOR TESTS OF 560-HP., 225-R.P.M. SYNCHRONOUS MOTOR DIRECT-CONNECTED TO AIR COMPRESSOR
Exciting current remaining constant at all loads

	Quarter Load	Half Load	Three-Quarters Load	Full Load	One-and-a-Quarter Load
Efficiency	92.6 per cent	95.6 per cent	96 per cent	96 per cent	95.4 per cent
Power factor	73 per cent Leading	93 per cent Leading	98 per cent Leading	100 per cent	98 per cent Lagging

nected synchronous-motor-driven machines is less per ton of ice manufactured than is the case with any other type of motor drive.

Once it was considered essential, in order to meet the varying demands for ice, that the speed of the ammonia compressors should be adjustable. This is no longer necessary. In place of one large unit running at variable speeds, ice plants can have two or more smaller units which run at constant speed. By running different combinations of the compressors in parallel, fluctuation in demand can be easily cared for without any provision for speed adjustment. When the demand drops to a minimum the smallest compressor only may be used, so the losses may be kept at the minimum. It can be seen that the over-all efficiency of such a plant will be very much higher than in the old-fashioned variable-speed plant.

Another method of varying the output of the compressor at constant speed is by means of an adjustable clearance pocket, or cylinder, at each end of the compression cylinder. By means of these the clearance can be increased and the capacity lowered to any desired point between full load and one-quarter load or even lower. Thus the flexibility of the compressor is fully equal to that of the old adjustable-speed compressors driven by low-speed Corliss engines.

The efficiency curve of the synchronous motors is quite flat throughout a wide range of load, so that

TABLE III—EFFICIENCY AND POWER-FACTOR TESTS OF 450-HP., 200-R.P.M. SYNCHRONOUS MOTOR DIRECT-CONNECTED TO AMMONIA COMPRESSOR
Exciting current remaining constant at all loads

	Quarter Load	Half Load	Three-Quarters Load	Full Load	One-and-a-Quarter Load
Efficiency	87.7 per cent	92.6 per cent	93.7 per cent	94 per cent	93.8 per cent
Power factor	70 per cent Leading	94 per cent Leading	99 per cent Leading	100 per cent	99 per cent Lagging

there is very little loss in efficiency on the part of the motor when run at part loads. As far as the compressor is concerned, the efficiency at part loads seems to be practically as good as at full load. This is due to the general conditions under which ice-manufacturing plants operate. The efficiency, power factor and starting torque for a typical synchronous motor direct-

connected to an ammonia compressor are indicated in Table III.

Direct-Connected Centrifugal Pumps.—Quite a number of installations of synchronous-motor-driven centrifugal pumps have been made recently. In most cases the motor is directly coupled (through flexible coupling) to the pump shaft. Starting requirements of a centrifugal pump can be met by a properly designed synchronous motor. Before starting, the pump is primed. The discharge valve is closed when the motor starts, so the impeller merely churns the water. The load increases rapidly, running up to 30 per cent, or even 50 per cent, of full load as the motor approaches synchronous speed. When full voltage is applied and the motor is pulled into step, there is a momentary rush of current, which, however, should not be excessive and should fall almost immediately as the motor settles down to synchronous operation. The maximum peak at pull-in should rarely exceed 150 per cent of the full-load kva.

As long as the discharge valve is closed the impeller is churning the water, and this energy is transformed into heat. If this operation is continued too long, steam might be generated. A small by-pass for liberating air relieves any possibility of steam pressure. Of course the proper thing to do is to open the discharge valve as soon as the motor is running at synchronous speed and allow the pump to begin discharging at its normal head.

There are numerous cases where centrifugal pumps driven by synchronous motors are used for suction dredging. As the pipe lines which carry the discharge are extended from point to point as the dredge continues its work, a large change in the friction head occurs which necessitates two-speed drive for the pump. This requirement can be met by using a two-speed helical gear.* The over-all maximum efficiency of a centrifugal pump directly driven by a 300-hp. synchronous motor is shown in the chart on page 604.

Each installation of centrifugal pumps is a special problem, and both motor and pump must be designed as such if best results are to be secured. Generally speaking, centrifugal pumps are designed to operate at constant speed. Synchronous motors with speeds as low as 72 r.p.m. are used directly coupled to low-head pumps. High-head pumps with speeds as high as 1200 r.p.m., or even 1800 r.p.m., are also directly coupled.

Unity Power Factor Operation.—A synchronous motor designed for so-called unity power factor operation has a fixed exciting current which cannot be exceeded, so that absolutely unity power factor cannot be maintained if the load fluctuates. As the load drops off the power factor will change to leading, but the change in power factor from full load to quarter load is surprisingly small. From one-and-a-quarter load to one-half load the change in power factor is less than 10 per cent. At one-half load the power factor is slightly leading and at one-and-a-quarter load slightly lagging. If the load should be removed entirely from the motor, it would operate at approximately zero power factor up to about one-half of its rated kva. capacity.

*In one plant using this drive which the writer inspected the energy cost was only five-sixths of the amount that fuel cost when steam was used for the same purpose. Furthermore, the motor-driven suction dredge was handling considerably more material. If the present price of coal was taken into consideration, the energy cost would be only about five-twelfths of the full expense.

The friction losses in the motor would constitute a load, so that in practice the power factor could never reach zero.) The limitation to the exciting current prevents the motor from carrying its full kva. rating. Of course, variations of design will change the characteristics of motors, so the preceding statements are only general and must be modified under certain conditions. The extent to which a power user can afford to go in installing synchronous machines depends largely on the annual cost of power. The advantage to be obtained may run anywhere from 10 per cent to 30 per cent of this amount.

Correcting Power Factor.—In the case of an isolated plant generating its own alternating current, the use of an over-excited synchronous motor at a leading power factor is often very desirable. Such a motor if properly designed may operate at a power factor, say, 80 per cent leading, while at the same time carrying three-quarters of its rated mechanical load in horsepower.

Under this condition the motor may exert nearly the maximum corrective effect on the system's power factor. The magnitude of the system load and the power factor must be taken into consideration, however.

This problem of power-factor improvement cannot be met in the future, as it has been in the past, simply by the central station installing large synchronous condensers. It will become more and more desirable to have a connected load of many fair-sized synchronous motors scattered over the system. This is much better from the standpoint of voltage regulation, transmission efficiency, etc., than the old method of combining all the power-factor correction for the circuit in one or more synchronous condensers.

The result will be that central stations will encourage the use of synchronous motors more and more on their lines. This tendency is already apparent in many sections of the country, especially where large individual users of power are scattered over the system.

Changing Aspects of Factory Lighting Legislation

More Elaborate Classification of Requirements Desirable—Glare More Important than Intensity—Emergency Lighting Receives More Attention—Portable Photometer Facilitates Enforcing Legislation

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This article and one to appear subsequently have been written to review the marked changes which have taken place in state factory lighting legislation during the past months and to outline the principal revisions in the Factory Lighting Code of the Illuminating Engineering Society since June 1, 1917. Emphasis is placed upon the five main elements which call for legislation in this field and also upon the chief points which have come up for discussion in designing new codes and in revising the codes which have been in force since 1915. Notes are included on recent instances which have an important bearing on the intelligent enforcement of such regulations. Plans to give lectures on factory lighting to the state factory inspectors of Pennsylvania and New Jersey at the University of Pennsylvania are also outlined.

A REVIEW of the original I. E. S. Code of Lighting¹ for factories, mills and other working places seems especially desirable at this time for several reasons: (1) Because important revisions were made by the committee on lighting legislation of the Illuminating Engineering Society in June, 1917; (2) because a complete revision of the Wisconsin code has been under way since the fall of 1917; (3) because a lighting code committee was appointed in 1917 by the Ohio Industrial Commission to prepare a set of factory lighting regulations² for that State, and (4) because of an important revision of the codes which were adopted in 1916 by the States of Pennsylvania and New Jersey as made in January, 1918.

¹The original Code of Lighting for factories, mills and other workplaces, as discussed from various standpoints by the writer during the past two years (see ELECTRICAL WORLD, Vol. 66, No. 21, p. 1135, and Vol. 69, No. 25, p. 1203; *Factory* for September, 1917; *Industrial Management*, Vol. LV, No. 2, p. 117) contained regulations on the following principal points: (a) Intensity required for various classes of work, (b) distribution of light, (c) inspection and regular maintenance, (d) location of switches at entrances, (e) lighting of stairs and passages, (f) advantage of the overhead system of lighting, and (g) auxiliary or emergency lighting.

²A draft of this code is now available.

To the four points cited there may be added the significant appointment by the committee on labor of the advisory commission, Council of National Defense, of a committee on lighting³ for preparing a code of lighting for mills and workshops, having in mind four points, (a) the conservation of the eyesight of employees, (b) safety, (c) increased labor efficiency, and (d) larger output and decrease in spoilage.

From this list of very recent developments it will appear that the last half year has witnessed an unusual interest in the question of lighting rules for factory plants. Moreover, the two years which intervened between the preparation of the I. E. S. code in 1915 and the present have afforded additional experience and data on which to base the revisions of June, 1917. A number of interesting technical points have arisen in this work of revision, making the present an appropriate time for a brief discussion of these developments.

REVISIONS OF THE I. E. S. CODE

The original code of the Illuminating Engineering Society contained regulations on seven principal points as outlined in a preceding paragraph, these seven points being included in nine articles suggested as a basis for legislation or guidance. Following the issuance of this code in 1915, the States of Pennsylvania and New Jersey adopted it in slightly revised form, and it became effective in both States in 1916. After about two years these two States asked for revisions of the original code, if any were desirable, and requests for co operation were received by the committee on lighting legislation from Wisconsin and Ohio, all of which convinced the I. E. S. committee that the time had arrived for a

³ELECTRICAL WORLD, Jan. 5, 1918, on "Activities of the Engineering Societies in War Work."

careful study of its original code before further adaptations were made.

As a result the whole matter was carefully considered at a meeting in New York in June, 1917, and a decision reached to limit the suggested regulations to basic points, as follows: (1) Intensity requirements (which include the question of classifying industrial work), (2) the elimination of glare by proper shading

take into account those cases of rough manufacturing which involve a closer discrimination of detail than is implied by rough machinery or rough assembling. This new class is given under heading (e). Several minor, although important, changes are made in the intensity requirements.

Thus, for rough manufacturing the original code called for a minimum intensity of 1.25 and gave a range of 1.25 to 2.5 foot-candles for desirable practice. The revised rules do not change the minimum but increase the range from 1.25-2.5 to 2.0-4.0 foot-candles. The minimum intensity is given second place in the revised code so as to place extra weight upon the higher values of ordinary practice. Figs. 1 and 2 show these changes and values graphically, the former giving a comparison between the more important older values and the new revised values, while Fig. 2 shows the new values in complete form.

The note at the end of Rule 2 calls for measurements by a portable photometer. At the end of the last paragraph of Article V of the old code the use of such an instrument is recommended. The committee included a definite statement in the revised rules regarding the use of such an instrument with greatly increased confidence due to the commercial perfecting of the foot-candle meter (Figs. 3 and 4), which now places at the disposal of the state inspectors an inexpensive and sufficiently accurate instrument for checking up intensity values. Representatives of state labor boards have expressed the opinion that the appearance of such an instrument removes the chief difficulty in the enforcement of such legislation.

GLARE MORE IMPORTANT THAN INTENSITY

Rule 3 of the revised code introduces into the body of the code the item of glare, which is looked upon as an item of even greater importance, in the present condition of industrial lighting, than the intensity require-

of lamps, (3) the distribution of light on the work, (4) emergency lighting, and (5) pilot or night lamp control near entrances. A comparison of these revised rules with the original code can readily be made from the parallel passages in Table I, and also Tables II and III, which serve as a basis for the discussion to follow.

DISTINCTION BETWEEN VALUE OF DAYLIGHT AND ARTIFICIAL LIGHT

Referring to Tables I, II and III, it will be seen that the revised rules omit all efforts to include daylight, except indirectly in the last two lines of Rule 1. This reference to natural light implies indirectly that the intensities of daylight which correspond with those for artificial light given in Rule 2 are satisfactory, namely, that there is no difference between the minimum requirements of artificial and of natural illumination. In the second paragraph of Article I of the original code the minimum requirements for natural lighting were set at three times those for artificial lighting. While experience indicates that some distinction between the two kinds of light, as outlined in the original code, is warranted, the committee did not feel able, in the present state of the art, to assign any definite figure for this difference, in spite of the fact that in 1915 such a distinction seemed advisable in definite form.

A comparison of Article V with Rule 2 shows that a slightly more elaborate classification of work seems desirable. Thus roadways and yard thoroughfares and office work are two new classes. Further, it was felt advisable to separate storage spaces and stairways, which were combined in the original code, making them into separate heads and increasing the range of intensities for ordinary practice for stairways. The committee also felt it desirable to insert a new classification between rough and fine manufacturing work to

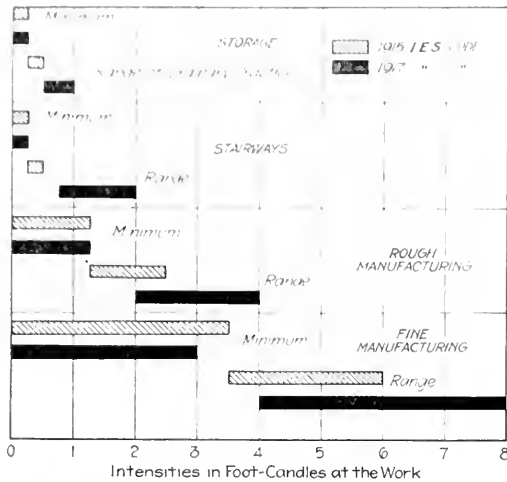


FIG. 1—COMPARISON OF THE INTENSITIES REQUIRED BY THE 1915 I. E. S. CODE OF FACTORY LIGHTING WITH THE REVISED INTENSITIES RECOMMENDED BY THE 1917 I. E. S. COMMITTEE ON LIGHTING LEGISLATION

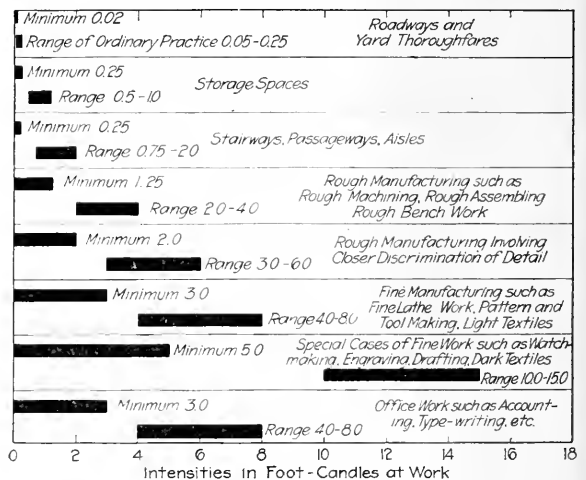


FIG. 2—MINIMUM INTENSITIES AND RANGE RECOMMENDED FOR ALL CLASSES OF WORK LISTED IN THE REVISED I. E. S. CODE

ment. Considerable discussion has arisen during the past months as to the possibility of drafting a regulation covering glare which will be definitely enforceable. Obviously, such a rule, if readily interpreted, would be preferable to the general statement of Rule 3. It has been found difficult to formulate such a rule in definite terms, although there is reason to believe that a more tangible wording will develop in the near future. This

atter will be discussed in more detail later in connection with the recent revisions of the Wisconsin code.

Article VI and Rule 4 are comparable. Here again, with Rule 3, there has been considerable agitation for a definite statement of what is meant quantitatively by "a good distribution"; in other words, what ratio of maximum to minimum intensity could be considered as falling within the meaning of a *good* distribution.

TABLE I—PARALLEL PASSAGES FROM THE ORIGINAL AND THE REVISED I. E. S. CODE OF LIGHTING FOR FACTORIES, MILLS AND OTHER WORKPLACES

ORIGINAL CODE, 1915

ARTICLE III. All buildings, whether old or hereafter constructed, must be provided during those hours of work when natural light is insufficient or not available with adequate artificial light according to the following articles.

ARTICLE V. ARTIFICIAL LIGHT; INTENSITY REQUIRED. The average illumination intensity throughout any month actually measurable in foot-candles on a horizontal plane through the work is to conform to the following table. Uncertain cases which arise as to how to classify given manufacturing operations are left to the judgment of a lighting expert.

Class of Work	Minimum Foot-Candle Intensity	Desirable Foot-Candle Intensity
Passage, passageways, stairways and the like	0.25	0.25-0.5
Light manufacturing and other operations	1.25	1.25-2.5
Heavy manufacturing and other operations	3.50	3.50-6.0
Special cases of fine work		10.00-15.0

Where operations are performed on the sides of the work in which they shall be classified according to this table, and if the illumination is furnished from an overhead system, it shall preferably be not less than 50 per cent of the foregoing values, when assured on a vertical surface. If the illumination is furnished by an individual lamp or lamps close to the work, the intensity shall conform to the minimum or desirable intensities required in the foregoing table.

NOTE.—As a guide to inspectors and others it may be stated that with modern lamps roughly 1 cp. per square foot produces effective illumination of 3 foot-candles when the lamps are arranged according to the uniformly distributed overhead system, with mounting heights ranging from 12 ft. to 16 ft. above floor, and when the light is directed from said lamps to the work in an efficient manner. A rough idea may thus be secured of the candle-power per square foot necessary to conform to the foregoing table of intensities by taking one-third of the intensities given in the foregoing table.)

Thus for fine manufacturing and other operations the minimum foot-candle intensity is 3.5, which is approximately equal to 1.2 per square foot. The use of a portable photometer or illuminometer, however, is recommended for the determination of existing intensities, and all uncertain cases are finally to be established by these instruments.

ARTICLE VI. LAMPS AND MACHINERY, jointly, are to be arranged as to avoid the casting of shadows over belts and other obstructions on important parts of the work, and the distribution of light from the lamps should be such as to avoid sharp contrasts of light and shade on the work.

ARTICLE XI. AUXILIARY LIGHTING should be provided for all large work spaces, such lamps to be in operation simultaneously with the regular lighting system, so as to be available in case the latter should become temporarily deranged.

ion. This subject also will be referred to in greater detail under the Wisconsin revisions which are to be stated later.

There has perhaps been no rule which has received more careful attention than Rule 5, concerning emergency lighting. It has been felt that too drastic a rule on an auxiliary system might work a hardship in some cases, whereas there can be little doubt as to the wisdom of such a provision for the great majority of industries. It is believed that Rule 5, in its revised form, covers the practical needs better than was the case with the old Article XI. The wording of Rule 5, however, leaves the interpretation of ways and means for the supply service for the emergency lamps to the judgment of the industrial commission or to its engineering representatives.

Old Article VIII contains a reference to control apparatus at the entrances of certain spaces. New Rule 6 makes such switching or controlling apparatus, at least pilot or night lamps, essential for all main points of entrance.

SUMMARIZATION OF CHANGES WHICH HAVE BEEN MADE IN I. E. S. CODE

In summarizing the changes which have been made in the original I. E. S. code, a fair conclusion of the work of the committee on lighting legislation can be secured from the accompanying tables. Clauses or articles which were felt to be superfluous in the original draft have been omitted, and other important

AS REVISED, 1917

RULE 1. GENERAL REQUIREMENT: Working or traversed spaces in buildings or grounds shall be supplied during the time of use with artificial light in accordance with the following rules, when natural light is less than the intensities specified in Rule 2.

RULE 2. INTENSITY REQUIRED: The desirable illumination to be provided and the minimum to be maintained are given in the following table:

	Foot-Candles* at the Work		
	Ordinary Practice	Minimum	
(a) Roadways and yard thoroughfares....	0.05-0.25	0.02	
(b) Storage spaces	0.50-1.00	0.25	
(c) Stairways, passageways, aisles	0.75-2.00	0.25	
(d) Rough manufacturing such as rough machining, rough assembling, rough bench work	2.00-4.00	1.25	
(e) Rough manufacturing involving closer discrimination of detail	3.00-6.00	2.00	
(f) Fine manufacturing such as fine lathe work, pattern and tool making, light-colored textiles	4.00-8.00	3.00	
(g) Special cases of fine work, such as watchmaking, engraving, drafting, dark-colored textiles	10.00-15.00	5.00	
(h) Office work such as accounting, typewriting, etc.	4.00-8.00	3.00	

*The foot-candle, the common unit of illumination, is the lighting effect produced upon an object by a standard candle at a distance of one foot; at two feet the effect would be not one-half foot-candle, but one-fourth foot-candle, etc. A lamp which would give off 16 cp. uniformly in all directions would produce a uniform illumination of one foot-candle at a distance of four feet in any direction.

NOTE.—Measurements of illumination are to be made at the work with a properly standardized portable photometer.

RULE 4. DISTRIBUTION OF LIGHT ON THE WORK: Lamps shall be so installed in regard to height, spacing, reflectors or other accessories as to secure a good distribution of light on the work, avoiding objectionable shadows and sharp contrasts of intensity.

RULE 5. EMERGENCY LIGHTING: Emergency lamps shall be provided in all work-space aisles, stairways, passageways and exits to provide for reliable operation when, through accident or other cause, the regular lighting is extinguished. Such lamps shall be in operation concurrently with the regular lighting and independent thereof.

features have either been revised or added after the most careful and painstaking study by experts in this

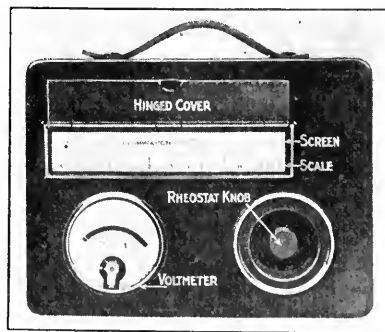


FIG. 3—THE FOOT-CANDLE METER, WHICH PROMISES TO BE OF MUCH HELP IN THE CONTROL OF INDUSTRIAL LIGHTING

field. New and important additional weight will be given to these changes by the discussion in a subsequent article of the points which have come up through

the work of committees or engineers in various states where attention has been directed to lighting legislation during the past six or eight months.



FIG. 4—READINGS OF ILLUMINATION MAY BE MADE VERY SIMPLY WITH FOOT-CANDLE METER

Two fundamental requirements must be met if state regulations of this kind are to be enforced intelligently. The one is to place at the disposal of the state factory inspectors instruments suitable for measuring illumination intensity, and the other is to train the inspectors

TABLE II—ARTICLES OF 1915 I. E. S. CODE WHICH WERE OMITTED OR RADICALLY REVISED IN 1917 CODE

ARTICLE I. DAYLIGHT.—All buildings hereafter constructed must be provided with adequate window area. Awnings, window shades, diffusive or refractive glasses must be used for the purpose of improving daylight conditions or for the avoidance of excessive brilliancy wherever they are essential to these ends.

The windows, skylights, saw-tooth or other roof lighting constructions are to be arranged with reasonably uniform bays, and the daylight openings shall be so designed and proportioned that at the darkest part of any work space, when normal exterior daylight conditions obtain, there shall be available at least a minimum intensity equal to three times the minimum intensities given in Article V. for artificial light.

NOTE.—The intensity requirements for daylight are higher than those for artificial light because the physical condition of the eye during the daytime is usually such as to require a higher intensity of natural light for satisfactory vision than is required at night under ordinary well-designed artificial lighting systems.

ARTICLE II. Old buildings at present constructed and not having adequate window area must be provided with adequate artificial light according to the following articles, so as to supplement the natural light during normal daylight hours.

ARTICLE IV. Adequate intensity of the light must be provided for each class of work, both on a horizontal plane as well as on a vertical plane passing through the work, according to Article V. In all cases, however, glare on working surfaces is to be avoided as it tends to reduce the visual efficiency of the workmen and to increase the likelihood of accidents.

ARTICLE VII. INSPECTION AND REGULAR MAINTENANCE of all lighting systems is required in spaces where work is being conducted, and in no case must the lighting devices, whether windows, lamps or auxiliaries such as globes and reflectors, be allowed to deteriorate, due either to dirt accumulations or to burned-out lamps, more than 20 per cent below the minimum intensity values required by Article V.

ARTICLE VIII. ROADWAYS, YARDS AND PLACES NOT USUALLY FREQUENTED must either be provided with illumination during working hours when natural light is absent or partly absent, to make them safe against accident to employees traversing or engaged in such places, or a convenient control or controls must be placed at the entrance to basements, stock rooms and the like, so that a person on entering can readily turn on the lamps beforehand.

ARTICLE IX. STAIRWAYS AND PASSAGEWAYS must be provided with lamps and reflectors or shades carefully located so as to shed their light generally over the entire space or spaces involved, and in sufficient quantity to make the stairways and passages safe against accident to employees traversing or engaged in such places. For intensities see Article V.

ARTICLE X. Each working space is preferably to be illuminated by lamps mounted overhead according to the system of general lighting, in preference to individual lighting. The overhead method of lighting, besides possessing many other advantages, also tends to reduce dark spots throughout the floor area, a feature usually objectionable with the use of individual lamps. This particular article is not an absolute requirement, but a suggestion enforceable at the discretion of a lighting expert.

themselves in the fundamentals of illumination so that they may be capable of sizing up a lighting installation for its main defects at a glance, and at the same time may appreciate the economic advantages of good factory lighting to such an extent that the enforcement of such rules will appeal to them and that they, in turn, may convincingly represent to the factory owner that

TABLE III—NEW RULES WHICH WERE INSERTED IN 1917 REVISION OF I. E. S. CODE THAT HAVE NO PARALLELS IN 1915 CODE

RULE 3. SHADING OF LAMPS:

Lamps shall be suitably shaded to minimize glare.

NOTE.—Glare, either from lamps or from unduly bright reflecting surfaces, produces eye-strain and increases accident hazard.

RULE 6. SWITCHING AND CONTROLLING APPARATUS

Switching or controlling apparatus shall be so placed that at least pilot or night lights may be turned on at the main point of entrance.

the adherence to such rules is in no sense a hardship but a benefit to his employees and consequently to his plant as a whole. One channel through which education of this kind is planned for the definite help of the inspectors in two states, along with details of the new and forthcoming state codes which have grown out of the revisions of the I. E. S. code discussed in this article, will be outlined in the subsequent paper on the same general topic.

Fan, Blower and Air-Compressor Applications

With reference to his contribution on "Fan, Blower and Air-Compressor Applications," which appeared in the *ELECTRICAL WORLD* for Jan. 26, Prof. C. E. Clewley writes:

"My attention has been directed to a possible misinterpretation which may be made of the statement on page 197 reading: 'With an alternating-current supply all types may be driven by induction motors.' C. M. Lynge of the Pittsfield Works, General Electric Company, has indicated to me that, while this statement is literally true, it might have been elaborated to include both single-phase and three-phase supply.

"Mr. Lynge is engaged in the design of alternating current motors for propeller fans, and he mentions the development by the General Electric Company of a straight repulsion-type motor known as the type H motor for operating propeller fans, and also the fact that exhaust fans are operated most satisfactorily by motors possessing series characteristics in order to give positive starting and to compensate for load changes due to restricted inlets or outlets, to opposing winds and the like. On this account the straight repulsion motor, as pointed out by Mr. Lynge, is desirable. A motor possessing series characteristics may, in fact, readily be used since the direct-current propeller fan is always under load irrespective of outlet restrictions and cannot therefore reach excessive no-load speeds.

"Mr. Lynge also points out the fact that when an induction motor operates a fan in a duct system against a restricted outlet the motor will be heavily overloaded because of the corresponding drop in speed, and that the repulsion motor is therefore preferable to the induction type for fan service. These comments by Mr. Lynge are submitted for the purpose of avoiding any misunderstanding of the statement referred to above."

Logic of Public Utility Consolidations

Both Physical and Fiscal Combinations Are Economical of Investment and Operating Cost and a Public Benefit—Statistics of Progress
—Centralized Power Production

BY CLARENCE P. FOWLER

IT IS generally conceded that public service enterprises are natural monopolies and that the best interests of the public are served when such undertakings are operated as monopolistic but regulated enterprises. When such monopolies are properly regulated and at the same time protected from the unjust attacks of the ever-present demagogue the necessity for competition vanishes. Competition as a means of checking certain corporate abuses has proved itself damaging to the investor in public service securities and it has also been demonstrated that a competitive situation in the operation of utilities is a menace to public welfare.

The inherent monopolistic nature of the public service business is accorded the fullest recognition in those states where commission supervision of public service corporations is most firmly established, notably in New York, New Jersey, Massachusetts and Wisconsin. The position taken by the Massachusetts and Wisconsin commissions is reflected in recent decisions pointing out the failure of competition as a regulator of public utility service and rates.

COMPETITION AND REGULATION ARE CONTRADICTORY

The suppression of competition in furnishing public services has been the outgrowth of bitter experience. In fact, competition and commission regulation are contradictory, and the latter to be effective should be of such a nature that the profits from any one enterprise should not be sufficiently large to warrant wasteful duplication of capitalization through competition for the same business. Particularly is this true when, as is most frequently the case, such competition affords no additional facilities or service and is neither an extension or improvement over existing service.

The unified method of handling public service enterprises is co-operation whereby waste, duplication and the depleting warfare of competition can be avoided. It may also be termed the labor-saving, capital-conserving and modernizing appliance of the public service business.

The tendency to unite groups of public service properties, whether contiguous or not, suggests that consolidations may be divided broadly into two radically distinct classes—physical and fiscal.

The actual union of service in contiguous properties generally involves a certain amount of physical reorganization, bringing the system into unified action and securing the full advantage of single equipment and management. Practically without exception, the public gains by every consolidation of this character.

The American steam railroad corporation may be said to be the pioneer in the movement toward physical consolidation in the public service business on this continent. As an illustration of the adverse circumstances which confronted the shipper or traveler on the early American railroad the conditions at one time existing between New York and Chicago are typical.

One part of this route, between Albany and Buffalo, a distance of only 297 miles, was originally served by no less than eleven individual railroads, owned by as many distinct companies.

Then, again, to those engaged in commerce and transportation it became evident that, with the growth in population, the exchange of commodities between districts of production and consumption would be seriously hampered by unrestrained competition between rival lines, the effect of which is to favor certain towns and cities known as competitive points which are served by two or more railroads. At competitive points, without consolidation of the properties interested, freight rates are usually fixed at little above the cost of transportation, making it necessary for the non-competitive points served by only one line to provide the major portion of the funds required for operating charges, interest and dividends. As a result of this state of affairs population and industry become congested at localities where rail and water competition reduces the cost of transportation, thus rendering it extremely difficult for many industries to succeed in locations which are served by no more than one line of railroad. If, however, a consolidation of railroads, serving a certain territory, is effected, it is conceivable that with such a readjustment of rates between competitive and non-competitive points each will contribute its proper share to the operating expenses and fixed charges of the various constituent companies.

GREAT RAILROADS COMPLETELY UNIFIED

The most recent and impressive example of the consolidation of public service corporations and the fullest recognition of its advantages is found in the decision of our federal government to unify the operation of all of our great transportation arteries into one gigantic railroad system. This contemplates the pooling of all traffic and facilities, the common use of terminals, tracks and equipment, and the hauling of freight by the shortest route regardless of billing.

While this is not a time for captious criticism, however, it is worthy of note that the government has for a generation denounced pooling and has, through the Interstate Commerce Commission, succeeded in repressing it. The adoption of pooling now justifies the assumption that its suppression in the past may be regarded as an error, for the reason that if this method of operation offers the nation a more effective conduct of the industries incidental to the war, it seems reasonable to affirm that it would in the last thirty years have increased the effectiveness of the industries of peace.

Fiscal consolidations, of which the holding company is an example, possess the advantage of bringing a group of properties under a single and intelligent management with strong financial backing and render it possible to make economies and give better service which benefits the public. The holding company greatly

increases the development and service efficiency, as the different departments of operating companies included in a holding company are constantly under the stimulus of competition with similar departments in other companies of the group.

Holding companies make possible the procurement of capital for the development of public utilities which would otherwise not be developed at all or at best would be incompletely or inefficiently expanded. In rare instances are communities able to supply adequate funds for the creation and development of public services of the most approved type. The necessary capital must be secured from without, and this is especially advantageous for sections not fully developed, which are thus enabled to draw upon older and richer portions of the country. The capitalist, as a rule, is not willing to scatter investments in small isolated units throughout the country because it is practically impossible to give each one the proper attention. He prefers rather to invest in the holding company, relieving himself of the burden of supervision while, at the same time, securing a desirable diversification of risk. Moreover, the financial strength and prestige of the holding company is able to command capital and purchase materials and supplies on more favorable terms than the small individual company, and this means better rates.

It is of interest to show the tendency toward the holding company idea in the electric central-station industry as reflected by recent statistics compiled from authentic sources. These figures were gathered primarily to show the number of central stations owned or controlled by syndicate interests, the number owned independently and finally the number of municipally owned plants. These investigations were confined to towns and cities of 1000 population and more and are subdivided separately for communities of from 1000 to 5000 population, from 5000 to 10,000 population, 10,000 to 50,000 population and of more than 100,000 population. The totals for the entire country, eliminating, of course, communities under 1000 population, show that out of 4774 electric lighting plants 29 per cent have syndicate affiliations, 48 per cent are independent and 23 per cent are municipally owned.

It appears that the largest proportion of syndicate plants is in the Eastern States, with the next largest in the New England States, the Western States being third, Middle States fourth and Southern States last. The percentage of municipal plants is largest in the Middle States, with the South next and West third.

PROPORTION OF SYNDICATE PLANTS GROWS

The proportion of syndicate plants becomes larger as the size of the communities increases. Thus the proportion of syndicate plants advances from 20 per cent of the total number of plants for the smallest towns to 87 per cent in cities of the largest size. Conversely, the proportion of independent plants decreases as the size of the community increases; where it was 55 per cent of the total in towns of 1000 to 5000 inhabitants, it decreased to 10 per cent in cities of the largest size. The proportion of municipal properties also decreases as the size of the community increases. Where municipal plants formed as much as 25 per cent of the total for towns of 1000 to 5000 population, the proportion decreased to 3 per cent for the largest cities.

Of approximately \$5,000,000,000 securities invested

in street railways, about 82 per cent are organized into or affiliated with holding companies. Of about \$3,000,000,000 securities outstanding in the electric light and power business, about 83 per cent are operating subsidiaries of holding companies. Of the \$1,500,000,000 outstanding securities of gas companies, in excess of 66 per cent are organized into or affiliated with holding companies. Thus out of approximately \$9,500,000,000 traction, electric light and gas capital about 80 per cent is now organized into or affiliated with holding companies.

ADVANTAGE OF CENTRAL ELECTRICAL PLANTS

Centralized electric power production, with a single high-tension transmission network serving a large area, forms a typical example of public utility consolidation, which is justly claiming additional attention.

Interesting figures concerning an electric lighting and power system serving one of our largest metropolitan centers may be cited. The average yearly load factor (or the ratio of the average to the maximum load) was only about 30 per cent. Further, 97 per cent of the total kilowatt-hour output was produced by 50 per cent of the generating capacity, while it was necessary to have an investment in the remaining 50 per cent of the generating capacity to handle peak loads; but this latter half of the generating capacity generated but 3 per cent of the output. In other words, it may be stated that 50 per cent of the generating equipment was operated at about 46 per cent load factor, whereas the balance of the generating apparatus was operated at only about 5 per cent load factor. This example of the rather poor earning capacity of a large portion of the investment points to the urgent necessity for the creation and development of unified power systems.

That consolidated systems of power supply have not reached their fullest development is illustrated by the writer's recent experiences in the investigation of already extensive properties of this type, which contemplate further transmission line connection with similar systems serving contiguous territory but controlled by outside financial interests.

Modern hydroelectric systems operate to prevent the monopolistic use of water powers, so common in past years, and make possible the subdivision and distribution of these powers in the smallest units, thereby rendering the greatest good to the greatest number. In fact, not only do these hydroelectric enterprises make possible the supply of water power to a great many small consumers that could not be supplied without them, but through the medium of long-distance electrical transmission several powers on the same stream, or even different streams, may be linked together physically, and with the power of several watercourses so connected under common control a great diversity in power demand and supply is secured. Diversity in power supply often means that it is practicable to match the minimum discharge on one stream with a higher on another or to interchange power of streams having large storage capacity with those having little or none, which increases reliability of power supply and in many cases avoids the use of expensive auxiliary steam power, resulting in advantage to the public in keeping down rates and with common control giving the consumer at one point the advantage of securing water power from another point, perhaps 200 miles (321.8 km.) away.

Increasing Carrying Capacity of Underground Cable

The Substitution of Crude Vaseline for Air in Ducts Will Reduce Heating Effect, Eliminate Hot Spots, Decrease Electrolysis and Afford Mechanical Protection

BY E. O. SCHWEITZER

Chief Testing Engineer Commonwealth Edison Company

REALIZING that the dissipation of heat from cables is limited by the high heat resistance of the cables and surrounding medium, the writer has conducted a laboratory investigation in which the space between a section of cable and the inclosing duct was filled with crude vaseline. As a result of the test it was concluded that such practice increases the carrying capacity considerably, eliminates hot spots, decreases electrolysis and affords mechanical protection. Before the practical value of such an arrangement can be determined, however, it will be necessary to conduct investigations in connection with actual installations.

The tests were made on a 45-ft. (13.7-m.) length of 250,000-circ. mil., 12,000-volt, three-conductor cable, 15 ft. (4.6 m.) being run through stone conduit. Measurements of the copper and sheath temperatures were made at different points within the conduit by means of thermocouples. The joints and ends of the conduit were sealed with concrete, a pipe being introduced at either end for filling purposes. The three conductors were connected

in series and current was circulated through them at low pressure. No pressure was applied between conductors and sheath during the various heat runs. A general view of the set-up is shown in Fig. 1.

COOLING MEDIUM EMPLOYED

Crude vaseline, commonly known by the company's employees as "cable grease" and called "dark petroleum" by the manufacturers, was used in this test, as it was found to be inexpensive and to possess good characteristics as a filler for the space between the duct and cable. It has a very high viscosity and does not become fluid at any safe operating temperature for cable. These properties tend to prevent its escape through concrete or tile ducts and may be considered real advantages should the ducts prove pervious to highly

fluid materials. However, it is generally held that concrete is quite impervious, as the latest engineering experience and data indicate that it is being successfully used in tanks for the storage of oil. The filling of the ducts presents no serious difficulty as the grease can be heated until fluid and readily pumped in.

Other methods for the removal of heat from cable in duct lines have been tried, but all of them appear much inferior to the crude-vaseline plan. The use of air blowers by the Duquesne Light Company, Pittsburgh, Pa., for cooling an overheated duct line lowered the temperature of the cable by about 12 per cent. The

high-capacity blowers necessary in alternate manholes make the cost of such a cooling method prohibitive and applicable only in isolated cases. Dissipation of heat by circulating water, tried by other companies, is also inferior on account of the danger from cable failures due to defective sheaths, electrolysis and corrosion.

Some preliminary experiments on improving the heat-dissipating quality of the crude vaseline by introducing other

materials, such as graphite, seem to show that the additional cost will offset any advantage. This phase of the subject will probably be investigated further, however. At the same time the favorable effect of introducing flake graphite in the cement itself will be determined. The possibilities of both these lines of development are strictly limited, however, by the characteristics of the cable now in use.

The "internal" heat resistance of the conductor and belt insulations of cables now in service is a fixed and unalterable quantity. On the other hand, the "external" heat resistance from the cable sheath to the earth surrounding the ducts is a variable and can be decreased considerably by replacing the air now present by materials having better heat conductivity, such as crude vaseline. The resulting improvement in heat dissipa-

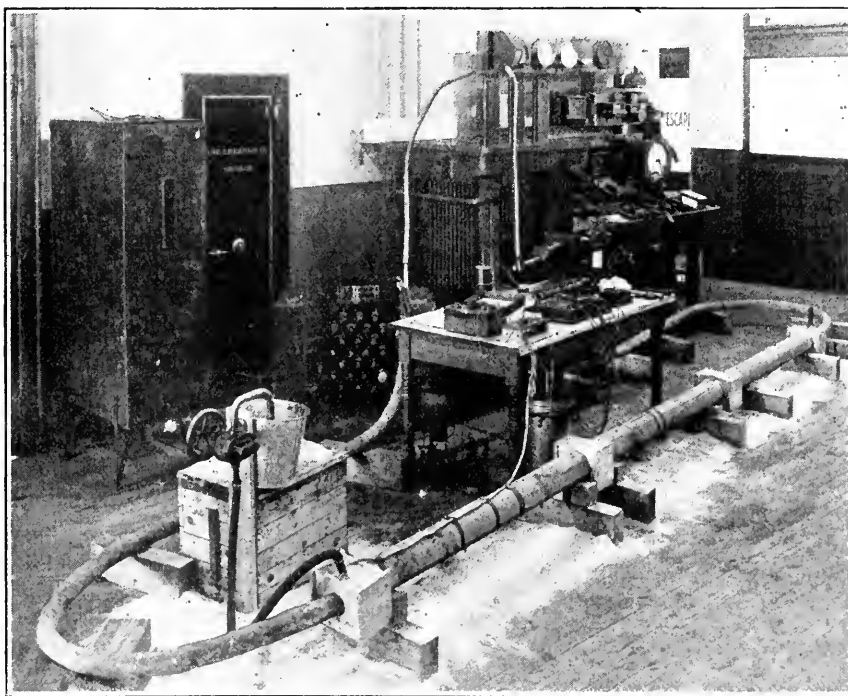


FIG. 1—VIEW OF LABORATORY IN WHICH CARRYING CAPACITY OF CABLE WAS TESTED

tion from conductor to earth, however, will depend on the relation of the "internal" to the "external" heat resistance. This relation for any fixed cable installation is a definite ratio which increases with any reduction in the "external" heat resistance. The degree of effectiveness of any cooling means is thus limited, depending upon the value of this temperature gradient in the cable itself.

For cables now in service test results showed this "internal" heat resistance to be about 60 per cent of the total, with air in the ducts. Hence, if it were possible to introduce a perfect conductor between sheath and earth, the current-carrying capacity could be in-

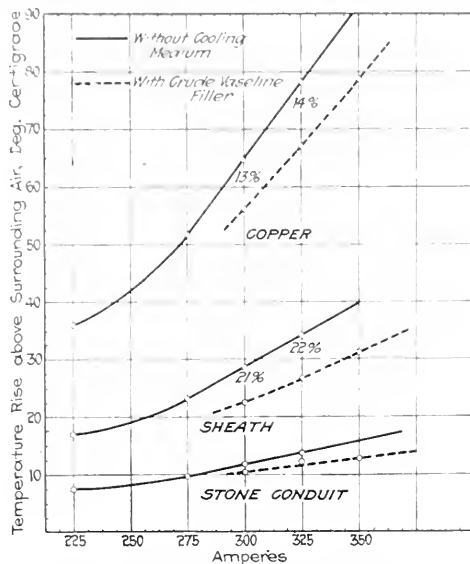


FIG. 2—EFFECT OF CRUDE VASELINE FILLER ON CARRYING CAPACITY OF CABLE

creased only 29 per cent. But if the "internal" resistance were 50 per cent under such ideal conditions, the current-carrying capacity could be increased by 42 per cent. Therefore it is evident that the greatest obstruction to rapid dissipation of heat from cables now in use is in the cables themselves.

This fact emphasizes the desirability of using in all future installations cable in which the "internal" heat resistance is as low as possible. In this connection recent investigation has shown a marked difference in the heat conduction of paper-insulated cables, depending upon the kind of impregnating compound used. The use of vaseline to "short-circuit" the heat resistance of the air ducts, however, has been found to result in notable improvement.

ADVANTAGES OF USING FILLER BETWEEN CABLE AND DUCT

Increased Capacity.—With crude vaseline in the conduit, the copper temperature is reduced 14 per cent at a load of 325 amp., as shown by accompanying heating curves. This reduction in temperature will, of course, permit carrying 7 per cent more load for the same rise. The degree of effectiveness of the vaseline seems to increase at higher temperatures, as shown by slope of the curve. This, together with the elimination of "hot spots," as noted below, will allow a much higher operating temperature for the cable and a corresponding larger increase in capacity.

Elimination of "Hot Spots."—In addition to the more rapid dissipation of heat, a more even temperature was

obtained in the cable itself. A difference of copper temperature of $3\frac{1}{2}$ per cent on the same conductor at points 5 ft. (1.5 m.) apart existed without the filler in the ducts; with it this difference was reduced to 0.5 per cent. As the fundamental cause of many cable failures is overheating at certain "hot spots," such an equalizing of temperature is important. In connection with the present practice of some electric service companies of reinstalling old cable in which weak points are very likely to exist any additional factor of safety seems well worth obtaining.

Decreased Electrolysis.—It is believed that the use of the vaseline as an insulating medium surrounding the cable sheath will eliminate trouble due to electrolysis. Tests have been projected to prove this point.

Mechanical Protection.—The value of the vaseline as a means for preventing the mechanical abrasion of the lead sheath is apparent. Where such faults already exist the grease will be effective in preventing failures.

EXPENSE INVOLVED

Introduction of crude vaseline between the cables and ducts would be attended by considerable saving in many cases in Chicago not only in old duct lines but also in new construction. However, it would not be advisable to consider using it in the entire system of transmission. It would be especially beneficial on circuits which feed the loop district and are operated at maximum load nearly all day, or on certain tie lines that are very heavily loaded.

To replace the air space in stone conduit with grease when occupied with 250,000-circ. mil., 12,000-volt cable will require about 1.5 lb. per ft. (2.23 kg. per m.) of duct length. At 4 cents per pound (8.9 cents per kg.), allowing 2 cents per foot (6.6 cents per m.) for labor, the total cost of introducing filler will be in the neighborhood of 8 cents per single-duct-foot (26.2 cents per single-duct-meter). Assuming an actual circuit having a length of 50,000 ft. (15,240 m.), the investment represented, at \$1.80 per ft. (\$5.90 per m.) for the 250,000-circ. mil. cable, 25 cents per single-duct-foot (82 cents per single-duct-meter) for conduit, and \$3,000 for operating apparatus at generating and substation ends, is \$111,000. To obtain 7 per cent increased capacity with new equipment would cost \$7,770, whereas obtaining it by using vaseline filler would cost only about \$4,000, an approximate net saving of \$3,770. On the basis of increasing the capacity of fourteen lines by 7 per cent a net saving of one line could be realized, where such a large group of parallel lines is required.

Magnets Recover Sunken Pig Iron

The Arrow Transportation Company, operating barges on several Southern rivers, lost one barge in the Tennessee River near Paducah last March. This barge, loaded with 420 tons of sand-cast pig iron, collided with the pier and dropped its load gradually. The loss represented about \$10,000, and the insurance company paid this to the transportation company. The insurance company arranged to recover what it could by means of a lifting magnet purchased from the Cutler-Hammer Manufacturing Company, Milwaukee, and approximately 400 tons were recovered. Because of the rising cost of pig iron it was sold for \$16,000. Total cost of recovering amounted to \$4,000.

Raising Wages with Cost of Living—II

A Plan for Paying Workers in the Electrical Contracting Industry on the Basis of Living Cost as That Cost Is Indicated by Index Numbers of Responsible Commercial Organizations

BY L. K. COMSTOCK

This is the second and final article on the views of Mr. Comstock on this vital topic, first presented before the Conference Club and published here because of the critical character of the relations between capital and labor.

FOR years it has been a common practice to trace general commodity price tendencies and reduce them to a common number called an index number. This index number is indicative of general tendencies and takes due account of both the simultaneous rise and fall of different commodity prices and their proper weighting. There are several institutions producing these index numbers monthly, and they are in general agreement, although developed in different ways.

A cursory examination shows that seven series of index numbers, made by five independent organizations, have a marked family resemblance. The testimony concerning the major facts of price fluctuations from these seven different sources is so unanimous that one can scarcely doubt its validity.

PRICES LIKELY TO CONTINUE TO RISE

In thinking of index numbers it should be remembered that during the last twenty years throughout the gold standard world the general level of prices has been rising, or, in other words, the purchasing power of gold has been falling; that all indications point to the continuation of this tendency for many years to come, and that this progressive shrinkage in the purchasing power of gold is a serious menace to the stability of business, disturbing the normal relations between those forms of income or prices which are relatively fixed, such as interest, rent, salaries and wages, and those which are more promptly adjusted, such as the prices of most staple commodities.

It is entirely within the possibilities that prices may rise more and more slowly until many years hence we shall see the culmination of this rising price epoch unless in the meantime wonderful new gold fields are discovered. The synthetic chemist and the electrical engineer may, of course, check this rising tide of prices in spite of any failure to discover new gold deposits sufficiently large to be effective. The generation which succeeds in producing flour and meal and sugar cheaply, by a synthetic process, will have made vastly more progress in world production than the nineteenth century made when it added the Mississippi Valley and the Canadian and South American plains to the world's producing areas.

Rising prices are by no means an unmixed evil; for a prolonged period of rising commodity prices energizes the business world generally, operates to the advantage of debtors and of owners of production processes, and to the disadvantage of creditors generally, of wage earners, of salaried persons and of receivers of fixed incomes; causes interest rates to rise, lessens the severity of crises and the duration of depressions, and stimulates social reconstruction.

During the decade 1899 to 1909 the general price index rose from 99.5 to 130, an increase of over 30 per cent. In other words, the commodity price level went up faster than the money earnings of labor, according to the figures prepared by the Bureau of Labor Statistics; and hence the real annual returns of labor showed a decline, slight in some trades but large in others. The evidence, then, indicates that all the intrenchments of organized labor, all the legislation in favor of the laboring classes, have failed to prevent the downward trend of commodity wages.

To consider specifically the application of such an index number to the wage scale of the New York Electrical Workers' Union, let us assume a base or par rate of wages, arrived at by mutual agreement, say, for instance, \$5.20, which is the rate that went into effect April 1, 1917. Dun's index number on that date was \$190.012. Let us assume that wages shall be readjusted once in six months. Dun's index number of Oct. 1, 1917, six months later, was \$219.679, or an increase in general commodity prices of \$29.667, or 15.6 per cent.

On the authority of the Bureau of Labor Statistics, the wage earner spends three-quarters of his wages for food, clothing and rent and other things responding to these general price fluctuations; he would, then, set aside \$3.90 out of the \$5.20 for subsistence. The index number for the end of the six months' period indicates that subsistence costs 15.6 per cent more; therefore increase \$3.90 by 15.6 per cent, making it \$4.50, to which should be added the quarter of the base rate not affected by the commodity market, \$1.30, thus making the readjusted rate \$5.80, or a net advance over the base rate of 60 cents per day.

The corresponding Bradstreet numbers are 14.5769 and 16.9117; the difference, 2.3348, shows an increase in the index of almost exactly 16 per cent. Applying this number as before, the adjusted wage is \$5.824, or an advance of sixty-two and four-tenths for the six months' period ending Oct. 1, 1917.

Let us examine the rate of wages of the New York Electrical Workers' Union from the index number point of view over a longer period of time, beginning with the year 1900. The rate in 1900 was \$3.50 per day. The Bradstreet index for that year was 7.88. The average monthly index for eleven months of 1917 was 15.4595. The difference between the two indexes, 7.5995, shows an increase in 1917 of 96 per cent. Increasing three-quarters of the 1900 rate by 96 per cent (\$2.52), the corrected rate for 1917 would be \$6.015, or, in other words, the purchasing power of a wage of \$3.50 in 1900 is just equal to the purchasing power of a wage of \$6 in 1917.

RELATION OF WAGE INCREASES TO CONTRACTS

It may be argued that a periodic adjustment every six months would interfere with contracts in course of execution. Let us admit this objection and at the same

time analyze it. If no allowance were made in estimating future work for the contingency of an unknown advance in the rate of wages due to the change in the index number, then under the conditions specified above the advance of 60 cents would cost the contractor 3.9 per cent, assuming the labor to be 35 per cent of any given contract, or 2.78 per cent, assuming the labor to be 25 per cent of any given contract.

INCREASED LABOR EFFICIENCY A FACTOR

An advance in the rate of wages which apparently increases the cost to the employer 3.9 per cent would be, in my judgment, more than offset by an increased labor efficiency; because the employee would be appreciative of the spirit of co-operation reflected by the adoption and practice of a plan of wage adjustment calculated to protect him against advances in the cost of living, and he would, consciously or unconsciously, respond to such an effort at practical co-operation on the part of his employer.

It should be stated, however, that in the example cited above the index number used might not be quite accurate in this particular application, because it is composed to some extent of factors which affect the cost of living only vaguely and indirectly. This number, for instance, gives the aggregate prices per pound of ninety-six different articles, including not only all kinds of food products, but also thirteen metals, eleven chemicals and drugs, seven building materials, and also raw and manufactured textiles, coal and coke, mineral and vegetable oils, naval stores, and seven miscellaneous articles; but nevertheless it gives a broad general indication of the changes in general price levels, and so perhaps would be as applicable as an index number derived from the price movements of only foods, clothing, rent and fuels.

It may also be argued that this plan of wage readjustment would tend continually to raise wages even beyond the critical point at which the tendency would begin to slow down the industry. This objection leads to a consideration of the fundamental theory of wages.

Labor has a value because its services or products have a value. If the labor is mispent, the product is valueless, and in the long run the labor will be equally so. Labor secures a remuneration because it produces something for which people are willing to pay. In other words, wages depend on productivity. The wages of the laborer depend upon the value of his labor and not upon his wants. But wages vary with the standard of life, and anything which lifts the standard will raise the rate of wages. The highest standard, though, will not prevent wages from falling in the face of a decrease in the demand for the product and a decline in industrial prosperity. However, anything which tends to increase the productivity of labor will raise the rate of wages. Raising the rate of wages in the long run will raise the standard of living, and in general a higher standard of living reflexively raises the productivity.

This being so, we can safely leave this objection as being one which might as well apply to the present method or any other method of readjusting wages.

It will be argued that union men will not be content with a relatively constant wage position in the economic world; that they will demand also an absolute advance, an advance beyond the point indicated by an index number. As long as the national wealth tends to increase

faster than the population, this demand on the part of union labor will be justified and will be justified in some more or less definite ratio to the increase of national wealth. This is the laboring man's only way of participating in an increased national wealth, national surplus, in the creation of which he has had so large a share. The demand for an absolute increase on the part of any particular trade, however, will be restrained by force of public opinion and by economic forces if such a demand is out of step with the demands of other trades requiring equal or similar skill.

Some may say that the advance in wages in the electrical trade has been absolute instead of relative, and they may point to the wages of the Chicago union as an example. Let us analyze this case from the index number point of view. In 1907 the wages in Chicago in the electrical trade stood at \$4 per day. The Bradstreet index number for 1907 averaged \$8.90. On Sept. 1, 1917 the index was 16.6441, and the average index number for twelve months of 1917 was 15.655.

Applying as before the average index number for 1917 to this case, we find that a \$4 wage in 1907 would be equivalent to \$6.28 in 1917. If, however, we compare the average index number for 1907 with the index number for Sept. 1, 1917, when the \$6.25 wage took effect in Chicago, we get a wage of \$6.61, which shows how conclusively the \$6.25 wage is justified and also that there has been no absolute advance whatever.

By the intelligent application of some such plan as the one outlined, there will result as a matter of fact an absolute advance in wages to the union man, due to the fact that he will work more days in the year when and because wage disputes are eliminated. This absolute advance is not one in the economic sense, but purely in the personal sense.

After all, any discussion of the wage question, if confined to the rate of wages per day, is inadequate and superficial; the yearly income is the only important desideratum for a wage earner, as it is also for any person whose income takes any other form.

FIXING THE BASE RATE OF WAGES

There remains the more difficult problem of scientifically fixing the base rate for wages. This is a much more complex problem than applying an index number to raise or lower the base. It would probably be sufficiently correct to assume any present wage as a base rate; it would certainly avoid endless discussions and fruitless speculations on the cost of keeping an average family. Probably all parties concerned would rather avoid the question by arbitrarily accepting the existing rate than to create a new rate, however scientific.

The United States Bureau of Labor has selected the years 1900-1909 for striking an average to serve as a base, or par, for developing its index number. Commodity prices for this period are averaged for the ten years and the result is called 100. If the weighted average of basic commodity prices is 3 per cent higher for 1913, the index number for 1913 is + 3 or 103. A base or par rate of wages could similarly be established from the prevailing wages during the same ten-year period and in as many localities as might be found desirable. Wages could then be adjusted from this par periodically by comparing the index number corresponding to par with the index of the next period preceding the time selected for adjustment.

Liberty Loan Sale Stimulants

The Use of the Spirit of Competition Within the Company to Produce 100 per Cent Participation—Bulletin Boards, Thermometer Charts and Other Methods for Keeping Up the Interest of Employees

IN TWO weeks the national campaign on the third Liberty loan will open, to continue for three weeks. As was pointed out last week, the success of this loan lies not wholly in the total subscription but to a considerable extent in the number of people participating.

To a large extent, therefore, the employers of labor are in a position to make this the most successful of the three loans. Employees must be made enthusiastic



FIG. 1—A TYPICAL GRAPHIC CHART SHOWING PERCENTAGE OF EMPLOYEES SUBSCRIBING

—made to understand why they should lend their money to the government. Plans, therefore, must be laid to insure a 100 per cent subscription in every plant, shop and office in the electrical industry.

An investigation is being made by the ELECTRICAL WORLD of how other employers have interested their help in the preceding loans in order to give to the industry the best results of the experience of others.

Last week the necessity of getting together a committee of the men was emphasized. This week another preliminary step is to be developed—making a plan to stimulate interest throughout the campaign.

Because of the human element in every man, the competition method of sustaining interest is the most common one and the one which is most uniformly successful. Under this method departments can be played against each other or any other division of employees that naturally suggests itself very effectively. Where there are a number of district offices this plan can be followed out between offices.

In using this competitive plan the ultimate goal must be kept well in mind—namely, not total subscriptions, but 100 per cent participation. Therefore the tally

sheets should not record the total subscription, but the percentage of employees taking bonds. This places every department on a more equitable basis for running a race with the other departments.

Undoubtedly the most effective way of keeping these tally sheets is by graphic charts. Fig. 1 shows a suggestion for a company with but one department or where it is decided to hold no intra-company competition. Obviously the idea is to do better in the percentage of employees participating than in either of the first two loans with the bogies set at 100 per cent. This chart should be corrected daily by some authorized person and placed in as conspicuous a place as possible. Those selected to make a personal canvass of employees can make one of their appeals on the basis of the chart.

INTRA-COMPANY COMPETITIONS

If an intra-company competition is undertaken, the chart idea can be carried out much more logically. With one tally master to see that the score is kept right and corrected daily, each participating team or department, or whatever the division may be, is plotted in terms, not of dollars, but of percentage of members subscribing, no matter how small or how large the

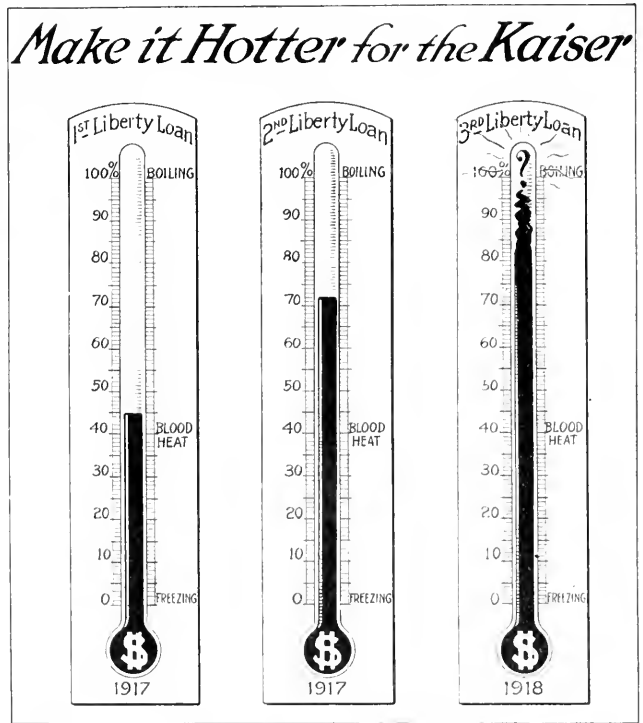


FIG. 2—CAMPAIGN THERMOMETERS HAVE A STIMULATING INFLUENCE

subscriptions. The race then is to see which will first reach the 100 per cent mark, or if none does so, which will stand highest at the end of the campaign.

In this manner a strong feeling can be aroused that will find a ready answer in bond subscriptions. Workmen are not apt to let another department go them one

better, particularly in patriotism, if it can be prevented.

As a further stimulus to a large participation, the employer can afford to allow a bonus of one dollar on every fifty-dollar bond for the members of the first department to reach the 100 per cent mark. Or there are other means. Following the lead set by the national committee, the first department to reach the goal can be presented with an American flag or some similar patriotic token, and this flag or token can be striven for in each succeeding campaign, the holders to keep it until defeated.

Along this same line the thermometer chart usually keeps interest up. In fact, with this type of chart, as illustrated in Fig. 2, the interest becomes more keen as the campaign progresses. As with the other charts, the thermometer method can be used for intra-company competition, using a separate thermometer for each participating team or department, etc. The thermometer is so arranged that the "mercury column" moves upward with the subscriptions.

Besides, the thermometer idea lends itself well to almost numberless catchy phrases embodying the idea of "making it hot for the Kaiser."

In the intra-company competition each participating department should have its own bulletin board showing how the individual members are signing up, and then there should be a master board at some convenient place in the plant or office or shop where the comparative standing of all departments is kept.

As there are only two more weeks left before the campaign starts it is well to see that all preliminaries have been taken care of. (1) Are all committees appointed and do they feel the right enthusiasm? (2) Have arrangements been made for an easily accessible, centrally located Liberty bond desk? (3) Have Liberty loan buttons or other means of designating a subscriber been procured? (4) Are the subscription blanks on hand? (5) Have arrangements been made for bulletin boards? (6) Are the charts or "thermometers," etc., ready? (7) Have arrangements been made for a sufficient supply of Liberty loan literature? (8) In fact, is everybody ready to make the third Liberty loan a 100 per cent success?

Other ways of selling bonds to employees will be described next week, and a plan to steady labor conditions by aid of the Liberty loan will also be described.

Output of Large Generating Systems

Great Growth in Use of Central-Station Energy Shown by Returns from Forty-seven Companies in United States and Canada—Increase More than 4,000,000,000 Kw.-Hr. for Year

THE usual statistics for 1917 on the outputs, peak loads and load factors of the largest generating systems of the country are given on the opposite page. The list has been expanded so that it now contains every generating company in the United States and Canada having an output of more than 100,000,000 kw.-hr. per annum. The aggregate output of the companies listed was 21,000,000,000 kw.-hr., of which the companies operating in Canada generated 3,500,000,000 kw.-hr.

Although the greater part of the electrical energy was generated from water power, it is of interest to note that almost all of the hydroelectric systems having steam reserve stations were obliged to use them during the year. This is indicative of the necessity for further water-power development if our fuel resources are to be conserved. For instance, the great hydroelectric systems on the Pacific Coast had to resort to steam to meet their demands as follows: Pacific Gas & Electric Company, 195,000,000 kw.-hr.; Southern California Edison Company, 144,000,000 kw.-hr.; Southern Sierras Power Company, 7,000,000 kw.-hr.; Portland Railway & Light Company, 23,000,000 kw.-hr.; Puget Sound Traction, Light & Power Company, 5,400,000 kw.-hr.

These statistics show clearly how baseless is the assertion that these systems are overdeveloped hydraulically. The shortage of hydroelectric energy at Niagara is well indicated by the large output that the Buffalo General Electric Company was called upon to turn out in its steam-driven station, where approximately 130,000,000 kw.-hr. had to be manufactured from coal. The dearth of water power is also indicated in the outputs of the Southern power companies, the

Tennessee Power Company turning out by steam over 84,000,000 kw.-hr.; the Alabama Power Company, 41,000,000 kw.-hr., and the Georgia Railway & Power Company, 22,000,000 kw.-hr. Other hydroelectric companies which had to fall back on steam equipment to carry their load were the Adirondack Electric Power Corporation, 51,000,000 kw.-hr.; Rochester Railway & Light Company, 51,000,000 kw.-hr.; New England Power Company, 54,000,000 kw.-hr.; Wisconsin Edison Company, 77,000,000 kw.-hr.; Electric Company of Missouri, 112,000,000 kw.-hr., and the Minneapolis General Electric Company, 75,000,000 kw.-hr., all of which merely confirms the need of further water-power development.

Only one company in the entire list shows a slight decline in output over that of the previous year. All the others show increases, and considering the enormous outputs involved and the handicaps under which the central-station industry was operated during 1917, the showing is phenomenal. All the Canadian companies show large increases, due chiefly to the great demand made for power by war industries. The same is true of many of the Eastern power companies, as, for instance, the Public Service Electric Company, Detroit Edison Company, Philadelphia Electric Company, Cleveland Electric Illuminating Company and the Consolidated Gas, Electric Light & Power Company.

It will be appreciated that there is some duplication in the returns of some of the companies which purchase energy from other sources and include the purchased energy in their returns. For the sake of convenience, similar statistics for the years 1915 and 1916 are published side by side with the statistics for 1917.

DATA ON OUTPUT AND LOAD FACTOR OF LARGEST GENERATING SYSTEMS IN AMERICA
(This includes all companies in the United States and Canada having yearly outputs in excess of 100,000,000 kw.-hr.)

System	1917				1916				1915			
	Peak Load (Kw.)	Date of Peak Load	Yearly Output (Kw.-Hr.)	Yearly Load Factor (per Cent)	Peak Load (Kw.)	Date of Peak Load	Yearly Output (Kw.-Hr.)	Yearly Load Factor (per Cent)	Peak Load (Kw.)	Date of Peak Load	Yearly Output (Kw.-Hr.)	Yearly Load Factor (per Cent)
Commonwealth Edison Company	302,330	Dec. 28	1,488,080,000	44.6	369,740	Dec. 19	1,341,964,000	43.20	337,900	Nov. 29	1,198,636,900	42.50
Niagara Falls Power Company†	152,340	Aug. 11	1,188,221,770	88.97	143,360	Nov. 24	1,015,525,680	80.64	126,320	Dec. 27	899,427,550	81.28
Ontario Power Company of Niagara Falls	123,500	Nov. 11	990,086,100	91.5	123,900	Oct. 12	942,221,900	86.80			737,713,600	
New York Edison Company & United Electric Light and Power Companies	278,097	Dec. 12	954,913,584	39.2	254,824	Dec. 20	856,385,319	38.30	239,416	Dec. 6	740,873,162	35.30
Montana Power Company	147,712	Jan. 11	947,732,014	73	149,740	Dec. 19	867,940,326	84.30	89,000	Dec. 20	489,831,218	84.10
Montreal Light, Heat & Power Company	152,665	Nov. 12	946,832,817	70.8								
Hydraulic Power Company	113,663	June 9	871,363,138	87.6	89,275	Dec. 26	717,079,320	91.50	87,395	Dec. 16	685,619,456	91.00
Pacific Gas & Electric Company	158,272	Nov. 27	854,099,030	61.6	141,008	Dec. 21	768,304,907	62.20	139,540	Dec. 1	725,715,020	59.40
Toronto Power Company	118,000	Dec. 14	800,638,000	84	129,000	Dec. 20	660,873,579	58.40	102,000	Dec. 29	348,000,000	39.00
Southern California Edison Company	166,755	Oct. 11	794,687,405	54.4	60,930	Dec. 28	299,950,513	56.04	56,625	July 13	286,985,095	57.80
Public Service Electric Company	181,500	Nov. 27	734,665,649	46.20	174,000	Dec. 14	608,018,729	39.82	143,000	Dec. 10	490,684,988	37.73
Detroit Edison Company	152,300	Nov. 27	672,200,600	50.4	130,200	Dec. 19	546,925,300	47.80	101,800	Dec. 17	393,129,850	44.10
Shawinigan Water & Power Company	119,000	Dec. 21	633,373,610	60.4	108,000	Dec. 14	478,540,000	50.00	*			
Philadelphia Electric Company	148,931	Nov. 20	600,583,589	46.0	124,260	Dec. 12	444,785,884	35.6	*			
Duquesne Light Company	125,000	Nov. 9	592,375,925	54	101,000	Dec. 21	463,537,660	52.30	83,000	Nov. 29	347,514,317	48.00
Tennessee Power Company	85,200	June 15	547,945,475	73.41	81,650	Dec. 14	483,354,162	67.00	*			
Pennsylvania Water & Power Company	79,011	Dec. 21	516,891,000	68.6	77,000	Dec. 14	417,837,600	61.8	76,000	Dec. 12		51.90
Utah Power & Light Company	86,400	Oct. 31	502,183,040	72.5	68,894	Dec. 6	412,726,000	67.8				
Mississippi River Power Company	74,900	Oct. 6	476,500,000	63.0	82,400	Nov. 27	393,400,000	54.3	77,300	Nov. 18	370,330,680	54.60
Great Western Power Company			457,998,635	71.13	74,100	Dec. 14	408,391,067	62.65	62,100	Nov. 15	337,264,400	62.00
Cleveland Electric Illuminating Company	113,228	Nov. 27	444,735,309	45	84,999	Oct. 25	340,670,721	45.8	*			
Buffalo General Electric Company	95,400	Dec. 6	440,596,100	52.7	65,500	Dec. 14	328,412,550	57.00	62,460			
Puget Sound Traction, Light & Power Company	83,800	Dec. 21	396,600,000	54.0	77,030	Nov. 28	353,697,263	51.8	66,000	Dec. 30	275,766,712	51.20
Consumers' Power Company	94,235	Dec. 6	380,570,917	46	88,544	Dec. 11	315,964,337	43.1	66,930	Dec. 29	245,300,654	52.50
Electric Company of Missouri	92,300		376,891,756	46.5			333,964,652		76,303	Nov. 29	308,759,186	42.60
Union Electric Light & Power Company												
Consolidated Gas, Electric Light & Power Company	69,980	Dec. 4	343,723,580	62.4	55,626	Dec. 11	249,836,310	59.1	40,580	Dec. 20	171,095,74	55.0
New England Power Company	71,500	Oct. 30	300,600,000	48	64,000	Dec. 12	246,000,000	44.00	49,300	Dec. 29	172,863,764	40.05
Alabama Power Company	58,250	Nov. 14	289,715,125	56.7	40,500	Dec. 11	184,345,360	51.07	28,750	Dec. 21	123,882,040	48.00
Wisconsin Edison Company	71,106	Nov. 30	275,666,740	44	64,170	Dec. 5	218,421,711	39.00	52,458	Nov. 19	158,089,543	35.00
Milwaukee Electric Railway & Light Company												
Edison Electric Illuminating Company, Boston	83,966	Dec. 19	265,430,474	36.1	80,539	Dec. 12	239,557,144	33.72	72,802	Dec. 13	208,358,400	32.70
Georgia Railway & Power Company	78,200	April 24	258,607,882	43.1	72,600	Mar. 17	211,872,638		77,100	Dec. 17	179,976,396	26.65
Edison Electric Illuminating Company, Brooklyn	78,000	Dec. 19	255,912,300	37.5	67,200	Dec. 19	253,452,900	38.1	62,000	Dec. 23	188,516,851	34.70
Pacific Light & Power Corporation		Dec. 6	222,146,210	46.16	82,765	Dec. 22	376,308,731	51.76	76,150	Oct. 28	316,098,189	17.30
Minneapolis General Electric Company	51,940	Dec. 13	162,490,264	44	43,640	Dec. 14	171,672,890	44.9	33,100	Dec. 6	128,941,588	44.30
Portland Railway, Light & Power Company	50,620	Dec. 31	218,086,315	49	47,335	Nov. 29	194,146,555	46.5	47,150	Dec. 30	186,372,553	45.10
Sierra & San Francisco Power Company	45,270	Jan. 11	196,669,588	49.44					40,500	Feb. 26	165,913,500	53.50
Washington Water Power Company	36,767	Oct. 20	188,311,100	58.5	30,440	Dec. 14	162,825,400	60.80	28,691	Jan. 29	165,249,020	66.00
Great Northern Power Company	10,000	Oct. 24	180,383,920	51.5	38,200	Nov. 21	163,807,560	48.8	32,000	Nov. 23	165,249,020	50.80
Rochester Railway & Light Company	42,154	Dec. 13	162,490,264	44	40,250	Dec. 16	146,069,428	41.00	37,000	Dec. 15	125,401,451	38.00
Toledo Railways & Light Company	37,627	Dec. 7 & 14	162,061,232	49.4	36,428	Dec. 22	134,842,360	42.2	33,370	Dec. 31	100,168,375	
Adirondack Electric Power Company	42,000	Dec. 18	158,570,164	43.1	41,375	Dec. 12 & 22	151,128,310	41.40	38,000	Dec. 13 & 29	128,640,000	38.20
Virginia Railway & Power Company	37,000	Dec. 18	153,128,026	47.39	33,900	Dec. 18	152,275,500	44.54	20,300	July 21	114,187,385	61.20
Southern States Power Company	25,900	Aug. 9	153,267,885	65.3	22,400	April 28	131,684,265	66.5				
Nevada California Power Company												
Potomac Electric Power Company	44,800	Nov. 17	140,762,616	36.09	38,600	Dec. 18	122,158,818	36.1	36,200	Nov. 30	111,082,725	35.03
Southwestern Power & Light Company	31,500		126,396,800	46	25,600	Oct. 5	95,740,000	43.0	16,600	Dec. 22	87,089,000	44.00
Southern Power Company												
Empire District Electric Company	23,000	April 1	165,487,860	52.4	26,900	Mar. 26	119,280,363	49.7	*			

*No data received.

†Includes Canadian Niagara Falls Power Company.

‡Consolidated with Southern California Edison Company.

STATION & OPERATING PRACTICE

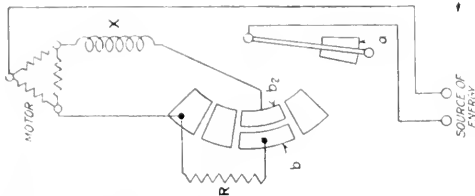
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

CAUSE OF TROUBLE WITH SINGLE-PHASE STARTER

Often Due to Poor Contact Between Moving Contact and Stationary One Connected with Resistance and Reactance

BY E. C. PARHAM

When trouble with single-phase starters having connections like those shown herewith occurs it will usually be found that the contact *a* fails to touch both *b* and *b₂*, or that there is an open circuit in the leads between



SIMPLIFIED DIAGRAM OF SINGLE-PHASE STARTER CONNECTIONS

these contacts and the motor. Failure of *a* to make contact with either *b* or *b₂* may be due to a weak spring or blistered contacts. If any of the faults mentioned exist, the production of a split-phase for starting the motor is prevented.

THE SYSTEM LOAD FACTOR VERSUS STATION LOAD FACTOR

Study of Operating Conditions in an 18,500-Kw. Turbine Plant—Cost of Coal and of Hydroelectric Energy

In making up operating data from central stations where energy is purchased in considerable part a distinction should be made between the system load factor and the station load factor. A study of operating conditions in an 18,500-kw. turbine plant producing 40,507,750 kw.-hr. in 1917 was recently completed. The yearly load factor of the station on the basis of an average output of 4625 kw. and a maximum peak of 14,000 kw. was 33 per cent. Incidentally the coal consumption per kilowatt-hour was 2.64 lb. (1.197 kg.) and the net cost of production at the bus-bar was 9.21 mills for locally generated energy. Coal cost 5.73 per ton at the plant, with rail delivery, and bituminous coal of high grade was burned under boilers equipped with mechanical stokers.

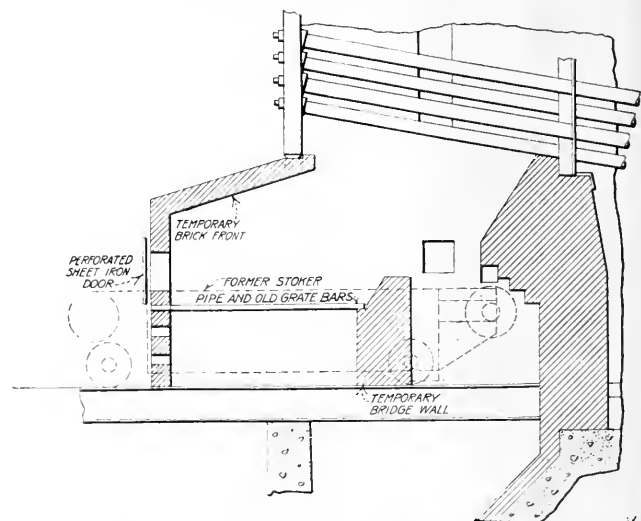
This company, however, purchased 10,670,650 kw.-hr. from a hydroelectric system traversing the State, so that the average load on the system was increased to 5850 kw. and the load factor, assuming a common point of supply, was raised to 41.6 per cent. The net cost of delivery of each kilowatt-hour to the system from the local plant and from the wholesaler of energy was \$429,571, or practically 8.5 mills per

kilowatt-hour. The hydroelectric energy supplied cost about 5.3 mills per kilowatt-hour. The central-station interchange contract with the hydroelectric company resulted in the sale by the former to the latter of 365,400 kw.-hr., at 8.05 mills per unit; but in the main the supply of energy from the water-power system was sufficient to make it necessary to furnish supplementary service only occasionally.

OPERATING A FURNACE WHILE MENDING STOKER

Chain-Grate Stoker Is Backed Out and Temporary Bridge Wall and Brick Front Constructed to Permit Firing

In the power houses of one of the Illinois state institutions where inmates were used as firemen, two 400-hp. stokers failed completely owing to the warping of the shaft at the rear ends of the grate. These stokers were backed out of the furnaces and temporary bridge walls and temporary fronts of brick were placed as shown in the accompanying illustration. Old plain grates secured from other inoperative plants were secured and laid on this foundation of brickwork so that the boilers could be fired by hand through an opening left in the brick front. This opening was closed when



PIPES RESORTED TO FOR GRATE BARS WHILE AWAITING REPAIR PARTS

the men were not firing by a perforated piece of sheet iron which had holes enough in it to keep it from getting red hot.

While the foregoing method of repairing and operating a boiler is not recommended for prolonged service, it did meet an emergency and kept the plant running until the delayed repair parts were received and placed in service.

ESTIMATED TOTAL COST OF SEMI-OUTDOOR SUBSTATION

Consists of an Outdoor Transformer Station and an Indoor Converting and Distributing Station—Will Energize City Street Railway

In the accompanying table the estimated total cost is given of a semi-outdoor substation now approaching completion in Massachusetts for the supply of energy to a Springfield urban street railway from the Turners Falls Power & Electric Company system at 66,000 volts.

TOTAL COST OF SEMI-OUTDOOR SUBSTATION IN MASSACHUSETTS

OUTDOOR TRANSFORMING STATION	
Two 6000-kva., 66,000-13,200-volt transformers (\$2.08 per kva.)	\$25,000
Two 66,000-volt lightning arresters	5,000
Four 66,000-volt oil switches	10,800
Seven 66,000-volt disconnecting switches	1,400
Foundations for equipment	2,000
Copper tubing and insulators	1,174
Water pumps, tools and piping	7,000
Labor of installation	2,100
Engineering and contingencies, 20 per cent.	10,894
Total	\$65,368
INDOOR CONVERTING AND DISTRIBUTING STATION	
Building and foundations, 50 ft. by 70 ft.	\$50,000
Three 1500-kw. motor-generator sets (\$22.22 per kw.)	91,000
Switchboard, thirty-six panels	25,800
Wire, cable and conduit	15,000
Labor of installation	5,500
Engineering and contingencies	37,460
Total	\$224,760
Grand total (\$24.18 per kva.), initial transformer capacity	\$290,128

The exterior equipment includes two 6000-kva. transformers and necessary oil switches, "disconnects" and auxiliary equipment, with lightning arresters mounted on concrete bases in the substation yard. Inside a brick and concrete substation building are three 1500-kw. motor-generator sets, receiving energy at 13,200 volts alternating current and delivering direct current at 600 volts to the local trolley lines.

RELIABILITY OF METHODS OF TESTING GROUND RESISTANCE

Bureau of Standards Opposes Lamp-Bank, Fuse, Single-Voltmeter and Magneto Methods of Testing and Recommends Kohlrauch Bridge

After a series of extended experiments on testing the resistance of ground connections, the Bureau of Standards has come to the conclusion that most of the methods commonly used do not give correct results. Dependable results can be obtained by use of the ammeter-voltmeter method when a proper selection of instruments is made. The disadvantages of this method, however, are the non-practicability, the possible absence of energy supply, the amount of calculation required and the necessity for two auxiliary grounds or one of assured low resistance. If a potential as high as 600 volts is available, direct current may be used as efficiently as alternating current, but this method must be discarded if other ground connections than those to be investigated exist.

A direct-reading, portable, rugged and fairly reli-

able means of testing the resistance of ground connections is found in the use of the Kohlrauch bridge method or a modification of it. A separate source of energy may be obtained from a dry cell, and two auxiliary grounds must be available. Actual practice shows that the Kohlrauch bridge method checks with the ammeter-voltmeter method to within an average of 3 per cent. The error very seldom approaches 10 per cent.

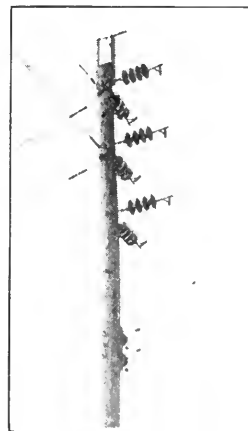
The present-day methods of ground testing used by many electric companies have been found very unreliable. These methods consist chiefly of the lamp-bank, fuse, single-voltmeter and magneto methods. The results by these methods are not even approximately correct. The single-voltmeter method gives a degree of accuracy that depends largely upon the resistance of the voltmeter and possible fluctuations in the voltage of the line.

An extensive study of the effect of high voltage upon the electrode and the surrounding soil showed that the energy liberated at first causes the resistance to decrease about 20 per cent. If the critical value is reached, the soil will commence to dry out and an increase of resistance will follow. It is necessary, therefore, to read the meters immediately on the closing of the circuit.

INEXPENSIVE CORNER FOR LINE WITH MANY TURNS

Right-of-Way Difficulty Solved by Designing Special Inexpensive Type of Corner Construction

The 33,000-volt, three-phase transmission-line corner construction shown in the photograph reproduced herewith was designed especially for a 12-mile (19.3-km.)



TURNING CORNER ON STRAIN INSULATORS SAVES EXPENSE

line in which there are seventeen turns. When the right-of-way was being purchased it was found necessary either to follow this devious route or to pay exorbitant prices for pole rights for a straight run between the plant and end of the line. According to the engineering estimates, this type of corner is about 75 per cent cheaper than a two-pole corner and is approximately 70 per cent cheaper than a buck-arm corner of single-pole construction. The guying for any one of the three types of corners would be practically the same, but the large difference in cost would come in the reduced labor and material charges entering into the construction at the top of the pole.

REMOTE-CONTROL AIR-BREAK SWITCH OF INEXPENSIVE TYPE

Operating Force Imparted by Weight, and Control Impulses Are Electric—Details of the Method of Construction Followed

The San Diego Consolidated Gas & Electric Company has recently utilized remote-control mechanisms to operate air-break switches employed on its 11-kv. distribution lines. Type 1420, style 5008, made by the Pacific Electric Manufacturing Company and rated at 100 amp., 20 kv., are used. The operating handle has been replaced, however, with a distant-control mechanism mounted in a box on the pole, the operating force being imparted by a weight and the control impulses by electricity.

As the switch mechanism is designed primarily for use as switching centers on long suburban 11-kv. feeders, in districts where the only available supply of energy is from the very feeder to be controlled, it was seen at once that motor or solenoid operated mechanisms were out of the question, since the expense of an auxiliary source of supply would be excessive, while if such supply were not furnished, the switch might prove inoperative because of failure in the line at the very time it was most needed.

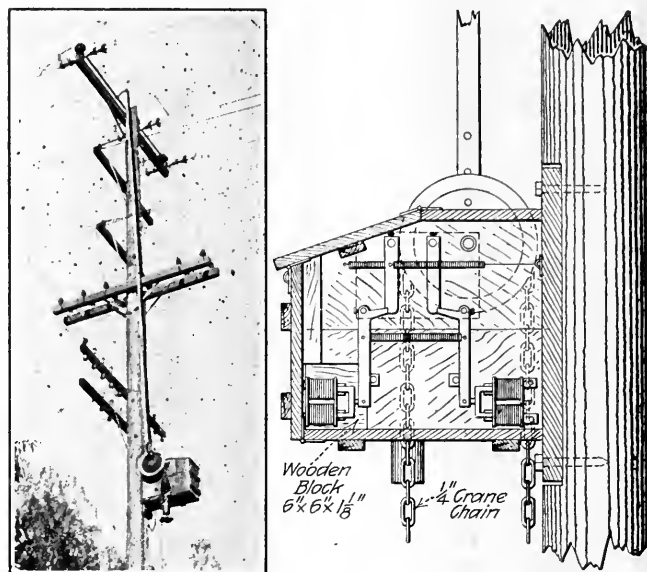
The mechanism consists of a cast-iron pulley wheel, to which the wooden switch-operating rod is attached eccentrically and over which the chain supporting the weight is passed. As the operating impulses are imparted to triggers, the wheel is repeatedly released and arrested, and after each impulse is caused to rotate through a half revolution by the weight. With the rod-attachment point in the upper position the switch is closed; when in the lower position the switch is open, the wheel giving the same throw to the rod as would be imparted by an operating lever when switched by hand control.

It will be noted that at the beginning of each movement the motion of the end of the lever is perpendicular to the normal operating motion, which gives the weight an opportunity to gather momentum and apply the necessary force to open or close the switch properly. At the end of the stroke the motion is similarly retarded, and the large spring interposed between the weight and the chain further takes up the jar of the arrested weight. The chain is endless, and consequently the balance is not changed after successive operations. The weight is attached to the chain by a hook device, and the switch is rewound after several operations by detaching the weight and rehooking it to the chain higher up. Six or eight successive operations are possible (depending on pole height) before the switch requires rewinding, this being as many movements as will ordinarily be desired before an opportunity for re-setting presents itself. An old arc-lamp reel and pulley is provided and the weight can be raised by one man.

The trigger system is designed to give positive operation with small direct-current impulses. For this reason a double system of levers is employed. The turning movement of the weight is resisted by secondary levers, so that there is very little friction on the primary triggers. After release each lever is returned to position by a coil spring. The tripping mechanism is mounted in a heavy poplar box, with top and end hinged to permit ready inspection. A lineman may trip the switch

by hand manipulation of the triggers, or if desired a pair of tripping cords can be run down the pole.

The tripping solenoids are series coils from old arc lamps. A small 24-volt storage battery at the distant control point furnishes the momentary direct-current impulses to operate the switch. A pair of contacts is also provided on the main shaft to operate pilot lamps at the control point, thus affording a return signal to prove the operation of the switch. As the operating current is only momentary and a small switch is provided in the lamp circuit so that the lamps are lighted only during switching or testing operations, the draft on the battery is small and it need be recharged only at considerable intervals. The remote-control operating switch is a double-throw knife switch with positions properly designated "open" or "close." Throwing of the master switch to the wrong position will not affect the



AUTOMATIC AIR-BREAK SWITCH, WITH DETAILS OF OPERATING MECHANISM

tripping mechanism. In order to have the indicating lamps entirely independent of the tripping circuits, five wires are run between the switch and the control point. The switch is tested monthly on a Sunday morning, so as to keep all contacts free.

The switch was designed primarily for use at important switching centers and test points. For instance, in one case an 11-kv. feeder, after passing through several small towns, spreads out over an extensive agricultural district covered with many line hazards in the way of trees, river crossings, brush-fire hazards, etc. A switch of this type is installed beyond the largest town, and the control is installed in the home of the district troubleman near by. In case of trouble on the feeder the line may be quickly sectionalized at this point, and if the trouble is beyond in the agricultural district, as is usually the case, service may be immediately restored over the more important part of the circuit. Considerable time is saved, particularly at night, over the old hand operation, and if the troubleman is absent on his regular duties, his wife may be called on in emergency. In quickly restoring service and in line testing this non-automatic switch is a great improvement over fuses, and in fact it practically replaces a far more expensive automatic oil switch.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

EDUCATING WOMEN IN CENTRAL-STATION WORK

Meeting in Los Angeles Shows Method Adopted for
Giving New Help a General Knowledge
of the Business

That women are more and more making a place for themselves in the conduct of public utility business is recognized. Of late the war has called so many men that women have been forced into utility work that they could probably otherwise have had difficulty entering for years. An evidence of how women are beginning to take hold and how they can quickly be given a general knowledge of the business is contained in the following report of a meeting of 150 women employees of the Southern California Edison Company, Los Angeles, which was held a short time ago. Those who were present are employed in the company's offices in Los Angeles and the adjacent cities. Probably 100 of the company's woman employees were not able to attend on account of distance or other reasons. Only seven or eight men were invited, and they were officers of the company.

The object of the gathering was to inaugurate a series of meetings to be held at regular intervals by the company women, and it is the intention to invite to each meeting one or more officers or department heads, who will address the women on subjects which are to be agreed upon later, but all pertaining to the affairs of the company and the best way to handle them. Miss Gertrude Tucker presided, and in her opening remarks explained that many vacancies had occurred in the executive, commercial and engineering departments during the past year because of the war and that a considerable number of these positions had been filled by bringing into the organization many capable women. Woman's work in the company was increasing every month, not only because of the greater number of women employed, but also because women were filling the positions which had heretofore been reserved exclusively for men.

These meetings are for the purpose of informing the newer women employees as to the history and traditions of the company and educating them as to the company's responsibilities, aims, ambitions and expectations. At future meetings one of the officers will tell of the number and variety of companies which have been consolidated in past years to make the Southern California Edison Company of to-day. Another will tell where the power comes from and where it goes to; another will explain where the money comes from and where it goes to, and still another will tell where the 175,000 consumers are and how they are looked after. Others will discuss such matters as departmental work, taxation, regulation and kindred subjects—all to be treated in an interesting, understandable and non-technical manner.

THE CREDIT DEPARTMENT'S RELATION WITH CUSTOMERS

Methods Adopted by Large Utility for Obtaining
Credit Information and Light and
Power Deposits

When every dollar means so much, when losses must be minimized, the necessity for stricter credits becomes apparent. The credit department of a central-station company therefore occupies a much more important position than formerly. Strict methods calculated to keep down losses are all the more desirable. Such methods are outlined in the following statement showing how a large Middle Western utility takes care of its customers' credits.

TWO CLASSES OF CONTRACTS

Commercial contracts are received in the credit department from the contract department, and on receipt are stamped on a receiving time stamp showing the exact time of arrival in the department. They are then checked off in a receiving book, which is an index as to whether or not the contracts have been received or are being held in the department. The credit slip attached to each contract then receives a number similar to the contract, by which it can be identified later on should it become necessary to refer to it. After a careful examination of the signature on each is made, the contracts, which may be divided as class 1 and class 2, are handled in the following manner:

Class 1—Applications from those claiming to be former consumers and giving address of former location as reference. The account is looked up to ascertain the customer's habit of pay and to find out whether the account is paid up to date. If the investigation proves satisfactory, the application is passed without further delay. If, however, the customer has paid penalty month after month, or if it has been necessary to cut off his service in order to force payment, a deposit for the new address is required.

When a deposit is necessary the customer is so notified by letter and the application is held pending its receipt. Upon receipt of the deposit a deposit certificate is issued and mailed to the depositor and the application is approved for service. When more than the current bills at the previous address are found owing a statement is sent the customer, with a letter notifying him that no service will be given until payment is made. The account in arrears is noted "Notify credit department when paid," so that in the event of the payment crossing the letter in the mail, the bookkeeper will advise of receipt of payment at once and thus avoid unnecessary delay. The application is filed in the holding file, and no service given, until account is paid.

Class 2—Applications from those claiming never to have used company's service. This class of applications

is looked up in the suspense file to ascertain whether the applicant has not overlooked a previous address where service has been used and a balance remains unpaid. If the suspense file discloses such an account, the applicant is advised by letter of such indebtedness and payment requested, the application being held and no service given until payment is made.

DUPLICATE COPIES OF APPLICATIONS

When the suspense account discloses no indebtedness, rating books are consulted, in some cases special reports from the rating agencies are obtained, or references offered as to the responsibility and credit standing of the applicant are investigated. Should the investigation prove unsatisfactory, a deposit is requested which is equal to two months' bills, the amount of the bills being estimated by installation, location and class of business. This deposit is requested by letter and the application filed in the holding file until received.

Owners of real estate in good standing are passed after claim of ownership has been verified. Applicants who object to making a cash deposit can furnish a guarantee from a real estate owner in good standing, or from a responsible business man, guarantor being required to sign a form adopted for this purpose.

A duplicate copy of all resident applications taken in the contract department is received in the credit department each morning. On these applications the service has been given before the credit has been passed so as not to inconvenience the applicant while credit is being investigated. On receipt of these duplicate copies of the application the same routine is followed as with the commercial contracts. When deposits are required which the applicant refuses to pay service is disconnected and the meter removed in a manner to be explained further along.

All letters requesting a deposit or unpaid balance have two carbon copies. One of these copies is attached to the application and filed in the holding file and the other is filed in an every-day file seven days after date. When these copies are reached they are checked with the holding file, and in all cases where the request has been complied with the copies are destroyed, but those from whom there has been no reply receive a second letter calling attention to the first one and requesting a reply. These second letters also have two copies, one of which is attached to the application and returned to the holding file and the other placed in the every-day file seven days ahead. If no response is had to this letter at the end of seven days, the application is removed from the file, and if the applicant has no service at the new address it is canceled and returned to the contract department.

Where a deposit is found to be necessary from applicants for commercial lighting who move into a location where light is already installed and in use, and for all resident applications where service has been turned on before credit is investigated, a shut-off notice is made out at the time the first deposit letter is written. This shut-off order instructs the shut-off collector to call and obtain the deposit or disconnect the service. When the collector calls, unless deposit is received or a good reason given for its not being made, or satisfactory information as to the applicant's credit standing given, service is discontinued. These cut-offs are held ten days, and if the applicant does not call or make some attempt

to satisfy credit, the meter is ordered removed. When the repair department reports back that the meter has been removed the application is canceled and returned to the contract department.

In all cases where commercial applications are held in the credit department the contract department is notified at once why application is being held, and in cases where the applicant is the successor and the service has not been discontinued for the predecessor, status slip accompanies the notice requesting that the successor be billed from the date of his application.

When a final bill is rendered and not paid a statement is made out in duplicate by the collection department and a duplicate copy is sent to the credit department where a record is taken of it on a card and the card then filed in the suspense file. Where the delinquent is a corporation or partnership the credit slip received with the contract is referred to, and the officers' or partners' names and addresses are ascertained and a card made in each of their names, with a notation thereon to refer to the card for the company of which they are members. The duplicate statement is then stamped "Suspense" and returned to the district head in charge of collections, to be used as a check on the collector. The statement is then worked by the collector, and a report of his calls and their results is noted on the reverse side. Should the statement be collected or paid at the office, the statement is returned to the credit department so noted, and the card is withdrawn from the suspense file and destroyed. Should the account prove uncollectible and it be found necessary to send to an attorney, the statement of the collector, with his reports noted thereon, is returned to the credit department and any information of value obtained by the collector is transferred to the suspense card to aid in the collection of the account later if opportunity arise.

The value of the suspense file depends in large measure on obtaining the applicant's full first name. If the customer insists on signing the first initial only, he may be allowed to do so, but effort is made to find out what the initial stands for and to note this on the application. The number of suspense cards made out and filed by this company averages approximately 3500 per month, and the average monthly revenue obtained from this file during the past year amounted to \$800, or almost \$10,000 in the course of the year.

HANDLING MERCHANDISE SALES ORDERS

Merchandise sales orders are handled as are light and power applications. Many firms are trading on open account with this company, and some accounts must be watched closely, letters being continually written requesting payment on slow accounts, and in a few cases credit being stopped completely pending settlement.

A card file is kept in the department showing customer's name, service location, date signed, the predecessor's name if it is a successor application, the name of the company's agent obtaining the business, and the order number of the contract, which number agrees with the number on the credit slips. Another file is kept which shows all deposits of record, by whom made and for what address, and still another file for line extension advances, which are taken by the credit department and either applied on the light and power account, if the customer is a consumer, or transferred by journal entry to a holding account.

SALES BULLETIN FOR ALL THE EMPLOYEES

Sheet Designed to Help Those in Every Department to Turn in Domestic Business on Commission Basis

In its endeavor to increase the sale of electrical energy in the home through a more liberal use of appliances the Public Service Company of Northern Illinois has started publishing what is known as the *Public*

SALES BULLETIN

ANNOUNCEMENT OF NEW SALES POLICY
Company to Pay Commission on Sales

Ladies and Gentlemen:
Meet Mr. Ironmonger.

This energetic little man, whom you see at your left, represents a commission of 5% which the Company will pay you on Gas and Electric Appliance Sales which you make. Now just a moment.

Don't all you at once!
We know you are not in the Sales Department; and that this is not a part of your work, and that you have had no experience in selling, and all that.

To begin with: It is not expected that you will neglect your regular duties to do sales work. This plan is based on the proposition that each one of our 2,000 employees has a certain number of friends, and neighbors, who are customers of the Company, and who they come in contact with from time to time.

If you will only take advantage of this opportunity to call their attention to one or more of the many gas and electric labor saving devices we have for sale, you will be surprised to see, "How easily a sale is made." And after each sale, Mr. Ironmonger will come around with the 5%.

Now as to Experience:
The first salesman that every lived, began without experience. His experience came only after repeated effort. Who can say but that in our organization of 2,000 employees, there are many potential salesmen and saleswomen.

Now is your chance to demonstrate your sales ability, and incidentally add to your bankroll. Opportunity in the person of Mr. Ironmonger is knocking at your door. It is up to you to let him in.

Inspiration is more likely to strike a busy man than an idle one.

Hustle will get you more than hushes.

Don't wait for opportunity. Go after it.

Be a Live Wire and you won't get stepped on. It is only the dead ones that are used for door mats.

SALES BULLETIN ISSUED MONTHLY FOR THE INFORMATION OF EMPLOYEES

Public Service Sales Bulletin. This one-sheet folder will be published monthly and will be distributed with the pay envelopes of the employees. The first issue contains an announcement that the company will pay a commission of 5 per cent to its employees on all appliance sales.

The rules governing the payment of these commissions to employees are as follows: All employees are eligible except division superintendents, assistant division superintendents, gas salesmen, industrial gas salesmen, electric salesmen, electric power salesmen and clerks in sales rooms. The commission of 5 per cent will be paid to all other employees on retail sales of gas and electric appliances, except gas ranges, gas stoves, incandescent lamps, fans and automobile-charging outfits, for use in the homes of customers of the company. The commission is payable as soon as the customer pays for the appliance, and in the case of deferred payment sales as soon as the customer has made the second payment. The commission will be paid monthly on or about the fifteenth of the month following the sale. The employee must obtain a signed order in duplicate from the customer on a form provided for the purpose. The employee must make sales

during his spare time or after the company's regular business hours. Employees must find their own customers; if they are unable to close the sale, they may, if they so desire, ask the division salesman for assistance, and by mutual agreement divide the commission in such cases. Appliances will not be placed on trial.

HYDROELECTRIC COMPANY ADVERTISES FUEL SAVING

Interesting Circular Points Out the Way in Which One Company in 1917 Saved 300,000 Tons of Coal

The Southern Sierras Power Company of California, in a concise circular entitled "Electricity's Part in Fuel Saving," recently gave its customers some interesting data on the saving which water power has made and can make in the amount of commercial fuel used in California. A copy of the circular distributed to the customers is shown herewith. It points out that in 1917 the Southern Sierras Power Company and associated companies generated 148,267,885 kw. of electrical

ELECTRICITY'S PART IN FUEL SAVING

So serious is the coal shortage throughout the United States that it has become the patriotic and imperative duty of each individual to aid to the utmost in the conservation of commercial fuel.

This can best be done by the use of electricity, generated solely by water power, which has the recommendation and approval of the government.

The generating of hydroelectrical energy requires no fuel.

Even the water turning the wheels of the enormous power plants operated by this company is not consumed or contaminated, but returns at once and without diminution to its natural channels. During the year 1917 the Southern Sierras Power Company and associated companies generated 148,267,885 kw.-hr. of electrical energy (all but 6 per cent of which was water-generated), which in its many uses is doing work in the mines, factories, farms and homes of this great Western territory that otherwise would have necessitated the use of 300,000 tons of coal. It would have required 7500 coal cars to have transported this vast quantity of coal to the consumers.

To curtail your use of electric service, or to fail in utilizing electricity to the very fullest extent in business and in your home, is to fail in doing your full share to support the government's fuel conservation policy.

There are many uses in every business and in every home for electric service where a direct and material saving of coal will result.

Electric cooking and electric ironing are important factors.

In residences, hotels and restaurants throughout this company's territory electric service is being used to-day for cooking, and by using electricity for this purpose these consumers are saving the government an equivalent amount of coal annually.

If our 11,000 consumers used electricity for cooking, the saving would be 150,000 tons of coal annually.

In practically every industrial pursuit in the West electricity is simplifying production, abolishing wasted effort, increasing production, cutting operating costs—and SAVING FUEL.

THE SOUTHERN SIERRAS POWER COMPANY

energy, all but 6 per cent of which was water-generated, and in so doing eliminated the necessity of the same power consumers using 300,000 tons of coal which it would have required 7500 coal cars to transport. The circular also points out that if the company's 11,000 consumers used electricity for cooking the saving in coal would amount to 150,000 tons annually.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Periodical Insulation Tests.—P. M. LINCOLN.—The article contains replies from twenty-five out of about eighty electric service companies in twenty-seven states to the following questions: What companies apply potential tests to the insulation of their generators and other similar apparatus? (2) How frequently is such a potential test applied? (3) What test voltage is applied (measured in terms of normal operating voltage)? The main information was contributed by the Commonwealth Edison Company, the Niagara Falls Power Company, the Interborough Rapid Transit Company of New York City, the Edison Illuminating Company of Brooklyn and the Philadelphia Rapid Transit Company. Of the eighty replies received, seventy-five admitted more or less frankly that no attempt has been made to apply periodical high-potential tests to generator apparatus for the purpose of determining the condition of the insulation after the apparatus has once been placed in service.—*Electric Journal*, March, 1918.

Essentials of Transformer Practice.—E. G. REED.—Seventh installment of a series of articles on this subject. In the article the author discusses the initial rate of temperature rise, temperature gradient between windings and oil, heating and cooling curves, overload temperature-rise curves, and safe maximum operating temperatures.—*Electric Journal*, February, 1918.

Generation, Transmission and Distribution

Ground Connections for Distribution Systems.—W. C. HESTON.—The great cost of the prescribed ground for overhead distributing systems led a Portland company to experiment with various types of ground to see whether a less expensive method might not be found which would meet requirements. The results of these comprehensive tests and the conclusions drawn from them are presented in the article.—*Journal of Electricity*, March 1, 1918.

Long-Distance Transmission in Germany.—(Abstracts from data given by F. Niethammer in a recent issue of *Elektrotechnik und Maschinenbau*.) The author gives some particulars of the generation of electricity in Germany, which in 1916 amounted to 10,000,000,000 kw.-hr., as compared with 2,600,000,000 kw.-hr. in 1913, and discusses a possible electric network covering the entire country. The potentialities of water power are being much appreciated in Austria and Germany, and schemes are being promoted for the utilization of a large part of the power to be derived from waterfalls in the Austrian Alps. It is also stated that in the near future Germany aims at the complete electrification of all her railways and the erection of super-generating stations using power derived both from water and from the exploitation of her large fields of turf and bituminous coal. A still further development in the general industrial use of electricity in large cities

for heating, lighting and power is considered probable.—*London Electrician*, Feb. 8, 1918.

Combustion of Coal and Design of Furnaces.—HENRY KREISINGER, C. E. AUGUSTINE and F. K. OVITZ.—After several years of experiments in fuel combustion in a special furnace the Bureau of Mines, Department of the Interior, makes the announcement that from the results it has obtained it is possible to design a furnace with considerable more assurance as to its capabilities than has heretofore been possible. The process carried on in the combustion space is influenced by many factors, the most important of which are the volume and shape of the combustion space, the kind of coal used especially the character and amount of volatile matter it contains; the rate of firing, the quantity of air supplied over the fuel bed, the rate of mixing the air with the combustible rising from the fuel bed, the rate of heating the coal, and the temperature in the combustion space. The qualitative effects on the rate and completeness of combustion of many of these factors have been known for a long time, but the quantitative data presented in definite units of seconds, pounds, feet or percentages, have been lacking. To obtain such definite information a study of combustion in the space beyond the fuel bed was undertaken, and the results of extensive tests are given in this bulletin. About 100 elaborate tests were conducted in a special furnace using three kinds of coal—Pocahontas, Pittsburgh and Illinois—and at rates of combustion covering the full range found in practice. These are believed to be the most extensive tests of the kind ever undertaken. While the bulletin is especially for those interested in the design or reconstruction of fuel-burning furnaces it contains much of interest to the general engineer interested in fuel problems. Some of the statements are as follows: The size of the combustion space required appears to be directly proportional to the percentage of oxygen in the moisture-free and ash-free coal. The percentage of excess air that gives the best results varies with the size of the furnace and the kind of fuel. This fact explains why in one plant the highest efficiency may be obtained with 14 per cent of CO₂ in the gases and in another plant with only 10 per cent of CO₂. There is a definite relation for each coal between the excess air supply and the percentage of CO₂ in the furnace gases. Soot is formed at the surface of the fuel bed by heating the hydrocarbons in absence of air. It is not formed by the hydrocarbon gases striking the cooling surfaces of the boiler. As a matter of fact only a very small trace of the hydrocarbon gases ever reaches the surface of the boiler. Hydrocarbons that do so are prevented from decomposition by the cooling effect of the contact. The cooling surfaces do not cause the formation of soot they merely collect soot and prevent its combustion. It seems that most mechanical stokers are smokeless.

not because they burn the smoke, but because they burn the coal in such a way that very little soot or smoke is produced. Hand-fired furnaces are smoky because soot is produced in or near the fuel bed and cannot be burned in the limited combustion space of the furnace.—*Bulletin* 135, Bureau of Mines.

Traction

Connecticut Company's Power-Saving Campaign.—WILLIAM ARTHUR.—Systematic educational work has reduced the energy consumption per car-mile by 11 per cent in five months. The general details of the plans are given.—*Electric Railway Journal*, March 2, 1918.

Six-Motor Multiple-Unit Trains for Montreal.—KEITH McLEOD.—Details of a system of two-car semi-trail operation on grades up to 13 per cent. Among interesting features that are pointed out are the multiple-unit control with hand and automatic acceleration, semi-automatic brake system, emergency opening coupler and air-operated doors with safety interlocking control.—*Electric Railway Journal*, March 2, 1918.

Voltage Regulator and Phase-Balancer Regulator Equipment of Philadelphia Electric Company.—R. M. CAROTHERS.—The equipment described in this article was installed to distribute a heavy single-phase railway load over the three phases of the generators. The boosters with their independent exciters maintain constant voltage on the phase from which the railway load is taken, and a shunt phase converter distributes the load to the other two phases and maintains the voltages of these phases equal to that of the first. The single-phase railway load at times reaches the value of 24,000 kva., and the manner in which this load is smoothed out is shown by a chart from a recording voltmeter. Records from the indicating wattmeters and ammeters also show how satisfactorily the phase converter adjusts the load between the three phases.—*General Electric Review*, March, 1918.

Installations, Systems and Appliances

Voltage Regulation of Three-Phase Feeders by Automatically Controlled Induction Regulators.—M. UNGER.—This article treats of the voltage regulation of a three-phase feeder by one three-phase automatic induction regulator and by two or three single-phase automatic induction regulators. Three means are thoroughly discussed and the conclusion is drawn that two single-phase regulators will maintain a better regulation on a three-phase three-wire feeder, carrying mixed power and lighting load, than will a three-phase regulator. The cost, losses and efficiency of either method of regulation will be practically the same. In case it is desired to obtain the best possible regulation on all of the three phases a third single-phase regulator should be added.—*General Electric Review*, March, 1918.

Selection of Steel-Mill Auxiliary Motors.—J. D. WRIGHT.—The functions, mechanical layout and operation of blooming-mill manipulators are discussed. Conclusions are reached as to the size and type of motors as well as the type of control best suited for driving these auxiliaries.—*Proceedings A. I. E. E.*, March, 1918.

Economic Industrial Applications of Electricity.—NORMAN T. WILCOX.—Among the subjects discussed by the author in this paper are the following: Economic

uses of electric service, industrial and domestic service, economy of isolated plants, the electric vehicle, refrigeration, electrochemical applications, electric steel furnaces (basic and acid process) and furnaces for non-ferrous metals.—*Journal of the Western Society of Engineers*, October, 1917.

Wires, Wiring and Conduits

Current Capacity of Copper Busbars.—F. M. BILLHIMER.—Considering direct-current conductors, the author says that since the temperature rise of a conductor carrying a direct current depends upon the amount of surface exposed to the air and the resistance of the conductor, it is evident that a conductor large enough in cross-section to carry several thousand amperes with a given rise can be replaced by several small conductors with a total surface greater than that of the large conductor, but with a smaller total cross-section. Problems which are encountered in the application of conductors to direct-current circuits also apply to alternating-current circuits, but in addition to the limits which resistance, shape and spacing place upon the capacity of the direct-current conductor, skin effect and mutual induction must also be considered, as these factors cause non-uniform current distribution in the alternating-current conductor. For laminated-bar conductors arranged with vent ducts and carrying alternating currents the current distribution will, in general, be made as nearly uniform as possible by separating the conductors as far as practicable and making the thickness of the conductor a minimum. For mechanical reasons the thickness of individual bars cannot be reduced too far. In general, no exceptional mechanical difficulties should be encountered in handling currents of 2000 amp. or 3000 amp. For heavier currents careful consideration must be given to the design of both direct-current and alternating-current conductors. Tables and curves are presented giving the effect of spacing on the current-carrying capacity of direct-current copper conductors, variation of temperature with different bar spacings, effect of spacing on current-carrying capacity of conductors, etc.—*Electric Journal*, March, 1918.

Electrophysics and Magnetism

Edge Effect in Copper Bars at Electric Lighting Frequencies.—The results of experiments made to determine the extra resistance due to non-uniform current density in large copper bars carrying alternating currents at 60 and also at 25 cycles per second. Under the conditions which existed in the test, the ratio of the alternating-current resistance to the direct-current resistance is 1.1 to 1.3 at 25 and 60 cycles respectively. These results indicate that the edge effect in large copper bars is of considerable practical importance at ordinary lighting and power frequencies. The ratio of the alternating-current resistance to the direct-current resistance in circular copper bars having the same cross-section as the rectangular bars investigated was less than half that found in the latter. The largest resistance ratio found was 2.2 at 61 cycles in the case of a loop 4.9 m. long with its sides 5.1 cm. apart. Each side of this loop was composed of three copper bars in parallel, clamped in such a way that the individual bars were 6.35 m. apart.—*Journal of the Franklin Institute*, March, 1918.

Electron Discharge Apparatus.—Description of a new form of vacuum tube in which the filament consists in part of thorium, which at a given temperature has a much greater electron emission per unit surface than refractory metals such as tungsten. With this tube substantially the same electron emission per square centimeter has been obtained at a temperature of about 1300 deg. to 1380 deg. K. as with a pure tungsten filament at 2000 deg. K.—*Wireless Age*, January, 1918.

The Electrical Properties of Some High-Resistance Alloys.—M. A. HUNTER and F. M. SEBAST.—In this article the authors point out that high-resistance alloys must be sought for among those combinations in which metals are in solid solution in one another. An increase in the resistivity of an alloy is usually associated with a decrease in the temperature coefficient, although this is not always so. Ternary alloys have in general a higher resistivity than binary alloys of the same approximate composition. The highest resistivities in the binary alloys were found with nickel-manganese and nickel-chromium alloys. In ternary alloys the highest resistivities were met with ferro-nickel-manganese and ferro-nickel-chromium and copper-nickel-chromium. Chromium alloys withstand oxidation at high temperatures better than the corresponding manganese alloys. Wires of low temperature coefficient were found chiefly among the copper-nickel-manganese alloys. A series of alloys of copper-chromium are indicated which have relatively high conductivities and tensile strengths.—*Rennselaer Polytechnic Institute, Bulletin No. 10*.

Units, Measurements and Instruments

Characteristics of Current Transformers on Open Circuit.—W. R. WOODWARD.—By means of vector diagrams the author explains the operation of a current transformer under normal and open-circuit conditions. Curves are given showing typical current-transformer current and voltage waves with the corresponding flux wave and hysteresis loop for high-grade transformer steel. Reference is made to two methods of measuring the peak voltage on open circuit—one by the crest voltmeter and the other a modification of this method. It is pointed out that when the secondary is open the voltage will, in general, be increased with greater area of magnetic circuit, greater number of secondary turns or higher frequency. The converse is also true.—*Electric Journal*, February, 1918.

Telegraphy, Telephony and Signals

Telegraphic and Telephonic Progress in the United States.—A reprint from the *Annales des Postes, Télégraphes et Téléphones* of the general features of the report submitted by the engineers sent by the French government to examine into American methods and progress in the administration of the post office and in telegraphy and telephony. Results achieved in long-distance telephony, in radio-telegraphy and radio-telephony and in the use of multiplex printers in the reception of telegraphic messages are among the things commented on appreciatively by the visitors.—*Revue Générale de l'Electricité*, Feb. 2, 1918.

Telephone Exchange Transfers and Their Organization.—F. G. C. BALDWIN.—(Abstract of paper read before the Institution of Electrical Engineers.) After giving three ways of effecting telephonic exchange transfers, the author discusses the relative advantages

of each and outlines the problems involved in carrying out the various steps of the transfer. Methods of extracting the heat coils, withdrawing the fiber separators, providing testing and other facilities, changing all of the circuits by making T-connections and handling the exchange organization while the transfer is being made are discussed. The steps which can be taken to secure uniformity of attention to calls, to preclude interruption of service, etc., are outlined.—*London Electrical Review*, Feb. 22, 1918.

Telegraphy Through the Ground.—CHARLES NORDMANN.—A recent order of the German General von Galwitz contained instructions telling how the Germans are using a method of communication known as "telegraphy through the ground." In general, it is a method of communication which is a compromise between wireless telegraphy and one-wire telegraphy. One feature which the new method and the wireless method have in common is that two communicating stations are not connected by wire. They differ in that the wireless sends its waves through the air while the new method transmits them through the ground. These currents are nothing more than induction currents. A wire is placed along the fighting front with both ends extending into the ground, and current is produced in the circuit by some such means as a Rhumkorff coil. Installed similarly at some distance from this wire and parallel to it is another wire in which current is induced by the first, thus permitting the sending of signals from one station to another.—*Le Matin*, Jan. 18, 1918.

Miscellaneous

Horsepower Obtainable from French Rivers.—More than 9,000,000 hp. is obtainable from French rivers for 180 days in the year. Corresponding figures for other European countries show that France is especially favored in this respect, her water-power resources being considerably larger than those of Norway, Sweden or Italy, or, in fact, of any other country, except perhaps Russia, for which no statistics are given. It is also interesting to note that, although the German available water resources amount to only about 1,500,000 hp. per annum, she has utilized 31 per cent of them, whereas only 10 per cent of French water power is yet developed.—*Railway Electrical Engineer*, February, 1918.

Empirical Method for Determining the Ultimate from the Proximate Analysis of Coal.—J. P. CALDERWOOD.—Considered from the chemist's viewpoint, the empirical equations given in this article will not give accurate results, but they are suitable in connection with boiler testing. From an analysis of the possible errors involved, it is interesting to note that the largest error introduced is 1.4 per cent approximately, and that is produced in finding the theoretical air required per pound of coal. Another error which is introduced in calculating the terms of the heat balance amounts to about 8.5 B.t.u. Some relation between the hydrogen volatile matter, fixed carbon and heating value may be developed, the author says, which would add materially to the accuracy of the equations. In deriving the relation between the proximate and ultimate analysis of the coal, a theoretical formula was first established, found from observation or experimental values which contain the coefficients in a literal form.—*Pennsylvania State College Bulletin*, Vol. XI, No. 14, Nov. 15, 1917.

NEWS OF THE INDUSTRY

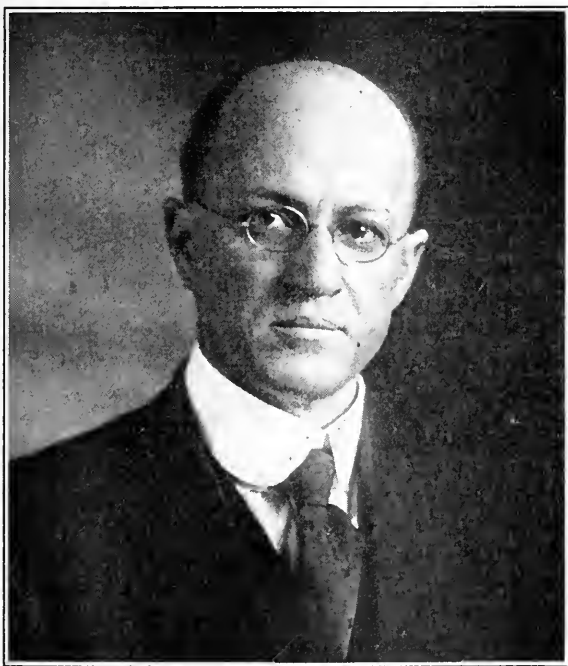
Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

PROF. COMFORT A. ADAMS FOR NEXT A. I. E. E. PRESIDENT

He Is the Nominee of the Directors for Chief Executive of the Institute in the Year Beginning
Aug. 1, 1918

Prof. Comfort A. Adams of Harvard University and the Massachusetts Institute of Technology is the nominee of the directors of the American Institute of Electrical Engineers for president for the year beginning Aug. 1, 1918. This is substantially equivalent to his election.

The board has selected from the list of nominees its directors' ticket. Ballots, which will be sent to Institute members the latter part of this month, must be mailed, in order to be voted, to reach the office of the secretary, New York, not later than May 1.



COMFORT A. ADAMS

The list of directors' nominees to be elected at the annual meeting on May 17, 1918, is as follows:

For President—Comfort A. Adams, Cambridge, Mass.
For Vice-Presidents—William B. Jackson, Chicago; Harold Pender, Philadelphia; John B. Taylor, Schenectady; F. B. Jewett, New York; Allen H. Babcock, San Francisco; Raymond S. Kelsch, Montreal.
For Managers—Frank D. Newbury, Pittsburgh; G. Facioli, Pittsfield, Mass.; Walter I. Slichter, New York.
For Treasurer—George A. Hamilton, Elizabeth, N. J.

Comfort Avery Adams, the newly elected president of the American Institute of Electrical Engineers, was born at Cleveland, Ohio, in 1868. He was educated at the Case School of Applied Science, where he received

the B.S. degree in 1890 and the degree of E.E. in 1895.

Professor Adams assisted in physics prior to his graduation; he was engaged in engineering design in 1890 to 1891. In the latter year he became an instructor in engineering at Harvard University, being appointed assistant professor in 1896. Ten years later he became full professor, and since 1914 he has been Abbott and James Lawrence professor of engineering at Harvard and the Massachusetts Institute of Technology.

Professor Adams has been actively engaged in consulting engineering for the past sixteen years, among his clients being Stone & Webster, Boston; American Tool & Machine Company, Boston; Warner Sugar Refining Company, New York; Simplex Wire & Cable Company, Cambridge, Mass.; the Okonite Company, New York, and the Boston Edison company. He was a member of the international jury of awards (department of electricity) at the Louisiana Purchase Exposition, St. Louis, Mo., in 1904.

Besides being a member of the Engineers' Club of New York and other organizations of non-technical character, Professor Adams is a fellow of the American Academy of Arts and Sciences and of the American Institute of Electrical Engineers, having been chairman of the Boston branch in 1905 and 1906, and is secretary of the standards committee of the American Association for the Advancement of Science. Professor Adams also is a member of the Institution of Electrical Engineers, London; of the Illuminating Engineering Society, Society for the Promotion of Engineering Education, American Physical Society and National Electric Light Association.

He has contributed many scientific papers to the technical press and is the author of "Dynamo Design Schedules."

Professor Adams has a host of friends in the electrical profession, who have been drawn by his sterling worth as a man no less than by his scientific and engineering attainments. He has never lost touch with the practice of his profession, although much of his work has lain in the fields of theory and investigation, and his interest in so-called "practical" affairs has led him to contribute many valuable discussions to engineering society meetings.

National Contractors Now in New York

The National Association of Electrical Contractors and Dealers announces that since March 20, 1918, the organization headquarters have been at Room 1703, 110 West Fortieth Street, New York City.

This change, it is agreed, is to the best interests of the association and the industry in general, says Harry C. Brown, the secretary, in announcing the opening of the new headquarters.

Hearings on Administration Water-Power Bill

Congressional Committee in Receptive Mood, and the General Atmosphere Appears Favorable for Legislation Permitting Development Under Conditions Attractive to Private Capital

HEARINGS on the so-called "administration" water-power bill were held in Washington this week before the joint power committee of the House of Representatives which was recently created to pilot the measure through the House. The atmosphere which permeated the committee room was unlike that at other water-power hearings, and there were unmistakable signs that the committee appreciates the necessity of water-power development and is anxious to ascertain under just what conditions private capital can be induced to accept the financial burdens incident to such development.

While every effort is being made to safeguard the interests of the government and of the consuming public, the disposition is to be as liberal as possible in other details so that no injustice shall be done.

Government officials themselves have experienced a change of heart, and there has been no bitter attack on the "water-power trust" or grasping monopolies. In fact, some of the Congressmen have been at pains to draw out from witnesses whether there was such a thing as a "water-power trust" and seemingly were convinced from the answers that no such trust exists or has existed.

Now and then the chairman of the committee, Congressman Sims of Tennessee, put leading questions which might cause one to suspect that the government itself might engage in hydroelectric development if permitted to do so under the Constitution.

None of the witnesses who appeared up to Thursday morning had any serious objections to make to the measure as a whole, which they considered to be the best of its kind thus far offered, and the amendments and changes which they suggested had in view the elucidation of some of the minor features or a change to make the bill more attractive to private capital.

The position of the government with reference to the bill and to water-power development in general was outlined by O. C. Merrill of the Forestry Service, who appeared before the committee on Monday and Tuesday. H. J. Pierce of Seattle, Wash., Calvert Townley of the Westinghouse Electric & Manufacturing Company, New York, and E. K. Hall, vice-president of the Electric Bond & Share Company, were heard on Tuesday afternoon, and John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company of San Francisco, took up all of Wednesday morning and a part of the afternoon discussing California conditions. H. T. Freeman of the Connecticut River Company of Hartford and H. J. Harris of the Big Horn Canyon Irrigation & Power Company of Hardin, Mont., were also heard on Wednesday afternoon, Mr. Harris resuming his testimony on Thursday morning.

POSITION OF THE GOVERNMENT

Speaking as the representative of the Secretary of War, the Secretary of Agriculture and the Secretary of the Interior, Mr. Merrill said:

"The shortage of fuel, the overloading of our transportation systems, the demands for industrial power and the unsatisfactory financial situation of our public utilities emphasize as never before the imperative need of immediate, adequate and comprehensive legislation. Our industrial efficiency, both during the war and thereafter, will be increased or diminished according to whether we do or do not make adequate provision for the development of our water-power resources. In view of these circumstances, it is submitted that water-power legislation should be considered a war emergency measure and as such should be taken up by Congress and passed at an early date."

As the background for this statement Mr. Merrill showed the rising cost of all structural material and how power-plant equipment likewise has gone soaring. Hydraulic machinery has advanced, he said, from 100 to 150 per cent over 1914 prices; electrical apparatus from 125 to 150 per cent; steam turbines, 150 per cent; water-tube boilers, 170 per cent, in addition to uncertainties in delivery. He showed the increasing scarcity of coal, fuel oil and labor and their consequent higher cost and what effect these have had and will have on power production, especially on the Pacific Coast.

These increased costs have resulted in increased cost of steam-power production and have made water-power development increasingly attractive. In fact, they have placed a considerable premium on water power, the utilization of which reduces the use of fuel and the drain on the fuel reserves. Water-power development is therefore a measure of economy as well as a measure of conservation.

INCREASING DEMAND FOR POWER

Notwithstanding increased costs of construction and of operation, the demand for power has increased not at a uniform but at an accelerating rate until during the past two years the annual increment in power generated by central stations alone has been from three to four billion kilowatt-hours, requiring an annual increase in installation of from one and a half to two million horsepower. From the close of 1914 great expansion has taken place, and in 1917 the output of 64 per cent of the industry was 61 per cent in excess of the output of 1914, which in turn was greater than that of any preceding year. Output figures for 1914, 1915, 1916 and 1917, computed from data published in the *ELECTRICAL WORLD*, were offered by Mr. Merrill.

It was Mr. Merrill's firm belief that the demand for power will continue to increase while war continues, in order to supply power to constantly expanding war industries, and when the war is over to provide for the extension of public utilities and of the electrochemical industries, for electrification of railroads, and for a multitude of other activities that will accompany the period of reconstruction. As for financing of public utilities, Mr. Merrill said, "The power industry must continue to expand or war preparations will be halted."

RELATION OF LEGISLATION TO EXISTING DEVELOPMENT

The situation, according to Mr. Merrill, shows the need of immediate action on the present measure. He said:

"Even if new water-power developments for the period of the war may be few or none, extension will be required to existing plants in order to meet constantly increasing power demands. If satisfactory legislation is passed, such extensions will be made, particularly in those sections of the country where the rising cost of fuel has become a serious factor in steam-plant operation. But even if new water-power developments could not be undertaken and extensions to existing developments could not be made, legislation will still be necessary in order to give such security to existing developments, hitherto made under unsatisfactory laws, that they may be able to meet their maturing obligations.

"Under the existing financial conditions, uncertainty of tenure places a serious handicap on corporations, making the refunding of obligations unduly expensive if not altogether impossible. Legislation which will permit of the financing of water-power developments upon favorable terms and legislation such as is contained in the 'War Finance Corporation' bill are imperatively needed if our public utilities in general and our water powers in particular are to be able to satisfy the unprecedented demands placed upon them and at the same time to meet their financial obligations.

"While it is essential that water-power legislation should protect fully the public interests in our national resources, it is equally essential that adequate protection should be given to the private capital by means of which such resources are developed. It is believed that the bill before you meets both requirements and that under its provisions capital can be secured and development will take place."

EXTENDING NAVIGATION ON THE COLUMBIA RIVER

Henry J. Pierce of the Washington Irrigation & Development Company told of the possibilities of the Columbia River at Priest Rapids in the central part of Washington. There, by means of a dam at the foot of the rapids and the expenditure of \$25,000,000, the river would be made navigable for a further distance of 200 miles; 250,000 hp. could be developed continuously and an additional 250,000 hp. during flood water, or a period of six months. In addition 500,000 acres of desert land would be brought under cultivation. He asked that a holder of a priority permit be protected in all expenditures made in good faith in the development of water power and that he be given the preference for a permit as against others who have not expended time or money. He also asked that any tax imposed should be on the actual power developed, and that in case the license is to be renewed the original licensee have the first right.

Mr. Townley's testimony did not differ essentially from his brief before the United States Chamber of Commerce, which was outlined in the *ELECTRICAL WORLD* of Jan. 26, 1918. His contention was that, no matter how favorable the legislation, no very great amount of hydroelectric development would be undertaken because of the competition with steam-turbine equipment and the cheapness with which a steam station could be built.

THE VIEWPOINT OF THE INVESTMENT BANKER

E. K. Hall of the Electric Bond & Share Company made an excellent presentation of the water-power situation from the viewpoint of the investment banker. He assumed that Congress would cast every safeguard about the water-power resources for the protection of the public. Having done that and provided for the recapture of the property at the end of fifty years as well as for the regulation of the rates and service by public service commissions, it should make it as attractive as possible to get the water powers developed.

He found two fundamental defects in the bill and suggested remedies for these. No other commercial enterprise, he maintained, called for so large an investment for the profit derived as did a water-power station. In commercial circles the usual turnover is four times a year, while in hydroelectric work the turnover is only once in seven years. Moreover, the amount of investment required is very large in proportion to the amount of the business done. The investment must therefore be protected and made as safe as possible, otherwise money would not be forthcoming. A hydroelectric station differs from a steam station in that if it is a failure it is good for nothing else, whereas a steam plant can be utilized for some other purpose.

He cited by contrast the case of investments in land, where the owner holds title forever, as compared with a heavy investment in a hydroelectric property, where the lease is short, fifty years, with no surety as to what will happen to the title after that except that the property may be taken over by the government for the net investment, or passed to some other lessee or to the original lessee for no specified time. He asked that in the latter case the bill be amended to give a new lease to the development for at least thirty years.

People who invest in bonds, he said, cannot afford to take chances on the principal. They are satisfied to take a smaller return in order to secure safety, therefore the bond should not carry any greater hazard than that inherent to the business. There should be nothing in the legislation that should lead to uncertainty. After the end of the fifty-year period the investor should be assured of a fair deal. The term "just compensation" in the recapture clause would carry conviction and be acceptable to investors. If possible, enterprise and efficiency on the part of the licensee should also be rewarded.

CONDITIONS ON THE PACIFIC COAST

Mr. Britton traced the history of hydroelectric developments on the Pacific Coast and showed to what extent the State of California was indebted to the public utility companies for its upbuilding. As indicative of the unsatisfactoriness of existing regulation relative to development on the public domain, he cited the case of one of his company's projects having a potential possibility of 200,000 hp., which has been built, so far as its reservoirs, canals, flumes, forebays, pipe lines and power houses are concerned, entirely upon land, aggregating 12,578 acres (more than 5000 hectares), owned in fee by the power company, with the single exception of 38.7 acres (15.65 hectares) of land overflowed by one of the reservoirs. These 38 acres have been placed in the forest reservation. It is land barren and bare of any vegetation, granite rocks rising above other granite rocks, upon which vegetation would be im-

possible, and yet because the flooding of this meager acreage by the backfilling of the water from the dam impinges upon the alleged forest reserve, the government demands that all parts of the project shall come under its control and domination and be subject to the provisions and permits heretofore quoted.

In another instance his company has a power project having a potential possibility of 250,000 hp., said Mr. Britton, in which less than 2 per cent of the entire land devoted to the project is upon government reservation. The project could be developed (but the power would be lessened some 10 per cent) by moving down the stream a few feet, and the project would then be entirely without the forest reservation. Patriotic duty would seem to impose upon the promoters of this project the utilization of the water to the fullest extent possible, yet these conditions of patriotic submission would result in cost charges and obligations that would render it impossible to finance the project under the conditions imposed by present rules and regulations.

Mr. Britton said that the demands made upon the power companies for quick developments, owing to the building up of the population of California by the creation of industries and by the reclamation of other lands, taxed the resources of the power companies to such an extent that they could not, either financially or physically, keep pace with the demand, because of the restrictive conditions recited. Steam plants, therefore, because of less first cost, were erected as auxiliaries to water-power plants, and cheap oil in the earlier days of power demands made it possible to install steam plants near the center of load and to carry the peak load economically, and by tying in with the hydroelectric system to insure continuity of service economically. The low price of unit installation of steam plants, as against the much greater price of hydroelectric, also made such a condition possible. Because of shortage of rainfall last winter the Pacific Gas & Electric Company, with the consent of the Fuel Administration, is installing a 20,000-kw. steam-turbine unit so as to insure service to war industries this fall.

The necessities for hydroelectric development in California, if propounded in the form of an inquiry,

could best be answered by the statement that there is an extreme necessity for the conservation of that which is limited and exhaustible and has certain superior uses, as has oil, and the providing of a substitute therefor which is perennial and inexhaustible, such as water.

The dependency of the State upon a water supply sufficient to operate its hydroelectric plants during the ordinarily dry season has been upon the stored water, not in reservoirs alone but as well in the frozen packed snow in the high ridges of the mountains that flank its eastern border. This frozen and packed snow slowly melts during the spring months, and the run-off is ordinarily amply sufficient to prevent draft on the reservoir storage until the months of June or July.

In the absence of this frozen snow and in the absence of additional reservoir capacity in the mountain regions, the supply of energy must be made up by steam plants. This situation now confronts California, the available storage being good for but forty-five days of demand, and it follows that steam must be resorted to for the other forty-five days of normal dry season to carry the load on the combined systems.

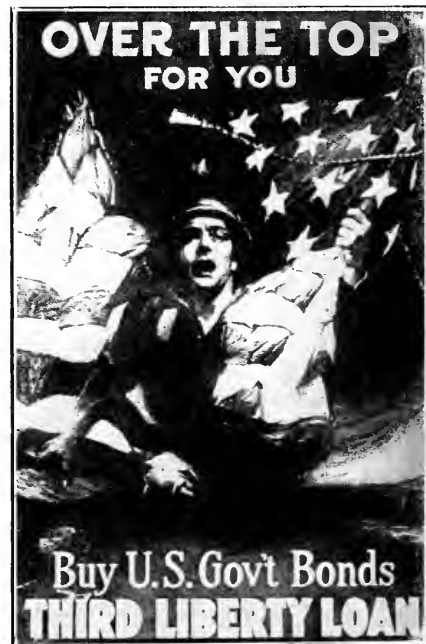
Encouragement of power projects by the government must be made by liberal terms, in order to insure the building of additional reservoir capacity to tide over abnormal years, such as this, and to minimize as much as possible the necessity for steam plants.

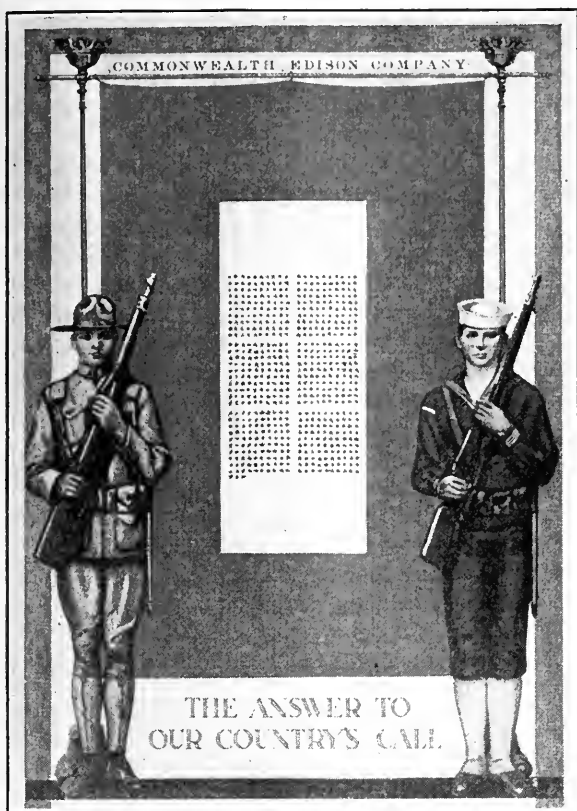
ANNUAL MEETING OF THE ASSOCIATED MANUFACTURERS

Large Advance Registration for Gathering on March
21 Indicated Successful Convention of Manufacturers in New York

A large advance registration indicated that the annual meeting of the Associated Manufacturers of Electrical Supplies at Delmonico's, New York, on March 21 would be attended by a great number of representatives of the companies.

The program, as outlined generally in previous issues of the *ELECTRICAL WORLD*, provided for a business session at 2 p. m. and a banquet at 7.30 p. m.





The Commonwealth Edison Company, Chicago, inserted in copies of its annual report to stockholders a reproduction of the company service flag, thus calling attention to the war activities of the many employees who are at the front.

LARGE BUSINESS OF THE WESTERN ELECTRIC COMPANY

Total Sales of More than \$150,000,000—Engineering Department Renders Important Service to the Nation in the War

Sales of the Western Electric Company, Inc., in 1917 were \$150,340,000, an increase of 40.5 per cent over 1916. This large total puts in concrete form the statement of President H. B. Thayer that "the business of the company has been larger than in any previous year. This is true of both the sale of its own manufactures and the sale of merchandise not made by it."

For 1916 the sales were \$106,987,000, and for 1915 they were \$63,852,000. The orders on hand Dec. 31, 1917, were \$1,950,000 in value less than on Dec. 31, 1916. The average value of an order filled during 1917 was \$107, as compared with \$75 for 1916.

Mr. Thayer says in the report to shareholders:

In our own manufactures the demands from regular customers (the Bell Telephone companies) were very heavy at the beginning of the year, but as the demands for equipment to meet emergency requirements directly or indirectly caused by the war have increased the ordinary requirements have decreased so that to a large extent a more expensive and less profitable business kept us busy during the latter part of the year. Therefore, while the profits in this class of business have been larger than in 1916, they have not, as compared with earlier years, been in proportion to the increased investment in the business. On sales of merchandise not made by us the profits have been very satisfactory.

There is no return from foreign investments included in the profits of the company for 1917. As to some information

is entirely lacking, and as to others it is incomplete. It is our belief, however, that as a whole a conservative valuation of them would require no addition to reserves, the earnings of some of them being apparently sufficient to offset the possible losses of others.

On the entry of this nation into the war we practically placed our engineering department at the service of the nation and believe that it has rendered important service. This has involved large expense and indirect loss through the interruption of our regular engineering program, but because we believed that we were able to render great service we believed also that the responsibility upon us to render it was great and that our stockholders would approve of our action. On such orders as we undertake for the military departments we have agreed to a basis of cost plus a very moderate profit.

The difference between present cost and cost on the basis of prices before the war on buildings and equipment added to the plant during the year has been credited to reserve for depreciation on plant.

It has seemed wise on account of the large merchandise investment and the prevailing high costs to set aside to the reserve for contingencies \$2,000,000 and on account of the large increase in the number of employees since the establishment of the employees' benefit fund there has been added to that fund the sum of \$500,000.

Our shop force increased during the year from 18,928 to 21,549 employees. The total number of employees at Dec. 31, 1917, was 30,737.

The total disbursements from the employees' benefit fund for 1917 amounted to \$173,915. These payments covered all classes of benefits and were made to 2894 beneficiaries.

Earnings for the year ended Dec. 31, 1917, follow:

Sales	\$150,340,359	
Other income	1,309,192	
		\$151,649,551
Cost of merchandise	\$135,427,053	
Expenses	8,487,527	
Taxes	1,073,411	
Appropriated for:		
Reserve for employees' benefit fund..	500,000	
Reserve for contingencies	2,000,000	147,487,991
Available for interest and dividends.....		\$4,161,560
Interest paid	\$1,309,844	
Dividends	2,550,000	
Carried to common stock.....	301,716	\$4,161,560

Real estate and buildings stand in the balance sheet at \$12,911,537 and machinery and equipment at \$12,134,759, a total of \$25,046,296. Total current assets of \$74,527,538 are divided as follows: Merchandise, \$44,415,028; cash, \$4,257,150; bills receivable, \$1,177,166, and accounts receivable, \$24,678,194. Sundry investments are \$13,094,686.

The 300,000 shares of preferred stock are listed at par, \$30,000,000. The common stock, 150,000 shares of no par value, is carried at \$25,755,364. There is also \$15,000,000 bonded debt, making total capital liabilities of \$70,755,364. Bills payable aggregate \$10,600,000 and accounts payable \$9,194,558. There are reserves of \$16,285,136 for depreciation on plant, of \$1,500,000 for employees' benefit fund and of \$4,333,462 for contingencies.

PACIFIC COAST SECTION OF N. E. L. A. POSTPONES MEETING

Convention Scheduled to Be Held at Del Monte on April 24 to 27 Is Postponed Indefinitely to Avoid Interference with Liberty Loan

Definite arrangements had been made by the Pacific Coast Section of the National Electric Light Association to hold a convention at Del Monte, Cal., on April 24 to 27, but to avoid interference with the campaign for the third Liberty loan it has been decided to postpone the meeting indefinitely.

ELECTRIC HOIST MAKERS FORM NEW ASSOCIATION

Services of Member Companies of Electric Hoist Manufacturers' Association Are Offered to Government to Facilitate War Service Work

The Electric Hoist Manufacturers' Association, by a resolution adopted at its last meeting, has offered the services of member companies to the government in meeting the extraordinary demand for their product.

The War Industries Board of the government has requested full information concerning the ability of the electric hoist manufacturers to handle the volume of business offered them, as well as regarding the effect of priority orders and embargoes on shipments upon the trade.

It is evident that the association will be of great assistance to the War Industries Board, as it is becoming more apparent from day to day that there are numerous advantages for all concerned in having manufacturers in certain lines organized. This is especially so now in the hour of national crisis. Instead of vindictive competition and antagonism along business lines the association brings the spirit of co-operation and exchange of ideas, looking toward increased output.

Electric hoists for shop use and handling material have gone through various stages of development during the last fifteen years and, like all other classes of shop machines, they cannot be successfully designed on the basis of theory alone. Actual experience in meeting hoist requirements and innumerable corrections and refinements in design on the part of the manufacturers have marked the progress of these last fifteen years in this important field.

The many mistakes on the part of both manufacturer and user during this development period have created in some instances a lack of confidence in electric hoists as a class. On the other hand, many users have been led to believe that such hoists are unaffected by abuse and can consistently be called "fool-proof."

Some discredit to these machines has developed on account of lack of standardization in nomenclature, service rating and general characteristics on the part of the makers.

Now that it is thought that the experimental stage has well passed and acceptable designs have been developed by various manufacturers, it appeared wise to co-ordinate the total experience and to make available for the user all that is best in electric hoist design and practice. With this object in view the manufacturers of the United States organized the Electric Hoist Manufacturers' Association, comprising the following companies: The Brown Hoisting Machinery Company, Detroit Hoist & Machine Company, Euclid Crane & Hoist Company, Franklin-Moore Company, Link-Belt Company, Roeper Crane & Hoist Works, Shepard Electric Crane & Hoist Company, Sprague Electric Works and Yale & Towne Manufacturing Company.

The officers of the association are as follows: F. A. Hatch, chairman, Shepard Electric Crane & Hoist Company; F. W. Hall, vice-chairman, Sprague Electric Works; C. W. Beaver, secretary-treasurer, Yale & Towne Manufacturing Company.

The association holds monthly meetings for the purpose of studying the specific needs of the hoist user and to develop standardized methods of presenting informa-

tion to him so that guess work will be eliminated. The association will consider uniform nomenclature pertaining to types and parts of electric hoists, fix upon a standard by which hoist motors shall be rated and promote the standardization of electric hoists as far as possible. It will also collect and disseminate information and statistics relative to the electric hoist industry, provide facilities and opportunities for study and education in regard to the economics of the industry, extend the use of the product by pointing out the great number of material-handling problems of different classes that can be solved by the use of electric hoists, promote friendly intercourse and co-operation among the members and disseminate information that long experience has taught is essential to any hoist to insure good results, and recommend to the members of the association well-established principles as to both construction and equipment that will tend to eliminate any possibility of inferior equipment.

The membership of the association is confined to those engaged in the manufacture of monorail electric hoists, which have revolutionized the handling and transportation of material in and about industrial plants.

SIGNAL CORPS HAS OPENING FOR MANY ELECTRICAL MEN

They Are Required for Various Branches of Important Army Radio-Communication Work of Several Classes

The Signal Corps, United States Army, has announced that it can use the services of a large number of men having electrical training. They are needed especially in connection with the radio-communication systems in use in the military service. All classes of electrical men—wiremen, expert electricians, storage-battery men, telegraph and wireless operators and men with electrical engineering training and experience—are wanted. The opportunity offered is unusual because of the great interest and importance of this branch of the service, which has been most aptly characterized as the nerve system of the army. Men engaged in the radio division of the communication work in particular have an increasingly important part in the great intelligence system upon which army operations are almost totally dependent.

The scope of this work requires men who will fall in general into three classes, depending on the character and amount of experience had by the individual; namely, radio operators, radio mechanics and field radio experts.

Application blanks for service in the radio work of the Signal Corps may be secured by addressing the office of the Chief Signal Officer, Land Division, Training Section, Washington, D. C. Men of draft age may make application and if qualified will be inducted into the army, at their request, for service in this branch of the Signal Corps.

After enlistment or induction, all personnel will be sent to one of several radio schools for six weeks to three months of intensive training in that one of the three general branches of the radio work for which their previous experience qualifies them. Some of the personnel completing these courses will be commissioned, advancement depending on individual ability.

DUTY OF THE COMMISSIONS IS CLEAR

BY MAX THELEN

President California Railroad Commission

In the situation which now confronts many of our public utilities the duty of the State commissions is clear. While providing for the continuation of adequate service, it is their duty to act promptly and vigorously on applications for increased rates based on increased operating costs.

Where the usual methods of rate making would result in unreasonable delays, short cuts must be applied to meet the emergency conditions.

Our public utilities must be kept in a sound and healthy financial condition, so that they will be able to meet not merely the requirements of their existing patrons but also the additional requirements of the war.

The State commissions should not wait until the utilities come to them with their pleas for assistance. It is their duty to inform themselves by their own investigations, if necessary, concerning the condition of the public utilities under their jurisdiction and to keep themselves constantly informed.

If the State commissions rise to meet the situation, as they are doing in all sections of the country, they will be rendering a substantial service not merely to the utilities and their patrons but also to the nation itself, which is largely dependent for war efficiency on the service of public utilities.

WAR-TIME PROBLEMS OF THE UTILITIES IN CALIFORNIA

President Thelen of the State Commission Shows How That Body Looks Upon the Conditions Created by the War

Max Thelen, president Railroad Commission of California, gave a lecture in the University of California extension public utility regulation course on March 6, at the Fairmont Hotel, San Francisco. His subject was "War-Time Public Utility Problems." President Thelen dealt with such utilities as street railroads, gas companies, electric companies and water corporations. He spoke of rates, services, extensions, and particularly finances. He set forth the problems and what is being done toward their solution. This lecture was open and free to the public.

Mr. Thelen divided his problems into four headings—rate, service, extension and financial problems. On rates he showed the difficulties of utilities in confronting the increased cost of operation, due to higher cost of fuel, materials and labor, the price of almost all materials having practically doubled. He said in part:

In California 106 formal applications have been made to the commission for authority to increase rates between April 1, 1917, the day on which war was declared to exist, and March 1 last, by such utilities as water, gas, warehouse, steamship, electric, railroad, telephone, jitney and express companies. These applications have ranged from requests for slight increases in small communities to applications of widespread interest and importance affecting all or large portions of the State, such as the applications of the Pacific Gas & Electric Company and the Great Western Power Company for authority to increase electric rates in the entire territory served by them in the central and northern sections of the State.

Forty-seven applications have been granted, sixteen have been denied or dismissed and forty-three are now pending. The commission realizes that the public utilities are suffering. Where an emergency exists and where the

usual method of handling rate applications, including a valuation of the property and an audit of the books, fails to meet the situation, the commission does not hesitate to apply emergency measures. We fully agree with President Wilson's letter to Secretary of the Treasury McAdoo that it is essential that these utilities be maintained at their maximum efficiency during the war, and that everything reasonably possible should be done to accomplish this end, and we act on that view. Public utilities should not expect to increase their profits during the war.

When a street railroad or other public utility comes before a State commission and asks for increases, it should come prepared to show that it has eliminated all unnecessary expense and has introduced all economies of operation compatible with the continuation of reasonably good service to its patrons.

Electric companies and their patrons in various sections of the country have already felt the effect of the so-called "lightless nights." These and other service problems must be solved, not on the basis of pre-war conditions, but from the point of view primarily of assisting to meet the nation's war requirements.

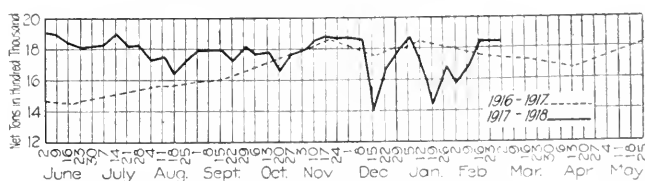
The necessity of conserving man power, materials and money necessarily has an important influence on the extensions of public utility systems during the war. Capital expenditures which before the war would have been entirely justified from the point of view of a particular utility and its patrons may now be inadvisable and undesirable because the utility may be able to get along for awhile without them, or because they do not harmonize with the unified operation of the particular utility concerned and other like public utility systems, all laying aside their purely competitive activities during the war. On the other hand, the requirements for additional light, heat, power and transportation by industries engaged in the production of necessary materials, supplies and food are such as to require imperatively all over the United States additions and extensions to the existing production and distributing systems of public utilities to meet the added requirements. It is essential that the financial strength and stability of these utilities be conserved by deferring capital expenditures not directly needed for war purposes, and that the funds thus conserved and such other funds as may be necessary be used for such additions and betterments as will assist most effectively to meet the nation's war requirements.

Soon after the outbreak of the war it became almost impossible for public utilities to secure large amounts of additional funds by the sale of securities in New York, Chicago and other financial centers of the country, with the exception of the sale of short-term notes, well secured and, in a few cases, of gilt-edge bonds at 6 per cent. The requirements of these utilities must be met.

Thus, in California, the commission during the eleven months beginning April 6 last authorized the issue by public utilities of \$72,828,150 stocks or bonds, as contrasted with \$99,625,000 during the twelve months ended June 30, 1917, and \$231,644,870 during the twelve months ended June 30, 1916.

The government has taken steps to provide that large issues of securities of public utilities and other concerns, both public and private, shall not be sold during the war in competition with government issues, and in no event unless really essential to the interests of the nation at this time.

Coal Production Better



Bituminous coal production, as reported by the United States Geological Survey, is now running ahead of last year's output.

HEAVY COSTS FOR POWER PRODUCTION

W. C. Slade, Telling Experiences of Rhode Island Company, Shows Great Need of Considering Boiler-Room Expense and Practices

Walter C. Slade, superintendent of power and lines of the Rhode Island Company, Providence, addressed the New England Street Railway Club at Boston recently on the difficulties and trials of producing steam-generated energy in war times.

"The question of the cost of production, although always of prime importance," said Mr. Slade, "has at times been obscured at least temporarily by the more important question whether for certain periods power could be produced at all, irrespective of the cost. In Rhode Island we have felt the shortage of bituminous coal keenly. The two power-producing utilities at Providence have been operating of late with inadequate coal reserves, and the Rhode Island Company in particular has recently been forced to operate its main power station for three or four days with borrowed coal entirely." Mr. Slade continued in part:

The prices which we have been forced to pay for coal in cargo lots alongside the Providence plant have varied, but they seem to be constantly increasing. In the spring of 1917 we paid as high as \$11 and \$12 a ton for some coal and bought considerable coal at prices between \$6 and \$9 a gross ton. Later developments proved that this action was justified.

The effect of the quality of the coal was reflected directly in the cost of operation, in addition to the effect of the higher cost of the coal alongside. It resulted also in increased boiler-room maintenance. The net result was to raise the unit cost of power for the year 1917 by 104 per cent, as compared with the twelve months ended June 30, 1916.

Between the average large 60-cycle central station and the average large 25-cycle railway station there can be no interchange of power except through frequency changers, a method which is sufficiently uneconomical to make this exchange feasible only for emergency purposes. Such an arrangement for emergency operation is, however, feasible.

It is also equally practicable in certain cases, it would seem, when new equipment is added to existing 25-cycle power plants, to install the equipment for 60-cycle operation, so that in the future more railway plants would be able to take advantage of central-station power, which in normal times is steadily being produced at decreasing cost, as well as of hydroelectric 60-cycle developments that will, doubtless, be made throughout the country.

But what of the small engine-driven railway plant that is struggling along trying to produce power cheaply even in normal times? Many of these plants could and should be shut down as soon as arrangements can be made for equipment suitable for operating from central station or hydroelectric service. With increasing cost of coal, the balance is all in favor of the big station, and it is questionable if the price of coal in future years will reach a minimum that is \$1 to \$1.50 a ton above the prices that prevailed before the war.

As regards increasing economies in our power stations I am going to speak principally of the boiler room. In ordinary times the fuel item will represent from 70 per cent to 75 per cent of the total cost of generated power. I recently stated that our own experience had seen the fuel cost reach a point equal to 83 per cent of the total cost; in fact, at least 90 per cent of the total cost was expended in the boiler room for fuel, water, wages, supplies and materials required for maintenance. We should indeed consider spending money in such a field where such a large proportion of the expense of production lies.

The best solution, perhaps, is to follow the practice, already observed I believe in a few cases, to put under the chief engineer a technically trained man or at least a man who understands the theory of combustion sufficiently well,

who can keep constant check of operating conditions in the boiler room, working in constant touch with the chief engineer. This type of man has been termed "combustion engineer."

Working with the assistance of the necessary weighing measuring and metering devices with which he should be provided, he could put the true spirit of industrial control into boiler-room practice. To aid the "combustion engineer," so called, in effecting the desired economies, it would be well to consider the advisability of making the operation of all equipment as nearly automatic as possible.

WORK ON FUEL ECONOMY BY NEW YORK COMMISSION

Conference in Albany Decides to Appoint Coal-Saving Committee if State Fuel Administrator Approves the Plan

How to effect economy in fuel and power consumption was the subject of a conference held on March 6 in Albany by the New York Public Service Commission, Second District, acting in co-operation with A. H. Wiggin, the New York Fuel Administrator. Chairman Hill of the Public Service Commission presided, and the Empire State Gas & Electric Association, which represents 90 per cent of the output of gas and electric light for commercial and street-lighting purposes, was represented by J. T. Hutchings of Rochester, C. A. Graves, C. H. B. Chapin and Stuart Wilder of New York and H. W. Peck of Schenectady.

The conference decided that, if the State Fuel Administrator approves the plan, a committee will be appointed to consider the possibilities of coal saving. The committee will consist of representatives of the State Fuel Administrator, the New York State Conference of Mayors, the Public Service Commission, Second District; two or three representatives of the gas and electric producers and the New York State Manufacturers' Association.

The plan, as outlined, provides for an educational campaign to effect economy in lighting and cooking and curtailment of non-essentials, including signs; economy in street lighting and in the operation of power plants and through saving of coal by concentration of generation; the utilization of water power through interconnection of systems and the development of unutilized water power.

DAYLIGHT SAVING HOUR WILL BE PUT IN FORCE

Effective from March 31 to Oct. 27, Central-Station Industry Is Studying the Possible Effect on Revenue and Output

President Wilson signed without ceremony the daylight saving bill on March 19. The effect of it will be that all clocks will be put forward one hour on the last Sunday in March and turned back again on the last Sunday in October. The official change in time will take place at 2 a. m. on the days mentioned.

The daylight-saving law is recognized in the electrical industry as primarily a war measure and is, of course, accepted patriotically as a necessary step in conservation. It is expected that the resulting curtailment in lighting will have some effect on revenues and the operation of the law is awaited with much interest.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Patent Office Improvements.—A composite committee has been created by the National Research Council to make a preliminary study of the problems of the United States Patent Office and its service to science and the useful arts. This committee comprises L. H. Baekeland, W. F. Durand, Thomas Ewing, Frederick P. Fish, Robert A. Millikan, E. J. Prindle, Michael I. Pupin and S. W. Stratton. All interested in making any patent-reform suggestions are advised to forward them at once to Dr. W. F. Durand, National Research Council, Washington, D. C. The particular point upon which suggestions are desired is the manner in which greater efficiency and work of higher quality can be secured in the Patent Office.

Financial Extensions in War Time.—The Mount Whitney Power & Electric Company, Visalia, Cal., has filed with the California Railroad Commission an application for approval of a plan for financing the construction of necessary extensions to its system during the war. The company distributes electric energy in Tulare, Kern and Kings Counties and has estimated that it will have to expend during 1918 \$108,561 upon its system, besides \$216,936 for extensions. It will have available for the latter purpose only \$60,000 and has therefore devised a plan under the terms of which those making application for power will be required to advance to the company part of the cost of building the necessary lines. The plan further provides that ordinarily the company will not accept applications for power where they do not yield an income the first year equal to 20 per cent of the total cost of installation.

Rate Increase Sought in California.—The San Joaquin Light & Power Corporation has filed with the California Railroad Commission an application for authority to increase electric rates in Mariposa, Madera, Merced, Fresno, Tulare, Kings and Kern Counties. The application says that heretofore, under normal conditions of rainfall, the company has been able to generate almost all its energy at its hydroelectric plants, but that owing to the failure of rain this year in the San Joaquin valley, the lack of snow in the mountains and the consequent shortage of water for irrigation by gravity flow, even if there should be a normal rainfall for the remainder of the season, the company's hydroelectric plants could generate less than half of the required power for its consumers. It will therefore be necessary to operate steam plants and generate electricity by the

use of gas and oil as fuel, adding \$600,000 to the company's annual operating expenses, besides increased cost of materials, the larger sum paid in wages and higher taxes.

The Government Rebuffs the Sanitary District.—In one of the various controversies between the federal War Department and the Sanitary District of Chicago a special board appointed by the Secretary of War made the following statement as a part of its report: "To restore the diminished levels in the lakes by constructing contracting works in their outlets does not, however, present any series difficulties. Compensation for the loss of elevation on Lakes Michigan, Huron and Erie and their connecting rivers, due to an assumed diversion from Lake Michigan of 10,000 second-feet, will by the plan above outlined involve an expenditure of \$475,000. It is the opinion of the board that, while other plans have been proposed, compensation by fixed contraction works similar in general to those above described affords the cheapest and most satisfactory method of preserving the levels of the Great Lakes." Subsequent to this report the Sanitary District, in order to remove the continuous government objection to the withdrawal of water from Lake Michigan, offered to build and maintain the contracting works. On Feb. 26, 1918, the engineering bureau at Washington, through Chief of Engineers Black, reported adversely on the Sanitary District's proposal, finding that the bill for permitting the construction of the contracting work was in violation of a treaty with Great Britain.

Extension of Activities by Wisconsin Operators.—The Wisconsin Security Company, the main activities of which were formerly the financing and operation of Wisconsin public utilities, has increased its capital stock from \$300,000 to \$1,300,000 in the last year. During that time the company acquired the entire capital stock of the Manitowoc & Northern Traction Company. It also acquired the Calumet Service Company, furnishing Chilton, Wis., with light and power, as well as control of the Baltimore (Md.) Dry Dock & Shipbuilding Company. The latter is now the largest property controlled by the company. It is said that with its new addition this property represents an actual physical value of more than \$7,000,000. On the property of this company eight ships of 8800 tons are now being built for the Emergency Fleet Corporation, according to Clement C. Smith, president of the Wisconsin Security Company. The company is also building ten 6200-ton steel cargo ships under contract for the Cunard Steamship Company, the French Republic and Norwegian and British owners. These have been commandeered by the Emergency Fleet Corporation. The company is building seven ships for the Navy Department. In his report Clement C. Smith said: "This shipbuilding activity is a big feature of our 1918 business. Our Wisconsin enterprises will be held in obedience until a more favorable time."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Providence Engineering Society.—"Motor Troubles" were discussed by W. F. Hodges of the J. H. Electric Company before the Providence Engineering Society on March 13.

N. E. L. A., Brooklyn Section.—W. Uckele presented a paper on "Pressure Regulation on Two-Phase, Sixty-Cycle Feeders" before the Brooklyn company section of the N. E. L. A. on Feb. 19.

Engineers' Society of Milwaukee.—Prof. C. M. Jansky, assistant professor of electrical engineering, University of Wisconsin, gave a talk entitled "Science in War" before the Engineers' Society of Milwaukee, March 13, 1918.

A. S. M. E., Philadelphia Section.—A paper on "Recent Developments in Methods of Measurement" was presented by Dr. F. W. Stratton of the United States Bureau of Standards on March 26 before the Philadelphia Section of the American Society of Mechanical Engineers.

Columbus Electrical Contractors' Association.—At the annual meeting of the Columbus (Ohio) Electrical Contractors' Association on March 14 Carl Entekin was chosen president, William McGarait vice-president and Charles Weisz secretary-treasurer. The members reported business conditions good.

Engineering Society of Buffalo.—"Hydroelectric Power Problems" was the title of a paper by J. A. Johnson presented before the Engineering Society of Buffalo on March 13, 1918. In this paper the author discussed the general considerations involved in the location of industries for economic reasons.

New York Electrical Society.—"Experiences at the Front in France and Flanders" was the title of a talk at a joint meeting of the Engineers' Club and the New York Electrical Society by Lieut. Pierre Chevalier, Twenty-second French-Canadian Battalion, on March 18, 1918. Dr. Charles A. Eaton, head of the National Service Section of the United States Shipping Board, Emergency Fleet Corporation, also spoke on "The United States as a Test of Democracy."

Spring Meeting of the A. S. M. E.—General war subjects and a discussion of how the engineer can help the government in the war will be the important features of the spring meeting of the American Society of Mechanical Engineers in Worcester, Mass., June 4 to 7. The meeting will open on Wednesday, June 5, which will be New England Day, and the discussion will dwell on the interests of New England in relation to the war. The remainder of the time will be spent in general and technical sessions and inspection trips.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Implied Repeal of City Charter.—A municipal corporation whose charter as amended in 1901 gave it general authority to take water from any brook in a named town instituted condemnation proceedings for the purpose of increasing its water supply by taking the waters from a tributary to a creek in which the defendant corporation proposed to erect a power plant and had erected dams, etc. The respondent corporation, chartered in 1905, was authorized to build dams on the creek and its tributary for the purpose of providing necessary ponds and reservoirs to utilize the power of the stream, and in that connection was granted the powers of individuals to flow lands. The respondent corporation was also authorized to generate electricity and distribute it, and further to construct a railroad, etc. The Supreme Court of Errors held, in *East Hartford Fire District versus Glastonbury Power Company* (102 A. 592), that, as it only received the flowage rights of individuals, and the flowage act does not authorize the condemnation of land except for raceways, respondent's authority to build dams was necessarily to be exercised on lands acquired by consent of the grantors and lessors, and hence its charter was not an implied repeal of the authority of the municipality to take water to increase its water supply.

Property Devoted to Public Use in Eminent Domain Proceedings.—As virtually all streams available for municipal water supply were at an early date utilized for water power either directly or through their connecting waters, statutes generally authorizing municipal corporations to acquire waters for municipal water supply must be deemed operative upon streams already used for water power, at least when such water power is not already employed in some other public use at the time of the proposed taking, the Supreme Court of Errors of Connecticut held in *East Hartford Fire District versus Glastonbury Power Company* (102 A. 592). Property already appropriated to one public use cannot thereafter be condemned for an inconsistent public use unless such taking is authorized expressly or by clear implication, and this rule applies to property about to be lawfully appropriated to a public use, though the appropriation is not complete. Where respondent corporation authorized to exercise the flowage rights of individuals and use water of a creek to generate electricity had not commenced the generation and distribution of electricity, although it had acquired rights in the stream for that

purpose, such corporation cannot, its property not being devoted or about to be appropriated to a public use, defeat condemnation by municipal corporation which sought to take the waters of a tributary stream to increase its water supply.

Failure to Remedy Defect in Abandoned Charged Line.—A power company that left a branch wire across a pasture connected and charged after abandoning its use had no right to presume that the wire would continue to remain in a proper and reasonably safe condition without being looked after, the Kansas City Court of Appeals held in *Kribs versus the Jefferson City Light, Heat & Power Company* (199 S. W. 261). Where an unused branch power line was left highly charged in a place where persons frequently went it was the duty of the power company to see that the line was maintained in a reasonably safe condition, and if it got into a dangerous condition and remained so for such a length of time that the power company in reasonable prudence should have discovered and remedied the defect before an accident, it was negligent. That boys, one of whom was killed when he grasped a guy wire dangling from a charged power wire, were in the pasture without authority from the owners could not excuse the power company from liability for its negligence, persons having frequently passed through the pasture for so many years that it was incumbent on the company to keep its line safe and that it incurred legal liability because of any failure to do so.

Date and Point of Shipment Determine Classification of Goods Shipped.—The Gibbes Machinery Company had a fire in its storehouse in which a lot of gasoline engines were badly damaged. All the small parts of the engines, including trimmings, etc., were either melted or broken off, and for the purpose of having them rebuilt, if it could be done profitably, they were sent to the factory where originally made. The machinery company offered to ship them as scrap iron, but the carrier refused, and they were shipped as "burned engines," and the rate for that class was charged. Upon their examination at the factory it was found that the cost of rebuilding the engines would be more than new engines were worth, and they were therefore sold as scrap iron by direction of the machinery company, whereupon the latter demanded of the carrier the difference between the rate paid and that which would have been paid if the shipment had been classed as scrap iron. The Supreme Court of South Carolina, holding the shipper not entitled to recover (93 S. E. 718), said: "The justice of the case as well as the law is with defendant. Plaintiff had no right to require defendant to assume or bear any part of the expense incident to its experiment. Under the act of Congress, the classification of the shipment was to be determined at date and point of shipment, and charges made and collected according to the schedules and tariffs filed with the commission."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Property Values Under War Conditions.—The decision of the New York Public Service Commission, First District, reducing electric rates of the Flatbush Gas Company says, in speaking of value: "It is contended by the respondent that it is entitled to a fair return upon the amount of property used by it in the public service, measured by opinion estimates of the reproduction cost thereof, even where data of actual cost are available. The claim that its return should be calculated on estimates of what it ought to cost to reproduce the property is moderated slightly by its obviously proper concession that there should first be deducted from the face of these estimates the amount of the accrued depreciation, figured, not on the reproduction cost new of the property, but upon the much lesser amount of original cost, and also that the unit prices to be assumed or assigned for the reproducing of the property should be taken from or reduced to pre-war and normal market levels. If, however, it is to be recognized that the value of the property upon which the respondent is entitled to earn a return through its rates is to be measured solely by the reproduction cost thereof, unaffected by consideration of the actual outlay therefor by the investors and regardless of the methods and conditions of original construction, then logically there would seem to be no escape from the conclusion that the respondent would be entitled to claim a return upon such a property cost as would be attributable to it if all the property were produced or reproduced in one continuous operation at present-day market prices of labor and materials. In the present juncture of universal upheaval, the application of such a postulate of evaluation to rate making would lead to startling consequences. Without a dollar of additional investment and in the face of adversity and suffering, the value of the respondents' property would be deemed to have vastly increased, and the amount which the company's investors are entitled to take from the consumers would be deemed to have much increased. On restoration of normal conditions investment made in property of the company at war-time market prices will of course shrink in value, perhaps violently, as prices tend to resume normal levels, and even the investments previously made might shrink if there should be a considerable depression in market quotations." The dangers of computing return on estimates of reproduction cost less depreciation were never so obvious as to-day, the commission holds.

K. E. N. Cole has been appointed manager of the Van Buren branch of the Fort Smith (Ark.) Light & Traction Company.

M. L. Hibbard, manager of the Union Light, Heat & Power Company, Fargo, N. D., was elected president of the Associated Charities of Fargo for the year 1918.

D. T. Laylin, formerly in charge of the electrical department of Strong, Carlysle & Hammond, has been appointed electrical engineer for the Standard Parts Company of Cleveland.

Herbert J. Baker, who has been a manufacturers' agent for electrical equipment at Denver, Col., is now electrical and mechanical engineer for the Evergreen Mines Company at Apex, Col.

Harry A. Porter, president of Harry A. Porter, Inc., Chicago, and vice-president of the Chicago Club-Jovian League, has been elected chairman of the electrical subdivision of the Chicago Association of Commerce.

Frederick W. Johnson, advertising manager for the Puget Sound Traction, Light & Power Company, formerly at Bellingham, Wash., has been appointed assistant to E. C. Macy, in charge of all construction for the Stone & Webster Corporation in the Northwest, with general headquarters in Seattle. Mr. Johnson has been in the employ of the Puget Sound company since July, 1906, in various capacities.

Roy B. Woolley, now in the publicity and sales department of the Society for Electrical Development, has been appointed director of publicity of the society to succeed Harry W. Alexander, resigned. Mr. Woolley was formerly sales manager for the Standard Electric Stove Company, Toledo, and at one time associated with the MacManus-Kelley Company, Toledo, and the F. Bissell Company, Toledo.

Dr. F. G. Keyes, formerly chief engineer of the Cooper Hewitt Electric Company, Hoboken, N. J., has received the commission of captain in the chemical section of the National Army. Dr. Keyes severed his connection with the Cooper Hewitt company late in 1916 to take charge of physical chemistry at the Massachusetts Institute of Technology, although he was still engaged by the company in a consulting capacity.

Harry W. Alexander, director of publicity for the Society for Electrical Development, New York, has resigned to become assistant to the president on sales, American Writing Paper Company, New York and Holyoke, Mass. It was Mr. Alexander who as publicity manager of the society organized and successfully directed the work of the local committees and the publicity and sales work of both the "Electrical Prosperity Week" (1915) and "America's Electrical Week" (1916) campaigns. Prior to joining the staff of the society in 1914 he was sales manager of the Federal Light & Traction Company, having earlier been a financial and political writer in Chicago.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

W. R. Putnam, district manager of the Utah Power & Light Company, has been made a director of the Utah Manufacturers' Association.

T. R. Steingoetter has been appointed manager of the Edwardsville (Ill.) office of the St. Louis County Gas & Electric Company. He has been serving this company as a traveling auditor and more recently as general auditor in East St. Louis. He began with this company as messenger boy in the Belleville (Ill.) office.

Prof. George F. Sever, formerly professor of electrical engineering and acting dean of the faculty of applied science at Columbia University and for over twelve years consulting electrical engineer for the department of water supply, gas and electricity in the city of New York, has been commissioned a major in the Engineer Officers' Reserve Corps, with headquarters in Washington, D. C. He has closed his engineering office in New York. Professor Sever first entered the teaching profession as instructor in the electrical engineering department of Columbia University after fifteen years of commercial experience, largely with the Thomson-Houston Electric Company. In 1900 he was promoted to be adjunct professor of electrical engineering, and five years later he became professor. He was a member of the commission appointed by Mayor McClellan to draw plans for a municipal lighting system for Greater New York. Professor Sever is the author of a number of books connected with the subject of electrical engineering.

Obituary

John P. Sparrow, chief engineer of the New York Edison plants, died on Monday at his home in Brooklyn, at the age of fifty-eight years.

Charles H. Williams, well known as a public utility operator, died in Denver, Col., on March 10 of pneumonia. Mr. Williams, who was forty-four years of age and a graduate of the University of Wisconsin in the class of 1896, was one of the first college engineers to work for Henry L. Doherty. This was with the Madison Gas & Electric Company in 1897. Subsequently he became general superintendent of that company, and in 1905 he was made manager of the Wisconsin Light & Power Company at La Crosse, Wis. Then he went west with the Northern Colorado Power Company. For the last half dozen years Mr. Williams has been engaged in building and operating gas and electric plants in the West.

Austin C. Dunham, who for many years was president of the Hartford (Conn.) Electric Light Company, during which time he was one of the recognized leaders in the central-station industry, died on Monday at St. Petersburg, Fla., at the age of eighty-five. Mr. Dunham retired from the presidency of the Hartford company in 1912 after a period of service extending over thirty years. During that time the Hartford Electric Light Company was constantly in the forefront in central-station advance and achievement. Because of Mr. Dunham's foresight and deep-founded faith in the future of the electric lighting industry, the Hartford company has the distinction of being the first to adopt modern methods of transmission of energy from water power, the first to use polyphase transmission apparatus and to introduce extensively alternating-current inclosed-arc lamps, 60-cycle rotary converters and the constant-current alternating arc-light system. It was also Mr. Dunham who led the way to the adoption of the steam turbo-generator as a part



A. C. DUNHAM

of regular central-station equipment and who besides launched the Nernst lamp into commercial being. In addition to these, the first storage battery used in connection with central-station service was installed at Hartford, as were also the first tungsten street lamps. In such manner did Mr. Dunham set the pace for the central-station industry. Mr. Dunham was born on June 10, 1833, in Coventry, and was graduated from Yale College in 1854. In addition to the central-station field, Mr. Dunham had been in the forefront in other industries, having been president of the Dunham Hosiery Company and the Rock Manufacturing Company, one of the founders of the Austin Organ Company and the Automatic Refrigerator Company, a director of the Aetna Insurance Company, the Travelers' Insurance Company, the National Exchange Bank of Hartford and the Cedar Hills Cemetery Association, besides having played a prominent part in the direction and management of many of the philanthropic activities that have figured largely in the life of Hartford.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

MOVEMENT TO DECREASE LOSS THROUGH FAILURES

New York Credit Men Give Further Evidence of
Growing Tendency Toward Co-operation
Within the Industry

Attention is now being directed by a special committee of the New York Electrical Credit Association toward preventing bankruptcies and minimizing losses through failures. The duty of this committee will be to aid in preventing failures wherever possible, and where failures are inevitable to study ways and means of conserving the assets which at that stage rightly belong to the creditors, promoting the most effective sale of the assets and expediting the distribution of dividends. Members of the association have been asked to lend their co-operation by placing before the committee, of which Franz Neilson is secretary, any information which tends to indicate the possible failure of a creditor in order that steps may be taken or, in case failure has already taken place, that the assets may be best conserved for those concerns.

This is but further evidence of the growing tendency throughout the industry to co-operate for the best interests of all. While the number of bankruptcies has not been particularly large, there is no desire on the part of any one to accept a loss where it can be prevented. Information given for the benefit of all will undoubtedly tend to minimize this loss.

Furthermore, there is always the added incentive that where failure impends the concern may be taken in hand promptly and through the injection of sound business principles be put on good footing in comparatively short time. Naturally where such results are achieved it is of advantage to the creditors not only in conserving their assets but also in continuing an outlet for their goods.

MAKING INTEREST CHARGE ON OVERDUE ACCOUNTS

Concerns That Have Had Experience in Following
This Policy Declare It Speeds Up Collections
and Reduces Credit Collection Cost

While the justice of charging interest on overdue accounts is pretty generally conceded, the question of policy is debatable. Aside from the fact that the policy of charging interest is not universal, about the only objection is the chance that the customer may impose more readily upon the seller, feeling that he is paying for the use of the additional time—that the seller is establishing banking facilities.

A certain Chicago jobbing house states that during its experience in charging interest a number of cases wherein the customer has stated by letter or stated to the salesman that he did not understand the attitude of the house in insisting on payment of interest on overdue accounts have arisen. As these cases have come up the house has taken great pains to explain intelligibly to the customer what prompts it to charge interest and what leads it to insist upon the payment of the account promptly even though interest is charged. In most cases it has been possible to convince the customer that the attitude of the house is proper. While this house feels that perhaps it should be conceded that the charging of interest on overdue accounts may have a tendency to increase the number of these, it is stated that this is only a tendency and not a certainty, if the situation is carefully watched and this tendency checked as

it occurs. The surest way of checking it seems to be by letters of explanation to the customer, pointing out that the house is a mercantile institution and is not engaged in financing retail enterprises.

It has been stated that the charging of interest has been definitely found to have a good effect as a collection policy. The house making this statement charges interest from the last of the month following the month in which the goods were purchased, or, in other words, on accounts averaging forty-five days old. In this way the charge goes out at a time when the calling of the customer's attention to the account is very desirable and still at a time when it would not be possible to do this by letter. The charge follows the statement by a few days and goes before any follow-up letters on the account. Where an account first shows a tendency to become overdue, making this interest charge is thought to be the best possible way of jolting into the customer's consciousness the fact that he has exceeded the terms of sale to a point where he is not pursuing a fair, businesslike course.

By watching the results of this policy it has become evident that charging interest actually helps collections. Moreover, the total of the interest charges collected amounts to a respectable sum and is a material item in lowering the cost of handling credits and collections for the company. The interest charges canceled for any cause since the policy has been in effect by this house amount to from one-half to one-third of 1 per cent of the interest charged, and it is believed that this amount will become less and less as this policy becomes more common among jobbing houses.

WHAT THE JOBBER CAN DO TO CONSERVE LABOR

Labor Economies Can Be Effectuated and Better Business Methods Adopted if Employers Realize
Obligations

At the annual meeting of the Pacific Coast Electrical Jobbers' Supply Association, held at Del Monte, Cal., E. J. Wallis, Pacific Coast manager of the Western Electric Company, read a paper on the conservation of labor, from which the following is taken:

"Labor is now employed under conditions more remotely removed from considerations of profit and compensation than ever before. The man who employs labor will feel the sense of responsibility that goes with a trust. He must use it without waste to the best advantage or be considered a slacker.

"Then there is work that has an apparent value but with which we may properly dispense at this time. Perhaps an elaborate acknowledgment of an order may be made simple or done away with entirely. We may have made it a practice to itemize a statement balance beyond the current month. There are some who are advocating now that statements be dispensed with altogether as most buyers pay individual bills and often merely a report of a balance would permit of sufficient check as between accounts. This might at least be done with some of our largest customers. Remittances are made without expectation of acknowledgment or receipts. A style of correspondence can be developed that works automatically to produce short concise letters and eliminate mere words and phrases like 'beg to advise' and 'beg to remain' and complimentary expressions. While we are going to be as courteous as ever, something more than has been the usual practice will have to be taken for granted.

"When there are changes in our organizations and men

leave for the country's service we will try by a detailed analysis of the jobs to determine if the work of, say, two experienced members of whom we are losing one cannot be carried on by the one of experience and two beginners, and for the beginners we may be able to substitute women. All prejudice against women at work has disappeared, and we are astonished at the tasks undertaken.

"We are working between ourselves so free an exchange of stock, not in quantities large but in articles and transactions numerous, that at some centers it would seem that our efforts tended to introduce something expensively better than a reasonably standard service. If we could organize an exchange that would hold forth for an hour or two each day, perhaps by telephone, we might possibly be able altogether to save a considerable amount of time and effort without inconvenience to our customers.

"The character and expense of a sales department in a supply jobbing business is determined as a judgment of the executives of the business. The foundation of the decision will be the amount of sales to which the business aspires.

"The amount of our sales promotion expense will depend on our ambition with respect to the desired volume for our business, and that volume is really our opinion of what is our proper proportion of the total possibilities in our territory. If the determination is reached to attain a greater volume under existing conditions, a larger percentage of realization on the possibilities is of course necessary. It is well to keep in mind that a larger percentage of realization on available business is possible even with a decreased volume of business. If this is not appreciated, an increased and unproductive sales promotion expense may be incurred on the supposition that we are losing our share when the contrary is the true condition.

"The extent to which a jobber will incur sales promotion expense will also depend on the amount and character of the service he figures he can profitably give a manufacturer by introducing new lines, novelties and specialties. Most electrical specialties are labor savers and as such can be introduced as an answer to the labor problem. But those devices that are not labor savers, or those articles that expect a market only to the extent that they can displace some older and more standard device, will probably be classified as luxuries, and the buying public is now being educated against any but justifiable and necessary expenditures."

METAL MARKET SITUATION

Attempts to Have Price of Copper Advanced Officially Will Be Futile—Other Metals Unchanged

It is admitted that the demand for copper for industrial or commercial purposes is being easily met. This is reflected in the reduction in the price of wire base. Producers are endeavoring to have the government or official selling figure of the metal increased at the expiration of the present arrangement, but those in a position to know say the present quotations for the metal will remain unchanged. The sale of rubber-covered, cable and weather-proof wire is active, largely for government work.

No change of any consequence is noted in the old metals market, and the demand is light.

NEW YORK METAL MARKET PRICES

	March 11			March 18		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	26.25	to	26.75	26.25	to	26.75
Lead, trust price		7.25			7.25	
Nickel, ingot		50.00			50.00	
Sheet zinc, f.o.b. smelter.....		*15.00			*15.00	
Spelter, spot.....	7.67 $\frac{1}{2}$	to	7.72 $\frac{1}{2}$		7.55	
Tin, Straits		*85.00			*85.00	
Aluminum, 98 to 99 per cent. Govt. price	32.00			*Govt. price	32.00	

OLD METALS

Heavy copper and wire.....	21.50	to	22.00	21.50	to	22.00
Brass, heavy	14.00	to	15.25	14.00	to	15.25
Brass, light	10.00	to	11.00	10.00	to	11.00
Lead, heavy	6.25	to	6.50	6.25	to	6.50
Zinc, old scrap.....	5.50	to	5.75	5.25	to	5.75

*Nominal.

THE WEEK IN TRADE

LITTLE change is noticed in the week's total volume of trade. With the exception of the Far West, building continues slow. The dearth in building has given rise to a very slow movement of stocks normally used by electrical contractors. Delivery conditions show slight improvement here and there. Jobbers' stocks on the whole seem to be in good condition. With the approaching third Liberty loan credits and collections show no appreciable change.

Prices are holding unusually steady. Some lines are advancing, but there are indications of a deterioration of peak prices beginning to set in. Wire is much lower than it was a year ago; for instance, conduit last week softened a few points. Fixtures, it is reported this week, have dropped below the figure at which market quotations for them have recently been made.

NEW YORK

Sellers and receivers of electrical goods, while agreeing that shipping and delivery conditions are improving, are still of the opinion that transportation facilities are far from satisfactory. Hereabouts factory shipments, unless from Connecticut, are delayed, so that stocks in certain lines are greatly depleted. With building operations almost wholly suspended the outlet for many staples is practically closed, or, as one large jobber explained, there is very little regular trade just now. What is going on is what is described as special—that is, government—orders, and they are tremendous in size, the requirements about keeping the nearby market cleaned up on many items. Jobbers, however, are very optimistic. Some price revisions have taken place, but it seems to be the opinion that they are at peak, excepting when it comes to prompt deliveries, and then the quotations for quick service are reported as advancing rapidly.

Collections are rather backward, and the granting of credits is restricted. Trade acceptances are not making the headway desired by distributors and jobbers.

SOLDERING IRONS.—A higher scale of prices, effective April 1, was announced last week on electric soldering irons under the Hoskins schedule.

INSULATORS.—All grades, glasses, sizes and makes are reported at a low level. There is plenty of stock at the mills, but the embargoes have shut off deliveries, which are six and eight months behind.

COLLECTIONS AND CREDITS.—Jobbers, with few exceptions, speak of collections as being slow. Credits remain restricted, and there is a greater volume of cash business than any one can readily recall.

ELECTRIC RADIATORS.—The market having been caught up with, stocks are in full supply again. In fact, reports of an overstock are heard, with a possibility of the goods having to be carried over for the following season's trade.

CONDUIT.—A shortage in all sizes is mentioned as a general condition. Traffic congestion is said to be the basic cause. Four or five cars a day will arrive here, jobbers state, and then there will be none for a couple of months.

ELECTRIC RANGES.—Activity is reported in this line with the approach of warmer weather. Twenty-four heavy-duty electric ranges, capable of taking care of 250 men and costing \$500 each, were purchased by the Navy Department last week.

FAN MOTORS.—Reports of a threatened scarcity in fan motors are in circulation. Some manufacturers are urging

jobber not only to specify their requirements promptly but also to accept shipments at once. It is said that unless cars are plentiful the War Industry Board may interdict all shipments. Stocks are said to be light in this territory, excepting in the case of special company agents. One prominent jobber who has the promise of three cars by May 1 is doubtful whether the delivery will be made. If the situation becomes acute on this account, a further advance in price may be realized.

ATTACHMENT PLUGS.—These goods are in ample supply, as they are easily obtainable from nearby factories in New England.

CABLE.—No building of any account being under way, there is little sale and stocks are heavy with jobbers and dealers.

SMALL MOTORS.—Shipments out of stock are prompt for small motors up to 75-hp. and have been improving. No change in price has occurred.

INDUSTRIAL AND STREET-LIGHTING FIXTURES.—Owing to lack of building operations, sales are far below the average. Factory deliveries are behind three months. Within a few weeks a reduction in price ranging from 5 to 10 per cent has been reported.

HOUSEHOLD SPECIALTIES.—With the growing sales in seasonable articles in this line, such as electric irons, sewing and washing machines, the trade expects still further developments. So far prices have not been affected, and no change is looked for unless the metal market takes an unfavorable turn. A vacuum-cleaner manufacturer, owing to lack of raw material and labor restrictions, has been obliged to hold in abeyance his plan of carrying a full line of household appliances.

CHICAGO

An investigation of business conditions in the territory surrounding Chicago shows markedly the effect of the war on trade. Building activities, except of the industrial sort, are almost nil. The industrial building, however, is on a grand scale. The electrical trade, except that part which relies entirely for its activity on residential building, is very active. Even the contractors with no stores are making out very well by taking up farm-lighting work.

CONDUIT.—The drop in price has in no way affected the conditions of supply and demand. In some places in the Chicago territory jobbers did not make the reduction until more than two weeks after the drop by the manufacturers.

CIRCUIT BREAKERS.—Deliveries from some factories are very slow. Some agents cannot quote better than three months.

TRANSFORMERS.—There is a steady demand by industrial companies.

SOCKETS.—Porcelain sockets have increased slightly in price.

SEWING MACHINES.—The Western Electric Company has increased the retail price of its motor-driven sewing machines \$2.50 per machine.

DOMESTIC APPLIANCES.—The Stirling Electric Company of Minneapolis, a jobbing and dealing concern, has just signed contracts for purchasing washing machines and vacuum cleaners to the aggregate amount of \$1,000,000. The vacuum-cleaner contract is for 9000 machines. It was made with the Ohio company and covers three years' purchases. The washing-machine contract was made with the Gainaday company and terminates in five years. Under its terms the Stirling company is to take 1800 machines this year and is to increase its quota 10 per cent each year, making a total of about 11,000 machines in five years. The contracts do not protect either party as to price, but do give protection on agency, territory and delivery.

FARM LIGHTING.—It is reported that one large company is shipping only one-third of its sales. Other companies are also having trouble getting out enough machines to meet the demand. Electrical dealers everywhere are entering this field of sales in an endeavor to bolster up the business lost because of the falling off in building.

BOSTON

Trade continues in heavy volume, but with jobbers reporting spotty days and a demand that is hard to forecast. Stocks are fairly full at present, despite the handicap of poor transportation conditions. Here and there signs of freer movement of freight on the railroads are to be seen. The coal crisis appears past, normal business hours continue, and more punctual passenger train movement is being experienced. Labor conditions are better than last week, the strike of textile firemen at Fall River being short-lived. The next draft is expected to cut heavily into New England resources in man-power, but time for readjustments mitigates the severity of labor withdrawals from civil life. Collections are good among the manufacturing buyers, but still somewhat slow among the small contractors. The granting of increased freight rates to the Eastern railroads will stimulate general business without question.

There is a strong undercurrent of feeling that the extremely conservative policy of central stations regarding new business will have to yield in the near future to a more liberal one. The pressure of the public for service beyond previously standardized lines is increasing and must be met. Improving relations between central stations and contractors are indicated by the recent establishment of a contact committee representing the New England Section of the N. E. L. A. and the Electrical Contractors' Association of Massachusetts, scheduled to hold a meeting in Boston this week. Prices show little change this week compared with last, but the rising cost of cotton tends toward the lessening of discounts on cable.

HEATING DEVICES.—There appears to be a temporary lull in this class of business, but with the approach of warmer weather a large turnover is expected. Irons are moving well, one jobber reporting that nearly as many units have been ordered since Feb. 1 by certain local purchasers for deferred billing or deferred shipments as were booked from these buyers all through 1917.

MOTORS.—Trade is as heavy as last year, which is saying a good deal. The demand for large motors is literally enormous, units up to 2000 hp. being sought for work related to the war. A better tone appears in the central-station field, notably among hydroelectric companies, which are inquiring more generally for equipment to meet increasing power demands. Prices remain steady and deliveries are better in the smaller sizes. Some stock deliveries have been made lately in sizes ranging from 10 hp. or 7.5 hp. down. Some gaps exist in the lists of available motors, but strenuous efforts to increase factory production are bearing fruit.

TRANSFORMERS.—Deliveries are improving, notably in sizes below 200 kw., where quotations are being made on a two to three months' basis. Below 100 kw. deliveries run from stock shipments to eight weeks. Prices are firm, with no prospect of early change.

METERS.—Large stocks of meters for house lighting are now on hand at the factories, ready for immediate shipment. The demand is rather small at present, and if the housing program in connection with shipyard expansion goes into effect soon, the meters will be "on the job" about as soon as any fittings needed. Prices remain unchanged.

LAMPS.—Conditions are constantly improving, and reserve stocks are now being accumulated in connection with some large orders by central stations which have as yet not been obliged to draw their full commitments from the manufacturers. The 50-watt tungsten lamp is growing in popularity and bids fair to drive the 40-watt and 60-watt units out of the field in due time. "Hooverizing" on light at one end and increased factory facilities at the other are putting a new face upon the lamp supply situation, which but a few weeks ago gave cause for considerable anxiety.

WASHERS.—Popular interest continues in these equipments; the installment plan of sales always appeals to the public, and the lifting of railroad embargoes has begun to help deliveries.

WIRE AND CABLE.—Orders are increasing slightly. Prices remain firm, with a tendency toward discount reductions due to the steady rise in cost of cotton. This is less pronounced in the larger sizes of cable on account of the

higher relative cost of copper. Deliveries are now fairly good. One manufacturer believes that the volume of business which could be realized from shipyard house wiring is nominal from the wire manufacturer's standpoint, pointing out that a million feet of No. 14 wire can be produced by a single factory in a week—an amount which would go a long way toward over-supplying the expected demand from the above source.

CONTRACTING CONDITIONS.—Despite the low volume of building wiring work now seen, contractors are in many cases doing an excellent business in industrial wiring. In the Berkshire Hills district of Massachusetts, for example, many textile and paper products bearing upon war work are being turned out, and local jobbers and wiring establishments report great activity. Larger sizes of conduit for such work have been purchased at high prices from the jobbers. An unusually busy branch of wiring work now being handled by some contractors is the rewinding of railway motor armatures for trolley roads suffering from burn-outs in recent heavy snows. Armatures have been burned out literally by the hundred this winter, and electrical repair houses capable of this class of rewinding are taking over not a little work which cannot be handled quickly enough by the street-railway repair shop itself on account of the excessive amount of motor trouble experienced.

ATLANTA

Governmental activity in shipbuilding, nitrate and powder distillate plants, together with contemplated cantonment extensions and additional construction for aviation purposes, is the overshadowing feature in trade lines at this time. A number of readjustments of outputs of divers industries are still being made in conformity with the exigencies of war, but the general order of things is forward. Meanwhile the magnitude of government requirements in textiles is illustrated anew by reports that 65 per cent of mill capacity is engaged in this business. Charleston, S. C., has definitely been selected by the Shipping Board as the site of one of the two additional shipbuilding yards to be constructed on the South Atlantic Coast. Twelve 9500-ton steel ships will be built at these yards. No definite information is at hand, but it is expected that the other yard will be located at Brunswick, Ga.

A considerable quantity of large apparatus has been contracted for lately, and where the shipment on turbines appeared to be unreasonable large direct-connected engine units have been purchased. Two 4000-kw. turbines have been ordered for the Tennessee Coal & Iron Company's Mobile shipyard. Transformers, switchboards and motors have also been contracted for to take care of the initial installation at Muscle Shoals. A large volume of general supply business is being done at Hadley's Bend, near Nashville, Tenn., for the new powder plant. This condition applies as well to Muscle Shoals.

Manufacturers carrying a general line of supplies are stocking large quantities of marine goods with Atlantic Coast jobbers to handle the present and future extensive demand for this class of material.

ELECTRIC RANGES.—The volume of business is very satisfactory and a steady increase in the demand is noted. Taken as a general average, deliveries are slowing up, and this feature has tended to dampen enthusiasm in certain quarters.

WIRE.—There is a very substantial demand for both rubber-covered and weatherproof. No material change in price has been recorded since the sag several months ago. Deliveries are fair. Stranded goods are hard to get.

KNIFE SWITCHES.—The volume of sales continues steady and local stocks are moving freely. Shipments are arriving steadily.

FUSES.—Activity in this line is about the same. A great number of the motors sold in this territory are provided with overload relays; this feature in itself has tended to offset any increased demand. Shipments are coming in promptly.

INTERPHONES.—Demand is fair, but nothing like the late 1917 business is being transacted. Government demands

and restrictions on this type of apparatus, together with very poor deliveries, have curtailed inquiries and, besides, jobbers and manufacturers are not going after this trade.

SEATTLE

Sales of power apparatus to the new shipyard in Everett and heavy demand for large-sized lamps and floodlighting outfits to yards in the Columbia River district particularly featured the week's business. Jobbers report a noticeable easing up of shipments in conduit and power apparatus. The conduit situation has been serious for months. Arrivals during the week will help temporarily, for the present relief in the freight situation is believed to be but temporary. Government buying for navy yard and cantonments has increased considerably in the past two weeks. The inability of jobbers to obtain deliveries is forcing them to place larger orders to keep stocks filled; merchandise investment therefore has increased materially and nothing like the turnover desired can be expected. Residence building in Puget Sound cities and in Columbia River districts continues exceedingly active. In Seattle and Tacoma building is particularly heavy. Building on a considerable scale has begun in Portland, and real estate values are increasing rapidly. The scarcity of housing facilities for shipyard employees at Astoria, Aberdeen, Hoquiam and other wooden shipbuilding centers is serious. The demand for houses in Spokane cannot be met. Dealers in the Northwest report to jobbing houses a constantly increasing demand for fixtures and house-furnishing material. The movement is expected to reach its peak in early summer, according to conservative jobbers. Some believe demand will continue until winter.

According to statements made by prominent lumbermen, under the eight-hour basis recently adopted lumber production has decreased 10 per cent. Many manufacturers declare that the next few months will show a decrease of 20 per cent. Sawmills in northern Washington on the eight-hour basis are equaling and in some cases exceeding the average output under the ten-hour schedule.

Rigorous steps by railways to stop accumulations of export freight for which no steamship accommodations have been arranged from reaching Seattle are being taken, and the railways may be asked to compel every shipper of export freight in the East to file an affidavit stating that he has secured steamship space on Puget Sound before he will be permitted to load a car.

Lamps of larger sizes are more difficult than ever to obtain, with stocks very low. Sixty-watt sizes and less are coming from factories, giving much easier stocks. The demand from shipyards has been very heavy. Power apparatus is temporarily loosening up because of shipments from the East. Inquiries and orders have been heavy during the past month, motor sales of medium sizes especially increasing rapidly, particularly in the Spokane and Portland territories. Sales to government increased slightly.

SAN FRANCISCO

The past week has been prolific in large jobs of a miscellaneous character. The Hercules Powder Company is adding a new unit to its plant. The city of Sacramento has let a contract for the construction of a new agricultural pavilion to house its annual fair, the electrical work alone being an \$8000 job. Fresno will construct a new 350-room hotel. The Bay Point shipyards will be protected by a new fire protection system utilizing a 50,000-gal. storage tank.

Credit managers report that collections are fairly easy but require careful nursing.

The Pacific Gas & Electric Company has changed its plan of a co-operative range campaign with the assistance of electrical dealers. The new schedule provides for sale to consumers at current list prices with a \$20 allowance for wiring and a 5 per cent cash discount for prompt payment. The installation will be done at the purchasers' expense with the exception of this \$20 allowance, and the power company plans to furnish contractors with special types of fuse blocks and double-throw switches, if required, at their cost plus 10 per cent. The customer will make four monthly payments.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List per 1000 Ft.
No. 14 solid	\$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor	
No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
Less than coil	No. 14 Solid List to \$61.00
Coil to 1000 ft.	10% to 59.17
Less than coil	No. 12 Solid List to \$71.00
Coil to 1000 ft.	10% to 68.87

Twin-Conductor	
Less than coil	No. 14 Solid List to \$105.00
Coil to 1000 ft.	10% to \$70.00 to 10%
Less than coil	No. 12 Solid List to \$135
Coil to 1000 ft.	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor	
Less than coil	No. 14 Solid 15% to + 20%
Coil to 1000 ft.	10% to 20%
Less than coil	No. 12 Solid 15% to + 20%
Coil to 1000 ft.	10% to 20%

Twin-Conductor	
Less than coil	No. 14 Solid 15% to + \$115
Coil to 1000 ft.	20% to \$80
Less than coil	No. 12 Solid List to + 20%
Coil to 1000 ft.	20% to 10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1 1/2 std. pkg.	10% to \$24.00
1 1/2 to std. pkg.	20% to 19.80
Std. pkg.	34% to 18.75

DISCOUNT—CHICAGO

Less than 1 1/2 std. pkg.	+ 20% to 12%
1 1/2 to std. pkg.	20% to List
Std. pkg.	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3175-.3195	.3215-.3295
Barrel lots	.2875-.2895	.2915-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than	Coil to 1000 Ft.
3/8-in. s. stp. Net to \$75.00	15% to \$69.75
3/8-in. d. stp. 10% to 75.00	List to 72.00
1/2-in. s. stp. List to 100.00	15% to 93.00
1/2-in. d. stp. 10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than	Coil to 1000 Ft.
3/8-in. single strip	\$75.00 \$63.75
3/8-in. double strip	78.25-78.75 71.25-71.75
1/2-in. single strip	100.00 85.00
1/2-in. double strip	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	2	.47
5/8	.15	2 1/2	.55
3/4	.18	3	.65

NET PER 1000 FT.—NEW YORK

Less Than	\$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$25.00-\$55.00	\$20.50-\$24.50	\$20.00-\$21.50
1/4-in.	\$28.00-\$60.00	\$22.50-\$27.00	\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than	\$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$36.00-\$55.00	\$25.00	\$22.50
1/4-in.	\$40.00-\$66.00	\$27.00	\$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

Size, In.	Couplings, List	Elbows, List
1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

Less than	2500 lb. 3.7% to 5.3%	5.7% to 7.3%	7% to 12%
1/4 in. to 1/2 in.	4% to 10%	8.7% to 10.3%	9% to 15%
3/4 in. to 3 in.	6% to 9%	9% to 15%	

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than	2500 lb. 3.7% to 5.3%	5.7% to 7.3%	7% to 12%
1/4 in. to 1/2 in.	4% to 10%	8.7% to 10.3%	9% to 15%
3/4 in. to 3 in.	6% to 9%	9% to 15%	

(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price	\$5.00 to \$6.00
Discount	25% to 30%

CHICAGO

List	\$5.00 to \$6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1 1/2 std. pkg.	28%
1 1/2 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1 1/2 std. pkg.	28%
1 1/2 to std. pkg.	38%

FUSE PLUGS		
3-Amp. to 30-Amp.		
NEW YORK		
Less than 1/5 std. pkg.	Per 100 Net	\$5.00 to \$5.75
to std. pkg.		4.50
Standard packages, 500.	List, each,	\$0.07.

CHICAGO		
Less than 1/5 std. pkg.	Per 100 Net	\$6.25
to std. pkg.		5.25
Standard packages, 500.	List, each,	\$0.07.

LAMPS, MAZDA		
105 to 125 Volts		
Regular, clear:	Std. Pkg.	List.
10 to 40-watt—B.	100	\$0.30
40-watt—B.	100	.35
40-watt—B.	24	.70
75-watt—C.	50	.70
100-watt—C.	24	1.10
100-watt—C.	24	2.20
100-watt—C.	24	3.25

Standard bulbs, 3 1/4 in., frosted:		
45-watt—G 25	50	.53
75-watt—G 25	50	.55
100-watt—G 25	50	.55
Standard bulbs, 3 1/4 in., frosted:		
40-watt—G 30	24	.77
Standard bulbs, 4 3/8 in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK		
Less than std. pkg.	Net	
to std. pkg.		10%

DISCOUNT—CHICAGO		
Less than std. pkg.	Net	
to std. pkg.		10%

LAMP CORD		
Cotton-Covered, Type C, No. 18		
NEW YORK		
Less than coil (250 ft.)	Per 1000 Ft. Net	\$24.90 to \$31.00
to 1000 ft.		22.72 to 27.90

CHICAGO		
Less than coil (250 ft.)	Per 1000 Ft. Net	\$29.00 to \$30.00
to 1000 ft.		21.50 to 22.50

LAMP GUARDS, WIRE		
Standard packages from 50 to 150		
NEW YORK		
per 100		\$20.00 to \$29.00
CHICAGO		
per 100		\$19.17 to \$21.75

OUTLET BOXES		
—A, A1 1/2, 4 S.C., 6200, 320.	List, per 100	\$30.00
—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.		30.00
—C.A., 9, 4R, B 1 1/2		25.00
—F.A., 7, C.S., 1 1/2, 3 R.		20.00

DISCOUNT—NEW YORK		
Less than \$10.00 list.	Black Galvanized	25%-37%
10.00 to \$50.00 list.		42%-45%

DISCOUNT—CHICAGO		
Less than \$10.00 list.	Black Galvanized	40% 35%
10.00 to \$50.00 list.		50% 45%

PIPE FITTINGS		
DISCOUNT—NEW YORK		
Less than 1/5 std. pkg.		10%
to std. pkg.		20%
Standard packages, 500.	List, each,	30%
DISCOUNT—CHICAGO		
Less than 1/5 std. pkg.		10%
to std. pkg.		20%
Standard packages, 500.	List, each,	30%

PORCELAIN CLEATS—UNGLAZED		
2 and 3 Wire		
NEW YORK		
Less than 1/5 std. pkg.	Per 1000 Net	\$20.00 to \$38.00
1/5 to std. pkg.		19.00 to 20.00
Standard package, 2200.	List per 1000,	\$20.

CHICAGO		
Less than 1/5 std. pkg.	Per 1000 Net	\$15.80
1/5 to std. pkg.		14.80
Standard package, 2200.	List per 1000,	\$20.

PORCELAIN KNOBS		
NEW YORK		
Per 1000 Net	Std. Pkg. 3500 Std. Pkg. 4000	
5 1/2 N. C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.		
1/5 to std. pkg.	\$27.50 to \$29.00	\$30.75
Standard package, 2200.	15.60 to 20.75	24.20

CHICAGO		
Per 1000 Net	Std. Pkg. 3500 Std. Pkg. 4000	
5 1/2 N. C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.		
1/5 to std. pkg.	\$11.85	\$30.75
Standard package, 2200.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES		
1/4-in. cap key and push sockets.	500	\$0.33
1/4-in. cap keyless socket.	500	.30
1/4-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK		
Less than 1/5 std. pkg.	Net to \$23.00	
1/5 to std. pkg.		20% to 21.00
NET PER 100—CHICAGO		
Less than 1/5 std. pkg.		24% to \$25.00
1/5 std. pkg.		30% to 23.00

SWITCHES, KNIFE		
250-Volt, Front Connections, No Fuse		
High Grade:		
30-amp. S. P. S. T.		\$0.80
60-amp. S. P. S. T.		1.20
100-amp. S. P. S. T.		2.25
200-amp. S. P. S. T.		3.48
300-amp. S. P. S. T.		5.34
30-amp. D. P. S. T.		1.20
60-amp. D. P. S. T.		1.78
100-amp. D. P. S. T.		3.38
200-amp. D. P. S. T.		5.20
300-amp. D. P. S. T.		8.00
30-amp. 3 P. S. T.		1.80
60-amp. 3 P. S. T.		2.68
100-amp. 3 P. S. T.		5.08
200-amp. 3 P. S. T.		7.80
300-amp. 3 P. S. T.		12.00
Low Grade:		
30-amp. S. P. S. T.		0.42
60-amp. S. P. S. T.		0.74
100-amp. S. P. S. T.		1.50
200-amp. S. P. S. T.		2.70
30-amp. D. P. S. T.		0.68
60-amp. D. P. S. T.		1.22
100-amp. D. P. S. T.		2.50
200-amp. D. P. S. T.		4.50
30-amp. 3 P. S. T.		1.02
60-amp. 3 P. S. T.		1.84
100-amp. 3 P. S. T.		3.76
200-amp. 3 P. S. T.		6.76

DISCOUNT—NEW YORK		
Less than \$10 list.	High Grade	List to + 5%
\$10 to \$25 list.		11%
\$25 to \$50 net.		14% to 15%
Less than \$10 list.	Low Grade	5% to 10%
\$10 to \$25 list.		16%
\$25 to \$50 list.		24% to 25%

DISCOUNT—CHICAGO		
Less than \$10 list.	High Grade	+5%
\$10 to \$25 list.		11%
\$25 to \$50 list.		14%
Less than \$10 list.	Low Grade	5%
\$10 to \$25 list.		16%
\$25 to \$50 list.		24%

SWITCHES, SNAP AND FLUSH		
5-Amp. and 10-Amp., 125-Volt Snap		
Switches		
5-amp. single-pole	Std. Pkg.	List
5-amp. single-pole, ind.	250	\$0.28
10-amp. single-pole	250	.32
10-amp. single-pole, ind.	100	.48
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd		
10-Amp. 250-Volt Push-Button Switches		
10-amp. single-pole	Std. Pkg.	List
10-amp. three-way	100	\$0.45
10-amp. double-pole	50	.70
	50	.70

DISCOUNT—NEW YORK		
Less than 1/5 std. pkg.		List
1/5 to std. pkg.		15%
Std. pkg.		28%

DISCOUNT—CHICAGO		
Less than 1/5 std. pkg.		+20% to list
1/5 to std. pkg.		List to —15%
Std. pkg.		List to 30%

SWITCH BOXES, SECTIONAL CONDUIT		
Union and Similar—	List	Each
No. 155		\$0.34
No. 160		.60

DISCOUNT—NEW YORK		
Less than \$2.00	Black	Galvanized
list.	List	Net
\$2.00 to \$10.00		
list.	10% to 20%	5%
\$10.00 to \$50.00		
list.	20% to 30%	15%

DISCOUNT—CHICAGO		
Less than \$2.00	Black	Galvanized
list.	25%	15% to 20%
\$2.00 to \$10.00		
list.	25%	20%
\$10.00 to \$50.00		
list.	25% to 35%	20% to 25%

TOASTERS, UPRIGHT		
NEW YORK		
List price		\$6.00
Discount		30%

CHICAGO		
List price		\$4.50 to \$6.00
Discount		25% to 30%

WIRE, ANNUNCIATOR		
NET PRICE—NEW YORK		
No. 18, less than full spools.	Per Lb. Net	\$0.44 1/4
No. 18, full spools.		0.43 1/4

CHICAGO		
No. 18, less than full spools.	Per Lb. Net	\$0.57 1/2 to \$0.65
No. 18, full spools.		0.55 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.		
Solid-Conductor, Single-Braid		

NEW YORK		
Price per 1000 Ft. Net		
Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No. 11	\$15.00 \$18.00 \$13.00	\$10.25 \$11.50
12	23.25-25.41	21.30-21.78 15.97-19.35
10	32.40-35.21	29.70-30.18 22.13-27.00
8	45.70-49.12	41.90-42.12 30.88-38.00
6	72.40-77.84	66.35-66.72 48.93-60.30

CHICAGO		
Price per 1000 Ft. Net		
Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
No. 14	\$18.00 \$13.00	\$11.50
12	25.33-26.25	22.02-25.33 18.35-20.40
10	30.48-36.54	27.44-31.26 22.86-29.23
8	42.54-51.57	38.99-44.13 31.90-41.36
6	67.46-88.38	56.15-75.61 50.53-56.39

WIRE, WEATHERPROOF		
Solid-Conductor, Triple-Braid, Size 4 0 to 8 Inc.		

NEW YORK		
Per 100 Lb. Net		
Less than 25 lb.		\$33.25 to \$35.25
25 to 50 lb.		31.25
50 to 100 lb.		28.25 to 34.25
CHICAGO		
Per 100 Lb. Net		
Less than 25 lb.		\$35.42 to \$40.35
25 to 50 lb.		34.42 to 39.35
50 to 100 lb.		33.42 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Convertible Electric Lantern

An electric lantern shown herewith operating on a standard flashlight battery is manufactured by the Lindstrom-Smith Company, Chicago. The battery is of sufficient size to give twenty hours of continuous use or forty hours of in-

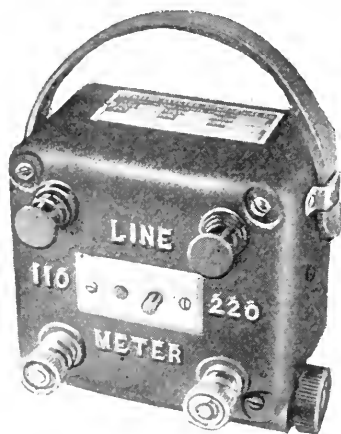


BATTERY SUFFICIENT FOR TWENTY-HOUR
CONTINUOUS USE

termittent service. It is estimated that it will supply light ten minutes a day for eight months. The entire outfit weighs 24 oz. (680 g.), and is 6 in. (15.2 cm.) by 5.5 in. (14.0 cm.) over all.

Artificial Load for Testing

The illustration reproduced herewith shows a portable "phantom" load manufactured by the Western Electro Mechanical Company, Oakland, Cal. It is used as an artificial non-inductive load for testing alternating-current watt-hour meters in conjunction with a rotating standard or an induction wattmeter. A compression-type carbon rheostat which, it is claimed, will maintain any current between zero and full value is



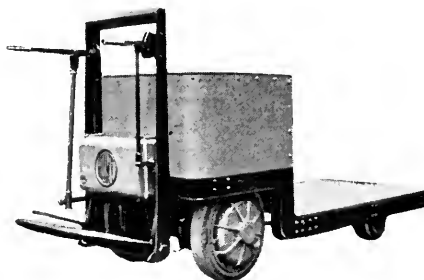
PORTABLE LOAD FOR TESTING WATT-HOUR
METERS

mounted on the side of the device in series with the secondary. The rheostat is an integral part of the cast case. The equipment is made in rat-

ings of 10 amp., 25 amp. and 50 amp. The 110-220-volt and 220-440-volt equipments are made in these sizes.

Industrial Electric Truck

The industrial electric truck of the motor-in-wheel type, illustrated herewith, has been designed by the C. W. Hunt Company, Inc., West New Brighton, N. Y., and is known as the company's type DF-60. It is built with a drop frame of 4-in. (10-cm.) heavy steel channels, the capacity of the truck being 4000 lb. (1814 kg.). As marketed it is equipped with either thirty Edison G-6 cells or twenty MV-11 "Ironclad Exide" cells. The battery is mounted in a box with recoil spring supports above and below and is placed directly over the driving wheels, insuring maximum tractive effort. In each of the 20-in. (50.8-cm) driving wheels is mounted a 35-volt, 30-amp., 1000-r.p.m. series-wound motor, this method



MOTOR-IN-WHEEL TYPE OF TRUCK

of driving enabling the truck to overcome obstacles to a degree which is unusual.

Series-parallel control is provided, with a range of from 2 miles to 7 miles (3.2 km. to 9.6 km.) per hour in both forward and reverse. The controller, cut-out, fuse and charging socket are mounted in a dust-proof case on the front of the frame, and the operating platform is so designed that when the driver steps off the platform the circuit is immediately opened. Similarly, if the operator removes his foot from the brake pedal, the brakes are immediately applied. The driving wheels are equipped with New Departure ball bearings and 3½-in. by 20-in. (8.9-cm. by 50.8-cm.) solid-rubber tires. The rear or trailing wheels are equipped with 5-in. by 10½-in. (12.7-cm. by 26.7 cm.) solid-rubber tires and Bock roller bearings. The armatures in these machines are of the same diameter as in heavy road trucks of the motor-in-wheel type, but are slightly foreshortened on account of the necessary space requirements.

Two pinions and shafts engage with an equalizing member, applying their power through a gear rack at the periphery of the wheel. The platform of ¾-in. (0.95-cm.) steel plate is only 11 in. (27.9 cm.) from the floor, and is 37 in. by 60 in. (94 cm. by 164 cm.) in size. A cover of ¼-in. (0.6-cm.) checkered steel plate is also provided for the battery box, thereby affording additional carrying space. This truck has an over-all length of 106 in. (269.2 cm.), a width over all of 37¼ in. (95.8 cm.), and an over-all height of 52¼ in. (132 cm.). The turning radius of the outside wheels is 5 ft. 8 in. (1.5 m.), and the truck is of unusually rugged and simple design, built to withstand heavy loads and to operate in narrow and congested areas.

Battery Switch

The Fahnestock Electric Company of Long Island City, N. Y., has recently developed a wooden-base battery switch equipped with Fahnestock spring-clip binding posts. This switch is made in both one and two points. The use of the spring-clip post eliminates all use of tools, it is pointed out, and the device can be wired up instantly. All metal parts of the switch are nickel-plated and are held to the wooden base by means of nickel-plated brass eyelets, eliminating the possibility of loosening.

Large-Size Electric Crane

The electric crane shown in the accompanying photograph is used by the LaBelle Iron Works plant at Steuben-



DYNAMIC BRAKING USED EFFECTIVELY
ON ELECTRIC CRANE

ville, Ohio, and is equipped with General Electric motors. The hoisting is accomplished by a 375-hp. slip-ring induction motor directly coupled to a 40-

direct-current motor. The crane hoist a 14-ton bucket of coal at 10 ft. (152 m.) per minute. The nature of the machine is the dynamic braking obtained by combining the direct-current motor with the alternating current one so that the direct-current unit serves as an exciter. The dynamic braking arrangement here used for the first time on cranes of this size is economical on first cost and has a number of practical operating advantages. Creeping speeds of 110 ft. (33.5 m.) per minute for lowering are obtainable with this crane under ordinary service conditions.

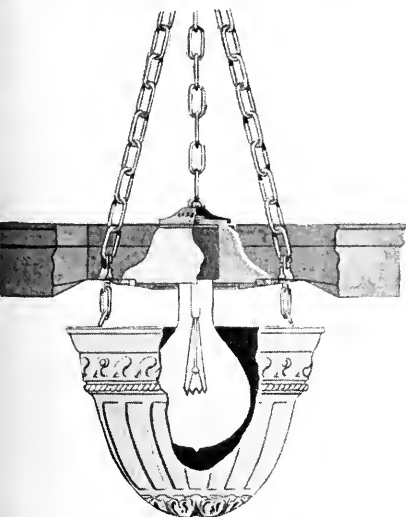
Home Motor

The A. C. Gilbert Company of New Haven, Conn., has developed a home motor that is easily convertible and with different attachments can be made to churn butter, whip cream and eggs, etc.; polish silver and sharpen knives. It can also be furnished with a vibration attachment for massage or converted into an electric fan by attaching guard, blades, etc. The frame is die-cast and the bearings are an integral part of the casting. The motor is nickel-plated and the cast base finished in rich velvet black. It is equipped with a rheostat and plug with rheostat for governing speed. The rheostat has a special lock so that any desired speed may be obtained.

Lighting Unit

The Reflectolyte Company, 914 Pine Street, St. Louis, Mo., is offering to the trade the lighting unit shown herewith, known as the "Ceiling-Bright Reflectolyte."

It consists of a bell-shaped glass diffusing shade, topped with perforated metal cap, which is held firmly in place in the middle of the reflector's base by three small clips. It is pointed out that the light passes through the glass diffusing shade, softly illuminating the ceiling. As in standard types, the reflector is of heavy steel with white polished porcelain enamel fused on



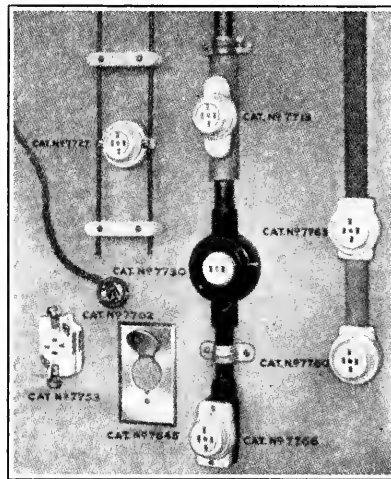
CROSS-SECTION VIEW OF UNIT

using shade, softly illuminating the ceiling. As in standard types, the reflector is of heavy steel with white polished porcelain enamel fused on

layer by layer. The reflector can be detached from chains in a moment by means of a patented device and removed to facilitate cleaning. Being metal throughout, the reflector is break-proof.

Standard Receptacles

The recent additions to the line of "Standard" receptacles made by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., were designed, the manufacturer states, with the idea of providing a "standard" receptacle for the more popular forms of conduit fittings, as well as for metal molding and for cleat work. The illustration shows how easily these receptacles can be used with the various fittings. Receptacle No. 7753 is intended for use with flush plates having a hinged lid. Nos. 7760 (one-way base) and 7763 (two-way base) are for metal molding. Receptacle No. 7730 can be used in a conduit as shown or with round uni-



RIVETED CONSTRUCTION PREVENTS LOOSENING OF CLIPS

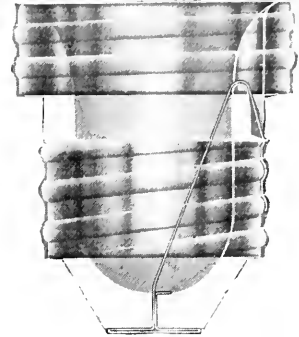
lets or any outlet box having sufficient depth and suitable cover. No. 7766 fits both 1/2-in. and 3/4-in. (12.7-mm. and 19.1-mm.) Paiste taplets, and No. 7713 is for 1/2-in. (12.7-mm.) Obround condulets.

The receptacle for cleat work No. 7727 has proved very popular where open wiring is permitted. It can be readily slipped under the conductors supported by cleats and provides an additional outlet for any appliance. These receptacles are of two-piece construction held together with one screw and nut. Besides being small and neat in appearance, liberal provision has been made for entrance of the wires, and they are very easily wired. Riveted construction is used to mount the contact clips, thus insuring against loosening, as often happens when screws are used. The "standard" straight pull attaching cap shown in the illustration is interchangeable on all "standard" plugs and similar "standard" caps and receptacles of six other manufacturers. This interchangeability is very desirable in the factory or home where electrically operated devices equipped with

various attaching caps are many times connected to plugs and receptacles furnished by several different manufacturers.

Refillable Fuse Plug

The accompanying illustration shows a refillable fuse plug manufactured by the Clemens Electrical Corporation of



REFILLABLE FUSE PLUG HAVING FEW PARTS

Buffalo, N. Y. The plug consists of three parts and the fuse element. To renew the fuse, the two brass rings are unscrewed from the porcelain holder, the blown fuse element slipped out and a new one placed in position. By screwing the rings back the fuse element is held firmly in place.

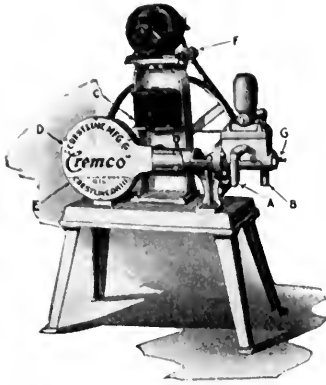
Vacuum Cleaner

Next to effective removal of dirt from carpets, rugs, etc., the most important point about a vacuum cleaner is its durability. For this reason the turbine principle has been most generally adopted by manufacturers, the typical machine having but one moving unit—an armature upon whose shaft extension is mounted the turbine rotor, the end of the shaft being housed in the bearing. Thus there are no gears, valves, bellows or diaphragms to require maintenance on the part of the user or the central station.

These principles are used in the "Vacuna" cleaner, manufactured by the Kent Vacuum Cleaner Company, Inc., of Rome, N. Y. The turbine used insures a constant flow of air, thereby maintaining the suction pressure at practically the same value whether the opening of the cleaning tube is closed by contact with the surface to be cleaned or whether it is free. The turbine operates at very high speed, and is carefully balanced so as to run steadily without vibration. Westinghouse alternating-current universal motors are used. This motor is designed on the principle used in the manufacture of very large motors, such as those used in railway work, and is of the concentric compensating type which insures very long brush and commutator life. Variation of speed at the same load between direct-current and alternating-current service is very small.

Electric House Pump Automatically Controlled

A small electrically driven pump for supplying rain water to residences is shown in the accompanying illustration. It may also be used for a general water supply where city service is



PUMP AND MOTOR MOUNTED ON SAME BASE

not available. The pump and motor are mounted on a cast-iron base and are connected by a belt. The pump is a slow-speed type. An automatic controller switch is connected with the discharge pipe and is set to operate between pressures of 20 lb. (1.4 kg. per sq. cm.) and 40 lb. (2.8 kg. per sq. cm.). It can be adjusted, however, to operate between any pressures that may be predetermined.

The pump is manufactured by the Crestline Manufacturing Company, Crestline, Ohio, and is equipped with a Robbins & Myers motor. The outfit is made in two capacities—125 gal. per hour and 250 gal. per hour, and in both sizes it will operate against a head of 50 lb. per square inch (3.5 kg. per sq. cm.).

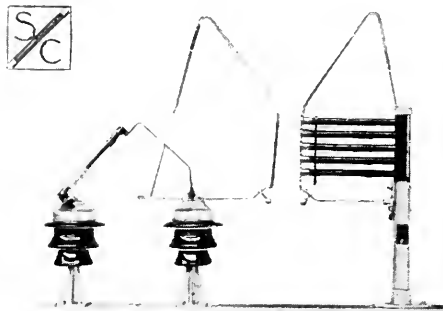
High - Speed Sphere - Gap Graded-Resistance Lightning Arresters

The accompanying illustration shows a new type of high-speed sphere-gap graded-resistance lightning arrester manufactured by Schweitzer & Conrad, Inc., Chicago. Lightning arresters, it is pointed out, to be effective in protecting electrical apparatus must offer instantaneous relief from abnormal voltages and at the same time prevent the flow of excessive dynamic or generating current after the abnormal potential has been dissipated. The gap shown is the smallest at the upper end of the converging portion of the horns, where the maximum resistance is inserted. At the lowest or "no resistance" step the gap is of considerably greater extent.

The manufacturers claim that this arrangement has several important advantages. With any potential rise on the system protected by the arrester, the arc will start across the smallest gap with all of the resistance in series.

If the power represented by the discharge is small, the current flowing through this gap and comparatively high resistance may be sufficient to keep the line voltage down approximately to normal. If the current flowing through the gap of maximum resistance is not sufficient to keep the line voltage down, the arc will break across the next lower step and a larger current will flow across this gap. If this current is still insufficient to keep the voltage at a safe value, then the next lower step will be across, and so on, until the "no resistance" or lowest step is reached, when a practically unlimited electric current is allowed to flow to ground.

When the particular step is reached where sufficient current will flow to dissipate the potential rise, the voltage will be reduced to its normal value, and the arc will then tend to rise along the converging part of the horn, being driven upward both by the heated air and by the electromagnetic effect. As the arc rises along the converging part of the horn the dynamic or generator current is cut down in value as the resistance in circuit is increased step



BAKELITE TUBES PROTECT RESISTANCE FROM EFFECTS OF WEATHER

by step until the diverging portions of the horns are reached, where it will rise and lengthen until the arc breaks. The resistance units are inclosed in high-grade Bakelite tubes which protect them effectively against the weather, so that the arrester can be used outdoors without any protecting coverings. By loosening two bolts of a clamp on the top of the porcelain insulator cap the live horn can be adjusted to meet any condition.

Portable X-Ray Set for Field Service

During 1917 the research laboratory of the General Electric Company made some experiments and developments in X-ray apparatus of interest to the medical and surgical professions. The concrete result of these efforts was a portable X-ray outfit, in order that troops in active service at a distance from base hospitals might have the benefits of X-ray examination promptly available. This was accomplished by a process of elimination through a series of tests which resulted in the final assembly of the most suitable

products of several manufacturers which are used in connection with the Coolidge tube. Particular care was taken to pick out those elements which were in actual production and available for immediate use.

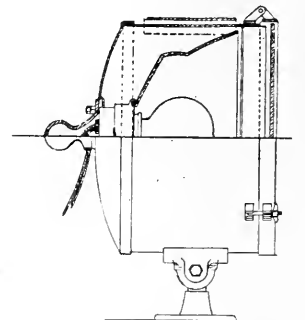
The equipment consists of a single-cylinder, air-cooled gasoline engine direct-connected to a 1-kw. direct-current generator provided with slip-rings, a main X-ray transformer, a filament transformer for lighting the filament of the Coolidge tube, a voltmeter and milliammeter, the necessary controls and switches and a special radiator type of Coolidge tube capable of rectifying its own current. Variation of X-ray output is obtained by variations of engine speed. The carburetor of the engine is controlled through a solenoid, and the necessary changes in speed are effected by means of a simple resistance unit installed at the head of the operating table when the outfit is in process of utilization.

For radiographic work the set will deliver 10 milliammeters at a voltage corresponding to a spark of 5 in. (12.7 cm.) between points. For fluoroscopic work the current is reduced to 5 milliammeters, the voltage remaining the same.

Owing to the rectification characteristics of the Coolidge tube no separate rectifier is required. The entire equipment, including the operation table, can be readily assembled or disassembled for transportation, the complete set having a net weight of about 860 lb. (390.1 kg.) While sets for similar service have been developed in Europe under the spur of urgent need, the equipment here referred to constitutes the first American portable X-ray outfit of this capacity to be manufactured.

Projector for Floodlighting

A powerful floodlight projector especially adapted to protective night lighting has recently been placed upon the



CROSS-SECTIONAL VIEW OF REFLECTOR FOR FLOODLAMP

market by the National X-Ray Reflector Company of Chicago. The projector ordinarily uses a 400-watt gas-filled flood-lighting lamp. The socket is adjustable and can be controlled from the outside so that the beam of light can be varied from a 12-deg. to a 30-deg. angle. A swiveling and tilting device at the base plate make the projector flexible in operation.

Trade Notes

THE ALBERT EMANUEL COMPANY, electric utility operator, 710 Schwind Building, Dayton, Ohio, has moved its offices No. 61 Broadway, Room 712, New York City.

W. F. GEORGES, formerly of the Western Electric Company of Cincinnati and New York, has joined the selling organization of the Trumbull Electric Manufacturing Company, with headquarters at the New York office, 114 Liberty Street.

J. G. SANDIDGE, who has been in the Chicago office of the Cooper Hewitt Electric Company of Hoboken, N. J., as district salesman for the last few years, is now at 11 Majestic Building, Milwaukee, Wis., and will look after Cooper Hewitt matters in that vicinity.

CYRUS SCHUMACHER of Bluffton, S. C., announces that he is going to manufacture air motors to be used in charging storage batteries for farm lighting and especially for irrigating purposes. Mr. Schumacher recently severed his connection as superintendent of the Bluffton Light & Water Works.

CHARLES G. ROBIN, INC., 48 Warren Street, New York City, announces its purchase of the Indesco Lighting Fixture Company at 47 Warren Street. The entire electrical stock of the former concern will be moved to the latter address at once, where complete line of electrical supplies and fixtures will be carried.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY announces at its Pittsburgh service department has moved from its former location on Amber Avenue to new quarters at 6905 Susquehanna Street, in the Homewood district of Pittsburgh. Express and freight should be assigned to East Liberty, Pa., via the Pennsylvania Railroad. The automobile equipment service department has also moved to the new location.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY of East Pittsburgh, Pa., has recently secured the exclusive sales agency for the United States for Frankel solderless connectors. Manufacturing facilities have been increased by the Frankel Connector Company in order to care for the new business to be secured through the Westinghouse sales organization. The Westinghouse company will act also as a distributor of Frankel testing clips.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY of Boston, Mass., at the annual meeting, elected Burtis H. Ellis first vice-president and treasurer, James Ryan second vice-president, N. F. Johnson second vice-president and assistant treasurer, Edgar Whitmore secretary, Rufus Wilbur, Arthur Guilds and Frank Pierce directors. A statement of earnings which is expected in a few days will, it is estimated, show profits after taxes applicable to dividends of nearly \$600,000.

WILLIAM T. PRICE resigned as manager and chief engineer of the De La Vergne Machine Company, oil engine department, recently, to become president of the P-R Engine Company of New York and second vice-president of the Rathbun-Jones Engineering Company of Toledo, Ohio, which will undertake the sale and manufacture respectively of Price-Rathbun stationary and marine oil engines built in accordance with a new principle of fuel injection developed by Mr. Price in the last few years. The P-R Engine Company has its main office at 110 West Fortieth Street, New York, and other offices in Philadelphia, Baltimore and Toledo.

THE FEDERAL SIGN SYSTEM (ELECTRIC), Chicago, the building of which was the scene of a severe fire last week, reports that it has entirely recovered from this unfortunate accident. The fire was discovered at 5:40 o'clock in the evening of March 13, and defied the firemen until 10 o'clock. The rooms which were wrecked were the tin shop, the machine shop and an auxiliary stock room used for storage of excess material. While the office suffered considerable damage from water, no records were lost. The office staff was doing business as usual in an adjacent building at 10 o'clock on the following morning. The company's sign, fuse, washing-machine and vacuum-cleaner departments were not damaged. While the loss occasioned was of the magnitude of \$200,000, it was fully covered by insurance. H. L. Markham, general manager of the company, stated that it was particularly fortunate that the fire broke out where it did rather than in some other location, since the departments destroyed were those in which work is now most

slack and can be most easily maintained by transferring activities to outside shops. Space to take care of this work in an adjacent building has already been arranged for. The fire, it is stated, will not have any adverse effect on deliveries of goods to the company's customers.

CAPTAIN RICHARD P. HENRY, late of the United States Army, has joined the selling forces of the Square D Company of Detroit, manufacturer of steel inclosed safety switches, and has been appointed to the Indiana territory, with headquarters at Indianapolis. He spent three years at Purdue University, since when he has been engaged in various branches of engineering work. His first position was that of assistant engineer for the Terre Haute, Indianapolis & Eastern Traction Company, Terre Haute Division. In 1912 Captain Henry joined the Santa Susana Syndicate, Los Angeles, Cal., in the capacity of engineer and assistant geologist, and later entered the contracting business for himself, with offices at Chicago. He finally enlisted in the Engineering Corps of the United States Army, from which he was recently given an indefinite leave of absence on account of physical disability.

Trade Publications

FANS.—Marelli fans for the 1918 season are illustrated and described in a circular prepared by H. Boker & Company, Inc., 101 Duane Street, New York City.

ARTIFICIAL LOAD.—The Western Electric Mechanical Company of Oakland, Cal., has issued a circular describing its "phantom load" for testing alternating-current wattmeters.

MOTOR NECESSITIES.—The Emil Grossman Manufacturing Corporation of Brooklyn, N. Y., is distributing its catalog No. 10, descriptive of its "Ever Good" motor necessities.

ELECTRIC LANTERN.—The Lindstrom, Smith Company of Chicago has issued a one-leaf circular illustrating its White Cross Electric Lantern and showing the uses to which it can be put.

ILLUMINATING GLASSWARE.—The Tarentum Glass Company of Tarentum, Pa., has issued a thirty-two-page catalog illustrating and describing its Tara glass products for direct and indirect illumination.

CABLE CLAMPS.—W. N. Matthews & Brother, Inc., St. Louis, Mo., has issued a one-page circular entitled "Labor Conservation." The circular explains the use and shows illustrations of the Matthews wire and cable clamps.

GENERATING SETS.—The Universal Motor Company of Oshkosh, Wis., has prepared bulletin No. 26, showing its 4-kw. generating sets. Photographs showing the various uses to which the generator sets may be put are printed.

EXPANSION JOINTS.—A circular from the Nuttall one-piece expansion joint which is being distributed by Nuttall of Pittsburgh, Pa., refers to an expansion joint which requires no packing and eliminates loops and bends in the pipe lines.

REFRIGERATING MACHINERY.—Bulletin No. 17 of the De La Vergne Machine Company of New York City shows actual installations of the De La Vergne ammonia condensers. The bulletin shows both the counter-current and parallel-flow types.

OIL FUSE CUT-OUTS.—The D. & W. Fuse Company of Providence, R. I., has recently issued a well-illustrated catalog showing the different types of fuse cut-outs which it manufactures. The booklet contains the rating of the different fuses and also a price list. Several actual installations are shown.

LIGHTING FIXTURE.—The Beardslee Chandelier Manufacturing Company of 216 South Jefferson Street, Chicago, has prepared a full-page circular showing the construction and method of support of its "quick-action" ceiling ring. Several sizes of ceiling rings are shown, together with various styles of glassware.

REFLECTOLYTE.—This is the name of catalog No. 4 issued by the Reflectolite Company, 914 Pine Street, St. Louis, Mo. The bulletin is well illustrated and shows a number of semi-indirect lighting units made by the company. The illuminating requirements of public, private and industrial institutions are well outlined.

MODERN METHODS IN TEXTILE MILLS.—Under this name the Westinghouse Lamp Company, 165 Broadway, New York

City, has issued a publication showing the need of better lighting in textile mills. It gives pictures comparing the effect of ill-lighted mills and well-lighted mills. The booklet is bound with a substantial cloth cover.

AUTOMATIC SKIP HOIST.—The Otis Elevator Company, Eleventh Avenue and Twenty-sixth Street, New York, has issued a bulletin referring to its skip hoists, which are automatically operated. Different types of skip hoists, their layout, and some typical installations in manufacturing plants, coal and coke plants, gas, electric light and power stations are shown.

SINGLE-PHASE MOTORS.—The Century Electric Company of St. Louis, Mo., has issued a catalog of its single-phase self-starting motors which are rated at 0.1 hp. to 30 hp. and which are of the repulsion-start induction type. Cross-section views of several types of motors are shown in the booklet. Actual installations and applications of the single-phase motors are also shown.

CIRCUIT BREAKERS.—The Automatic Reclosing Circuit Breaker Company of Columbus, Ohio, has recently issued bulletin No. 30, entitled "Automatic Reclosing Circuit Breakers and Relays for the Protection of Direct-Current Circuits." The bulletin gives a general description of the principle and applications of the circuit breakers and shows actual installations in several mines. It is well illustrated and contains several wiring diagrams of the apparatus.

PUMPS.—The C. H. Wheeler Manufacturing Company, Eighteenth Street and Lehigh Avenue, Philadelphia, is distributing a booklet entitled the "Radojet Air Pump." The bulletin is well illustrated, giving the outside views of various size injector-type pumps and showing the application of the so-called air "pump" in a power plant. The general arrangement of the piping system for air removal from condenser, etc., is also shown. Steam tables are included.

FARMERS' ELECTRICAL HANDBOOK.—This is the title of a valuable book published by the Western Electric Company on the application of electricity to farm service. Besides being a complete catalog of the apparatus and appliances used for farm lighting, the booklet shows how to wire a house and how to start telephone companies in rural districts. The book mentioned is the fourth edition of the "Farmers' Electrical Handbook," the previous editions being issued in 1916 and 1917.

New Incorporations

THE SUPREME ELECTRICAL CONSTRUCTION COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of \$5,000 by E. B. Cohen, H. Rothenberg and H. Bertinger, 135 Broadway, New York, N. Y.

THE HARTWELL - RADEMAEKERS MANUFACTURING COMPANY of Newark, N. J., has been incorporated by William H. Rademaekers and Albert E. Hartwell of Newark. The company is capitalized at \$150,000 and proposes to manufacture electric motors.

THE MERRILL MANUFACTURING COMPANY of Boston, Mass., has been chartered with a capital stock of \$50,000 to manufacture spark plugs and mechanical and electrical appliances. William J. Russell is president and Thomas B. Sweeney, 50 State Street, is treasurer.

THE STANLEY ENGINEERING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$4,000,000 for the purpose of installing steam, electric and hydraulic plants, etc. The incorporators are: C. L. Rimlinger, M. M. Clancy and F. A. Armstrong of Wilmington, Del.

THE VICTORIA SALES CORPORATION of New York, N. Y., has been incorporated by A. Ornstein, 1838 Seventh Avenue, New York City; P. A. Larter, Bensonhurst, N. Y., and F. A. Schilling, 647 Academy Street, New York, N. Y. The company is capitalized at \$30,000 and proposes to manufacture electric lamps for automobiles, etc.

THE CINCINNATI SPECIALTY MANUFACTURING COMPANY of Cincinnati, Ohio, has been incorporated with a capital stock of \$25,000 by J. E. Snyder, S. S. Oakley and others. The company formerly operated a plant at Powers Street and Sylvan Avenue under a partnership. One of the specialties manufactured by the company is an automatic extension reel for electric lamps.

New England States

BURLINGTON, VT.—The Electric Light Commissioners are considering the question of renewing the contract with the Burlington Light & Power Company for furnishing hydroelectric power for the municipal electric light plant, which expires April 1.

CAMBRIDGE, MASS.—Plans have been completed and bids taken by the Cambridge Electric Light Company, 16 Blackstone Street, for the construction of and addition to its power plant, about 30 ft. by 40 ft., one story high.

EAST HAMPTON, MASS.—Work has begun on the construction of a new power plant and switchroom at the works of the Glendale Elastic Fabrics Company, to cost about \$10,000. Contract has been awarded to the Casper Range Construction Company, 29 Bond Street, Holyoke.

WORCESTER, MASS.—Plans are being prepared by the W. H. Sawyer Lumber Company, 66 Lincoln Street, for the construction of a power house in connection with its proposed new plant. The cost of the work is estimated at \$70,000.

FORESTVILLE, CONN.—The power plant of the Peck & Young Manufacturing Company was completely destroyed by fire on March 10.

TERRYVILLE, CONN.—At the annual town meeting it was voted to change the street lighting system from arc lamps to incandescent.

Middle Atlantic States

BINGHAMTON, N. Y.—Contracts have been awarded by the Binghamton Light, Heat & Power Company for furnishing energy to the amount of 300 hp. to two large manufacturing plants, due to the destruction of a portion of a dam in the Susquehanna River rendering useless the water-power plants of the two companies.

BUFFALO, N. Y.—Plans have been prepared by the National Aniline & Chemical Company for the construction of an addition to its power house, to cost about \$8,000.

BUFFALO, N. Y.—Bonds to the amount of \$60,000 have been authorized by the City Council to provide funds for the proposed improvements in the police and fire-alarm systems, including the installation of underground conduits to replace overhead wires.

LOCKPORT, N. Y.—Notice has been filed by the Lockport Light, Heat & Power Company with the Public Service Commission of an increase in capital stock from \$150,000 to \$350,000, the proceeds to be used for extensions, etc., to its system.

NEW HAMPTON, N. Y.—The contract for the construction of a new power house at the local reformatory for the Department of Correction, Municipal Building, New York, has been awarded to Nelson & Miller, West Main Street, Middletown.

NEW YORK, N. Y.—Plans are under consideration by the New York Telephone Company, 15 Dey Street, for building an addition to its telephone exchange building at West New Brighton.

NEW YORK, N. Y.—The National Lead Company has awarded a contract to Charles E. Knox, 101 Park Avenue, New York, for electrical work in connection with its new six-story factory building, to be erected at Marshall and Gold Streets, Brooklyn.

NIAGARA FALLS, N. Y.—Contract has been awarded by the National Carbon Company to the Osborn Engineering Company of Cleveland, for erection of additional factory buildings at its plant in Niagara Falls, including a six-story building, 54 ft. by 193 ft., a two-story 20 ft. by 114 ft., and two one-story buildings, 70 ft. by 144 ft. and 49 ft. by 70 ft., to cost about \$200,000.

JERSEY CITY, N. J.—Bids will be received by the Boulevard Commission until April 3 for furnishing new lamps, generators and other appliances for use in connection with the proposed improvements to the electric-lighting system on the Boulevard.

NETCONG, N. J.—Plans are being considered by the Council for the installation of a new ornamental lighting system on Main Street. Lamps of larger candlepower will be installed.

NEWARK, N. J.—A permit has been taken out by Maas & Waldstein, Inc., Avenue R, for the construction of an addition to its plant and for improvements to boiler house. The cost of the entire work is estimated at \$12,000.

TRENTON, N. J.—Plans for the construction of a new municipal hydroelectric power plant, to be located on Sanhican Creek, is under consideration by the City Council.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

DELAWARE WATER GAP, PA.—The Pennsylvania Utilities Company of Easton has applied to the Borough Council for a franchise to furnish electricity for lamps, heaters and motors in Delaware Water Gap for a period of 15 years. Application was also made to the Council for permission to tie in the 2300-volt transmission line of the utilities company, which extension was made from the Analomink Paper Company about a year ago.

ERIE, PA.—The Council has appropriated \$4,756 for the construction of a conduit for low and high tension wires through the Parade Street subway, extending from Fourteenth to Seventeenth Street.

NANTICOKE, PA.—Contract has been awarded by the board of managers of the State Hospital to John Curtis & Company, 1 Hickory Street, Wilkes-Barre, for the construction of a new power house, about 50 ft. by 65 ft., one story high.

PHILADELPHIA, PA.—Contract has been awarded by Andrew J. Sauer & Company, architects, to the Coneen Construction Company for a one-story power house to be erected at 2626 Martha Street, for M. A. Lieberman.

STEELTON, PA.—Plans are being considered by the Bethlehem Steel Company for the installation of four new boilers of 250 hp. each in the new addition now under construction at its works near Swatara Street.

TOPTON, PA.—The Bowers Electric Company has petitioned the Public Service Commission for approval of a franchise granted by the borough of Tipton to supply electrical service in the borough.

TYRONE, PA.—The West Virginia Pulp & Paper Company has awarded a contract to John G. Livingston, Jr., 70 East Forty-fifth Street, New York, for electrical work in connection with the construction of its new manufacturing plant, consisting of eight large buildings, under construction at Tyrone, at a cost of about \$500,000.

BOWERS, DEL.—Steps have been taken to organize a company to install and operate an electric-light plant in Bowers. W. E. Kelly is reported interested in the project.

BALTIMORE, MD.—Preparations are being made by the Consolidated Gas, Electric Light & Power Company for the erection of a branch power station in Linthicum, 40 ft. by 26 ft., to cost about \$7,000, for which bids have been submitted.

ELLICOTT CITY, MD.—A bill has been introduced in State Legislature authorizing the Commissioners of Ellicott City to issue bonds for the installation of a municipal electric-light plant, providing a majority of taxpayers ask for same.

BLUEFIELD, W. VA.—Plans are being considered by the City Council for improvements to the street-lighting system. It is proposed to discard the arc lamps now in use and install incandescent street lamps.

NEWPORT NEWS, VA.—Plans are under consideration by the Chesapeake & Potomac Telephone Company for the erection of a new telephone exchange plant. P. G. Burton, 108 East Lexington Street, Baltimore, Md., is engineer.

WASHINGTON, D. C.—The Potomac Electric Company is planning to build a boiler house on Benning Road, to cost about \$75,000.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded contract to the General Electric Engineering Company, 317 Canal Street, New York, N. Y., to install an electric-light and power system at the navy yard at Anacostia, D. C., to cost \$10,539.

WASHINGTON, D. C.—Contract has been awarded by the United States Food Administration to the George A. Fuller Company, Munsey Building, Washington, D. C., to erect an office building at Twentieth and D Streets, N. W., two stories, 155 ft. by 334 ft., with five courts, 2 ft. by 105 ft., to cost about \$150,000.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent of the Post Office Department, Washington, D. C., until April 9, for furnishing electrical supplies (motors, carbons, fuses, etc.). Blanks for proposals with specifications may be obtained upon application to the purchasing agent.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of

the District of Columbia, Washington, D. C., until April 2, for furnishing and delivering during the fiscal year beginning July 1, 1918, and ending June 30, 1919, the use of the various branches of the government of the District of Columbia supplies as follows: Electrical supplies, chemical laboratory supplies, etc. Form of proposed specifications and necessary information may be obtained from the purchasing office of the District of Columbia, Room 320, District Building, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 1725—134,000 ft. leaded and armored, plain interior communication cable, 870,000 ft. leaded and armored, plain, duplex double-conductor wire, 140,000 ft. armored, duplex double conductor wire, 260,000 ft. plain single conductor wire, 158,000 ft. soft steel leaded and armored, single-conductor wire; Schedule 1724—400,000 ft. twin lamp cord, 50,700 ft. lead-covered wire, 202,500 ft. duplex rubber-covered wire, 37,000 lb. weather proof wire on reels. Philadelphia, Pa., Schedule 1725—miscellaneous plain and armored magnet wire. Application for proposal blanks should designate the schedule desired by number.

North Central States

MARQUETTE, MICH.—Plans are being prepared by the Arnold Company, 10 South La Salle Street, Chicago, Ill., for the construction of a plant, consisting of 10 buildings for the Lake Superior & Ishpeming Railroad Company, to cost about \$400,000. Bids, it is understood, are now being received by the architects for construction of the buildings.

NORTHPORT, MICH.—Plans, it is reported, have been completed by the Electric Point Mining Company for the installation of an aerial tramway, connecting the shaft with the wagon road at Leadpoint, distance of 2¼ miles. It will have a capacity of 20 tons an hour and will cost from \$40,000 to \$50,000.

PORT HURON, MICH.—The City Commission is considering a proposal for the installation of electrically operated pumps to replace the steam pumps at the water works station. The cost is put at \$19,000.

READING, MICH.—The Council is considering submitting the proposal to issue \$8,000 in bonds for improvements to the water and light systems to the voters.

CARTHAGE, OHIO.—Contract has been awarded by the Polak Steel Company of Cincinnati to the M. Marcus Building Company of Cincinnati for the construction of an addition to its power plant at Carthage.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until March 29, for valves for the division of light and heat. Specification may be obtained at the office of the division of light and heat.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has awarded contract for construction of a one and two story reinforced concrete steel and brick power house, 150 ft. by 200 ft., to be erected on East Seventieth Street, to the National Concrete Fireproofing Company, Citizen Building. The cost is estimated at about \$1,000,000.

HAZARD, KY.—The Perry Coal & Lumber Company is contemplating the installation of an electrically-operated plant for coal development on the Louisville & Nashville Railroad in Perry County. Frank Nudelman and others of New York, N. Y. are reported interested in the project.

ATTICA, IND.—The municipal electric light and water works plant was destroyed by fire on March 9, causing a loss of about \$60,000. At present the city is without electrical service and the water supply is inadequate. Steps have been taken to rebuild the plant and \$100,000, or as much as needed, was pledged by the business men.

BIGGSVILLE, ILL.—The Biggsville Light Company is contemplating changing its system to alternating current, single phase, and extending its service to two small towns and farmers along the line which will require about a 75-kva., single phase, 2200 or 1100-volt machine. D. V. Lee is vice-president.

CHARLESTON, ILL.—Bonds to the amount of \$20,000, the proceeds to be used for improvements to the municipal electric light plant and water-works system, have been authorized.

CHICAGO, ILL.—The Drainage Board has decided upon an expenditure of \$50,000 for rehabilitating the electrical system. The report of the engineers estimated the cost of the work at \$200,000.

CHICAGO, ILL.—The War Department planning to erect several large warehouses in Chicago for army supplies. Contract has been awarded to the E. W. Sproul company, 1129 West Thirty-fifth Street, for the erection of a six-story, 500 ft. by 600 ft., army distributing warehouse, with a three-story tower and one-story power house. Thirty-ninth Street and Ashland Avenue. No units are to be built at once at a cost of about \$2,800,000. Work has begun on the above buildings. George C. Nimmons, 2 South Michigan Avenue, will have charge as supervising architect for the government.

MOUNT OLIVE, ILL.—At an election to be held April 16 the proposal to issue \$8,000 bonds for improvements to the municipal electric-light plant will be submitted to the voters. It is proposed to equip the waterworks pumping station with electrically-operated pumps. W. S. Merkle of St. Louis, Mo., is engineer in charge of the proposed improvement.

SIDNEY, ILL.—The Village Board has accepted the proposal of the Homer (Ill.) Electric Light Company to supply electrical service in Sidney for one month. If the service is satisfactory the local plant will be closed down and energy will be supplied from the Homer system.

CLINTONVILLE, WIS.—Work has started on the construction of a hydroelectric power plant on the Embarrass River, about 12 miles north of the city, for the J. P. Stewart Tractor Company of Clintonville. The plans provide for an initial installation of 750 hp. Electricity generated at the plant will be transmitted to the new tractor factory in Clintonville.

GREEN BAY, WIS.—Contracts have been awarded by the Northwest Engineering Works of Green Bay for the construction of a new fabricating shop, 30 ft. by 10 ft., and an addition to the boiler shop, 10 ft. by 150 ft. Two floors of an adjoining building will be remodeled into mold lofts. Considerable equipment is being purchased for the company, including a 10-ton jib crane, two furnaces and an electric air compressor. The company has contracts for construction of several steel ships.

MILWAUKEE, WIS.—Bids, it is understood, will soon be called for by the Board of Directors for the construction of a new high school building to cost about \$450,000, including manual training and domestic science departments. Frank M. Harbach is secretary.

WAUSAU, WIS.—Bids, it is expected, will soon be asked by the board of education for the construction of the first unit of the proposed new industrial and vocational training institute, to cost about \$50,000. The first building will be 90 ft. by 200 ft.

BOYDEN, IOWA.—Veenschoten Brothers, owners of the local electric-lighting system, are erecting an electric transmission line to Sheldon, where they will purchase electricity from the Iowa Light & Power Company. Energy will be transmitted at 6600 volts, 60-cycle, single-phase and stepped down to 100 volts at Boyden. The local system will be changed from direct to alternating current. It is expected to have the line completed about April 1.

BOSSIAN, IOWA.—The local electric-light and power plant, owned by Harry Bullard, has been purchased by A. G. O'Rear of Mason City. The new owner, it is understood, will make improvements to the system.

PALMER, NEB.—The local electric-light plant was recently destroyed by fire.

CHAPMAN, KAN.—Work will begin on the construction of the new transformer station of the United Telephone Company. A number of important improvements, it is understood, will be made by the company this spring.

MORAN, KAN.—The Municipal Light and Water Department is considering the question of supplying electricity in Bronson for domestic and power purposes. If the project goes through a 100-hp. oil engine will be required in addition to the present equipment, to be installed within three to six months. Correspondence is solicited from parties who have a second-hand 60-cycle, three-phase, 2300-volt alternator of 5 kva. capacity to sell. R. S. Parsons is general superintendent.

OAKLEY, KAN.—The erection of an electric transmission line from the municipal electric-light plant to Colby is under consideration by the city of Oakley to secure electricity to operate the local system.

PITTSBURG, KAN.—Bids will be received by the Sisters of St. Joseph, care of W. W. Van Meter, Caldwell-Murdock Building, Wichita, until March 27 (extension of date) for construction of addition to Mount Carmel Hospital, two and three stories and basement, 50 ft. by 136 ft. Separate bids

to be submitted on heating, electric wiring, plumbing, elevator and vacuum cleaner, etc. The cost is estimated at \$100,000.

YATES CENTER, KAN.—The municipal electric-light plant was wrecked by a tornado on Feb. 28.

Southern States

SOUTHPORT, N. C.—The property of the Southport Electric Light & Power Company is reported to have been purchased by J. G. White & Company, 43 Exchange Place, New York, N. Y., for \$50,000. Improvements, it is understood, will be made to the system, involving an expenditure of about \$20,000, and will include the installation of a 20-ton ice plant.

ATLANTA, GA.—The Board of Water Commissioners has rejected the bid of the Georgia Railway & Power Company to furnish electricity for a proposed new pumping plant, at an annual charge of \$58,000. The Council has appropriated \$34,500 for the construction of a pump having a capacity of 15,000,000 gal. per day.

ATLANTA, GA.—The Department of Justice has asked for an appropriation of \$1,000,000 for the installation of 500 light and medium weight looms, 1050-hp. electric motor drive, etc., for weekly capacity of 116,000 lb. of cotton duck. This machinery is to equip a 457-ft. by 210-ft. reinforced concrete brick construction weave mill, one story, constructed by prison labor, at a cost of \$129,500, at the United States penitentiary, Lockwood, Greene Company of Atlanta, Ga., and Boston, Mass., are architects and engineers.

MACON, GA.—Contract has been awarded by the War Department, Cantonment Division, Washington, D. C., to W. Z. Williams, Georgia Casualty Building, Macon, for construction of the proposed hospital buildings at Camp Wheeler, to cost from \$150,000 to \$170,000.

ANNISTON, ALA.—The War Department, Washington, D. C., has awarded the Crowell Construction Company of Chicago, Ill., the contract for construction of buildings for hospital at Camp McClellan, to cost about \$500,000.

BIRMINGHAM, ALA.—The Alabama Interurban Railway Company, which is planning to build an electric railway from Birmingham to Lock No. 17 on the Warrior River, a distance of about 20 miles, is also contemplating building branches, one to Patton Ferry, 5 miles long, and to Shoal Creek, 15 miles. Another extension to Lock No. 16 and Davis Creek is also under consideration.

LITTLE ROCK, ARK.—Bids will be received by the school board until March 28 for construction of a grade and junior high school building, to cost about \$100,000. Separate bids to be submitted on wiring, plumbing and heating.

JENNINGS, LA.—An election will be called to submit the proposal to issue bonds for the installation of an electric-light plant, ice factory and sewer system to the voters.

PLEASANTON, TEX.—The Town Council has decided to take over the local electric plant for a period of 60 days to test municipal ownership. If it proves satisfactory the plant will be purchased by the city.

Pacific and Mountain States

CENTRALIA, WASH.—F. M. Lewis and others have organized a company for the purpose of manufacturing and using a propeller type current water motor, which will operate pumping machinery for placing water on desert land. The machine was patented by Mr. Lewis.

CHEHALIS, WASH.—The proposal to grant O. B. Anderson of Portland, Ore., a franchise to supply electricity for lamps and motors in Chehalis will be submitted to the voters at a special election to be held April 20. The Council recently refused to grant this franchise on the ground that it would result in a duplication of systems. Upon refusal of the Council a petition was circulated by the promoter, and sufficient signatures were secured to warrant placing the matter before the voters.

HOQUIAM, WASH.—The City Council has entered into a contract with the Grays Harbor Railway & Light Company of Aberdeen for lighting the streets of the city for a period of five years. Under the terms of the contract the company is to install and maintain 220 incandescent lamps of 80 cp. In relocating lamps or placing new lamps the city is to bear the expense of erecting poles and stringing wires.

FOULSBRO, WASH.—The Puget Sound Pulp & Paper Company has been granted a franchise to erect and operate an electric transmission line in Foultsboro for a period of 25 years.

SEATTLE, WASH.—Plans are being prepared by the Puget Sound Traction, Light & Power Company for the construction of coal bunkers for its coal-pulverizing plant, at 1316 Western Avenue, to cost about \$17,000.

SEATTLE, WASH.—Plans have been submitted by A. H. Dimmock, city engineer, for the proposed elevated railroad to the shipyards. It is proposed to erect a timbered elevated roadway to extend from First Avenue South and Washington Street and West Waterst to Riverside, the shipyards and West Seattle.

SPOKANE, WASH.—The City Council has awarded the Washington Water Power Company a contract to install the new ornamental lighting system on Post Street from the east end of the Post Street bridge to the north side of Third Avenue, at \$40,545. The contract includes maintenance of lamps and furnishing electricity for same for a period of 10 years.

TACOMA, WASH.—Plans are being prepared by the electrical department for the construction of a substation to supply electricity from the municipal electric plant to operate the municipal tideflats car line.

REEDSPORT, ORE.—The Umpqua Power Company, recently incorporated, will take over the plant of the Gardiner Light & Power Company of Gardiner. The plant will be removed to Reedsport, but electrical service will be furnished in Gardiner. It is understood that the Umpqua Power Company and the Coos & Curley Telephone Company will erect a joint pole line.

BOVILL, IDAHO.—The installation of a storage battery in the municipal electric-light plant this summer is under consideration; also a third wire to cut out the street lamps at will, by the City Council. J. L. Shampine is engineer of power station.

NAMPA, IDAHO.—The City Council has awarded the Idaho Power Company a new contract under the terms of which the present arc-lighting system will be replaced with incandescent tungsten lamps. One hundred lamps varying in candlepower from 100 to 400 will be installed. At present there are 61 arc lamps.

HELPER, UTAH.—Application has been filed with the state engineer by G. R. Corey of Salt Lake City for permission to use 125 second ft. of water from Price River to develop 1600 electrical horsepower. The proposed plant will be located within a few miles of Helper. The plans provide for the construction of a concrete dam, 3 ft. high and 40 ft. long, the water to be carried in a ditch for a distance of 1½ miles, passing through two 4-ft. wheels under an 85-ft. head.

YUMA ARIZ.—Several additions and extensions are contemplated to the municipal electric-light, power and water plant: (1) The erection of an electric transmission line, 6600 volts, south and one to the west of town, at present to supply ranches nearby, and to be extended as demanded until they reach some nearby towns; (2) to extend the present secondary network to supply every part of the town, which will need about 1½ miles of line. It is possible that demand for electrical service on these new lines will make it necessary to install a new unit in the power plant. Bids have been received on a 50-hp. unit. Several petitions for street lamps in various parts of the town which are as yet unlighted are under consideration by the Council. Fred Kuecke is superintendent.

JOPLIN, MONT.—Sufficient signatures have been placed on a petition to practically insure the erection of an electric transmission line by the Montana Power Company to supply electricity in Joplin and other towns in this district.

DES MOINES, N. M.—The Village Trustees have decided to call an election to submit the proposal to issue \$50,000 in bonds to purchase the local electric-light plant and water works system and make extensions to same to the voters.

SANTA FE, N. M.—The first step has been taken by the City Council toward municipal ownership of the water and light plants. A committee has been appointed to place a valuation on the property of the company. The franchise of the Santa Fe Water & Light Company expires this year.

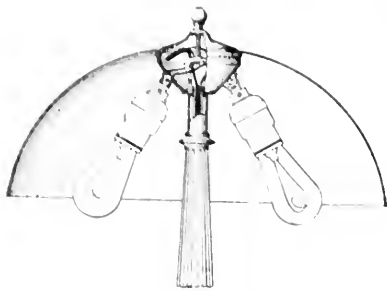
Canada

ARMAGH, ONT.—The Armagh Electric Company, it is reported, will ask for tenders for electrical equipment, to cost about \$49,000.

(Issued Feb. 19, 1918.)

1,257,100. ELECTRICAL FUSE; John H. Naylor, Everett, Mass. App. filed Nov. 17, 1913. Cartridge type.

1,257,106. ELECTRIC HEATING DEVICE; Leon F. Parkhurst, Pittsfield, Mass. App. filed July 23, 1911. Applies particularly to such as are provided with a flat heating surface and may either be used independently as stoves or heaters or in conjunction with other heating apparatus.



1,257,496—Lamp Cluster

- 1,257,117. AUTOMOBILE SIGNAL; Frederick Rauscher, Port Richmond, N. Y. App. filed May 27, 1916. Operable to indicate when there is a change in the direction.
- 1,257,155. IGNITION DEVICE; Harry R. Van Deventer, Sumter, S. C. App. filed Feb. 15, 1916. For internal-combustion engine.
- 1,257,163. ELECTRICAL BATTERY - CHARGING SYSTEM; Harry G. Webster, Chicago, Ill. App. filed April 18, 1912. Automobile.
- 1,257,177. DYNAMO - ELECTRIC MACHINE; Sven R. Bergman, Nahant, Mass. App. filed Oct. 13, 1915. Relates especially to direct-current dynamo-electric machines adapted for operation as motors and as generators of practically constant direct-current electromotive force when operating at variable speed.
- 1,257,178. DYNAMO - ELECTRIC MACHINE; Sven R. Bergman, Nahant, Mass. App. filed Oct. 18, 1915. Novel method of assembling parts of a dynamo-electric machine.
- 1,257,180. IMPULSE TRANSMITTER FOR AUTOMATIC TELEPHONE SYSTEMS; Gotthilf A. Betulander, Södertörns Villastad, Sweden. App. filed July 13, 1915. Consists in the use of a rotatable screw spindle for transmitting the rectilinear setting movement into a rotary movement.
- 1,257,193. WINDING FOR ELECTRIC MOTORS; Neil Currie, Jr., Pittsfield, Mass. App. filed March 4, 1916. Improved winding.
- 1,257,246. MAGNETIC SHUNT; Lloyd M. Killgore, Pittsfield, Mass. App. filed Jan. 29, 1917. Each magnetic shunt is composed of a number of pieces of magnetic material, the number of which may be readily varied after the complete assembly of the transformer.
- 1,257,255. ELECTRIC SWITCH FOR MINES; Edward Leach, Rathmel, Pa. App. filed April 12, 1917. Automatic cut-out switch for use in connection with line and trolley wires.
- 1,257,272. ELECTRIC-RESISTANCE ELEMENT; Guy M. Laird, Chicago, Ill. App. filed May 19, 1916. Composed of a metal which shall have the property of being particularly low in electric conductivity, have a melting point exceeding that of pure copper, and be capable of resisting oxidation at all temperatures and under all conditions to which it needs to be subjected, while at the same time possessing characteristics permitting it to be drawn or otherwise worked to form strips, strands or filaments.
- 1,257,283. AUTOMATIC TELEPHONE SYSTEM; Alfred H. Dyson, Chicago, Ill. App. filed Aug. 19, 1907. Novel arrangement of electrical connections between the switches whereby the chances of the calling line finding an idle trunk through which to extend its circuits are greatly increased.
- 1,257,287. SWITCH DEVICE; William Kaisling, Chicago, Ill. App. filed June 5, 1914. Plurality of plungers are used, some of which are adapted for individual service and some of which are adapted for alternate service.
- 1,257,289. METER PANEL; Hubert F. Krantz, Brooklyn, N. Y. App. filed Dec. 18, 1912. Each busbar of panel can be connected to the same branch circuit.
- 1,257,294. AUTOMOBILE TURNING SIGNAL; Henry Patrick, New Brunswick, N. J. App. filed March 23, 1917. Improvements.

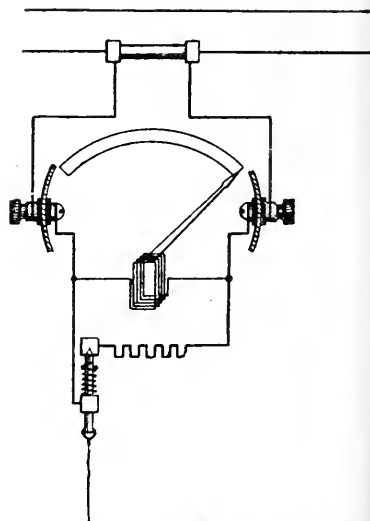
Record of Electrical Patents

Notes on United States Patents

(Issued Feb. 26, 1918.)

- 14,136. (REISSUE.) PROCESS FOR THE ELECTROLYSIS AND TREATMENT OF SULPHATE LIQUORS; App. filed Aug. 18, 1914. Improved process.
- 1,257,303. REPEATER SYSTEM; John H. Bell, East Orange, N. J. App. filed May 16, 1916. Simplifies the arrangement of repeater circuits.
- 1,257,312. ALKALINE - BATTERY PLATE; Campbell C. Carpenter, Niagara Falls, N. Y. App. filed Oct. 18, 1912. Adapted to withstand the expansion and contraction during the repeated charge and discharge.
- 1,257,317. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 12, 1915. Improvements in telephone trunk circuits.
- 1,257,336. SAFETY DEVICE FOR ELEVATORS; Alexander Gagnon, Bideford, Me. App. filed Nov. 8, 1916. Means for automatically bringing the elevator car to a stop.
- 1,257,338. LINE SWITCH; Charles L. Goodrum, New York, N. Y. App. filed Jan. 20, 1916. Relates to automatic telephone systems.
- 1,257,339. FLEXIBLE ELECTRIC HEATER; Albert E. Grapp, Minneapolis, Minn. App. filed Dec. 20, 1915. Adapted for use for warming up various parts of an internal-combustion engine.
- 1,257,349. CONTROL SYSTEM; Rudolf E. Hullmund, Pittsburgh, Pa. App. filed Jan. 6, 1916. Single-phase commutator motor for starting a phase converter.
- 1,257,356. ALUMINOUS COMPOSITION AND METHOD OF PREPARING THE SAME; Otis Hutchins, Niagara Falls, N. Y. App. filed Nov. 14, 1917. Electric furnace process.
- 1,257,361. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed April 24, 1917. Central-energy type; provides improved signaling means.
- 1,257,362. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed April 24, 1917. Battery type; provides improved signaling means.
- 1,257,370. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell and Franklin A. Steers, New York, N. Y. App. filed Oct. 26, 1916. Operator is informed that a calling subscriber desires her attention.
- 1,257,375. HOUSING ELECTRIC APPARATUS; Aldah R. Mecham, Oklahoma City, Okla. App. filed March 18, 1916. Moisture-tight.
- 1,257,381. LOW-FREQUENCY-SIGNAL REPEATER; Harold W. Nichols, Maplewood, N. J. App. filed Sept. 24, 1915. Amplifies and repeats low-frequency currents.
- 1,257,382. INDIRECT ILLUMINATION; Henry G. O'Neill and Ward E. Pearson, New York, N. Y. App. filed Oct. 30, 1916. Arrangement of indirect or reflected electric or other light rays with a mirror.
- 1,257,392. TELEPHONE - LINE - SELECTING SYSTEM; Frank N. Reeves and Alben E. Lundell, Newark, N. J. App. filed April 16, 1915. Improvements.
- 1,257,391. TERMINAL BANK; John N. Reynolds, Greenwich, Conn. App. filed Sept. 17, 1915. Inductive action prevented.
- 1,257,396. PROCESS OF MAKING METALLIC CATALYZERS; William D. Richardson, Chicago, Ill. App. filed Nov. 11, 1912. New method of preparing highly reactive catalysts.
- 1,257,412. TRAIN - DISPATCHING SYSTEM; Paul J. Simmen, Indianapolis, Ind. App. filed Nov. 18, 1911. Improved system.
- 1,257,418. REFILLABLE FUSE; Basil L. Spurr and Frank A. Tittmore, Richmond, Cal. App. filed April 27, 1916. Fusible element of the proper capacity only may be installed.
- 1,257,426. VOLTAGE - REGULATING SYSTEM FOR VAPOR RECTIFIERS; William Tschudy, Wilkinsburg, and Sidney W. Farnsworth, Pittsburgh, Pa. App. filed Feb. 19, 1914. Means for regulating the voltage in the direct-current circuit.

- 1,257,440. ELECTRICAL BURGULAR ALARM; Alfred Zehden, Berlin, Germany. App. filed March 18, 1914. Resistance connected as branch of Wheatstone bridge.
- 1,257,451. PROTECTION OF ELECTRIC CABLES; John H. Bowden, London, and Harry E. J. Thompson, Battersea Park, London, England. App. filed March 15, 1916. Protection of electric cables against leakage and faults in the insulation.
- 1,257,463. SWITCH; William D. Dean, Chicago, Ill. App. filed June 2, 1913. Simple and efficient arrangement of parts.
- 1,257,468. INTERNAL - COMBUSTION - ENGINE TESTING DEVICE; Roy G. Edgerton, Suffolk, Va. App. filed March 31, 1917. Readily applied to or removed from the cylinders.
- 1,257,496. LAMP CLUSTER; George L. Lamb, Nappanee, Ind. App. filed April 16, 1917. Adjustable lamp socket.
- 1,257,514. ELECTRICAL MEASURING INSTRUMENT; William Meyer, Chicago, Ill. App. filed Aug. 23, 1915. Double-scale instrument.
- 1,257,516. INSULATOR ASSEMBLY FOR ELECTRICAL CONSTRUCTION; Earle A. Muckey, San Francisco, Cal. App. filed Aug. 23, 1917. Universal detachable rigid connection.
- 1,257,526. CONSTANT-PRESSURE SOLID RECTIFIER; Greenleaf Whittier Pickard, Amesbury, Mass. App. filed Sept. 15, 1909. Improvements.
- 1,257,531. PROCESS FOR MAKING CATALYZERS; William D. Richardson. App. filed Nov. 11, 1912. Improved method of hydrogenating oils or fats to harden or solidify them.
- 1,257,533. ELECTRIC SWITCH; Joseph Sachs, Hartford, Conn. App. filed Feb. 18, 1915. Used in conjunction with electromagnetic actuating mechanism.
- 1,257,534. SWITCH; Joseph Sachs, Hartford, Conn. App. filed April 17, 1915. Pendant snap switch.
- 1,257,555. METHOD OF PRODUCING ANALGESIA; Frederick K. Vreeland, Montclair, N. J. App. filed June 25, 1914. By means of electric currents.
- 1,257,596. POCKET HAND-LAMP; Joseph C. Ford, Madison, Wis. App. filed May 17, 1917. A switch for connecting the battery and the electric bulb, located between the two.
- 1,257,599. ELECTRIC HEATER; William S. Hadaway, Jr., New York, N. Y. App. filed Sept. 5, 1911. Electric heating element is embedded in the device.
- 1,257,615. METHOD AND MEANS FOR ELECTRICALLY WELDING THE RIMS FOR FLANGES OF WHEEL OR CYCLE TIRES



1,257,514—Electrical Measuring Instrument

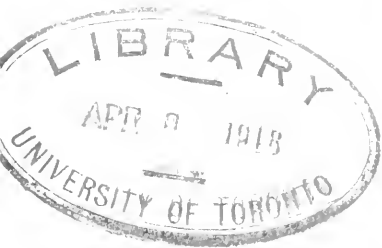
- Rudolf Kronenberg, Ohligs, Germany. App. filed Sept. 20, 1917. Full uniformity of welding.
- 1,257,618. ELECTRIC LIGHTING SYSTEM FOR AUTOMOBILES; Dominick F. Leone, Seattle, Wash. App. filed May 17, 1917. Improved controller and electrical connections.
- 1,257,646. AUTOMOBILE SIGNAL; Thomas E. Smith, Los Angeles, Cal. App. filed Jan. 8, 1917. Indicates the direction in which the automobile is to turn.
- 1,257,651. LINE-TESTING INSTRUMENT; Oscar F. Tallman and Fred E. Hubert, St. Louis, Mo. App. filed July 20, 1914. Compact and easily transportable.

Electrical World

New York, March 30, 1918

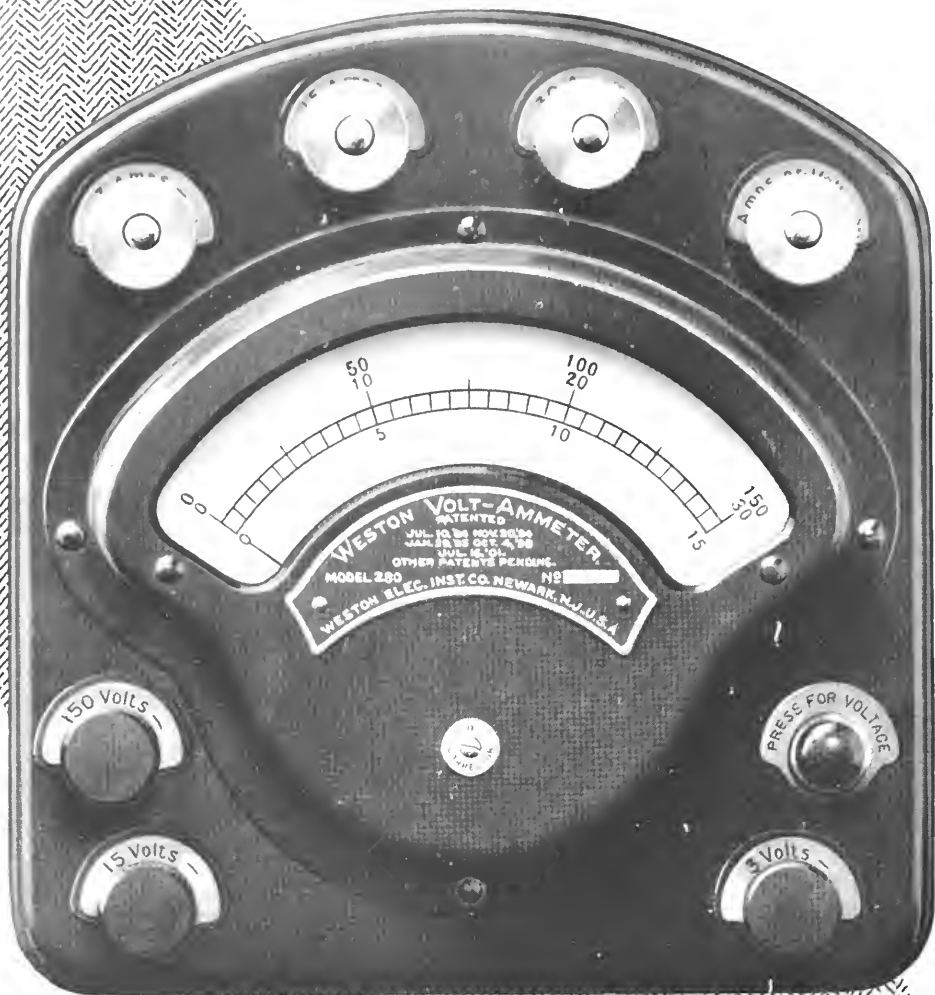
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Vol. 71, No. 13 10c a copy



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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Volume 71

New York, Saturday, March 30, 1918

Number 13

Support the Third Liberty Loan

TO WIN the war each of us must feel down deep in the innermost recesses of his heart a firm conviction of its righteousness. If as individuals we are not called on to shoulder a gun or to render some distinct personal service to the nation, we must be conscious of our obligation to support and sustain those who are. Above all, we must never lag in our zeal for the cause, but instead strive incessantly to create a sentiment which will cheer, inspire and keep flaming the light of courage and hope in those who face the foe. With this issue of the ELECTRICAL WORLD we distribute a colored cartoon showing how all may assist in the triumph of free democracy over ruthless autocracy. Consider the ample security back of the Liberty loan, think of the power of your investment to help in making the world safe, and buy your share of the bonds.

The Eternal Labor Problem in Industry

THERE has never been a time within the memory of living men when the labor question, involving all the intricate relations between the worker and the capitalist and the cost of living, has been so acute as at present. The situation, growing more critical for some years, has been aggravated by the world war to an unparalleled degree. The papers by L. K. Comstock published in the ELECTRICAL WORLD of March 16 and 23 give a striking analysis of the situation and suggest at least a possible remedy.

The long and short of the whole situation is, first, that we are going through a period of monetary inflation, complicated by the growth of a somewhat cumbersome industrial system in itself tending to needlessly increased costs of every kind; second, there has been superimposed on this the startling changes in demand and supply enforced by the conditions of war. We lay aside for the present the more or less theoretical factor involved in gold production, which has not been without its effect, but which is in only minor degree chargeable with the immediate situation.

For a good many years past those industries which have to do with the fundamental necessities of life have been gradually assuming a more and more complex development. It is a matter of common knowledge that in many of the commodities concerned there has been careful and thorough systematization of production and distribution for the purpose of controlling what would otherwise be the normal flow of supply and demand. Many commodities have been practically controlled in

their entirety by what are virtually trusts. The operations of these have been repeatedly disclosed, and they are in fact apparently well known to everybody except those whose official duty lies in the line of regulating them.

Their fundamental principle is by getting possession of large quantities of necessary articles to create at will shortage and surplusage which take the place of the ordinary supply and demand resting on the principle of an open market. When a shortage, real or artificial, is created in the supply of any article its price shoots upward, very rapidly at first, afterward more gradually, as rising prices forcibly curtail consumption. When there is a surplus prices fall, but at a much slower rate, forming a sort of hysteretic loop, the area of which represents in the main the profit of those who manipulate the market. The variation of price with shortage and surplus was actually worked out by an English investigator for wheat some years ago, but it has never been thoroughly studied for commodities in general under the control of single or closely allied bodies.

Added to this has been the effect of speculation pure and simple and an increasing complication of the whole matter of industrial distribution involving a long chain of intermediaries between those who produce and those who consume, all of them taking toll as the product goes by. The net result of these factors has been the startling rise in the cost of necessities to which Mr. Comstock directs attention. The effect has been to send up living costs, as he shows, out of all proportion to the rise in wages during the same period, and the attempt on the part of the wage earner to equalize conditions has resulted in very grave disturbances which are now rapidly becoming worse. Just at present the inflation due to the war is still further accentuating the difficulty. The huge loans negotiated both here and abroad have added to the inflation by a species of pyramiding, differing from country to country but producing the same effect, and the government in spending enormous sums under contracts which give every incentive to lavish expenditure has made a bad matter worse.

Broadly, the trouble with the situation is the lack of following the fundamental principles of righteousness, and the remedy, in so far as there is one, is to carry out the gospel of the square deal. Both workmen and manufacturer are at fault, since human nature is the same in both classes. On the one side is a frantic effort to keep down the labor cost of production, since the cost of materials cannot at present be kept down. On the other hand, there is the determination to get for labor as large a proportion as practicable of the

rapidly increasing profits of industry. The late James M. Dodge, a most patient and sympathetic student of the earlier phases of the situation, used to say that he felt it to be his duty to see to it that his workmen got a comfortable living wage at all times, and that he had found that in thus helping them they helped him in at least equal measure. Many another manufacturer takes the same enlightened view of the situation, but it is not yet sufficiently general to remedy the situation in hand.

Mr. Comstock's view of the matter is that it might be possible to effect by suitable regulation an automatic readjustment of wages at stated intervals, say semi-annually, based practically on maintaining wages and the cost of fundamental commodities on an even basis. Whether this could be carried out practically is not easy to determine, but it is, as a matter of fact, a process which is going on spontaneously, irregularly, and with rather disastrous results to the continuity of production. Perhaps Mr. Schwab is right in saying that by the end of the present conflict the workingman will be on the top of the heap. But, however this may be, it is certain that the classes which suffer most acutely are those with relatively fixed incomes, whether in the form of salaries or dividends. They are ground between the upper and the nether millstone, and no solution of the problem can be considered sound which does not take them into account.

Practically the present situation is disastrous in that it so greatly reduces the effectiveness of the American dollar in carrying on the war as to make the boasted wealth of the country of much less avail than we fondly supposed. These are times of enormously rapid changes, financially and socially, and the need of co-ordinating them and in so far as possible of regulating them is fundamental. It is the biggest task that lies before the government and its citizens in a period of prodigious efforts.

Safe Design for Switching Apparatus

THOSE of our readers who have to do with station operation will find much of interest in the paper by M. M. Samuels and F. N. Bechoff in the current issue. It takes up fundamentally the questions of switchboard design and operation with respect to safe and convenient working. All large stations nowadays have to depend to a very considerable extent on remote control. The fundamental points in planning a necessarily somewhat intricate system are to see that the switch controls are as easy as possible to handle and interlocked so that a necessary sequence of operations cannot be performed in the wrong order. One very useful suggestion is that control switches should have such conspicuous mechanical indicators, aside from all control lamps, as to show the last step taken by the operator and impress it upon him. Control lamps alone may lead to confusion. Another capital hint is that there are cases in which a little complication, like the necessary use of both hands, which the switchboard operator has to think about for a moment may prevent his doing the wrong thing in an emergency.

We note with pleasure the opinion expressed by the authors that most oil circuit-breaker compartments are too small and somewhat inaccessible. In a great

many stations an obsession of compactness has ruled switchboard design, and while in itself compactness is a good thing structurally, it has very often led to insufficient space, particularly between high-tension apparatus, leading both to danger to the operator and to considerable risk of involving a large amount of apparatus in a single accident which might otherwise have been trivial. It must be remembered that, particularly in a high-tension station, even apparently unimportant pieces of apparatus may be the source of very serious trouble, as when a whole station was put temporarily out of service because an inquisitive rat short-circuited a potential transformer. It may not be necessary to paint all high-tension wiring and connections red, but they always should be either so marked or so placed that there can be no possible mistake as to their character. The designing engineer will find the paper under discussion full of interesting hints, and its study will amply repay him.

The Working Temperature of Generators

IN THE good old times before generator design had been placed on a really scientific basis the heat limit as the ultimate index of capacity was somewhat neglected. Little was known of what the heating conditions really were, and still less of the distribution of temperatures throughout the structure, which in the last resort determines whether insulation is reliable or will break down. "Nigger on the core" was a common acquaintance.

In the current issue H. D. Stephens gives a very illuminating account of some of the recent methods which have been adopted to measure and keep track of the temperatures within the structure so that the approach of danger may be scented without smelling the insulation. The hottest spot in an armature rather than the average temperature is the thing to be sought, and while in small machines with shallow windings a thermometric method gave a useful approximation, it soon had to be abandoned, and the next step in advance was resistance measurement. But this was merely an average and could not give the necessary information regarding the approach to the danger limit.

Nowadays big generators are customarily built with telltales placed, as nearly as judgment and experience can indicate, at the hottest points in the winding. These have taken the form of exploring coils embedded in the winding, and of which the resistance can be quickly noted, or of thermocouples used in the same way. The indicating apparatus of either kind can be graduated in actual temperature, so that the rise of heating toward the danger point can be accurately followed and noted.

Mr. Stephens describes particularly the most recent form of thermo-electric detector, very convenient on account of its small bulk, which enables it to be readily embedded in the windings, and its combination of mechanical strength and sensitiveness. Both coils and thermocouples enable the operator to watch closely the performance of the generators during the time of heavy load and give very valuable information regarding failures of ventilation which may be due to the choking of the air passages and must be met by a thorough cleaning.

Thus far such apparatus has not been readily applicable to the revolving fields of alternating-current machines or the revolving armatures of direct-current machines, on account of the difficulties interposed by the moving contacts. The next step would seem to be to conquer these particular troubles so as to give the same valuable information regarding the moving parts which is now available with respect to the fixed ones. The difficulties are considerable, but probably not insurmountable, and the resourceful inventor has here a fine field for his activities.

Specifications for Factory Lighting

FOLLOWING up Professor Clewell's consideration of some of the changes in factory lighting comes his study of the changes embodied or proposed in some of the state codes. Leaving aside the questions of emergency and entrance lighting, the chief points in any such code are those regulating the intensity of the illumination, together with provisions for the elimination of glare and suitable distribution of light. Now, these three together make up the problem of the illuminating engineer in industrial lighting. If they could be really embodied in a code, the whole technique of illumination could be reduced to hard and fast formulas. Hence comes the difficulty of drawing suitable codes and particularly of drawing them so that they can be enforced.

In provisions for intensity of illumination the fundamental thing is the classification of work so that the requirements of the case in hand will be readily understood. Here is the main difficulty. While it is possible to generalize within reasonable limits of error, it is very difficult to make a sound classification which shall cover all the phases even of any particular kind of manufacture. As Professor Clewell notes, the proposed Ohio code attempts to classify under six main heads some 250 kinds of work. This lays too much stress on the mere matter of intensity and gives little information as to the other requirements of any particular situation, such as distribution of light and glare, which are at least equally important with intensity in determining the effectiveness of artificial lighting.

No specification with respect to glare has yet been devised which is of very much practical use. So much depends on the nature of the work and the situation of the machinery that generalizations are very unsafe. The best that can be done is to give sound advice and to leave its application to the expert on the spot. The mere question of reflecting surfaces on the work will go far toward determining the maximum permissible ap-

parent brilliancy of the source and its best location.

Looking at Professor Clewell's tabulation of the situation, the striking feature which at once presents itself is the upward tendency in the general level of illumination. The real economic question is, not how little light one can get along with, but how much can be applied advantageously toward the increase in the quantity and quality of the work.

Much of the burden of enforcing codes will rest on the state inspectors, who in the discharge of this duty ought to be particularly well informed concerning the methods of modern illumination. Wide-awake manufacturers in equipping their plants very commonly call in experts on lighting, and when this is done the inspector will find no infraction of the code. The inspectors' troubles arise when dealing with those who have not taken this wise precaution, and they ought to know enough of the art to steer them, at least, in the right direction. It would be a good thing if the Illuminating Engineering Society could take some suitable opportunity for instructional work with special reference to the needs of inspectors in enforcing the law. It would be no very difficult matter to provide a series of demonstrations which would impress most forcefully the fundamentals of factory lighting and tend strongly to higher standards of efficiency.

A Central-Station Pioneer, A. C. Dunham

THE death of Austin C. Dunham, former president of the Hartford (Conn.) Electric Light Company and one of the pioneers of central-station progress in this country, as reported in last week's issue, removes a historic figure closely identified with early central-station development. After the election of Mr. Dunham as president of the Hartford company in 1882 there followed year after year of brilliant development work in centralized electrical supply, embodied in such advances as polyphase transmission from water power, the use of alternating-current, inclosed-arc lamps, 60-cycle rotary converters, the constant-current, alternating-current arc-lighting system, the first steam-turbine application, the initial try-out of the Nernst lamp in commercial service, the installation of the first storage battery in central-station service, first tungsten street lamps, and epochal work along electric cooking and flat-rate residential lighting lines. Mr. Dunham was one of the first to appreciate the economies of energy production by high-powered steam turbines as compared with water powers of ordinary character. He carried his directors with him far beyond the conventional paths of every-day practice.

AS AN indication of the broad scope of the engineering subjects that the **ELECTRICAL WORLD** discusses each week, the following, which will be dealt with in early issues, may be mentioned: A technical discussion regarding investigations to determine methods of improving the starting qualities of synchronous motors; the concluding section of an article regarding the New Bedford (Mass.) generating station; specific examples of installations that have been converted from coal-burning to

The Coming Issues

oil-burning plants, with some operating results; an article by a central-station engineer telling how to obtain the proper protective action from transformer fuses without depreciating service; features of an outdoor substation, and some interesting details regarding a large hydroelectric development in Canada. The usual compilation of monthly central-station statistics, now in course of preparation for publication, receives added interest from the extraordinary war-time influences affecting it.

Safety Features in Switching Apparatus

A Compilation of Some Ideas That Have Been Developed for Ready Reference of Electrical Engineers in Designing or Remodeling Switching Installations

BY M. M. SAMUELS AND F. N. BECHOFF

WHILE in small installations it was generally possible for one switchboard operator to handle the entire switching equipment of the station, it has become necessary in large, modern, high-voltage stations, where the switching apparatus very often occupies several floors, to depend not only on assistant operators and helpers but principally upon electrical signaling and indicating devices. A great many ingenious and useful safety devices and schemes of connections have been devised within recent years, but the development of large-size and higher-voltage apparatus has been so overwhelmingly rapid that very often old and thoroughly experienced station operators find it difficult to keep in touch with them. Even though the designing engineer is familiar with all of them, he may easily forget to include one or more essential safety features in his design.

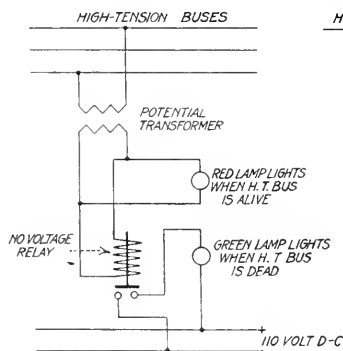
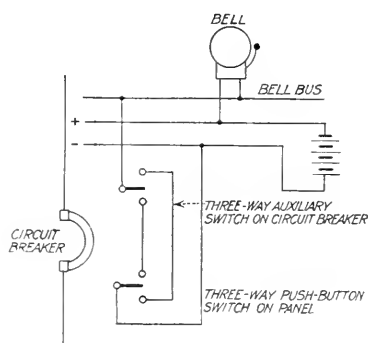
It is therefore the purpose of this article not so much to exhaust the whole field of safety engineering as to bring out in systematic form some of the well-known safety features and at the same time call attention to some which are less known but which are nevertheless of great importance. It is hoped that other contributors will in the future make additional suggestions so that by and by the designing engineer as well as the operator will have ready references whenever he requires them.

The design of control switches is one of the first things that demand attention, since switching apparatus used in modern power houses is usually installed remote from the switchboard and operated electrically therefrom by means of small control switches. To

and ready to perform safely the next operation. Poor contacts and hidden springs should therefore be eliminated. The usual method of indicating by means of colored lamps whether a circuit is open or closed is not sufficient for modern installations where it is possible not only for a circuit to open automatically but to be opened from other points' either inside or outside of the power house. The lamp indicates only that the circuit breaker is open but does not indicate whether the circuit was opened by the operator himself. It is therefore essential that the control switch should be equipped with a reliable, prominent and easily distinguishable mechanical indicator which will indicate the last operation performed by the operator himself. There are some switches now on the market which meet these requirements.

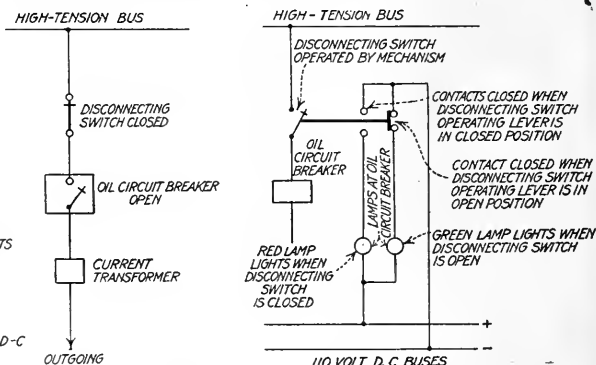
With the great number of indicating lamps on modern switchboards, it is preferable in order to avoid confusion to have the two lamps of a control circuit together with the respective name-plates on a common escutcheon plate with the control switch. It should further be possible to lock the control switch so that it cannot be operated whenever any repairing or inspection is being done on the apparatus controlled by it. Push switches should not be used except in cases where they could not possibly be operated accidentally by the operator's elbow or knee.

To avoid the possibility of closing a main generator circuit breaker without first going through the necessary process of synchronizing, it is customary to interlock the closing circuit of the circuit breaker with the synchronizing receptacle, so that the synchronizing plug



FIGS. 1 AND 2—THREE-WAY AUXILIARY PUSH-BUTTON INTERLOCKED WITH THREE-WAY AUXILIARY SWITCH FOR RESET-
TING BELL ALARM; METHOD OF CONNECTING DANGER SIGNALS
ALONG A HIGH-TENSION BUS

satisfy the majority of switchboard operators a control switch should be as easy to handle as possible and should be so constructed that the operator cannot perform the wrong operation. These requirements should be obvious, since it is very often necessary to open a circuit hurriedly without having any time for reflection. The switch should always be in working condition



FIGS. 3 AND 4—FAILURE TO OPEN DISCONNECTING SWITCH
MAY ENDANGER PERSON WORKING NEAR OIL-SWITCH TERM-
INAL; SIGNALS AT OIL SWITCH INDICATE WHETHER DIS-
CONNECTING SWITCH IS OPEN OR CLOSED

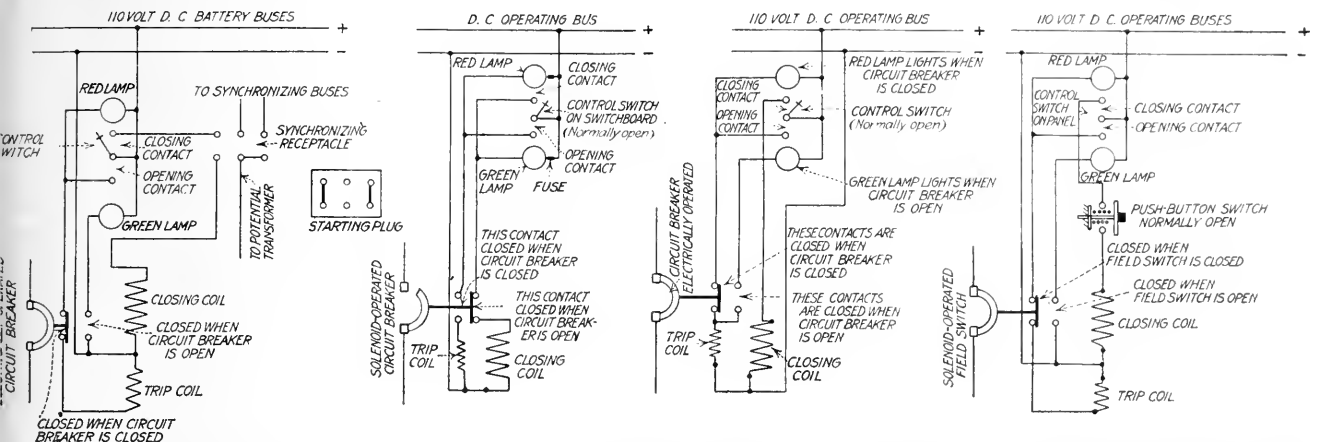
must be inserted before the circuit breaker can be closed, as shown in Fig. 5.

A system of control connections like that shown in Fig. 6 is still to be found in a good many installations.

¹For instance, it is possible in some of the modern railway systems to trip a circuit breaker in the station from various points along the track.

This method, although it employs a small number of wires between the switchboard and the circuit breaker, must be condemned from a safety point of view since it may happen, when a circuit breaker is being repaired, that an accidental short circuit across the green lamp, even with the control switch locked, would energize the closing coil and thus close the breaker and injure the

flashes. In this connection it may be suggested that it would be a great step toward safety if all lever switches, particularly those on 500-volt circuits, were similarly mounted on the rear of the panels. Carbon-break circuit breakers mounted on the front of the board should be so placed that they cannot strike a person standing near when they open automatically.



FIGS. 5, 6, 7 AND 8—METHOD OF INTERLOCKING OIL-SWITCH CONTROL CIRCUIT WITH SYNCHRONIZING CIRCUIT; THREE-WIRE AND FOUR-WIRE CONTROL CIRCUITS (THE THREE-WIRE ARRANGEMENT HAS ITS DISADVANTAGES); PUSH-BUTTON IN FIELD-CONTROL CIRCUIT TO AVOID ACCIDENTAL OPENING OF FIELD

operator. The scheme of connections shown in Fig. 7 is therefore to be recommended as far safer. The fact that with this scheme the red lamp is in series with the trip coil cannot be considered harmful, since a short circuit across the red lamp would only open the breaker. There is an additional advantage with this scheme, which is that any injury to the tripping circuit while the circuit breaker is closed will be called to the operator's attention on the switchboard by the automatic extinguishing of the red lamp. Thus the operator can always be certain that the tripping circuit is in good working order.

Whenever a field circuit breaker of a large unit is electrically operated by means of a control switch care should be taken that the operator does not open the field accidentally or hastily. In order to force the operator to give the matter a second thought before opening the field it is advisable to insert a normally open push-button in series with the opening side of the control switch, so that to open the field both hands must be used. This arrangement is shown diagrammatically in Fig. 8.²

All bell-alarm relays and other bell-operating devices should be so arranged that the bell continues ringing until stopped by the operator. However, whenever so stopped it should automatically reset itself and be ready for the next operation. A three-way auxiliary switch on the circuit breaker in connection with a three-way snap switch, as shown in Fig. 1, is often used for such purposes. The alarms for the various types of circuit breakers should be made distinguishable by using bells, horns or whistles having different sounds to indicate the automatic opening of different types of apparatus.

The field switch for small units, mounted on the switchboard itself, should not be placed on the front but on the rear of the panel, with an insulated operating handle on the front to avoid accident through

Double-throw switches, if not mounted horizontally, should be equipped with locks or steps to prevent accidental closing.

Fuses of heavy capacity should not be used in power stations at all, not only on account of their unreliability but also on account of the great expense of their maintenance. Automatic devices should be used instead. If fuses are used they should be of the inclosed type only and should be placed on the rear of the switchboard.

Care should be taken to allow for liberal passageways behind all switchboards. A mistake is often made

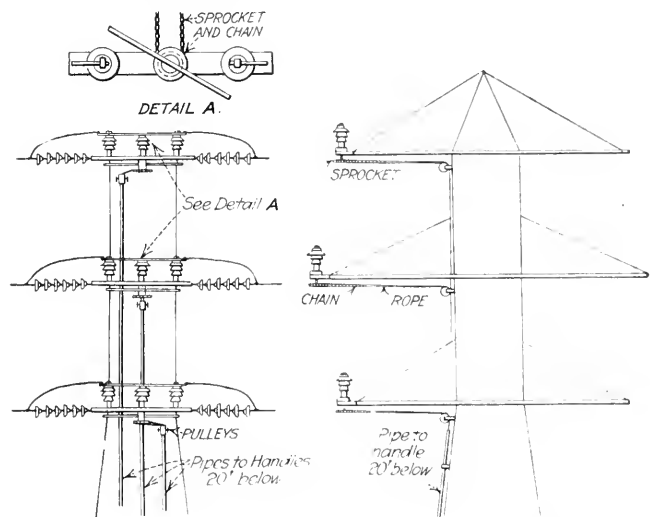


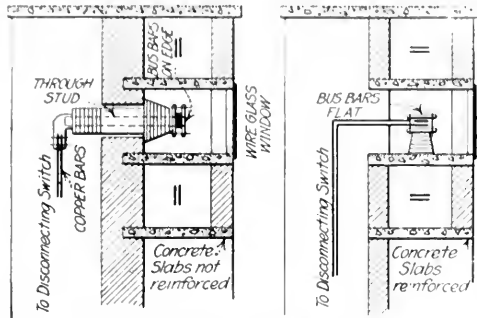
FIG. 9—70,000-VOLT LINE DISCONNECTING SWITCHES ON TRANSMISSION-LINE TOWER OPERATED BY MECHANISM INSTEAD OF BY SWITCH HOOK

by providing a certain distance from the back of the panels to the wall without regard to the fact that many pieces of apparatus project a considerable distance to the rear of the board, thus materially reducing the size of the passageway. The idea of insulating the switchboard frame must be considered altogether obso-

²By courtesy of C. O. von Dannenberg.

lete, and all switchboard framework should be grounded, this being by far the safer method.

Whenever oil switches are mounted directly on the switchboard provision should be made to catch the oil in case of a leak in the tank in order to avoid oily and slippery floors around the switchboards. Buses and connections within reach should be inclosed in grill-



FIGS. 10 AND 11—TWO METHODS OF MOUNTING BUSBARS, THE FIRST BEING PREFERABLE

work, and in cases where a craneway exists over the switchboard protecting covering should also be installed above the switchboard to protect it from anything which may accidentally fall from the crane.

Switchboard illumination is still a much neglected matter. For average switchboard heights 90-in. (228.6-cm.) shades, similar to Benjamin No. 5525, spaced approximately 5 ft. (1.5 m.) in front of board and 1 ft. (0.3 m.) above its top, will be found to give satisfactory results in most cases.

All modern control switchboards should be equipped with mimic bars between all control switches to indicate the interconnections between circuits. Such mimic bus arrangements should be made as simple as possible, and all control switches should be arranged with due regard to a simple layout of the mimic buses.

A great deal of information on the subject of bus and oil circuit-breaker compartments was presented in a previous article published in this paper.³ If more attention had been paid to the suggestions made therein, some of the awkward bus arrangements which have recently come to the writer's attention could have been avoided. A few additional remarks on this subject will therefore not be out of place.

All openings in the bus structure opposite bus supports as well as those in front of bus sectionalizing switches should be closed, preferably by wire-glass doors, which will prevent accidental contact with live parts and at the same time allow for frequent inspection. Such doors should preferably be equipped with locks.

The arrangement shown in Fig. 10 is to be preferred to that shown in Fig. 11 because the former allows complete inclosure of the buses without leaving any openings and at the same time gives greater accessibility to the bars. It also makes it easier to arrange the bus laminations in vertical planes, which gives better cooling. In Fig. 11, where the insulator is mounted on the concrete slab, the slab must be reinforced with iron, which is often the cause of heating, while in Fig. 10 no reinforcing is required.

Compartment doors in front of oil circuit breakers or fuses should be so constructed that they can swing

out in case of an explosion. On the other hand, doors in front of compartments containing apparatus not subject to explosion should be rigidly fastened. Hinged doors are to be preferred to removable doors, first, because the operator may forget to replace a removable door, thus leaving the compartment open; second, because a removable door is not adapted for locking, and, third, because a removable door if mounted at a considerable height may injure the operator while he is removing it. For compartments containing apparatus of high rating the doors should be provided with openings for ventilation purposes. Hinged doors can be grounded, therefore there is no argument against the use of either all-metal or part-metal doors. In some stations the doors are so interlocked with the circuit-breaker mechanism that they cannot be opened unless the circuit breaker is open. This arrangement, although seemingly offering features of safety, has been found in many cases not to fulfill the requirements for which it was intended, since such interlocks are necessarily complicated and often prevent the door from being opened altogether when it is necessary to open it hurriedly.

Generally it may be stated that the majority of oil circuit-breaker compartments are designed too small and are therefore inaccessible. Oil circuit breakers and mechanisms should be designed so that at least a 4-in. (10.1-cm.) brick wall can be built between phases and still leave ample handling space in the compartments for wiring inspection, repairing and removal of the oil tanks, particularly for cases where a single oil tank is used for multiple circuit breakers. Even in cases where tank lifters are provided there is often hardly room enough for properly attaching the lifter to the tanks.

For very long runs of busbars there should be lamps at certain intervals to indicate whether the bus is "alive" or not, a red lamp indicating danger and a green lamp indicating that the bus is "dead." A simple method for signals of this sort is shown in Fig. 2, where a potential transformer connected across the bus directly operates the red lamp, while the green lamp is supplied from an independent source of energy and

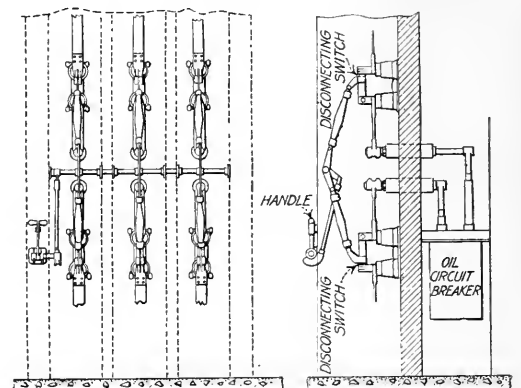


FIG. 12—SIX 2000-AMP. DISCONNECTING SWITCHES IN COMPARTMENTS OPERATED BY ONE MECHANISM

is put in circuit by a no-voltage relay on the potential transformer. A green lamp alone would not give sufficient indication that the bus is dead, since an accidental interruption of the potential transformer circuit, either through a short circuit in its winding or other causes, would cause the green lamp to light up even though the bus were alive. When both lamps are used

³ELECTRICAL WORLD, Jan. 15, 1916.

the operator will know that the bus is "dead" only when the red lamp is out and the green lamp is on. In such cases potential transformers should be connected to the buses without fuses, as is done in the case of potential transformers on voltage regulators.

Where disconnecting switches are operated by switch hooks they should be equipped with locks to prevent their accidental opening. Such locks should be arranged so that the switch hook cannot be removed unless the switch is either entirely open or entirely closed and locked. However, it seems that the time is ripe for the complete elimination of the switch hook, which has ever been a source of danger to operator and apparatus. It is possible to arrange disconnecting switches in such a way that they can be operated safely by means of a mechanism. On high-tension work, transmission lines as well as outdoor stations, the strain-insulator type of disconnecting switch has unfortunately been popular. For the operation of such switches, which are generally mounted very high, sometimes as much as 70 ft. or 80 ft. (about 23 m.) above the ground, it is necessary to provide operating platforms. The operator is forced to stand on such platforms and reach up to the switch with a stick which sometimes must be as long as 20 ft. (6 m.). Not only does it take a considerable length of time to clear a line in this manner, but when swinging the long switch hook the operator will often break insulators and other apparatus. Furthermore, there are cases on record where because of a heavy wind an operator was thrown off the platform and killed. Line disconnecting switches with operating mechanism can even be arranged on transmission towers.

An arrangement whereby the disconnecting switches are mounted on the ends of the cross-arms of a 70,000-volt transmission-line tower of popular form is shown in Fig. 9.⁴ It was not even necessary to make any changes in the design of the cross-arms. A chain mechanism is used, the chain running vertically, mostly in pipe, to prevent entanglement during wind. However, a simple pipe mechanism can also be devised to serve the purpose.

Where disconnecting switches are mounted in compartments it should be possible to open the disconnecting switch before opening the compartment door for reasons of safety. This, of course, is impossible when the switches are operated by means of a switch hook, but becomes feasible when the operation is performed by a mechanism, since an operating handle can be placed outside of the compartment. Switch hooks are often mislaid or even broken, and even when the switch hook is at hand it takes a considerable length of time to open six disconnecting switches, which must be done in the majority of cases to clear one circuit breaker. With a mechanism (see Fig. 12)⁴ all six disconnecting switches can be opened at once.

Where instrument transformers which are connected in series with oil circuit breakers have to be calibrated or repaired the operators sometimes open the oil switch, which of course "kills" the instrument transformer even if the disconnecting switch is closed (see Fig. 3). There are cases on record where an operator, after finishing his work, in attempting to descend from the common foundation of the oil circuit breaker and instrument transformer, accidentally reached over

to the live side of the oil circuit breaker and was killed. For this reason it might be advisable to have a warning signal at the oil circuit breaker to tell the operator that the disconnecting switch is closed. Such a signal cannot be provided easily where disconnecting switches are operated by switch hooks. However, where the disconnecting switches are operated by some mechanism it is a very simple matter to install an auxiliary switch which would light a red lamp at the oil circuit breaker when the disconnecting switch is closed and a green lamp when it is open (see Fig. 4). Such auxiliary switches can also operate red and green lamps on the switchboard panels in similar manner.

As an additional precaution, a multi-tumbler lock might be installed on the disconnecting switch handle to lock it in the closed position, so that nobody could accidentally open the disconnecting switch under load. It could also be locked in the open position, so that nobody could close the disconnecting switch when repairing or inspection is being done on the oil circuit breaker. Of course, better results could be obtained with electrically operated disconnecting switches, either by motor or solenoid, and where the extra expense is warranted electrical operation from the switchboard should be used. With this arrangement it is, of course, possible to go a step further and interlock the control circuits of the oil circuit breaker and the disconnecting switches.

Disconnecting switches should be so placed that the blade is dead when the switch is open. This is not always possible when using hook-operated switches but is possible in every case when the disconnecting switches are operated by a mechanism as shown in Fig. 12.

An Old Dynamo Redivivus

This photograph was taken recently at Bagdad, Fla., as the machine shown was being hauled to Bay Point, Fla. It illustrates that every machine and every known



OLD TIMES COME BACK

means of transportation is being brought into service. Things laid away for years must go to work again to help meet the demands. The machine in the picture is now furnishing light at a plant where submarine chasers are being built. This dynamo was out of service for many years, but like the team of oxen it has been put to work again.

⁴By courtesy of the J. G. White Engineering Corporation

Harmonics in Symmetrical M-Phase Systems*

A Consideration of Conditions Which Can Exist in Star-Connected or Mesh-Connected Systems Having Any Number of Phases, with a General Discussion of Mmfs. in Which Harmonics Are Present

BY V. KARAPETOFF

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SINCE more than three phases are occasionally employed in practice (for example, six-phase and twelve-phase combinations) it seems that the time is ripe for a general treatment of higher harmonics in any symmetrical m -phase system; that is, one in which the induced sinusoidal voltages are displaced from one another in time phase by an angle $2\pi/m$. Higher harmonics in the three-phase system have been treated extensively in electrical literature, two of the latest contributions at this writing being those by Damien and Robinson,¹ in which further references to literature will be found.

In the following article the writer has therefore considered higher harmonics under such general conditions for both star and mesh connection. It is shown which harmonics cannot exist in the mesh voltage although present in the star voltages and which harmonics give rise to circulating currents in a mesh. The phenomenon of oscillating neutral is explained, and the effect of secondary mesh currents in furnishing transformer magnetizing currents is discussed. Polyphase magnetomotive forces are treated in the most general case when harmonics are present both in time and in space. Formulas are given for the order of harmonics which produce gliding and pulsating mmfs.

STAR AND MESH VOLTAGES

Let the armature windings of an m -phase alternator be star-connected, and let an n th harmonic be present in each induced electromotive force. This harmonic may be due, for example, to the distribution of the field flux in the air gap. The time-phase angle between the emfs. of fundamental frequency in the adjacent windings is $2\pi/m$, while the corresponding angle between the corresponding n th harmonics is $2\pi n/m$, because their frequency is n times greater.

Let the windings and the line terminals be numbered consecutively 1, 2, 3, . . . k , . . . $(m-1)$, m , and let it be required to find the value of E_n between the terminals 1 and $(k+1)$. The value of e_n is supposed to be known.

MEANING OF SYMBOLS USED

- e_n = star voltage due to the n th harmonic.
- E_n = mesh voltage due to the n th harmonic.
- E_r = resultant voltage around the mesh.
- k = consecutive number of a phase winding or terminal.
- m = number of phases.
- n = order of a harmonic in time.
- N = order of a harmonic in space.
- p = an integer.
- X = reference axis.

The vector E_n is a geometric difference between the vectors e_n of the star voltages in phases 1 and $(k+1)$. These vectors are displaced by an electrical angle $2\pi nk/m$ with respect to each other. From the isosceles triangle e_n, e_n, E_n one readily finds that $E_n = 2e_n \sin(\pi nk/m)$.

The following particular cases are of interest: (a) $kn/m = p$; $E_n = 0$. (b) $k = 1$; $n/m = p$; $E_n = 0$; this is a generalization of the familiar fact that in a balanced three-phase system no harmonics which are multiples of three exist in delta voltages. (c) $kn/m = p + 0.5$; $E_n = 2e_n = \max$; this is possible with m even. (d) Let it be required that $E_n/e_n = E_1/e_1$; that is, the star and mesh harmonics in the voltage are to be in the same proportion as their fundamentals. Then the condition to be fulfilled is that $\sin(\pi nk/m) = \pm \sin(\pi k/m)$, or $\pi nk/m \pm \pi k/m = \pi p$, from which $(n \pm 1)k/m = p$. Thus, in a three-phase system this condition is satisfied for the harmonics of the order $n = 2, 4, 5, 7$, etc.; that is, for those not multiple of three.

EXPLANATION OF OSCILLATING NEUTRAL

The time angle between the star voltages e_1 of the fundamental frequency in two adjacent windings is $2\pi/m$. For the n th harmonic voltage e_n this angle is $2\pi n/m$. When $n = m$ all of the e_n 's are in time phase with each other, so that with respect to this particular harmonic all the star windings are like parallel branches of a single-phase winding. Let the neutral point of the generator be grounded and let that of a star-connected load at the other end of the line be insulated. The potential of the insulated neutral point will then vary periodically above and below that of the ground at the frequency of the n th harmonic, these variations being caused by the voltages e_n . This phenomenon is known as the oscillating neutral. It also is caused by the harmonics of the order $2m, 3m$, etc. If now the second neutral point be also grounded, considerable harmonic currents of the above frequencies will flow through the system and through the ground connections. The troubles due to the oscillating neutral and to harmonic currents in the three-phase system are well known to operating engineers, and the remedies need not be discussed here.

CURRENTS IN STAR AND IN MESH

Let the windings of an m -phase armature be connected in mesh. The voltage vectors of the fundamental frequency are displaced by $2\pi/m$, and their addition gives a regular closed polygon. In other words, the resultant fundamental voltage around a mesh is equal to zero. This fact makes the use of such a connection possible.

For the n th harmonic the time angle between the voltages in consecutive phases is $2\pi n/m$, and the polygon which represents the addition of vectors may be

*Presented before the American Association for the Advancement of Science, Section D, Dec. 29, 1917.

¹Jacques Damien, *Revue Générale de l'Electricité*, Vol. II (1917), p. 363; Lloyd N. Robinson, *Proceedings A. I. E. E.*, Vol. 36 (1917), p. 967.

regular, multiple re-entrant or star-shaped. As an example, the reader may draw polygons for the fundamental, the third and the fifth harmonics in a symmetrical twelve-phase system, to see the difference in their shape.

It is of interest to determine whether or not the resultant n th harmonic voltage around a mesh is always equal to zero. Take the direction of the voltage vector in phase 1 as the reference axis X . The vector of the k th phase voltage forms with this axis an angle equal to $2\pi n(k-1)/m$. Therefore the projection of the resultant vector E upon the axis is

$$E_r \cos(E_r X) = E_n \sum_{k=1}^{k=n} \cos 2\pi n(k-1)/m.$$

The angles follow an arithmetical progression and the vectors are uniformly distributed over a total angle $2\pi n$. Hence the resultant E_r is equal to zero, except when all the vectors E_n are in phase with one another. This latter exceptional condition obtains when n is a multiple of m , so that each cosine is equal to unity. In this case ($n = pm$) or $E_r = mE_{pm}$. Thus, in an m -phase mesh-connected system the harmonic emfs. of the order m , $2m$, $3m$, etc., are not canceled but may give rise to a considerable internal circulating current. It is a well-known fact that in a three-phase delta-connected winding circulating currents are sometimes observed, which are caused by the third, ninth, fifteenth, etc., harmonics of the voltage.

MAGNETIZING CURRENT IN SATURATED TRANSFORMER CORES

When a single-phase transformer core is saturated and the applied voltage is sinusoidal, the magnetizing current has a peaked wave form. The effect of hysteresis is to make the wave also unsymmetrical. Thus, generally speaking, in a transformer with a saturated core the magnetizing current has various harmonics, both odd and even, superimposed upon the fundamental current. In a bank of m star-connected transformers, with the neutral insulated, some of these harmonic currents cannot flow. Namely, the currents of frequency $n = m$, are in phase with one another in all the phases, and the same is true of the currents of frequencies $2m$, $3m$, etc. All such currents require two ground connections in order to form a closed circuit. But if these currents cannot exist, then generally speaking the induced counter-emf. of the transformers cannot be sinusoidal; it must have voltage harmonics of the order $n = m$, $2m$, $3m$, etc. This leads again to the phenomenon of oscillating neutral described before.

Let now the secondary windings of these transformers be mesh-connected. The harmonic voltages of frequency m , $2m$, $3m$, etc., are all in phase with one another, as has been shown above, and they cause circulating currents in the mesh connection. These currents tend to neutralize the corresponding harmonics in the flux and in the voltage and thus counteract the formation of an oscillating neutral. Another way of describing this phenomenon is to say that the secondary mesh furnishes the lacking primary harmonics in the magnetizing current. This is one reason for which transmission engineers often prefer the Y-delta connection of transformers.

Sometimes one m -phase transformer may be used in place of m -single-phase transformers; that is, a trans-

former with m -windings and m -interlinked iron cores, the same being provided with two common yokes for flux return. With a star connection of the windings, the m th, $2m$ th, $3m$ th, etc., harmonics are lacking in the magnetizing current, the same as in the case considered above. But, in addition, the fluxes of these frequencies are also limited on account of the common yokes. In other words, the polyphase magnetic circuit is also star-connected, and the harmonic fluxes of these frequencies, being all in time phase with one another, "buck" each other and have to find closed paths through the air.

MMFS. OF POLYPHASE ARMATURE WINDINGS WITH SINUSOIDAL MAGNETIZING CURRENTS

Consider a regular m -phase winding such as would be used in the armature of a synchronous machine or on the stator of an induction machine. The simplest element of such a winding is one turn consisting of two conductors 180 electrical degrees apart. At a certain constant value of the current such a turn produces a "rectangular" distribution of mmf. along the air gap. The mmf. has a certain constant value for 180 electrical degrees and then an equal and opposite value for the next 180 degrees. For convenience of analysis such a rectangular distribution in space is replaced by a series of sinusoidal distributions.² The frequencies in space of the higher harmonics of this distribution will be denoted by N to distinguish them from frequencies in time of the harmonics of the magnetizing current considered in the next section and denoted by n .

First, let us assume the magnetizing current to be truly sinusoidal in time, only the harmonics in space being present. As the magnetizing current varies in time, the space harmonics of the mmf. pulsate at the same rate. But an alternating mmf. can be replaced by two mmfs. gliding synchronously in space in the opposite directions. Thus, finally, each phase of the winding produces an infinite number of sinusoidal mmfs. of various wave lengths (space frequency), some gliding to the left, others to the right. The harmonics of each frequency belonging to all the phases are combined into one wave, and the following combinations are possible:

(a) The waves going to the left have a resultant equal to zero, while those going to the right are combined into a larger resultant wave.

(b) The same statement as (a) with the words "left" and "right" interchanged.

(c) Both left-going and right-going waves are canceled.

(d) Both the left-going and the right-going waves have a resultant different from zero, and the resultant waves are combined into a pulsating one. This case arises only when the magnetizing current has harmonics in time; see below.

Let us assume that the fundamental flux glides from right to left, so that the fundamental current in any phase winding lags by $2\pi/m$ with respect to the one in the adjacent winding to its right. Consider now the N th harmonic waves belonging to these two phases and gliding to the left. It is shown in "The Magnetic Circuit," page 138, that in a three-phase winding these waves follow each other at an angle $2\pi(N-1)/3$. By a similar reasoning one can prove that in an m -phase system these waves follow each other at an angle

²See, for example, the author's "Magnetic Circuit" (McGraw-Hill Company), pp. 123 to 138.

$2\pi(N-1)/m$. The waves gliding to the right follow each other at an angle $2\pi(N+1)/m$.

But m equal sinusoidal waves uniformly spaced over a total angle of 2π , or over any multiple of 2π , give a resultant equal to zero. The only exception is when the angular distance between two consecutive waves is 2π or a multiple thereof, because then all the waves are simply superimposed. In our case this means that either $(N-1)$ or $(N+1)$ must be a multiple of m . Thus, in an m -phase winding with purely sinusoidal magnetizing currents and with the main flux traveling to the left the following harmonics³ only can be present:

Gliding to the left:

$N = 1$ (fundamental)

$N = m + 1,$

$N = 2m + 1,$

$N = 3m + 1,$

$N = 4m + 1,$

etc.

Gliding to the right:

$N = m - 1,$

$N = 2m - 1,$

$N = 3m - 1,$

$N = 4m - 1,$

etc.

Both odd and even harmonics are included in this table for the sake of generality. The latter may be present in an exceptional case of unsymmetrical consecutive poles.

As an application of the above table we find that in a three-phase winding the flux harmonics which are multiples of three are absent, and that of the other odd harmonics the seventh, the thirteenth, the nineteenth, etc., travel with the main flux, while the fifth, the eleventh, the seventeenth, etc., glide against it.

EFFECT OF HIGHER HARMONICS IN THE MAGNETIZING CURRENT

If the magnetizing current possesses an n th harmonic (in time) the mmf. waves (in space) which such a harmonic produces pulsate n times faster than the corresponding mmf. harmonics due to the fundamental current. Therefore, the component gliding waves also move n times faster. By comparison with the foregoing formulas we find that for the N th harmonic in space due to the n th harmonic in time the angular distance between the adjacent waves moving to the left is $\pm 2\pi(N-n)/m$; the angular distance between the adjacent waves moving to the right is $\pm 2\pi(N+n)/m$.

Many sets of the waves give a resultant wave equal to zero, and only those have a real existence for which either $N = n$, $(N-n)$ is a multiple of m , or $(N+n)$ is a multiple of m .

The mmf. waves for which $N = n$ are of particular interest, because their direction and speed of rotation are the same as for the fundamental mmf., and they cause a permanent distortion of the revolving flux. For other harmonics the speed of rotation is (n/N) times that of the fundamental, and their effect is often wiped out by eddy currents induced in the rotor bars or in some other part of the machine.

Another interesting case is when N and n separately are multiples of m . In this case both $(N-n)$ and $(N+n)$ are multiples of m , and therefore the resultant left-going and right-going waves are equal to each other and are different from zero. The two resultant waves added give a stationary pulsating mmf. For example, in a three-phase induction motor the third harmonic of the magnetizing current ($n=3$) causes part of the third and ninth harmonics of the mmf. ($N=3$ or $N=9$) to be stationary in space.

For the sake of generality it has been assumed above that all the space harmonics are present. In reality some of them can be neutralized or considerably reduced by a judicious use of a fractional-pitch winding, but this topic is outside the present discussion.⁴

Recapitulating:

(a) The waves that glide in the same direction as the fundamental are those for which either $N = n$ or $\pm(N-n) = pm$.

(b) The waves that glide against the fundamental are those for which $N + n = pm$.

(c) Pulsating waves are caused by harmonics for which $N = pm$ and $n = pm$.

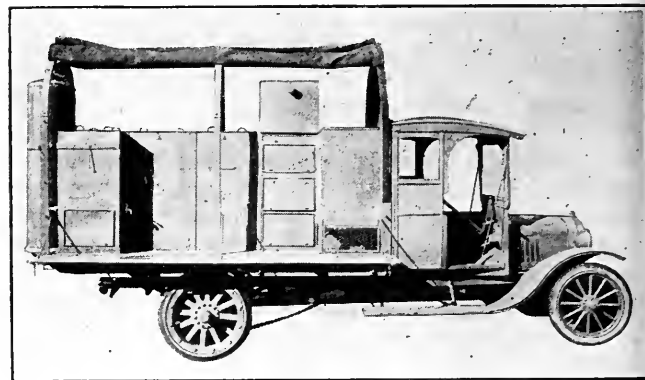
(d) No waves can exist for which neither $(N+n)$ nor $(N-n)$ is a multiple of m ; the case of $N-n=0$ is covered in (a) above.

The foregoing rules can be readily used to check the table given without proof in Arnold (*ibid.*), page 275, for two-phase and three-phase machines.

ELECTRIC ARMY KITCHEN FOR FIELD-SERVICE USE

Portable Device Adapted to Motor Trucks Using Exhaust to Supplement the Heat Derived by Means of Electricity

One of the developments made in the utilization of electricity for war purposes is a portable electric army kitchen designed to be used on the Smith "form-a-truck." This kitchen has been carefully worked out to meet requirements of Red Cross and army field service. The kitchen heat is obtained by the combination use of



PORTABLE ELECTRIC KITCHEN FOR ARMY USE

an electric generator driven by the automobile motor and the heat from the exhaust of the motor, which amplifies the heat obtained through use of electricity.

The portable army kitchen is equipped with two 30-gal. (113-l.) fireless cookers, with a twenty-six-hour cooking head efficiency; a 30-gal. coffee urn, a 30-gal. vegetable and soup urn, baking and warming ovens, and two large hot-water sterilizing tanks, which are designed to sterilize 120 gal. (454 l.) of water in two hours. The generator develops a current which is said to throw a searchlight ray for 3 miles (4.8 km.) and will carry the load of 600 110-volt lamps.

Because of the tie-up of the generator with the automobile motor this kitchen can be operated either while traveling or while at rest.

³See also deduction by E. Arnold, *Wechselstromtechnik*, Vol. III (1912), p. 243.

⁴See the author's "Magnetic Circuit," pp. 70-74.

Operating Temperatures in Large A.-C. Generators

Obstacles to Calculating Maximum Operating Temperatures from External Temperatures —Comparisons of Resistance, Thermometer, Exploring Coil and Thermocouple Methods of Measuring Temperatures

BY H. D. STEPHENS

Manager of Generator Section, Westinghouse Electric & Manufacturing Company

THE large amount of capital invested in generating equipment, the expense of repairs and the loss of revenue resulting from its shut-down all make it especially important that safe operation and continuity of service be assured. While the breakdown of insulation is not always the cause of apparatus failure, it is the cause often enough to make it essential to look into all conditions contributing to such breakdown and to ascertain how the approach of these conditions can be prevented or definitely determined.

One of the chief causes of insulator failure is excessive temperature, as all well-known insulators deteriorate rapidly when certain definite temperature limits are exceeded. These limits have been ascertained for most commercial insulations, but heretofore it has been a problem of determining when the prescribed temperature limit is exceeded. When thermometers have been used for this purpose the insulation apparently failed in some cases before the temperature limit determined by laboratory test was exceeded. This apparent disagreement was really due, however, to the fact that the thermometers were not placed where the maximum operating temperatures occurred. Later, when resistance-change measurements* were taken as indications of the temperature obtained, the point at which insulation breakdown occurred agreed more closely with that determined by test, but still there was a wide enough divergence to warrant looking into the cause of the difference. Obviously it was due to the fact that "hot spots" occurred and that the resistance measurements indicated only the average temperature of the entire circuit measured.

Since embedded temperature detectors have come into use, however, it has been possible to determine the maximum operating temperatures much more effectively as the thermocouple or exploring coil, the two types of detectors most generally used, can be installed where the hot spots are expected to occur. In fact, they have been found so effective that their use is becoming standardized in all large-size alternators having a core width of 20 in. (50.8 cm.) and in all machines wound for 5000 volts or over.

The exploring-coil type of detector consists of a coil of wire having a high resistance. Any change in resistance will be directly proportional to the temperature change; hence, if the resistance and corresponding temperature is known, the latter temperature can be readily calculated. The exploring-coil type of detector developed by the company with which the writer is connected consists of fine copper wire, is approximately 5 in. (12.7 cm.) long and has about 30 ohms resistance. The resistance is measured by a simple Wheatstone bridge (Fig. 3) arrangement in which the detector forms one of the four resistance arms.

*Coil with high-temperature coefficient embedded in part of apparatus of which the temperature is desired.

With this type of detector the readings will be absolutely accurate only when the temperature of the coil and leads is the same as that at which calibration took place. However, if the resistance of the coil is very high and the resistance of the leads relatively low, the percentage of error is very small indeed over the range of temperature found in practice. The fragility of the small exploring coil is its greatest drawback. If heavier wire were used for the coil, it would occupy more space in the slot, or the resistance would have to be made very much less. Further, even if only 5 in. (12.7 cm.) in length, it measures an average temperature over this entire distance in the core. If the core is only 20 in. (50.8 cm.) in width, the difference between the average

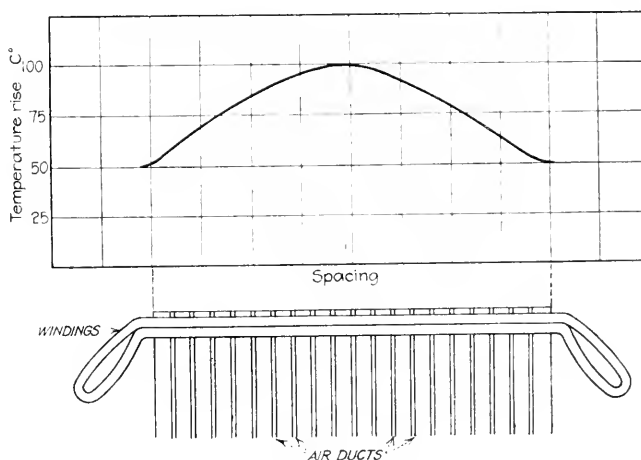


FIG. 1—TEMPERATURE VARIATION ALONG ARMATURE SLOT

and hot-spot temperature may be considerable, as the coil occupies 25 per cent of the width. A larger or longer coil will increase this percentage and render still greater the difference between the reading obtained and the actual "hot-spot" temperature.

The preceding disadvantages are absent with the thermocouple detector because the thermocouple registers the temperature at a single junction point, and it can be made of thin strong metal strips instead of very fine wire. The "hot" couple or junction point in the machine is at the point where the temperature is measured and connected to a "cold" couple in the temperature indicator. In the apparatus developed by one manufacturer this is a potentiometer of the galvanometer type arranged for switchboard mounting and with the measuring scale calibrated to read directly in degrees Centigrade.

The temperature as indicated by either the exploring coil or the thermocouple is practically valueless as an indication of safe operating conditions unless the detectors are installed at the spots where the highest temperatures will occur. These spots are difficult to determine because the resultant temperature is due to

several sources of heat, which may be widely different in different machines even if of the same general type, especially when there is a change of load or terminal voltage. For instance, heat results from the iron loss of the armature, from the resistance of the conductors, from eddy currents in the conductors proper, and from radiation from the field. Not only do these losses vary with change of load, but they may also be distributed unequally throughout the volume of the metal employed.

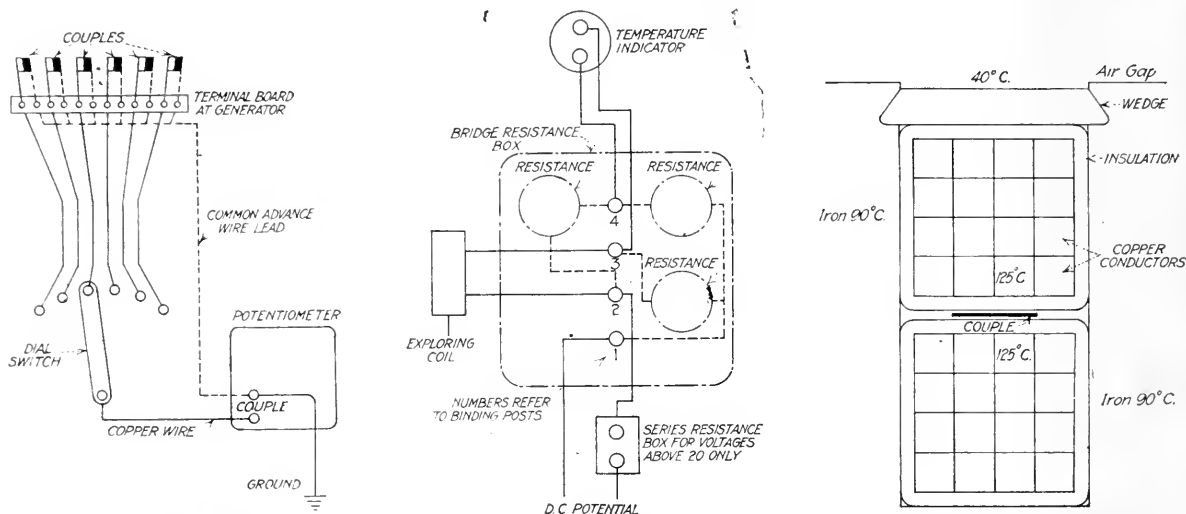
Further, as regards the dissipation of the heat generated in the conductors, it may flow along the conductor to the end turns, and thence through the insulation to the air, the thickness of the wall of insulation and its tightness making considerable difference in the heat drop resulting. On the other hand, the heat may flow through the insulation inside the core into the punchings. Here also two paths, widely differing in their conductivity, are available, one along the individual punchings to the back of the core, and the other through the punchings, with their separating walls of "japan," to the air passages spaced throughout the core.

In general, test data covering a large number of generators of different characteristics show the location of points of maximum temperature to be at or near the

ment of the "hottest-spot" temperatures is concerned. This has been due to a lack of definite data on the subject.

One scheme of connecting the equipment required with the thermocouple temperature detector is shown in Fig. 2. Six couples are ordinarily used per machine by the company with which the writer is connected, and the couples are made of thin ribbons of copper and Advance alloy welded together. The individual copper leads are run from the terminal board of the machine to the switchboard. A common Advance alloy lead forms the other side of the circuit. This keeps the wiring to a minimum and at the same time allows of reading on any one of the six couples employed. Where exploring coils are used, the same diagram as shown in Fig. 2 will apply except for the substitution of resistance coils for the couples and a standard type of voltmeter with scale marked and calibrated to read degrees centigrade.

Both methods of measurement described are superior to the older thermometer method for machines having large ratings. The detector is useful at times of heavy load in furnishing the operator with data so that the safe temperature of the insulation may not be exceeded



FIGS. 2, 3 AND 4—ONE METHOD OF CONNECTING THERMOCOUPLES WITH POTENTIOMETER; CONNECTIONS IN BRIDGE RESISTANCE BOX; BEST LOCATION FOR THERMOCUPLE TO DETECT MAXIMUM INTERNAL TEMPERATURE

center of the core and in the copper of the windings at this point. This is illustrated in Fig. 1, which shows a temperature curve obtained by installing a number of detectors at various points across the machine and all in the same armature slot.

The correct location for a detector in the armature slot is shown in Fig. 4. Nearly all modern alternators have two-coil-per-slot windings. Therefore, if the copper has the highest temperature, any location except that between the two conductors gives a reading intermediate between the temperature of copper and that of the iron, since the heat transfer from the hot to the cooler surface is accomplished only when a drop in temperature exists. When the two conductors in the same slot are at or near the same temperature, as they normally are, there is no tendency for heat transfer from one to the other, hence the detector at this point approximates the maximum temperature. Undoubtedly there are many large machines in service, equipped with temperature-indicating devices, whose temperature readings are absolutely valueless in so far as measure-

and to check conditions of operation to predetermined loads.

Accumulations of dust and dirt in the air passages of the machine will, for a given load, cause the operating temperature to rise. The detectors will give indications as to when such conditions exist and warn the operator to remedy them by cleaning the machine thoroughly. The use of detectors is not recommended for small-capacity machines because such units are usually narrow of core and have internal temperatures that differ but little from external accessible points. Furthermore, the armature slots are of such small proportions in these machines as to render the location of detectors either very difficult or impossible. Detectors cannot be used for measurement of temperatures of revolving fields of alternating-current generators nor for revolving armatures of direct-current generators because of the variable nature of the moving contacts and the large percentage of error that it would cause with such small values of current or voltage as are used in detector circuits.

Changing Aspects of Factory Lighting Legislation

Outline of the Proposed New Ohio Code and of the Principal Changes Which Have Been Made or Proposed in the Codes of the States of Wisconsin, Pennsylvania and New Jersey—Comparison with I. E. S. Code

BY C. E. CLEWELL

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The first part of this article reviewed the revisions and changes in the Factory Lighting Code of the Illuminating Engineering Society since June 1, 1917, emphasis being placed on the five chief elements on which these rules are based. This part outlines the new proposed code of Ohio and the principal changes which have been made or proposed in the codes of Wisconsin, Pennsylvania and New Jersey. While the intensity of illumination is only one of five important elements of the legislative rules, it is interesting to compare the values for various classes of work in the different codes and as given by several authorities. The table in this article is the most elaborate and recent compilation of factory lighting intensities by the author, and it indicates in readily comparable form the changes which have been made in state rules in 1917 and 1918.

IN THE first installment of this article, which appeared last week, it was pointed out that the principal items included in the latest revision (1917) of the Illuminating Engineering Society's Factory Lighting Code are: (a) Illumination intensity requirements for various classes of work, (b) elimination of glare, (c) distribution of light on the work, (d) emergency lighting, and (e) pilot or night lamp control near entrances. The purpose of the present article is to discuss some of these items on a basis of more complete or modified specifications than those outlined by the factory code of the Illuminating Engineering Society, which were given in Part I of this article. Certain changes in the manner of specification have been suggested by some of the state authorities who are revising old or preparing new codes of this kind.

INTENSITY REQUIREMENTS

For reasons which have been fully discussed in previous articles¹ the original I. E. S. Code made a radical departure by specifying the quantities of light for various classes of work in terms of the illumination intensity in foot-candles at the work. Two problems were faced in making such a specification, namely, (a) the proper classification of work and (b) the difficulty in checking up intensities when inspecting lighting conditions. Item (b) has been rendered much more possible by the appearance of the foot-candle meter as a simple and inexpensive instrument for the purpose.

Item (a) has led to some discussion on the wisdom of possibly having a more complete classification of work than that contained in the present I. E. S. Code. Wisconsin, Pennsylvania and New Jersey have practically decided to adopt a classification similar to that of the I. E. S. Code. In Ohio the effort has been made to use a much more extended classification in conjunction with the brief list as given by the I. E. S. Code and as given essentially in the accompanying table.

The proposed Ohio code contains, for example, six main headings for its work classifications and then adds an appendix containing about 250 classes of work, each

of which is classified under one of the six heads in the main list. While this kind of elaborate classification is commendable as an effort to aid the factory inspector quickly to place any given shop section in its proper class, it is open to two objections.

On the one hand, such a detailed classification accentuates the intensity specification and tends to minimize the importance of other regulations in the code, and, on the other hand, the elaborate list of detailed classes of work tends to make the code rigid and to eliminate the judgment of the inspector. Experts in the factory lighting field tend to view the present situation as one which demands even greater attention to glare than to intensity. This is evidenced by a statement like the following from an important report on industrial lighting:

"While it is desirable to have adequate light over the working areas, it is absolutely essential for the proper results to eliminate or minimize the light which otherwise would pass directly from the lamps to the eyes of the workers; that is, one must avoid glare, which is not only fatiguing to the eye but also conducive to the incorrect estimation of sizes and locations of objects in the field of view."

There seems to be a danger, therefore, that any code which is overburdened with too extended a classification of working processes will lead the average factory inspector to concentrate his attention on these elaborate lists in an effort to find how to classify a given kind of work, and that this very effort will have a tendency to make him overlook other and possibly more important code regulations. In other words, the current opinion is that a classification somewhat like that in the accompanying table is more flexible and, by leaving to the inspector the selection of any one of six or eight general heads to apply to a given factory section, renders him more free and consequently more likely to emphasize the other rules of the code with which he happens to be concerned.

THE TABLE OF INTENSITIES

The accompanying table of intensity of illumination in foot-candles required by various codes and by rules from other sources is probably the most complete compilation of such figures which has been possible up to date because of the very recent additions which code revisions and new codes have made to previous tables of this character.

The values given in this table furnish a convenient basis for comparing the intensity recommendations in old and revised codes and also those of older codes with the proposed newer regulations. It is desirable, however, not to lay too much stress on differences which may occur for any given class of work in the various columns since it is practically impossible in compiling such figures to be sure that the class of work con-

¹ELECTRICAL WORLD, Vol. 66, No. 21, page 1135, and Vol. 69, No. 25, page 1203.

sidered was exactly the same in each case. Thus, rough manufacturing might have meant one thing in one case and something different in another.

However, each column of the table indicates whether the intensity is a minimum or ordinary practice. In column (2) the values listed for ordinary practice

desire to reduce all proposed rules to as definite a basis as is possible with the existing state of the art. Up to the present time, however, it has not felt able to make a more definite rule regarding the shading of lamps than that given in Rule 3.

Interesting suggestions have been made, however, for

INTENSITY OF ILLUMINATION IN FOOT-CANDLES REQUIRED BY VARIOUS CODES OF FACTORY LIGHTING AND BY RULES FROM OTHER SOURCES																
Class of Work	Clegg's "Factory Lighting," 1913, Ordinary Practice	G. E. Co. "Handbook on Lighting," 1913, Ordinary Practice	"Orders" of 1913, Minimum	WISCONSIN		ILLUMINATING ENGINEERING SOCIETY				British Report of 1915, Minimum	PENNSYLVANIA AND NEW JERSEY				OHIO	
				HANDBOOK 1917		CODE OF 1915		CODE AS REVISED 1917			CODES OF 1916		PROPOSED REVISIONS 1918		PROPOSED CODE 1918	
				Minimum	Ordinary Practice	Minimum	Ordinary Practice	Minimum	Ordinary Practice		Minimum	Ordinary Practice	Minimum	Ordinary Practice	Minimum	Ordinary Practice
Column No.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
General lighting		1.20								0.25						
Roadways and yard thoroughfares		0.20		0.05	0.05-0.25			0.02	0.05-0.25	0.05	0.05	0.05-0.25	0.02	0.05-0.25	0.05	0.10-0.50
Storage spaces	0.50	1.00	0.38	0.35	0.35-0.70	0.25	0.25-0.50	0.25	0.50-1.00		0.25	0.25-0.50	0.25	0.50-1.00	0.25	0.50-2.00
Stairways, passageways, aisles	0.50			0.35	0.35-0.70	0.25	0.25-0.50	0.25	0.75-2.00	0.10	0.25	0.25-0.50	0.25	0.75-2.00	0.25	0.50-2.00
Foundries		3.00	1.50	1.75	1.75-3.50	1.25	1.25-2.50	1.25	2.00-4.00	0.40	1.25	1.25-2.50	1.25	2.00-4.00	1.25	2.00-4.00
Rough manufacturing, such as rough machining, rough assembling, rough bench work	3.00	3.50	0.75	1.75	1.75-3.50	1.25	1.25-2.50	1.25	2.00-4.00	....	1.25	1.25-2.50	1.25	2.00-4.00	1.25	2.00-4.00
Rough manufacturing involving closer discrimination of detail.								2.00	3.00-6.00	....	....	....	2.00	3.00-6.00	2.00	3.00-5.00
Fine manufacturing, such as fine lathe work, pattern and tool making, light-colored textiles	5.00	6.50		3.50	3.50-6.00	3.50	3.50-6.00	3.00	4.00-8.00	....	3.50	3.50-6.00	3.00	4.00-8.00	3.00	4.00-8.00
Special cases of fine work, such as watch-making, engraving, drafting, dark-colored textiles		10.0		8.00	8.00-15.0		10.0-15.0	5.00	10.0-15.0	....	5.00	10.0-15.0	5.00	10.0-15.0	5.00	10.0
Office work, such as accounting, type-writing, etc.	3.00	6.00		3.50	3.50-6.00		.....	3.00	4.00-8.00	....	....	.....	3.00	4.00-8.00	....	.....

*The intensity values given in column 3 of the table were estimated by the author from specifications of candle-power per square foot as listed in the original Wisconsin orders of 1913. Columns 4 and 5 give the actual foot-candle intensities as listed in the 1917 Wisconsin Handbook.

†In the 1915 British report there are no specifications of illumination intensities required for the work, and hence the values as given in column 10 of the table refer merely to general illumination recommendations as listed in the British report and have no regard to the needs of the work itself.

are, in general, means between two values given as limits in the handbook of the General Electric Company. Of the four states which have drafted codes thus far with the I. E. S. Code as a basis, each has followed the general plan of reducing the classification of work to a few headings, with the possible exception of Ohio, which has added the more comprehensive list as a supplement to the code proper.

There has been some call for a more definite specification of glare as an aid to the interpretation of the

drafting a definite rule on glare, notably by the Industrial Commission of Wisconsin, where an unusual amount of time and much commendable effort have been consumed to revise the older shop-lighting "orders" of 1913. The first effort of that commission to draft such a definite ruling on glare took the following form:

"Lamps within the glare angle shall be shaded in such a manner that the brightness of any part of the light source or accessory does not exceed 50 candles per square inch (7.75 candles per sq. cm.). When the

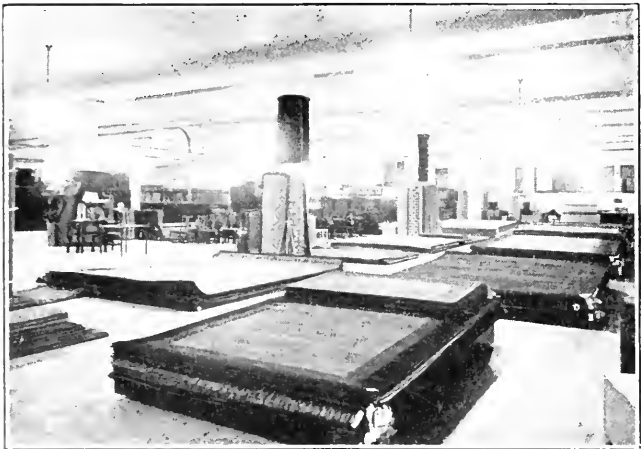


FIG. 1—AN EXAMPLE OF THE IMPORTANCE OF APPROXIMATELY UNIFORM ILLUMINATION ON HORIZONTAL SURFACES

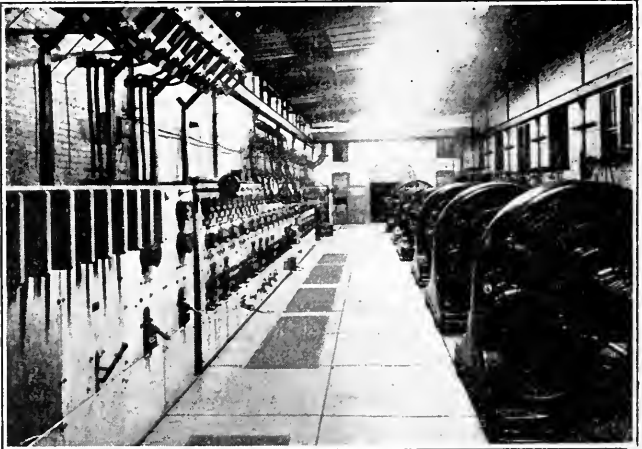


FIG. 2—UNIFORM ILLUMINATION ON HORIZONTAL SURFACES MAY RESULT IN POOR VERTICAL-SURFACE ILLUMINATION

rule and for the help of inspectors who are called upon to determine when the limits of glare are exceeded. Recognizing this need in a broader way, the committee on lighting legislation of the I. E. S. has evidenced a

line between the eye of a person stationed at one end of a room and the most distant light source makes an angle of 45 deg. or more with the vertical, the lamp

"Lamps shall be suitably shaded to minimize glare."

will be considered within the glare angle in interpreting this order."

A diagram illustrating how such a proposed ruling might apply to a given case is shown in Fig. 3. Apparently, from this diagram, practically all lamps would always fall below this glare-limiting angle in shop sections with the common ceiling height of approximately 20 ft. (6.1 m.).

This proposed glare rule has naturally resulted in much discussion, some experts contending that an angle

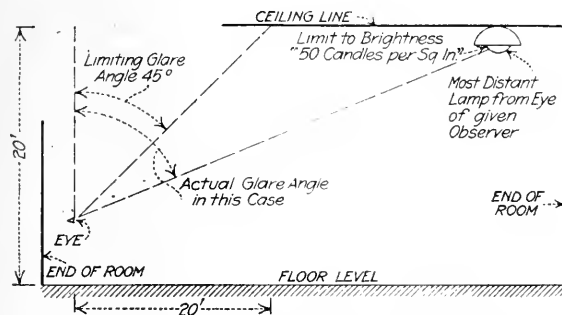


FIG. 3—DIAGRAM OF CONDITIONS CORRESPONDING TO ONE SUGGESTION WHICH HAS BEEN MADE FOR RENDERING A GLARE SPECIFICATION MORE DEFINITE

of 45 deg., as in Fig. 3, is too drastic, some that a brightness of 50 candles per square inch (7.75 candles per sq. cm.) is too low for certain cases, and others that it is much too high, the latter contention being based in one case on the fact that the I. E. S. committee on glare had previously gone on record as favoring a lower limit of brightness for lamps within the glare angle.

Toward the latter part of 1917 the Wisconsin suggestion was somewhat modified to the following effect:

Shading of Lamps.—Lamps for overhead lighting, suspended at elevations above eye level, less than one-fourth their distances from any position at which work is performed, shall be shaded in such a manner that the maximum brightness of the light source shall not exceed 75 candles per square inch (11.6 candles per sq. cm.).

Exception.—Lamps suspended at greater elevations than 20 ft. (6.1 m.) above the floor are not subject to this requirement.

Lamps for localized lighting, suspended at or near the eye level, shall be shaded in such a manner that the brightness of the surface presented to view from any position at which work is performed shall not exceed 2 candles per square inch (0.31 candle per sq. cm.)

It should be remembered that both of these proposed rules on glare have thus far been purely suggestive, and that the committee on lighting legislation of the Illuminating Engineering Society, although in sympathy with such efforts, has not yet gone on record with any more definite wording for glare than that given as Rule 3 above.

It is very interesting to note, however, that another modification of the Wisconsin proposed glare rule has been suggested, and this is added because of its important bearing on this topic.

MODIFICATIONS OF PROPOSED WISCONSIN GLARE RULE

Shading of Lamps.—Lamps shall be suitably shaded to minimize glare.

Note 1. In many interiors where overhead lighting is used a brightness for artificial light sources not exceeding that of the sky (two to three candles per square inch) will prove desirable. The rule prohibits absolutely the use of lamps for overhead lighting suspended at elevations above the eye level less than one-fourth their distance from any

position at which work is performed, unless they are shaded in such a manner that the intensity of the brightness of the visible light source does not exceed 75 candles per square inch (11.6 candles per sq. cm.).

Exception.—Lamps suspended at greater elevations than 20 ft. (6.1 m.) above the floor are not subject to the requirement stated in this note.

Note 2. In the case of lamps used for localized lighting suspended at or near the eye level the limits of permissible brightness are much lower than those given in Note 1. The rule does not permit the use of local lamps unless shaded in such a manner that the brightest surface exposed to view from any position at which work is performed does not exceed 2 candles per square inch (0.31 candle per sq. cm.).

Note 3. Where the principal work is performed on polished surfaces, such as polished metal, celluloid, etc., it is advisable (although at present not mandatory) that the limit of 75 candles per square inch be made to apply to the intensity of the source in all downward directions in order that the reflected glare from such surfaces may also be minimized.

Note 4. Glare either from lamps or from unduly bright reflecting surfaces produces eye strain and increases accident hazard.

The foregoing wording and the arrangement of notes following the rule proper possess a number of advantages over either of the two preceding proposed glare rules, chief of which is the emphasis placed on the desirability of keeping down to much lower limits than the value of 75 candles per square inch as given in Note 1. The conditions which would correspond with Note 1 of the last proposed glare rule are shown by Fig. 4. This diagram will give the reader a basis for picturing just what proportions the rule plans to cover.

DISTRIBUTION OF LIGHT ON THE WORK

Rule 4 of the revised I. E. S. Code reads as follows:

Distribution of Light on Work.—Lamps shall be so installed in regard to height, spacing, reflectors or other accessories as to secure a good distribution of light on the work, avoiding objectionable shadows and sharp contrasts of intensity.

To avoid the indefiniteness of the expression "a good distribution of light on the work" the Industrial Commission of Wisconsin, in the fall of 1917, suggested the following modification of the I. E. S. rule:

The reflectors or other accessories, mounting height and spacing employed with lamps shall be such as to secure a

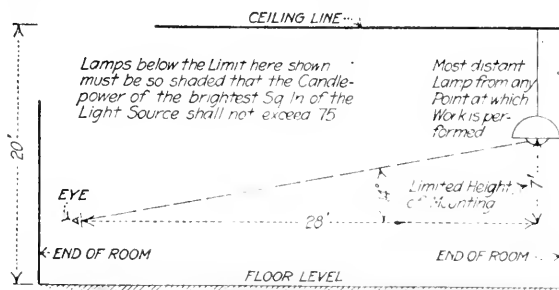


FIG. 4—DIAGRAM OF CONDITIONS CORRESPONDING TO ANOTHER SUGGESTION WHICH HAS BEEN MADE FOR RENDERING THE SPECIFICATION OF GLARE MORE DEFINITE

uniform distribution of illumination on the work, avoiding objectionable shadows and sharp contrasts of brightness.

Note. This order forbids the use of local lamps only, since with their use the field of illumination from each lamp is in sharp contrast to the surrounding darkness and causes severe eye strain and increases the accident hazard.

When local lighting is used there must be employed in addition a moderate intensity of overhead lighting uniformly distributed.

By uniform lighting is meant illumination such that the

ratio of maximum to minimum intensity at the work, for similar operations, will not exceed three, and between the work and adjoining aisles or passages, twenty.

This suggestion for a more definite rule on light distribution has also caused much discussion, and as one result a revised suggestion has been made which has some advantages over the suggested ruling as just given. The main clause of this revised rule, as proposed, is exactly the same as the first paragraph of the above rule except that the word "reasonably" is inserted just before the word uniform, and a note is appended as follows:

Note. This order forbids the use of local lamps as the sole source of illumination even if properly shaded, since with their use the field of illumination from each lamp is in sharp contrast to the surrounding darkness, thereby causing eye-strain and increasing the accident hazard.

When local lighting is used there must be employed in addition a moderate intensity of overhead lighting reasonably uniformly distributed.

It will be noted that this second proposed "distribution" rule omits any reference to an exact ratio of maximum to minimum. It has been felt that even this proposed rule, which is considerably less drastic, might work a hardship for some cases where a system of local lamps is in service with white ceiling and white or very light surfaces beneath, since sufficient general illumination may result indirectly from the local lamps to make additional overhead lighting unnecessary. Figs. 1 and 2 suggest cases where a definite specification of uniform illumination on horizontal surfaces might or might not prove adequate for the needs of the case.

MODIFICATIONS IN STATE RULES

The foregoing comments on "glare" and "distribution" cover the principal points which were involved in the preparation of the revised Wisconsin rules. They constitute points of fundamental importance, but, as already stated, the I. E. S. committee on lighting legislation has not seen fit thus far to modify its rules on these items any further than as outlined in the previous article. In case Wisconsin should decide in the end to incorporate one or another of the foregoing proposed definite rules, an opportunity would thus be afforded to try them out under actual working conditions. The additional information thus gathered would doubtless prove of value in reducing some of the I. E. S. Code rules to more definite form later on.

The Ohio code, as proposed, follows the general plan of the I. E. S. Code, but omits any reference to emergency lighting and controlling apparatus and appends the extended detail classification, under some two to three hundred heads, of various kinds of work in many industries.

The 1918 proposed revisions of the Pennsylvania and New Jersey codes include in practical entirety the revised I. E. S. Code of June, 1917, with a very slight change in Rule 3 and in Rule 6.

Two fundamental points must be covered before state factory lighting legislation can be enforced effectively. One is the availability of an inexpensive and fairly simple portable photometer. The new foot-candle meter meets this condition as far as the development of the instrument is concerned. However, the state departments of labor will be obliged to place a number of these instruments in the hands of their inspectors before much progress can be made.

The other point is that the inspectors in nearly all cases will require some instruction in the elements and practice of factory lighting before they can go through a factory and determine whether or not the rules of a code are being complied with. Engineers of various labor departments lay great stress on this latter point.

It is thus of peculiar importance at this time to record the arrangement which has just been completed between the Commissioner of Labor of Pennsylvania and the provost of the University of Pennsylvania whereby a course of lectures on factory lighting is to be given to the factory inspectors both of Pennsylvania and of New Jersey. This is a starting point along the lines of instruction for state inspection departments the importance of which can hardly be overestimated.

THE WAY TO JOIN THE ENGINEERS OF THE ARMY

First Replacement Regiment of Engineers Organized to Keep Army Engineering Units at Full Enlistment Strength

The German Kaiser has placed the keenest engineering talent of his own and allied empires into the imperial armies of the Central Powers to defeat the world. During these last three years the best engineering skill of France, Great Britain, Russia and Italy and their allies has been matched against the enemy. American employers are paying engineers such attractive salaries that voluntary enlistments of the high-class technical men in the United States Army are below requirements. This deficiency is also probably due in part to the lack of proper information concerning the engineering branch of the service. Few civilians know that it is possible for them to perform in the Engineering Corps almost exactly the same kind of work which they are now doing. The First Replacement Regiment of Engineers was organized at Washington Barracks, D. C., on Dec. 14, 1917, with the express idea of accomplishing this end. Its specific purpose is to keep all engineering units of the army at full enlistment strength during the period of this war. This regiment has not only the responsibility of finding men to fill up depleted ranks, but it must also fit them to become trained, efficient and disciplined soldiers.

The Replacement Regiment will be called upon to furnish men for the following organizations: Camouflage regiments, crane operating and maintenance regiments, depot detachments, electrical and mechanical regiments, forestry (sawmill) battalions, forestry (auxiliary road, camp and bridge) battalions, gas and flame service, general construction battalions, mining regiments, quarry regiments, sapper regiments, searchlight regiments, supply and shop battalions, surveying, ranging and map reproduction regiments, and water-supply companies.

To be assured of assignment to this regiment, the applicant for enlistment should write to the commanding officer of the First Replacement Regiment Engineers, Room 107, Headquarters Building, Post of Washington Barracks, D. C., for application blank. If the blank shows the man to be eligible, an enlistment card is filled out and sent to the recruiting officer nearest to the applicant's place of residence, with instructions to enlist the man for service in this regiment.

Liberty Loan and Labor

Details of the Way in Which the Coming Third Issue of Bonds Can Be
Employed to Stabilize Employment Conditions—New
York Plan for Floating Loan

THIS week's daily papers have contained the financial details of the third Liberty loan as announced by the Secretary of the Treasury. With the details known, the week remaining before the national campaign opens gives sufficient time to every company to decide definitely on the size of the company subscription and on the way in which the company will handle employee subscriptions, and also to perfect all plans for assuring 100 per cent subscription in the plant, office and factory.

So far as can be learned, very little has been done yet in preparation for the third loan. Employers must get ready. There is but one more week left before the campaign opens. The campaign will last only three weeks. It will take the whole of the three weeks to insure the desired 100 per cent subscriptions.

NEW YORK CITY PLAN

In New York City the electrical industry is making progress with its preliminary work. There are two general committees—one of the utility interests and the other of the remaining electrical interests. The second committee has seven divisional committees as follows: (1) Manufacturers; (2) jobbers; (3) contractors and dealers; (4) manufacturers' agents; (5) manufacturers' branch offices; (6) electrical inspectors, and (7) labor. In addition, there are two auxiliary committees, one of central stations and the other of electrical societies.

The general committee has a chairman, a vice-chairman, a secretary, an assistant secretary and a publicity director. This committee will help the divisions, which must work out their own individual plans. The committee has a professional bond salesman who is showing the members how to sell and how not to sell Liberty bonds.

Louis Kalischer has been appointed chairman for the contractor-dealer group, George Patterson for the electrical jobbers' division, J. Nelson Shreve for electrical manufacturers of New York City, Charles Crofoot for manufacturers' agents, E. D. Kilburn for New York branches of manufacturers, J. M. Wakeman for electrical societies, J. C. Forsythe for New York Underwriters, A. Goldman for central-station auxiliaries, and William Walsh for inside electrical workers.

Arrangements are being made to have all subscriptions by members of the electrical industry in New York City made through the electrical committee. The committee is also making arrangements to have a speaker at every meeting of an electrical society during the three weeks of the campaign.

In the past loan campaigns a great number of striking plans were worked out, but the purpose of these articles is not to show extraordinary methods but, rather, simple, workable plans that bring maximum returns.

In manufacturing plants, especially where there is any considerable foreign element among those em-

ployed, the following method has been known to get results. Each foreman is supplied by the employer with a number of blank forms—one for every employee under his direction. The foremen give the blanks to their men, who in turn must either signify their intention of subscribing to the loan or else state in writing on the blank their reason for not so doing.

There will, of course, be a number of men who for some reason or another cannot subscribe to the loan at the moment. These men may be able to subscribe later, and the method that naturally suggests itself in the third loan, provided that the individual has participated in the first or second loan, or both, is to accept his previous bonds as collateral in order to finance the purchase of the third issue.

Furthermore, it will probably be found that this latter method will help a number of holders of first and second loans to subscribe to the third. There will undoubtedly be a disposition on the part of those in the first and second loans to feel that they have about all they can carry for the present at least.

Another method for getting employee subscriptions that has been found to work well from every angle is very apropos under prevailing labor conditions. Under this plan the employer pays a certain proportion of the bond, provided that the employee remains in his employ until the whole sum is paid. Nor is it possible to pay other than at a certain rate.

Thus, one employer has been selling his men one-hundred-dollar bonds for \$75 in weekly payments of \$1.50. If an employee leaves the service of the company prior to the end of the fifty weeks, he loses the twenty-five dollar bonus, for that is what it really amounts to. The longer the employee remains the nearer the \$25 is and the more difficult it is to leave.

This particular employer takes the position that in these times it is worth \$25 to keep a good workman for a year. In a shop of, say, 100 men, provided that all subscribed, the cost would be but \$2,500 to keep the force practically intact for a year. It is doubtful if this could be done so cheaply in any other way.

PAYMENT COLLECTION

It is not necessary for a company to collect the installments on the bonds. In fact, it might be best to have some bank in the neighborhood handle this matter, for the reason that the habit of going to the bank weekly to make a deposit will in this way be encouraged. American labor needs some such stimulus to save, and by saving labor will become steadier.

Regularity in making payments, however, must be insisted on. Some companies take the required amount out of the pay each week. Others send a clerk around to each bondholder on pay days. If it is all left to the employee, there are a number who will allow the matter to slip until they find themselves in deep water. In such instances the purpose of the loan will largely be defeated.

Prevalent Trend of Domestic Appliance Market

Demand by the Public for Less Expensive Type of Goods Is Seen—How the Portable Lamp Trade Will Meet This Demand—Utility Rather than Luxury Is the Desideratum with the Rapidly Growing Clientele

BY E. A. EDKINS

General Manager of Electric Shops, Commonwealth Edison Company

IT APPEARS to me that there is a growing demand on the part of the buying public for less expensive electrical merchandise. The records of sales in the five electric shops of the Commonwealth Edison Company bear out this belief. Moreover, personal observations of prospective customers who are making selections of domestic appliances also assist in verifying these conclusions. By this I do not mean that I believe manufacturers' prices on existing types of merchandise are too high. Under the existing market conditions the prices could hardly be expected to assume other than their present level. What I do mean is that the class of people who are the potential buyers of electrical goods is not the same as the class that was in the market one year or two years ago. The world war has changed that, and the potential buyers of today are looking for types of merchandise that are less expensive than those which the electrical trade is showing. I do not believe in cutting prices to meet this demand, but I do believe in producing types of merchandise to satisfy it.

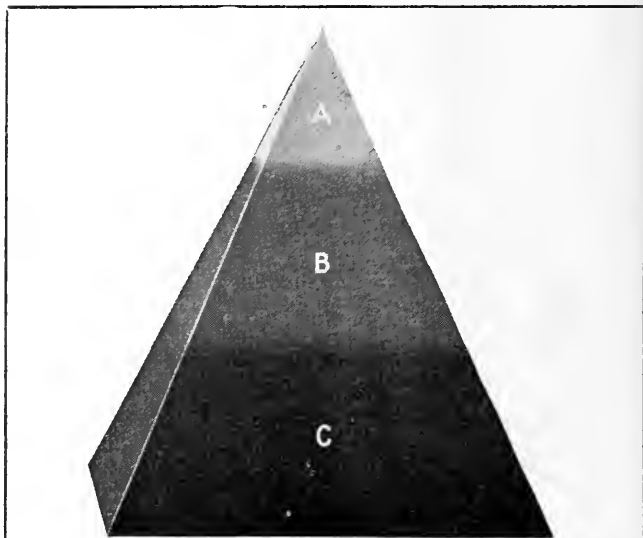
It may be well to analyze the situations which have brought about this condition. The reason the demand for less expensive goods has suddenly appeared will be found in the industrial conditions. The reason why the demand for expensive wares has decreased may be found in the declining stock market.

Conditions in the industrial world are such to-day that the workingman whose wages were formerly \$2 to \$3.50 a day now finds himself earning from \$6 to \$10 a day. Moreover, if he is a dependable workman, his services are in steady demand, whereas his employment was formerly more or less intermittent. The result is that he can, and in many cases does, save some money. Also he spends some, because he and his wife have for a long time looked forward to the day when fortune would make it possible for them to own certain home conveniences and comforts. Among the things they consider purchasing are electrical goods. But they do not consider the purchase of an alabaster lamp at \$250, nor do they spend much time investigating the convenience and utility of a ten-dollar waffle iron. They are looking for a portable lamp that does not cost much, will give good light and will make their home look cozy. Or perhaps they may want a medium-priced electric iron. That is the condition in the industrial working classes.

The wealthy people, who formerly walked into the shops, saw a beautiful lamp and bought it without asking the price are in a different frame of mind now. War taxes, Liberty bond purchases, the depreciated market value of securities they own, are to them all very real evidence of the necessity for cutting down purchases. These people are simply out of the market, and the sale of expensive merchandise is suffering accordingly. This is reflected in the sales of portable

lamps in the electric shops. A few years ago the average retail price per portable lamp sold was about \$25. To-day the average price is around \$15 or less.

Recognizing that these conditions exist, some steps have already been taken to get the waiting business. It was realized that the market exists for an attractive library table lamp at a lower price. As the result of several conferences with lamp manufacturers it developed that to produce the desired lamp at the desired price it would be necessary to have quantity production. There was no single lamp distributor who could place an order large enough to get that quantity price. Negotiations were then opened to see whether several central-station companies operating electric shops could agree to place an order which in the aggregate would be large enough to assure a manufacturer the econ-



THE PYRAMID OF MERCHANDISING POSSIBILITY

The volume of sales of any commodity may be represented by a pyramid. High-priced articles or style goods appealing to the luxury class of buyers have relatively small sales possibilities in volume, represented by area A. The great middle-class demand is represented relatively by area B. The utility and low-price market is the still larger area at the base of the pyramid. The electrical appliance field has been cultivated in general only in the luxury and the upper stratum of the middle-class market.

omies of quantity production. When the plan was proposed it met with instant favor. A lamp is now being created which will be marketed in the fall by this group of central stations at a price around \$7, which compares favorably in size, artistic design and intrinsic value with similar lamps now on the market that retail from \$15 to \$20. This incident indicates how strong and how general is the belief that the market for less expensive merchandise exists.

Another and somewhat different incident also has a bearing on this point. We were displaying some excellent electric waffle irons at \$10 each, the list price.

I persuaded some of my friends who I thought might be interested in them to go into the shop and examine them. The clerk, of course, explained the wonderful convenience and satisfaction of being able to sit at the breakfast table on Sunday morning and produce right there delicious crisp brown waffles. Everything went well until price was mentioned. I learned later that these same people left our shop, went down to a department store in the next block and bought a waffle iron of the type that operates from the gas stove and sells for 95 cents. When I talked to them about it later they said they would surely like to enjoy the convenience of the electric waffle iron, but that \$10 was too much money for an electric appliance when the gas-stove type cost only 95 cents. I explained that with the elec-

tric waffle iron the purchaser also got a stove. But the argument was unavailing, because they said they had the gas stove and might as well use it. An electric waffle iron that could be priced around \$5 would, I believe, have a big sale. Five dollars is a popular price.

The fact of the matter is that the group in the industry which is merchandising domestic electrical goods has hardly scratched the surface. We have all been appealing to the wealthy buyer. He is at the apex of the pyramid of sales possibilities. As we go toward the base of that pyramid the sales opportunities multiply at an astonishing pace. Educating the public, broadening the market and getting out less expensive merchandise all go hand in hand in the program of getting toward the pyramid's base.

Transmission Line Service in Illinois

Interconnected Electric Generating Systems Within the State and Also Connections with Other Companies Outside of the State—Districts Covered by the Lines of Twenty-eight Companies

Possibilities of interconnection in Illinois are of general interest to the central-station companies and of recognized importance to the nation as a measure for conserving fuel and power. Developments in the interconnection of electric generating systems have been followed closely in the ELECTRICAL WORLD. The issues of Jan. 5 and March 2, 1918, showed what is being done in New York, California and Massachusetts.

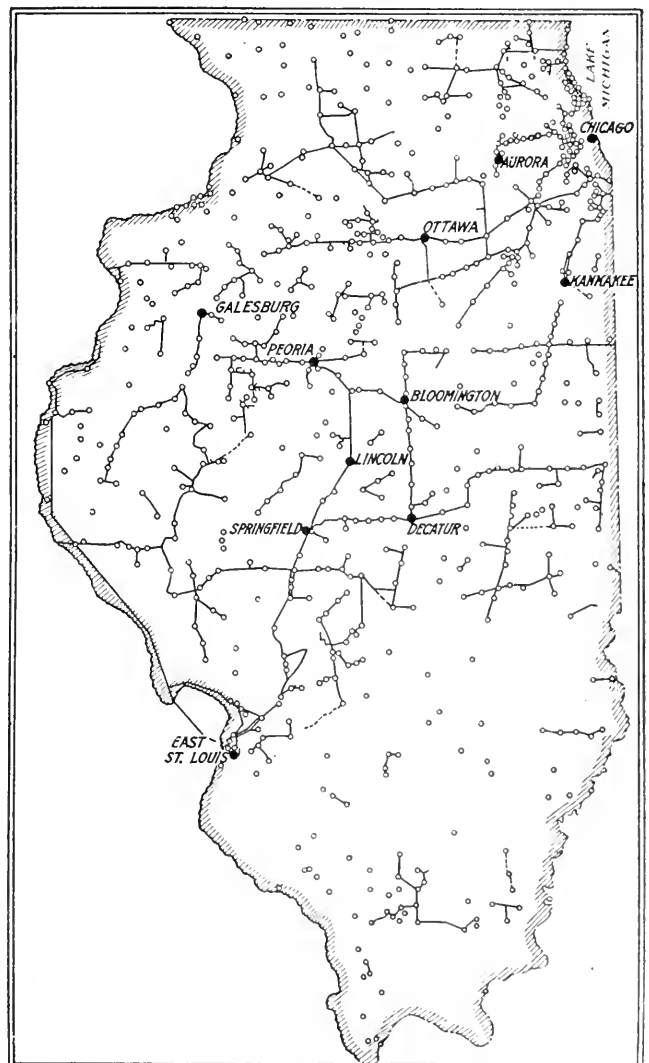
THE map printed herewith shows the transmission lines owned by twenty-eight companies within Illinois. A considerable number of these companies are already interconnected for exchanging service, when conditions make the interchange of power advisable.

There are several connections between systems in Illinois and those in neighboring states. The Central Illinois Utilities Company has a connection with the system of the Interstate Public Utilities Company of Indiana. This connection, it is understood, is used only for emergency purposes on account of the fact that the load characteristics of the two systems are very much alike.

The East St. Louis Light & Power Company has a connection with the Union Electric Light & Power Company of St. Louis by means of a submarine cable under the Mississippi River. The contract covering this service was authorized by the Illinois Public Utilities Commission within the last few months. This connection is now in use and is mainly for the purpose of supplying emergency and peak service to the East St. Louis company from the plants of the Union Electric Light & Power Company.

The Mississippi River Power Company, with its plant on the Iowa side of the Mississippi River at Keokuk, transmits energy into Illinois, after which the line goes down the river to Halls, Ill., where a tap is taken off for a cement plant at Ilasco, Mo. Energy is then transmitted further down the river on the Illinois side and crosses just above St. Louis for the purpose of supplying the requirements in St. Louis. Energy is also supplied to Alton, East St. Louis and Belleville, Ill., through

the system of the East St. Louis & Suburban Railway Company, which operates in connection with steam plants at Alton and East St. Louis.



INTERCONNECTED TRANSMISSION LINES OF ILLINOIS

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

HOW USE OF SPECIAL LAMPS WAS AVOIDED

Some Available Auto-Transformers Were Connected So as to Operate 6-Amp. Lamps from 4-Amp. Circuit

Apparatus for 4-amp. series alternating-current circuits is not so extensively used as formerly, installations of this character having been largely superseded by 6.6-amp. or 7.5-amp. circuits. In one instance a company having a 4-amp. circuit feeding a number of 40-cp. municipal lamps desired to add half a dozen 250-cp. gas-filled units to the circuit. As 250-cp., 6.6-amp. lamps were standard elsewhere on the system, it was not considered advisable to secure special 4-amp. lamps. Consequently several small auto-transformers which had been in operation feeding 20-amp., 600-cp. or 15-amp., 400-cp. lamps from 6.6-amp. circuits were utilized. They were self-contained in the type of pendant unit that was to be used. Tests were made on one of these auto-transformers with a 4-amp. primary current and no difficulty was found in locating a combination of leads which with this circuit current would give 6.6 amp. through a 250-cp. lamp. Utilization of this equipment permitted the use of standard lamps, and the arrangement has given perfect satisfaction ever since.

EFFECT OF POOR COAL ON PLANT EFFICIENCY

Increased Price Combined with Poorer Grade of Coal Brings About a Large Increase in the Unit Cost of Power

The effect of poor-quality coal on the performance of the Manchester Street turbine plant of the Rhode Island Company, Providence, was set forth at a recent meeting of the New England Street Railway Club by W. C. Slade, superintendent of power and lines. This station contains, besides other smaller equipment, two 15,000-kw. turbines delivering 25-cycle energy to the station buses. Its 1917 output was 73,492,300 kw.-hr., and the average price of coal is now over \$8.35 per ton alongside, excluding demurrage charges. Up to date the company has received nearly \$6,000 in demurrage bills on the last eleven boats, on which about two-thirds was incurred on the loading end.

From 8.5 cents per ton the discharging costs have advanced to 23 cents. This is due to the fact that the company is obliged to discharge boats on overtime work to avoid the high demurrage charges, and to-day coal passers along the Providence waterfront are receiving 50 cents per hour straight time, 65 cents for overtime, and 75 cents per hour on Sundays and holidays. The majority of these men are unable to read or write or to speak or understand English.

Prior to the time when coal-mining conditions be-

came abnormal and transportation facilities demoralized, the company usually burned New River or Pocahontas, with an average of about 14,900 B.t.u. per lb. Even the same grade of coal, owing evidently to poorer preparation at the mines and at a later time possibly to the pooling of the coal supplies by the government, gave a noticeably lower average B.t.u. on analysis. The spot cargoes purchased outside, consisting mainly of Pennsylvania coals, were in some instances of very poor quality. Of the coal placed in the yard storage, 35 per cent showed a heat value under 14,500 B.t.u., and 46 per cent under 14,750 B.t.u. In fact, 21 per cent was under 14,000 B.t.u. Owing to the deterioration of the coal in storage before it was consumed under the boilers, the average B.t.u. value of the coal as fired was not over 14,300 B.t.u. The effect of the quality of the coal was reflected directly into the cost of operation and was seen in increased boiler-room maintenance.

DATA ON COAL FACTOR OF PLANTS

Period	MANCHESTER STREET STATION		ROCKLAND STATION	
	Lb. Coal	Per Cent Increase	Lb. Coal	Per Cent Increase
Year ended June 30, 1916.....	2.28	....	3.49	....
Six months ended Dec. 31, 1916...	2.38	4.4	3.78	8.3
Year ended Dec. 31, 1917.....	2.69	18.0	3.99	14.3

The net result was to raise the unit cost of power for the year 1917 by 106 per cent compared with the 1916 fiscal year.

The coal factors for the Manchester Street station and also for the small engine-driven plant of the company at Rockland, R. I., have been growing worse since 1916, which was the last fiscal year not affected materially by the advancing costs of fuel, material and labor.

The unusually high coal factor of the turbine plant in 1917 was due to a combination of operating conditions requiring a large number of banked hours on standby boilers not used in 1916, together with the necessity of burning a considerable amount of inferior coal, as well as coal damaged by spontaneous combustion. The performance will not be repeated in 1918. Under favorable conditions the plant was operating for a part of January, 1918, at 2.13 lb. (0.96 kg.). The decrease in economy at both turbine and engine plants has been of the same relative order.

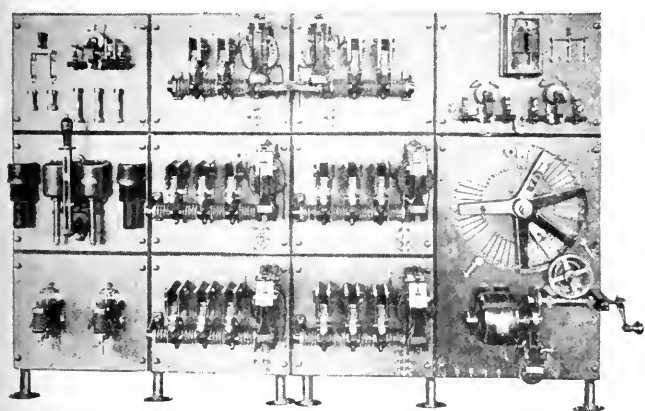
The cost of power at Manchester Street increased 23.4 per cent for the six months' period above tabulated and 106 per cent for the following year. At the small Rockland plant the increases were 31.8 per cent and 73.5 per cent. While the cost was due partly to the abnormally high price of coal, it was partly due to the poor quality of coal available. In the year 1917 steam-

plant maintenance at Manchester Street increased 75 per cent compared with the fiscal year 1916, and other maintenance charges increased only 13 per cent. The increase in the cost of fuel as fired was 132 per cent and raised the fuel charge in 1917 to as much as 83 per cent of the total maintenance and operating costs. Wages advanced 30 per cent and all other operating charges 25 per cent. The kilowatt-hours delivered increased only 4.9 per cent and the pounds of coal per kilowatt-hour 18 per cent. Mr. Slade expressed the belief that many small railway plants ought to be shut down and that electrical energy should be purchased from a central-station system.

MOTOR CONTROL ELIMINATES FUEL WASTE IN SUGAR MILL

Automatic Control Allows Power Input of Sugar Mills to Vary Directly as the Output, and Refuse Fuel Is Sufficient at All Times

A new system of electric drive and control has been designed and installed in a cane-crushing mill in Central Cunagua, Cuba, by the General Electric Company. The mill had previously been operated by variable-speed induction motors with manual speed control through a secondary motor reactance. When the mill operated at reduced speed it was found that the power input to the motors was the same as that required at full load. Hence, as fuel is supplied from refuse cane,



ENERGY INPUT MADE PROPORTIONAL TO OUTPUT OF MILL BY USE OF CONTROL APPARATUS

an adequate supply was not available when the mill ran at reduced output. Additional coal or wood for fuel was therefore needed at various times.

The new system installed provides for automatic control of the crushing rolls, for relative speed adjustments and operation of a variable-speed turbine-generator to vary the output of the mill. Each motor in the mill is served from an individual control panel shown in the accompanying illustration. This panel controls the speed of the motor by means of a balanced voltage relay and through a three-phase motor-operated rheostat. The several motors driving individual rolls composing a mill or tandem are operated from a turbine independent of the sugar house, and therefore speed changes of the mill will not affect the operation of motor-driven pumps and miscellaneous machines.

The equipment was furnished by the Westinghouse Electric & Manufacturing Company.

SHALL TRANSFORMERS BE BANKED IN A DISTRIBUTION SYSTEM?

Opinion and Practice of Ohio Operating Distribution Engineers Brought Out in Discussion of a Paper on Interconnecting Plan

At a recent meeting of the transmission and distribution engineers of the Ohio Electric Light Association M. E. Grah of the Toledo Railways & Light Company presented a paper entitled "Shall Transformers Be Banked in a Distribution System?" In his paper the author pointed out economies that can be effected by operating certain parts of a system in this manner and expressed the opinion that the plan should be applied only after a detailed study of the conditions existing in each case had been made and a design worked out to meet those conditions.

In the discussion W. E. Beatty of the Union Gas & Electric Company, Cincinnati, Ohio, said that the practice of banking transformers had been practically abandoned by his company because of the obstacles encountered and the greater hazards produced during adverse conditions, such as those presented by storms. Furthermore, when several transformers had been banked together it was difficult to re-fuse the transformers, especially if one or two had been put out of service by the storm.

G. M. Miller of the Louisville (Ky.) Gas & Electric Company outlined a plan of banking which necessitated the fusing of branch lines where they connect with main lines. The branch lines are connected solidly to the transformers, whether one or more in number. The primary fuse used at the main line was designed to carry 200 per cent of the total rating of transformers connected to the branch circuit. Lightning arresters were utilized to protect each transformer installation. The secondary system was grounded inside each house ahead of the main-line switch. Mr. Miller stated that they had not experienced any difficulty with the transformers burning out owing to the high degree of fusing used in the branch.

B. L. Chase of the Columbus (Ohio) Railway, Power & Light Company said that banking transformers and connecting the secondaries solidly therewith induced a dangerous condition. For instance, even if the primary fuses used for isolating the individual transformer should blow, thereby disconnecting the primary from the transformer, the transformer would still be "hot" because the secondary connection of the other transformer would act as a feeding point. This often deceived the lineman sent to clear the fault and sometimes caused a serious accident. In addition, the damaged fuse cut-outs might remain "alive" and cause trouble in the whole system.

I. L. Kentish-Rankin of the *Electrical Review* expressed the opinion that transformers should be banked because of the increased efficiency, better regulation and the lesser cost per kilovolt-ampere and because of the possible use of larger capacities in each unit.

J. W. Bryant of the Wagner Electric Company, Cincinnati, Ohio, pointed out that the continuity of service demanded to-day will not permit the continued use of the old scheme of banking.

M. H. Wagner of the Dayton (Ohio) Power & Light Company emphasized the importance of safety to linemen and pointed out that the present-day linemen are

not of the same caliber as the old-type linemen. In his opinion the old method of banking transformers and connecting secondaries in solidly should be abandoned. When the system to be rebuilt is in a fairly congested district where the diversity is regular, then installing secondary fuses at the neutral point in the secondaries may be advisable.

Concluding the discussion, Mr. Grah pointed out the necessity of using transformers having similar characteristics and the same rating in a banked system. He added that fusing the neutral point in the secondary presents two difficulties—first, that of obtaining the true neutral point; second, that of obtaining a suitable secondary fuse.

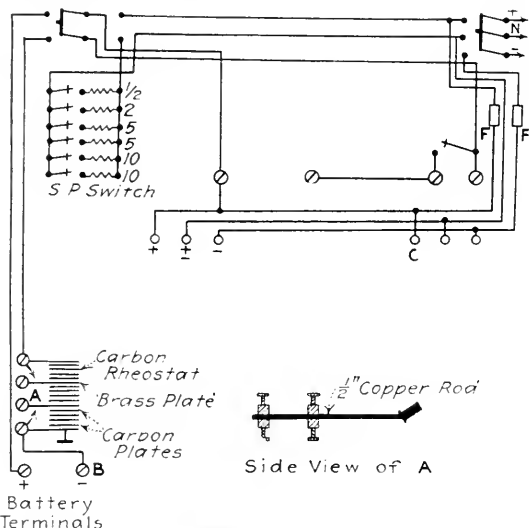
SIMPLE ARRANGEMENT FOR THE TESTING OF D.-C. METERS

Resistance and Battery Loads Can Be Adjusted Over Wide Range—Board Can Be Built for Any Rating Desired

BY J. M. M'CLURG

Meter Department, Scranton (Pa.) Electric Company.

The accompanying diagram shows a simple arrangement for testing both large and small direct-current meters that can be adapted to any size load. The board has two distinct loads, one being on 110-volt direct



CONNECTIONS FOR TESTING LARGE AND SMALL DIRECT-CURRENT METERS

current with resistance for a load up to $32\frac{1}{2}$ amp. The other load is a storage battery and depends on the size of battery used. The load is controlled by a double-pole, double-throw knife switch, making it possible to leave the triple-pole switch in circuit during the test and changing over from full load to light load by using the double-pole, double-throw switch. This economizes time, the tester setting the load he desires by the small single-pole, single-throw switches for light load and a carbon rheostat in the battery circuit for full load, thereby leaving only one switch to operate during the test.

A carbon rheostat is mounted under the table, the carbons being separated into sections by brass plates. This provides for the cutting out of sections of carbon plates if the resistance is too great, the brass plates being connected to the binding posts marked A. A

copper rod slides through the binding posts, so as to short-circuit part or all of the carbon rheostat as the test requires. This is a convenient carbon rheostat that can be used for light or heavy loads. The board can be built for any desired capacity by increasing the sizes of the load, terminals, circuits, etc.

NON-SWEATING LINING FOR ROOFS

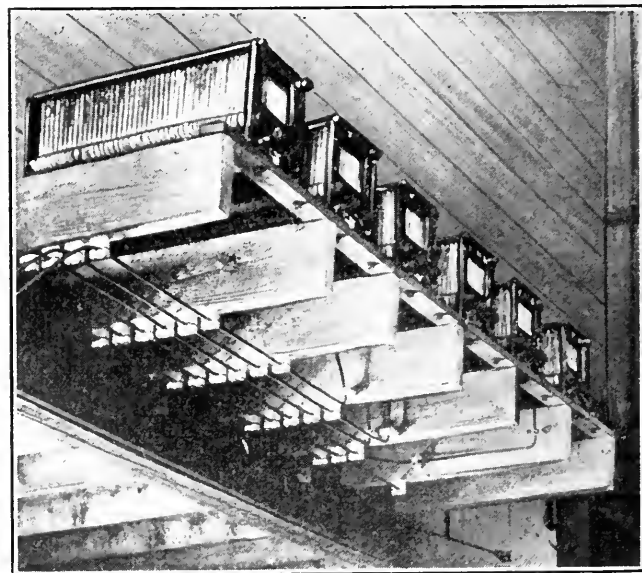
Waterproof Concrete Slabs, Asbestos Felt, Gypsum and Wood Fiber Employed

A form of roof construction was employed in the recently completed power plant at Columbus, Ohio, that may be found suitable in other central stations. The roof for the boiler room consists of concrete slab, waterproofed with three-ply J-M asbestos felt laid in asphalt. The turbine-room roof is similar, except that slabs made of a composition of gypsum and wood fiber are used, this construction being resorted to in order to avoid the possibility of condensation forming on the under side of the roof. The concrete slabs for roof and floors are supported by asbestos-protected corrugated metal with reinforcing fabric. The slabs are flat in both cases, being $2\frac{1}{4}$ in. (5.71 cm.) thick for the roof and 4 in. (10.16 cm.) thick for the floor.

RESISTOR MOUNTING THAT AFFORDS GOOD VENTILATION

Grids Supported Overhead on Projecting Floor Beams to Facilitate Rapid Dissipation of Heat Are Found Advantageous

In a New England shop where circuit breakers are tested frequently the resistors which are used to limit the load are mounted on extended wooden joists, as shown in the illustration. By so doing it was possible to keep the resistors off the floor and at the same time



MOUNTING PERMITS CIRCULATION OF AIR THROUGH GRIDS

facilitate the dissipation of heat generated in the grids. Since the resistors are not closed in on any side the air has free access to the grids. The open wiring run to the resistors is carried underneath the joists in porcelain cleats.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

RATE INCREASES JUSTIFIED IN THE LANGUAGE OF LABOR

Explanation of the Public Utility Rate Situation
Written from the Workingman's Point of View
That May Be Used as Copy for Local Papers

An Indianapolis publication devoted to the interest of organized labor and called the *Union* has been devoting considerable space to public utility topics as they affect labor. The editors of this paper, having the point of view of labor, are able to present the case of the public utilities in language and in a spirit that the workingman can comprehend and is in sympathy with. The following editorial from the *Union* is republished herewith with the thought that it may assist public utility managers in formulating the sort of arguments they need when rate increases are applied for. It might also provide the basis of an article for local newspapers in quest of copy:

A friend of the *Union* protests against the tone and subject matter of our article on the conservation of the public utilities. He does not deny that the facts are as stated and that there is a distinct prospect of the companies administering to the public going to the wall, but he says that will be good for the soul of them. "Moreover," says he, "let them stand by their contracts with the people from whom they derive their franchise rights. They have agreed to deliver

operating companies to go into liquidation, which is the apparent alternative.

The *Union* has no brief for these public corporations, but, standing as it does for justice for the man who has labor to sell, it must also stand for justice to those who have the contracts to sell those commodities without which the modern community cannot exist. The workingman could not prosper to-day on the wages of three years ago—he could not exist in the mass; and the same changing conditions that have made for the high cost of living in the home have enormously increased the standards of costs for all business. We must adapt all prices, whether for public service or for bread or cheese, to the new standards.

MAKING IT EASY FOR THE CUSTOMER TO SAY "YES"

Way in Which the Advertising Department of One
Central-Station Company Changed the
Stereotyped Return Post Card

The average return post card used in central-station companies smacks more or less of legal phraseology. It usually contains a formal statement that the person signing the card is interested in the proposition and a still more formal statement that signing the card places the signer under no obligation to the company. That is the sort of card the new-business manager

U have been saying in your letters just about as much as I can stand without asking you to submit some proof about wiring my home. I may or may not give you my business, but I should like you to come and give me an estimate. Perhaps you can wire my home after I know what it will cost. Of course, I understand this doesn't obligate me.

Name _____
Address _____

YES

You may send your representative to see me about Electric Light in my home. I take your word for it that this service will not obligate me in any way.

Name _____
Address _____
Best time to call _____

CERTAINLY!

Send your man along to give me an estimate on wiring our home. Of course I understand that this will not obligate me in the least

Name _____
Address _____

THREE POST CARDS WHICH GET AWAY FROM THE STEREOTYPED PHRASEOLOGY

certain service for a certain price; it is up to them to do it. If an individual having a contract loses money he has to stand the loss and go bankrupt if necessary. Well, the public utility companies have the wrong end of a losing contract, that's all."

But it isn't all. If John Smith has a private contract and goes broke on it by reason of a changing labor or material market that is tough on John Smith, but it does not disturb the community. But if the water or gas or electric light or traction company goes broke and stops doing business that touches us all. As a matter of public policy we must see to it that the public service in these commodities is maintained; whereas, as a matter of public policy, the fate of John Smith is not to be considered. As a body we could not step in and save John Smith from the evils that lie in a changing market; but the people may and should take such steps as may be necessary to protect themselves and their families and the city from the consequences that must follow on the suspension of any one or more of the public utilities companies.

And it would appear that it would be cheaper and more practicable to change the fixed rate of compensation for the services rendered where it is required than to permit the

fondly hopes a large number of people will enthusiastically sign and return. It is a surprising truth that some persons do sign them and send them in, but it has been truthfully said that such persons must be very much interested in things electrical. There is nothing on the card to inspire enthusiasm. Its legal phraseology makes its reader involuntarily suspicious, of just what it may commit him to, and in nine cases out of ten it is thrown aside or dropped into a convenient waste-paper basket.

Realizing this situation and feeling a desire to make all of its advertising as human as possible, the Minneapolis General Electric Company has printed some return post cards that are different. They are designed to make it easy for the prospective customer to say "yes." Three of them are reproduced herewith. They were one of the features of an exceptionally successful house-wiring campaign which the company has been running continuously for many months.

CONTINUOUS METER-READING IS A WAR-MEASURE PLAN

Necessity for Distribution of Work as Equally as Possible on Readers and Office Staff That Are Left

On Feb. 1 the Beverly (Mass.) Gas & Electric Company adopted the continuous system of reading meters and mailing bills, the new plan being adopted owing to conditions created by the war and the necessity for distributing the work as equally as possible for the meter readers and office staff. Under the old plan the bills were read between the fifteenth and twentieth of each month and were mailed on the first of the month.

The city, which has a population of around 20,000, has been divided into about twenty-four districts. The gas and electric meters in the first district are read on the first working day of each month and bills mailed two days later. The meters in the second district are read on the second working day of each month and bills mailed two days later, the meters in the third district on the third day, and so on. Ten days from the date of mailing bill are allowed in which to secure the discount for prompt payment. Discount dates are plainly stamped on all bills.

VIGOROUS CAMPAIGN ON ELECTRIC TRUCKS IN CHICAGO

Thirty-five of These Trucks Have Been Sold—A New Method of Charging for Garage Service Is Developed

Since last fall, when the Commonwealth Edison Company entered into an active campaign of advertising and special sales efforts to promote the electric truck business, thirty-five trucks of all sizes have been sold in Chicago. These truck sales were due in part to the company's efforts and in part to the hard work of representatives of the truck manufacturers. The trucks which have been sold were made by the Ward company, the Walker Commercial Truck Company of America and the Couple Gear company. The prospects for further business are exceptionally bright at this time, some twenty-five or thirty companies having under consideration the purchase of from one to twenty trucks.

The company's complete maintenance plan for electric trucks was described in earlier issues of the ELECTRICAL WORLD (June 2, 1917, page 1080, and Dec. 29, 1917, page 1247) and is briefly as follows: A customer by paying a flat charge per month gets everything his transportation service requires except liability insurance and the services of a driver. Ordinary repairs, tires, battery renewal and charging, washing, garaging and painting are all covered by the contract. The only stipulation is that the contracting party must start with new electric trucks. Energy taken from the company's direct-current substations is distributed to fifty-eight charging positions in the two rooms into which the one-story building is divided. Each circuit, in addition to carrying the usual switching equipment, also has an individual rheostat and meter. The rating of most of the circuits is 100 amp., but some circuits to carry 200 amp. are installed for boosting.

Besides its plan for maintenance, the company now

offers truck users an unusual garaging proposition. The trucks sold under this agreement are kept in the building which was built for housing trucks under the general maintenance plan. A feature of the measured garaging service which the company has recently started to offer is that it does not charge for truck storage on the basis of the truck ratings in tons, as is the usual plan. Instead it charges for the floor space occupied by the truck at a fixed price per square foot occupied. The price at present is 25 cents per square foot on the over-all dimensions of the truck. This charge includes, in addition to garaging, oiling, washing, placing the batteries on charge, flushing the batteries, keeping records and general inspection. In addition to this the company sells these truck users electricity at 5 cents per kilowatt-hour. This plan of charging for garage service is thought to be an exceptionally just one, as there are many 2-ton trucks which occupy as much space as some 5-ton trucks. This is particularly true where the truck body is designed for hauling waste paper or other very light and bulky products. All trucks taken into the company's garage on this plan have their batteries charged according to the rules approved by the local section of the Electric Vehicle Association, and records on the trucks are also kept according to the approved practice laid down by the same body.

Truck users in the city are finding this plan a very practicable one, and considerable business is expected to develop from it for the Commonwealth Edison Company as well as for the manufacturers of the trucks.

GETTING AFTER THE HIGH-RATE BUSINESS

Methods Adopted by Illinois Company for Taking New Business That Is Profitable and Does Not Require Additional Investment

The Public Service Company of Northern Illinois is among those utilities which believe it wise to seek additional income from business that does not require capital investment. John G. Learned, assistant to vice-president of the company, in commenting upon the company's efforts along this line, stated it as his belief that this can be accomplished by more completely equipping the home. Moreover, the additional business secured in this fashion is usually business that comes to the central-station company on the higher steps of its rate schedule.

With these facts in mind, the Public Service Company of Northern Illinois has published special advertising matter on the subject which was prepared at the company's suggestion by the Harvey Hubbell Company. These folders are being distributed among all of the public service company's residential customers. The pamphlets go somewhat further than the ordinary literature of this sort, for they not only show the advantage of having a baseboard receptacle but also point out the value of making this receptacle do double duty by installing a duplex unit. The company has arranged the following terms of payment for customers who wish to install additional outlets: Where the amount is less than \$6, cash thirty days; where the amount is \$6 to \$12, six equal monthly payments; where the amount is \$12 or over, twelve equal monthly payments.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Notes on the Design of Electromagnetic Machines.—STANLEY PARKER SMITH.—Magnetic leakage of the non-salient pole rotor consists essentially of slot leakage, says the author. The effect of slot leakage is to divert flux which would otherwise pass radially through each tooth, so that the lines of induction assume an oblique direction sloping away from the pole center. If magnetic wedges are used—e.g., cast iron—the slot leakage is considerable, but with non-magnetic wedges the effect of slot leakage is usually less than that of end-bell leakage. Bronze wedges are used. The article also dwells on excitation and the determination of the flux per pole and touches on other considerations. The author says that generally the reluctance of cores has no effect on the flux distribution in the gap. The excitation needed to send the current through the stator winding when short-circuited is due to the inductance and reaction of the stator winding.—*London Electrician*, Feb. 15 and 22, 1918.

Alternating-Current Single-Phase Motors.—GORDON FOX.—In this article the author explains the principles underlying the operation of different types of single-phase motors. The advantages and disadvantages of different forms of construction are discussed. Characteristic curves and connections for several kinds of motors are presented.—*Railway Electrical Engineer*, March, 1916.

Generation, Transmission and Distribution

Ninety-five-Thousand-Kilowatt Addition to Northwest Station.—The Commonwealth Edison Company of Chicago is completing the installation at its Northwest station of three additional turbo-generators of an aggregate capacity of 95,000 kw. Two are of the compound reaction type and the third is an impulse machine of new design. One of each type is now in operation, and the second compound machine is in course of erection. At the turbine throttle steam is supplied at a pressure of 230 lb. gage and 200 deg. superheat.—*Power*, March 12, 1918.

Standardized Flexible Distributing Systems in Industrial Plants.—BASSETT JONES.—The author has worked out a system for determining the power requirements of industrial plants in advance of construction, the method being based on a relationship between projected tool area, manufacturing area and total square feet of floor area. The study of this subject was undertaken in connection with the electrical distribution for a new factory building of the Sprague Electric Works, General Electric Company. The author points out that all equipment employed in the generation and distribution of electric power has practically been standardized, except distribution systems in industrial buildings, and he shows that standardization here is equally practicable and desirable. In any industrial plant flexibility in distribution to take care of

frequent changes in machine tool layout is of the utmost importance.—*General Electric Review*, March, 1918.

Interconnection of Electricity Supply Undertakings in the West of Scotland.—Some details of a report issued by the West of Scotland committee for the interconnection of electricity supply undertakings are given in this article. In order to facilitate investigations as to the possibility of and advantages to be derived from interconnection, the local authorities and companies operating electricity supply companies have been arranged in groups according to their geographical proximity and similarity of supply systems. Conditions that make it difficult or practicable to connect the systems of each group are outlined. Load curves of the individual corporations as well as composite load curves which would represent the total load if the systems were interconnected are given. Reviewing the subject of interconnection as a whole, the committee has come to the conclusion that financial benefit would be derived from linking up some of the systems for the purpose of interchange of energy. In some of the groups considered the economy of week-end supply from one station might be doubtful, but the committee is of the opinion that considerable economy could be effected in many of these cases by a supply in bulk from the larger to the smaller stations.—*London Electrician*, Jan. 15, 1918.

National Electricity Supply in England.—Comments of a power station engineer on the basis for the interim report issued by the coal conservation sub-committee to the Minister of Reconstruction (British) are presented in this continued article. The author, whose name is not mentioned, says that the report is undoubtedly strong in the main features of its findings, but the facts and figures on which many of the arguments are based are lamentably weak or absolutely inaccurate. He then goes on to discuss some of the points. Among one of the things he emphasizes is that if power plants were rehabilitated so that the fuel consumption of 5 lb. per horsepower-hour was reduced to 1.5 lb. per horsepower-hour, practically all existing power plants would have to be scrapped and new super-stations containing generating units rated at 30,000 kw. and 50,000 kw. would have to be provided instead.—*London Electrical Review*, Feb. 22, 1918.

Rapid Growth of Southern Canada Power Company.—Charts given show the territory served by the Southern Canada Power Company, and information is included regarding the extent of the company's operation and its past history, with a few words regarding future developments.—*Canadian Electrical News*, Feb. 1, 1918.

Traction

Electrical Signaling and Control on Railways.—C. M. JACOBS.—After outlining the cardinal requirements of railway signaling apparatus, the author takes up the

subject of track circuits, automatic train control, gravity-sorting sidings, single-line working, power for electric signaling and limitation of electric signaling methods. He points out that in order that track circuits may be reliable they should be adjusted for minimum train shunts at infinite ballast 5, 10 and 20 ohms respectively. By means of curves he shows that the problem is to reduce the fraction of the unshunted relay current which passes through the relay when it is shunted by a predetermined minimum ballast resistance to a lower fraction known as the armature release current, which is usually 60 per cent of the minimum pick-up current. Tables are given giving track-circuit factors and ratio of armature release shunt to minimum ballast shunt for various minimum pick-up currents. Some requirements of automatic train control are outlined and reference is made to the equipment used by the Great Western Railway. A system for operating the points of a gravity-sorting siding used on the Eastern Railway of France is described, together with an old British method of working single lines by means of tokens. In regard to power for signaling purposes, the author points out that in large centers, at any rate, it should be more economical to derive the energy for operating signals from a central battery than from individual batteries with limited output.—*Journal of the Institution of Electrical Engineers* (British), February, 1918.

Power Distribution for the Montreal Tramways.—Standardization combined with flexibility and the effective utilization of existing equipment were primary design considerations in the rehabilitation of the power system of this company.—*Electric Railway Journal*, March 9, 1918.

Electrophysics and Magnetism

Electrolysis of Underground Structures.—SAMUEL S. WYER.—A digest of publications of the Bureau of Standards on the electrolysis of underground structures caused by the disintegrating action of stray electric currents from electric railways has been compiled by the author. Among the subjects covered are cause and economic importance of electrolysis troubles, electrolysis surveys, corrosion principles, relation of soil characteristics to electrolysis, electrolysis of concrete, current leakage, mitigation applicable to pipes and railway negative return, and electrolysis regulations.—*Bureau of Standards Publication*.

Telegraphy, Telephony and Signals

Open-Circuit Oscillators as Receivers.—A detector circuit is described in which a three-electrode vacuum-valve detector is connected to the free end of a wireless telegraph aerial while a tuning coil is inserted at the earth end to tune the aerial circuit to resonance or to impress the maximum potential on the grid of the vacuum valve for a given group of incoming oscillations.—*Wireless Age*, January, 1918.

Production of Continuous Waves by Spark Discharger.—This article describes briefly a system for generating high-frequency alternating current which has been developed by Riccardo Arno. By means of the arrangement shown in the article the inventor states that he is able to secure more than 30,000 spark discharges per second, resulting in a practically continuous flow of high-frequency current in the wireless aerial. The Arno apparatus is not limited to the use

of the high-frequency alternator, any type of generators heretofore employed in connection with radio work being suitable.—*Wireless Age*, January, 1918.

Electrochemistry and Batteries

Dry Cells and Wet Batteries.—WILLIAM J. HEEDMAN.—The author discusses the primary and secondary types of cells, two classes of primary cells, general construction of dry cells and their care, closed circuit cells and their maintenance.—*Telephone*, March 9, 1918.

Installations, Systems and Appliances

Electric Cargo Winches.—E. F. WHITNEY.—This article dwells on the requirements which have to be met by motors in operating cargo winches. Some electrical equipment suitable for this service is described and the superiority of its operation is discussed in terms of reliability, speed, control, cost and efficiency.—*General Electric Review*, February, 1918.

Electricity in Logging and Saw Mills.—E. H. HORSTKOTTE.—A particularly satisfactory arrangement of power equipment in a large lumber mill in the West is described. This mill burns sawdust in the boilers to operate electric generators which are tied in with the power system of a local public utility for mutual exchange of energy when conditions require.—*General Electric Review*, February, 1918.

Miscellaneous

Notes on Electric Welding.—CAPT. JAMES CALDWELL.—The author gives a résumé of the chief methods of welding, beginning with resistance welding. He goes on to state that this is a form of electric welding which is the closest approach to original smith welding. Butt welding is applicable to the welding of rods, bars, etc., transverse to the length of the pieces, and spot welding is most commonly adopted in England to unite sheets or thin plates where a continuous weld or joint is not required. Seam welding is an extension of spot welding, applicable to comparatively thin sheet-work. With the carbon-arc method of welding 90 volts and 50 amp. to 500 amp. are required, according to the size of the work. The author explains that in one process involving the use of coated metal electrodes the covering is made of fireproof material so that as the metal electrode is melted it is directed on the work being welded. In another process the sleeve or covering on the metal electrode melts, forming a flux that protects the added metal from oxidation. The flux may contain constituents which have a chemical action on the fused metal.—*London Electrician*, Feb. 15, 1918.

The Boston Turbine Accident.—A detailed account of the wreck of a 35,000-kw. single-cylinder turbine at Boston. It seems that the deflection of the cast-iron diaphragm in the eighteenth stage, causing the diaphragm to rub the wheel and release the buckets, was the immediate cause of the accident. The question is raised whether it is not advisable to extend the use of steel to the large diaphragms in the lowest stages of these high-capacity machines. The opinion is advanced that if it is found that the cast iron is subject to frequent deflection, that the bond between the buckets and the disk and ring of the diaphragm soon weakens, or if these relatively thin disks are likely through any cause foreseen to be subjected to the stresses set up by centrifugal force imposed by accidentally revolving with the shaft, then steel seems advisable.—*Power*, March 19, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

N. E. L. A. PLANS TO HAVE WAR-TIME CONVENTION

Executive Committee Decides to Hold Meeting Between May 15 and June 15, Probably in Central West, for Serious Business Only

The executive committee of the National Electric Light Association decided at a meeting in New York on March 22 to hold a strictly war convention this year. The convention will be held, according to the present program, at some time between the middle of May and the middle of June, and probably in some city of the Central West, although the latter point is not entirely settled. A Central Western city is favored for the reason that such a location will minimize railroad travel of delegates, and this is an important consideration bearing on the war. If possible, the sessions will be kept within two days. No arrangements are to be made for entertainment or for the reception of ladies this year, it is understood.

A convention committee to take charge of the affairs connected with the meeting is being formed. Walter Neumuller, New York Edison Company, will be chairman and T. C. Martin secretary.

The need for a war convention this year arises from two general conditions on which members are seeking information and advice to guide them in their operations: First, thorough knowledge of ways in which they may assist in winning the war; second, a better understanding of the methods by which they may meet the internal problems resulting from the war.

ELECTRICAL MEN CO-OPERATE IN SOUTHERN CALIFORNIA

The Spirit of Co-operation Dominates a Successful Gathering Held at Los Angeles to Further the Cause of Harmony

The new word "synergism" was defined and elucidated at a banquet in Los Angeles on March 15, when 350 electrical men gathered to fire the first gun in the California electrical co-operative campaign. At the Riverside convention of the Pacific Coast Section, N. E. L. A., held April, 1917, a desire was expressed for a more harmonious alignment of the various branches of the industry. As a result a liberal fund has been subscribed by central stations, manufacturers, jobbers, dealers and contractors so that constructive work may be done by trained men whose time will be spent in skillfully pointing the way for closer co-operation.

S. M. Kennedy, secretary and general agent of the Southern California Edison Company, was toastmaster at the Los Angeles banquet. Willis H. Booth, chairman of the board of the Edison Electric Appliance Company, spoke on "Reciprocation"; W. D'Arcy Ryan, illuminating engineer General Electric Company, on "Electrifica-

tion"; L. H. Newbert, chairman advisory committee California electrical co-operative campaign, on "Co-ordination"; G. E. Arbogast, president Southern California Contractors and Dealers, on "Affiliation"; H. F. Jackson, president Pacific Coast Section, N. E. L. A., on "Unification"; D. J. Butts, manager Western Electric Company, on "Co-operation"; Albert H. Elliott, secretary Pacific Coast Jobbers' Association, on "Synergism," and B. F. Pearson, general superintendent Southern California Edison Company, on "Synchronism."

The enthusiasm displayed left no room for doubt that the electrical men of California have reached a permanent basis of understanding, the object of which is the good of the industry, the elimination of friction and waste, scientific efficiency, better work and better service for the consumer, and all in a spirit of co-operation in peace and in war times. Patriotic feeling and a determination to support the men "over there" characterized the speeches and the singing. There is little doubt that this meeting marked an important advance and that in some respects it may be considered historical.

SEES GREAT EXPANSION FOR ELECTROCHEMICAL INDUSTRIES

Secretary Lane Wants Hydroelectric Developments Started to Care for Chemical Needs of Nation After the War

While testifying before the joint special water-power committee of the House of Representatives in Washington March 27 and discussing the so-called "administration water-power bill," now pending before the committee, Secretary Lane predicted a great expansion of the electrochemical industries of the United States.

"We ought to appreciate more fully now," Secretary Lane said, "that after this war is over there will be the necessity of larger electrical development than we have ever had before in connection with the chemical industries of the United States."

Secretary Lane said that in the United States we are merely beginning to understand what electricity can do and what can be done with very high-power electrical establishments. "We have never been a chemical nation," the secretary pointed out, "and that side of our scientific development has been overlooked."

"It is quite manifest to me that there has got to be very large electrical development if we are going to have the largest uses made of our development along lines of chemistry, and perhaps the best sphere for a young man for the next twenty-five years will be as an electrochemical engineer in the United States. The water powers ought to be put into use now not only with the idea of taking care of plants that will be commercially successful propositions but with the purpose of experimenting and discovering what can be done."

Associated Manufacturers' War-Time Meeting

Proceedings Curtailed on Account of the War, but Great Work of the Year Is Reviewed and Plans for Development and Study of the Tariff Are Completed

—A. W. Berresford Is Elected President



H. B. CROUSE,
Retiring President



A. W. BERRESFORD,
Elected President



B. E. SALISBURY,
Elected Vice-President



J. W. PERRY,
Re-elected Treasurer



CHARLES E. DUSTIN,
Re-elected General Secretary

CURTAINED on account of the war, the third annual meeting of the Associated Manufacturers of Electrical Supplies, at Delmonico's, New York, on March 21, was nevertheless full of strong indications of progress and constructive promise for the future. Outside of the general program, the business session included as unusual features a discussion on the subjects of international trade conditions and trade acceptances.

H. B. Crouse, Crouse-Hinds Company, the president, spoke briefly in calling the meeting to order at 2:30 p. m. "The year's work," he said, "has shown clearly that we all know what this association is, and we are all using it and working hard for it."

Mr. Crouse added that it had been very gratifying as president to see how everybody was willing to help. The work had been done with a will, and as a result a great deal had been accomplished.

REPORT OF MR. DUSTIN

Charles E. Dustin, the general secretary, reviewed generally some of the lines of activity of the last year. The membership has shown a very satisfactory increase. Twenty-two new companies have affiliated, and while of course some companies have dropped out, it has not been through lack of faith in the value of the association, but by reason of consolidation with other member companies, in some instances, and in others because the particular products manufactured did not seem to fit in properly with the scope of the work of the association.

The basis of all co-operative work, Mr. Dustin continued, is through the sections, each particular line of the industry having its own section and these sections being subdivided to cover every special device coming under the general section head. Early in June, 1915, only two sections had been formed. To-day there are twenty-one sections, all actively engaged in work of particular advantage to the section members and of general advantage to the electrical industry as a whole.

In almost every section committees have been appointed to work with the industry conference committees of the Underwriters' Laboratories, and much good has

resulted without any friction or opposition, and many perplexing problems of the past have been satisfactorily adjusted. The association has a representative on the electrical committee of the National Fire Protection Association.

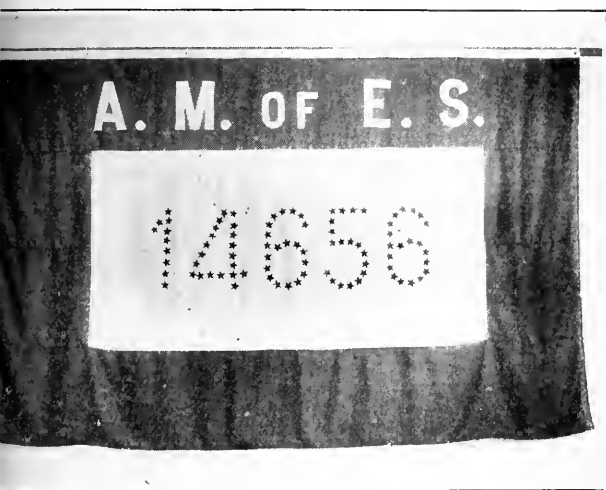
The distribution of industrial statistics has been continued with great satisfaction to members of a number of the sections. This has included the compilation of statistics pertaining to products handled by the members, tabulation of sales, tabulation of costs, movement of tonnage, etc., all of which is considered to be of value to the members interested.

The standardization of product and devices, added Mr. Dustin, has been carried on heretofore through committees working in each individual section, but it has been found that by co-ordinating the work of these committees from the various sections interested better results could be accomplished in less time, and with this in view the various standardization committees from the analogous sections have formed an interlocking standardization committee. This committee meets to consider such common subjects as might seem advisable and to report such common findings to the respective sections represented. The various standards adopted in the association are now known as A. M. of E. S. standards, and are referred to as such by the Underwriters' Laboratories.

In speaking of the war service work, Mr. Dustin said that the year has been one of unusual activity, due in great measure to the war situation and the keen desire shown by every member in the association to co-operate to the limit of his facilities with the government bureaus in furnishing necessary material required for war purposes. To make the co-operation of the greatest value to the government, the General War Service Committee of the Electrical Manufacturing Industry was formed, with Robert K. Sheppard as chairman. Supplementing this committee are twenty-five group committees representing different lines within the manufacturing industry and completing an intensive organization which is available for government service.

"We have many and extensive plans for the coming year," said Mr. Dustin in conclusion, "all of which will be more or less contingent upon the war situation and the requirements of the government. The association is ever broadening in its work, and we feel that we are starting on another successful year, which cannot but be of advantage to the members individually and the industry as a whole."

In the absence of Charles Blizzard, chairman of the finance committee, the report of that committee was read by Mr. Dustin. Commenting on the report, Mr. House said that the plans for the coming year are well laid, and he indicated that a membership drive will be made. The advantages of membership have proved to be of such value to those who are in the association that the results accomplished will be laid before others in the industry. Although the percentage of representation in the association is large, it is believed that better work can be done if it is made still greater, and that the



SERVICE FLAG FOR EMPLOYEES OF MEMBER COMPANIES OF THE ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES

benefits of closer co-operation will be realized in substantial measure by both new and old members.

STUDY OF INTERNATIONAL TRADE

John J. Gibson, chairman international trade committee, spoke at length of the work which is being undertaken. Mr. Gibson said in part:

Your international trade committee feels that it has a message to deliver which is of the greatest importance to every member. The rôle of the prophet of evil is not a very pleasant one. He that croaks a dismal song of warning can hardly expect to be as entertaining as he who pours a sparkling wine of promise, but your committee has tried to mix in a little promise with the warning and hopes the mixture will be more palatable.

If you knew a man who was the father of a large family and who lived in a frame house which was full of expensive furniture and rugs, who traveled a great deal and who owned a great deal in automobiles and who carried life insurance, accident insurance or fire insurance, what would you think of him?

If you knew of a community somewhere where every one lived in a frame house and where there was no fire department, nor any locks on the doors, what would you think of the people who lived there?

Now, before you hastily indulge in criticism of the stupidity of such people, let me remind you that the electrical industry to-day stands in exactly that position in respect to the tariff.

This committee was created as the result of a discussion on this subject which came up at our last annual meeting.

It was several months before we got under way after being appointed on account of the summer coming upon us, but since last fall the committee has been quite active. At least, we have been on the job long enough to learn one thing, and that is that in this great industry, through the whole length and breadth of it, from top to bottom, there is not a single man that could be called an expert on tariff. Not a single man! That is a very strong statement, but it is true. Not even the biggest companies in the business have a tariff expert. In past years, when tariff bills have been passed, at the eleventh hour and fifty-ninth minute there was an extended telephone conversation and possibly telegrams; two or three people hurried to Washington and appeared before a committee of Congress, with the result that to-day the electrical industry has no separate recognition in the tariff schedule of the existing bills. What are we going to do about it?

To-day the government is making an effort to put the regulation of tariff upon a business basis, to run it just as each of you run your business, and there has been, as you know, appointed a United States Tariff Commission for the sole purpose of collecting data with respect to conditions in every line of industry in this country; for the purpose of ascertaining what protection, if any, is needed and for the submission and furnishing of that data to Congressional committees which are appointed for the purpose of drawing up new bills.

We must realize that not only does American industry need protection for its home market but it also must develop foreign trade, and while we might fall into the error of thinking we should build a Chinese wall around ourselves, still we must repress our impulses in that direction respecting our own market because such an action would invite retaliation upon the part of nations with whom we must do business, and thereby we should be excluded from their markets.

Your committee issued a number of letters to the various sections of this association in which it tried as clearly as possible to outline these facts and asked each section to appoint a sub-committee on the tariff and made a specific request that each of these committees report to the main committee an expression of the desires of each branch of the industry for protection after a proper study.

In seven or eight months—six, anyway—we have had just one reply. Does that indicate to your mind a lack of interest or not? Does it to your mind indicate rather a lack of knowledge? I am absolutely of the opinion that it is the latter. The further your committee has gone into this matter the further it has felt the necessity of expert advice and felt the necessity of detailed accurate information, carefully extracted from its source, carefully tabulated, carefully analyzed, which can be used under expert guidance to protect our interests, and that means, gentlemen, a great deal of work. It means a great deal more work than I can do, a great deal more than any one of our committee can do, a great deal more than any of you can do.

We are to-day suffering from the lack of preparation for war. Three or four years ago nobody would have dreamed of war. I am not going over that ground again; we have all had it burned in upon our minds. Three or four years from now we may be accused of being just as sound asleep on this question of protecting our home market and developing our foreign trade. The subject is one that justifies our going to some expense in connection with it, and your committee, having carefully considered the matter, has recommended in all earnestness that \$5,000 be appropriated to carry on the work of the committee during the coming fiscal year of the association; \$5,000 is a trifling sum for such vast interests as we represent to spend on this important subject.

Your committee has in a sense established relations with the Federal Tariff Commission, as the chairman of your committee called upon the Tariff Commission and was welcomed cordially. One of the commissioners who is especially interested in the study of conditions in various industries of the country is willing and has offered the services of the commission to help us. He will meet us more than half way in the preparation of a statement of facts in connection with our industry, and with the statement of facts we will have a better hearing in that court of final result to which we must appeal when a tariff bill is out,

namely, the proper committee of Congress when there is a bill pending.

Furthermore, at the present time the administration of the tariff law is full of pitfalls, full of loopholes, and for the protection of our own interests, if the old bill remains, we need expert advice on how to obtain the protection the present bill has for us.

President Crouse said that the nations in Europe are getting ready for the period after the war, and that the proposed study of tariff conditions may prove to be the greatest thing done by the association. The hardest thing to do with a hard proposition is to get started, and this the committee has done, he declared.

Following the recommendation of Mr. Gibson, the association decided enthusiastically to contribute the necessary funds to develop the work of study of the tariff. It is purposed to employ a tariff expert.

Charles L. Eidlitz, Metropolitan Electric Manufacturing Company, as chairman of a special committee on trade acceptances, made a report.

Much discussion followed. Mr. Eidlitz, President Crouse, W. T. Pringle, A. W. Berresford and W. W. Orr, Jr., assistant secretary National Association of Credit Men, took part.

President Crouse crystallized the discussion by saying that the majority are very much interested in trade acceptances and in favor of them.

As part of his report Mr. Eidlitz submitted a tentative resolution. Attention was also called to the resolution passed by the board of governors and published in the *ELECTRICAL WORLD* of March 16, 1918, page 578. The report of the special committee was referred to the board of governors.

NEW OFFICERS

R. E. Gallaher, New York Insulated Wire & Cable Company, chairman of the nominating committee, presented the names of the following to be voted on for governors for terms of three years from April 1, 1918: Charles Blizard, Electric Storage Battery Company; D. R. Bullen, General Electric Company; H. B. Crouse, Crouse-Hinds Company; H. R. Holmes, R. Thomas & Sons Company, and J. F. Kerlin, National Carbon Company, Inc. The secretary was directed to cast a ballot for the nominees.

After the meeting adjourned the governors met to elect officers. A. W. Berresford, Cutler-Hammer Manufacturing Company, was elected president; B. E. Salisbury, Pass & Seymour, Inc., vice-president; J. W. Perry, H. W. Johns-Manville Company, treasurer; Charles E. Dustin, general secretary.

At the annual banquet, held in the evening, also at Delmonico's, the thought of the war was dominant. President Crouse, who presided, gave a toast to "Our country and our President." The Manufacturers' Chorus of Bridgeport, Conn., composed of forty men, sang patriotic songs.

A great service flag was unfurled and dedicated eloquently by Robert K. Sheppard, Simplex Wire & Cable Company, chairman of the General War Service Committee of the Electrical Manufacturing Industry. It showed that 14,656 men have gone from member companies of the association to serve the nation. Since this total was compiled nearly 200 additional have been reported at the general offices of the association.

The address of the evening, a stirring account of personal experiences in the war area and of strong faith

in the outcome, was made by Major Donald Guthrie of the First Canadian Expeditionary Corps, now of the British Recruiting Mission.

WAR-TIME PROBLEMS ARE DISCUSSED IN WISCONSIN

President Lyons Points Out at Milwaukee Meeting the Needs of Utilities for Increased Rates and Comments on Conservation

Addresses dealing with problems affecting public utility rates were the feature of the tenth annual convention of the Wisconsin Electrical Association at Milwaukee on Wednesday and Thursday of this week.

President B. F. Lyons of Beloit sounded the keynote of the meeting in his address, pointing out the need of the utilities of Wisconsin for increased rates, and commenting briefly on the national measures of conservation, including the shutting down of isolated plants the interconnection of generating stations, and the passage of the daylight saving bill.

Edwin S. Mack of Milwaukee dealt with two important phases of public utility depreciation. The first of these was the method of treating depreciation reserve in Wisconsin. He contended that while the Wisconsin commission has included depreciation reserve in value it has not followed this out to the logical result that where the depreciated-value basis is used the return on the fund should go to the investor and not to the fund. The other phase of depreciation discussed dealt with the elements of depreciation reserve.

William J. Hagenah, basing his address on curves showing the range of commodity prices over a period dating back to 1817, predicted that few if any public utility managers in the room would live to see prices return to their pre-war level. For this reason he urged the closest co-operation between the utilities and the commissions that the utilities may be adjusted to the changed conditions under which they are operating and will be obliged to operate for many years.

Harold L. Geisse, secretary of the Railroad Commission of Wisconsin, read a paper showing public utility men how to prepare and to present rate cases to expedite their passage through the hands of the commission.

Speaking on the fuel situation, W. N. Fitzgerald, State Fuel Administrator of Wisconsin, declared that the coming winter would bring a national demand for increased production amounting to 100,000,000 tons. It will be possible to increase production only 50,000,000 tons. The rest will have to be saved by conservation measures. He urged public utilities to help.

The report of the rural service committee, of which A. C. Babson of Watertown is chairman, showed that rural service in the State increased 163 per cent in the last year, that there was a tendency toward greater customer density and toward a greater use of the connected load. In summarizing conditions for the last year the committee emphasized the necessity of getting a relatively high minimum charge and giving a low secondary energy rate.

The committee on taxation, of which C. S. Secheverell of Superior is chairman, repeated its assertions of former years that public utilities are discriminated against in the matter of taxes.

Other papers were to be delivered after this report was telegraphed to the *ELECTRICAL WORLD*.

THIS

OR THAT!

FOR EVERYONE
MUST DO HIS
DUTY!



ELECTRIC WELDING IN THE BUILDING OF SHIPS

Work of the Electrical Welding Committee of the
Emergency Fleet Corporation—Prof. Comfort
A. Adams Chairman of the Committee

The question of electric welding as applied to shipbuilding was brought to the attention of the standards committee of the American Institute of Electrical Engineers in August, 1917. At that time Prof. Comfort Adams, chairman of the standards committee, appointed a sub-committee to investigate the possibilities of electric welding in shipbuilding. This committee included representatives from the manufacturers of welding machinery, the classification societies (Lloyd's and the American Bureau of Shipbuilding), the Bureau of Standards, the Navy Department and shipbuilders. This sub-committee was adopted in September last by the general engineering committee of the Council of National Defense, and later (Feb. 21 of this year) by the Emergency Fleet Corporation, as its electrical welding committee.

Since the appointment of the original committee much time has been devoted to the investigation of the character of electric welds and to the development of necessary apparatus. As a result of this work the members of the committee became convinced that much time and material could be saved by the introduction of electric welding methods in shipbuilding. This conviction was gradually transmitted to responsible government officials, with the result, as above stated, that the committee was reorganized under and assigned a definite work by the Emergency Fleet Corporation.

An office has now been established in Room 716 of the Engineering Societies Building, New York, for conducting this work, which is to push the application of electric welding methods to shipbuilding as rapidly as possible.

The Emergency Fleet Corporation has authorized the construction of a 50-ft. (15.2-m.) section of a 9600-ton standard ship at the yards of the Federal Shipbuilding Company, Newark, for demonstration purposes and for the development of methods of applying electric welding to an actual ship structure. The construction of this 50-ft. section will be under the direction of Arthur Mason of the Fleet Corporation, who has done much to stimulate interest in the subject of electric welding and also to develop methods of its application to shipbuilding. This ship section is to be sealed up at the ends, filled with water, and tested by hydrostatic pres-

sure. The foundation for this structure is already complete, and work will be pushed as rapidly as possible. Both spot and arc welding are to be employed.

Several meetings of shipbuilders in the various districts have been held, with the result that much enthusiasm has been aroused, and shipbuilders have indicated that they are willing to push the work just as far as the classification societies, the Fleet Corporation and the Navy Department will allow.

Large stationary and portable spot welders are being designed for this work, and various arc-welding systems are being studied. A considerable installation will be made in the Hog Island yard at Philadelphia, under the general direction of Admiral Bowles of the Fleet Corporation.

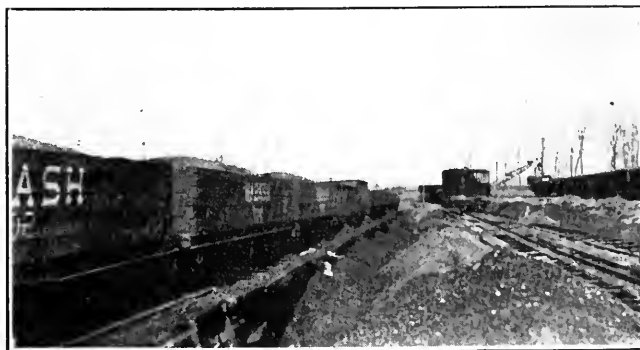
The committee as now organized consists of numerous active sub-committees, many of the members of which are devoting practically all of their time to the work.

The committee is responsible to Daniel H. Cox, manager of steel ship construction of the Emergency Fleet Corporation, who is lending every possible assistance to its work.

H. M. Hobart, chairman of the original sub-committee, spent several months in England investigating the electric welding work done by the British Admiralty, and brought back some valuable data. As a result of this visit, Capt. James Caldwell, R. E., representing the British Admiralty, is spending a couple of months here to help the committee in this work and to tell of the work along similar lines which has been carried out in England. In company with members of the committee he has visited many of our shipyards and has aided greatly in arousing interest in this movement. One important phase of the present work of the committee is the training of arc welders, of whom thousands will probably be required in the comparatively near future. This work is under the direction of E. E. McNary, Emergency Fleet Corporation, Sixteenth and Walnut Streets, Philadelphia, Pa.

The committee is collecting available information and data as to apparatus, tests and applications. This information, together with much already in hand, will be classified and sent out to all steel shipbuilders and to others interested.

20,000-Ton Coal Storage in Iowa



At Prairie Creek, several miles from Cedar Rapids and directly alongside its interurban railroad right-of-way, the Iowa Railway & Light Company has constructed a 20,000-ton submerged coal storage. The site is within easy hauling distance of the company's main 16,000-kw. steam power station at Cedar Rapids.

Secretary Lane Pleads for Water-Power Law

He Tells Congressional Committee that All of the Country's Resources Must Be Developed in a Large and Generous Way, but that No Development Can Be Had Under Existing Laws

HEARINGS on the "administration" water-power bill were continued before the joint power committee of the House of Representatives in Washington on Wednesday of this week. Practically all of the morning session was given over to Secretary Franklin K. Lane of the Department of the Interior, who appeared in support of the measure.

As father of the commission idea incorporated in the bill and as spokesman for the administration, Secretary Lane made out a very strong case. He insisted that nothing vital or fundamental should be surrendered by the government and that having safeguarded these matters through a fifty-year lease with provisions for recapture, inducements should be made to attract private capital so that the water powers will be put to use as speedily as possible.

After pointing out that the bill now before the committee has a long history and reciting some of the attempts to bring about water-power legislation during the past five years in which he and others have been concerned, Secretary Lane said that the matter of developing one bill in Congress was taken up and that there was strong opposition in some quarters against any kind of leasing system.

"Perhaps a very considerable portion of the time I have devoted to this matter," Secretary Lane said, "has been spent in attempting to convert members of the House and Senate who had notions in opposition that the leasing system was the only practicable one."

REVOCABLE PERMITS NOT ATTRACTIVE TO CAPITAL

The Secretary pointed out that there is still on the books a statute under which revocable permits are granted, but that the men who have money to invest in water-power propositions are not willing to allow any official to say when the investment they have made shall be thrown to the winds. The result, he said, has been that "we have stood for five years of which I know almost entirely without development of one of our great resources."

Secretary Lane continued: "Now, it is not merely the West that is concerned in this. It is the East just as well. Right now I can call your attention to one particular matter that shows how intimately East and West are tied up on such a proposition. You know John D. Ryan of the Montana Power Company. He has private rights, or his company owns certain dam sites and rights along rivers in Montana. I sent out a general request some time ago that the Eastern minerals which had not been heretofore developed in very great quantities, such as manganese and chrome, should now be developed for the purpose of saving ships.

"We get manganese, as you know, from Brazil. It takes a very large tonnage. We import some 800,000 tons a year. We get chrome from Africa and New Caledonia. We get nitrates from Chile, and for all those things a very large number of ships are at present required. We are short, the Allies are short, for

the carrying of nitrates to the other side and to the side—short for carrying pyrites from Spain to the side—short for carrying manganese from Brazil—short for carrying food to our own boys on the other side and munitions and food for the Allies; and no matter what comes out of this German drive now going on over there, there is an obligation upon us, and the pressure of necessity that we should supply those people on the other side.

"For that we must have ships. Now, Mr. Ryan came to me and said he had a plant in Montana which will develop 150,000 hp. That horsepower can be used in a process by which the low-grade manganese ores we take out of the Butte mines can be reduced, and by their reduction they can be made commercially available to the plant in Pittsburgh.

"So that a water power 2000 miles away in Montana makes possible the development and the support of industries in Pittsburgh and relieves ships that come all the way from South Africa."

INCENTIVE TO DEVELOPMENT

Secretary Lane then again went into the history of the various bills which have been before Congress and said that the executive branches of the government in the present bill, had united upon a measure under which "leases could be made that would govern the navigable waters and the unnavigable waters and control as to public lands and as to forests." He told the committee he felt sure its members would find the House and the Senate united in support of a measure such as that under consideration, which does the following:

"Gives a lease for a definite term of years, not to exceed fifty; gives an opportunity for the government to take over the property at the end of that period; gives an opportunity if the government does not want to take over the property at the end of that time for the lessee to take over the property, and I should say that reasonable terms to him would be that he should have that property if the government does not wish to use it and that he should have that property upon terms that would be more favorable to him than those that others might offer, but that he should have a preference. Into the hands of the men capable of developing them should be given sufficient to make a wise and large investment and development; we cannot save things for men who have no capital or men who go about things with a spade where a steam shovel is needed."

GOVERNMENT OWNERSHIP NOT SOUGHT YET

Secretary Lane spoke of the right of the community, of the nation, pointing out that the right of the people of the United States is superior to any right "that you or I might have to speculate upon those things that are primary resources," and adding that he believes as to lands, and as to minerals, and as to water

owers, that no man is entitled to anything unless he es it.

"If we had money enough," he continued, "if this ere not a time of war, if we could think in the terms money that we are now thinking of, or if four or ve years ago Congress had been willing to expend undreds of millions of dollars in the development of ater power as it is forced now to spend billions of ollars for war, it would be a wise thing to put a large art of the public revenues into such projects where ey are found to be needed.

"I have no doubt in my own mind that such schemes water-power schemes are perfectly practicable from government standpoint, no matter what your sympathies may be respecting government ownership, as a ale, of large utilities. A thing that is as well stand- ized as a water-power scheme can be operated succ- ssfully by the government. But I do not take it that is is exactly a practicable proposition at this time, or probably will it be for many years to come, and it necessary that there should be real development, and at soon."

Mr. Lane proceeded to elaborate his point of view in gard to the impracticability of devoting government unds at this time to the building of water-power ants by discussing the immense demands being made on the treasury now and in prospect.

WAR REQUIRES ALL OUR RESOURCES

"The news now coming from the other side of the ater," Secretary Lane said, "is disheartening, dis- uraging, but it leads me to believe that all the con- sion we can come to is that we are in this thing for longer time than we thought. Not," he went on, "that there is to be any cessation of effort on our art, but there is to be renewed effort, a stronger fight id a longer fight. And if we are to have a long fight, nd if we are to get into this thing with our full rength, if a larger portion of the burden of beating on Hindenburg and the other Germans is to fall upon s, then, surely, it becomes necessary that we should ot delay longer in the development of every resource at we can."

Secretary Lane spoke at this point again of the trate situation, pointing out that it is not one that an be looked upon with equanimity and remarking at "the more nitrates we have the more food we can et," and that "there is a large portion of the acre- ge of this country that is now coming to need fertil- ers of one kind or another." Mr. Lane then told of n offer he had had from a company in Washington ve years ago for the development of a water-power roposition.

"That proposition," Mr. Lane continued, "could have een financed successfully at that time if we had had uch a bill as the one which is now before you. Then ey wished to go into the business of developing ni- rates. The power is still there and is still unused."

GOVERNMENT MONEY NOT FOR PRIVATE ENTERPRISES

He said there are propositions of this kind all over e country, and that there is a supreme obligation pon all of the people of the country at this time, as ell as its officials, to think more seriously of such ings, and that "we will get no development under the resent law."

Answering questions by Chairman Sims, presiding

at the meeting of the committee, Secretary Lane, be- fore entering upon a general discussion of his remarks, participated in by almost all members of the committee, said that if there is a determination by Congress that there shall be water power development, for instance, along the Columbia River, or the Snake River, or the Colorado River, for the production of low-grade manga- nese, or for the development of nitrates, either for gunpowder or for fertilizer, and such works could not be financed, then "it is the duty of the federal govern- ment at this time to help out the proposition and put it on its feet." He added:

"I am not sympathetic generally with the idea of having the government lend money to private enter- prises because it is a hard thing to get it back.

DEVELOPER SHOULD HAVE CONSIDERATION

"But," Mr. Lane went on, "I am very much in sympa- thy with the government doing what it pleases with its own money, provided it knows where it is going, and what it wants, and how that money can be prop- erly handled, and I am not afraid at all of the govern- ment undertaking the development of water-power propositions, because we have had some experience with them in the Reclamation Service. The Salt River propo- sition which I have turned over to the water users is practically paying its own way now out of the power developed out of the Roosevelt dam. That was a ven- ture at the time. All of these propositions are gam- bles. That is one reason why a man who puts his money into a water-power project has got to have very real consideration. He is a developer, and every man who is a pioneer of any kind takes the risk, and for his risk he ought to be compensated."

Mr. Lane was asked some questions as to whether it will be possible for water-power plants to be built in time to be of service before the war is over. Very close attention was paid to the answer of the Cabinet of- ficer on this point because men in public life in Wash- ington have not recently been hazarding guesses as to the length of time which the struggle will continue. He said:

"I have no expectation that this war will be over be- fore water-power projects such as many that we know of can be developed. I think you have got to look at that thing with a long range."

OPPORTUNITIES ON NAVIGABLE STREAMS

M. O. Leighton, consulting engineer, Washington, D. C., and for many years with the United States Geo- logical Survey, who spoke on Wednesday afternoon, said that at least 10,200,000 hp. could be developed on 4325 miles of navigable streams at an expense of \$800,000,000 for canalization. He estimated that as much as 2,000,000 hp. would be developed or in process of development five years after the passage of a favor- able water-power measure, like the administration bill as amended during the hearings.

As showing the effect of unfavorable legislation on water-power development Mr. Leighton cited the gen- eral dam act of 1910 under which fifty-five grants were made, out of which only two could be financed.

The public hearings on the bill were suspended for the time being, it being decided to set aside another day to be announced later, at which time some Con- gressmen and the two other members of the Cabinet who will form part of the commission will be heard.

NATION'S BUSINESS MEN FOR WATER-POWER LEGISLATION

Five Hundred Thousand Business Executives Vote
Through United States Chamber of Commerce
for Action by Congress

By sweeping majorities 500,000 business executives, who compose the membership of the United States Chamber of Commerce, have adopted resolutions calling on Congress to make provision for water-power development.

The vote was taken through the more than 1000 commercial organizations throughout the country which compose the national chamber. Forty-five states, Alaska and Hawaii participated in the balloting, representing a wide range of industrial interests and opinions and reliably indicating to Congress how the business men of the nation look on the water-power situation.

The balloting was based on a series of recommendations contained in the report of the committee on water-power development of the Chamber of Commerce. These recommendations were:

That federal legislation encouraging the development of water power should at once be enacted. Adopted by the almost unanimous vote of 1324 to 6.

The authority to grant permits should be vested in an administrative department. Carried by a vote of 1253 to 17.

That the permit period should be at least fifty years, any shorter period being at the applicant's option. In favor 1216, opposed 42.

That tolls should attach only to use of public lands or benefits derived from head-water improvements. Adopted by vote of 1191½ to 40½.

That permittees should be entitled to acquire the right to use public lands forming only a small and incidental part of the development. Carried by a vote of 1210 to 25.

That recapture should be exercised only upon payment of fair and just compensation. In favor 1234, opposed 25.

That if recapture is not exercised the investment of the permittee should be adequately protected. Adopted by vote 1226 to 26.

That rates and service should be regulated by state commissions where the service is intrastate, with federal regulation only where several states are directly concerned and do not agree or there is no state commission. Carried by a vote of 1177 to 57.

That if any jurisdiction to regulate the issuance of securities it should be solely by the state. In favor 1114, opposed 117.

That no preference should be granted as between applicants amounting to a subsidy from the government, creating unequal competition. Adopted by a vote of 1191 to 38.

The committee which drew up the report and presented the resolutions was composed as follows:

L. S. Gillette, chairman, engineer and manufacturer, Minneapolis; Harry A. Black, wholesale merchant, Galveston; Rome G. Brown, lawyer, Minneapolis; Henry S. Drinker, president Lehigh University; Frank P. Glass, editor-in-chief *Birmingham News*; E. K. Hall, lawyer, New York City; Horace C. Henry, retired railway contractor, Seattle; Henry L. McCune, lawyer, Kansas City; Samuel V. Stewart, lawyer and banker, Virginia City, Mont., and Governor of Montana; George F. Swain, civil engineer, Boston, and C. F. Weed, lawyer and banker, Boston.

While the committee report is in itself favorable to positive legislation to enlarge water-power development, every ballot sent out was accompanied by an argument in the negative which clearly and positively set forth objections to the recommendations so that those

voting had at hand data on which to base their judgment for or against.

The report begins by pointing out that it is estimated that the undeveloped water power of the country exceeds the total steam power now in service. The federal government controls much of the water-power resources of the country. The report adds:

One of the first things to be clearly perceived is that water-power developments are not exceedingly profitable undertakings earnestly sought by capital as a means of securing large returns on a small investment, but that, on the contrary, steam power is the superior of water power in almost all respects.

The initial cost of a steam plant is in general but one-half to one-fifth that of a water-power plant of equal capacity. Moreover, a steam plant can be more easily enlarged from time to time and the initial development of a water-power plant must be a larger proportion of the ultimate development than that of a steam plant. The investor in a water-power plant is therefore burdened from the very start with a heavy fixed charge.

Water powers will not be developed unless the conditions are made comparatively favorable. Present demand for the development of such power comes, not from capitalists, but from communities which, on account of the high price and scarcity of fuel, are desirous in their own interest of inducing capital to make such developments.

EFFECT OF WAR CONDITIONS ON THE PUBLIC UTILITIES

Committee Representing the N. E. L. A. and Other
Utilities Takes Positive Steps to Present the
Facts Throughout the Country

The National Committee on Public Utility Conditions composed of Philip H. Gadsden, E. K. Hall and H. H. Crowell, has issued a statement dealing with the serious war problems affecting public utilities. The committee represents the National Electric Light Association, the American Electric Railway Association, the American Gas Institute and the National Commercial Gas Association.

The committee also announces the personnel of regional and state committees, the regional committees having the function of appointing state committees in their districts. The committees announced are:

REGIONAL COMMITTEES.

Maine, New Hampshire, Vermont, Massachusetts and Rhode Island.—H. G. Bradlee,* Stone & Webster, Boston; C. L. Edgar, Edison Electric Illuminating Company, Boston.

New York, Pennsylvania, Connecticut, New Jersey and Maryland.—J. K. Choate,* J. G. White Management Corporation, New York City; T. N. McCarter, Public Service Corporation of New Jersey, Newark; C. M. Cohn, Consolidated Gas, Electric Light & Power Company, Baltimore.

Ohio, Michigan, Indiana and Illinois.—B. I. Budd, South Side Elevated Railroad, Chicago; H. H. Crowell,* Michigan Railway, Grand Rapids; F. W. Coen, Lake Shore Electric Railway, Sandusky.

Wisconsin, Minnesota, South Dakota, Iowa, Nebraska, Kansas and Missouri.—P. J. Kealy, Kansas City Railway; William Chamberlain, Brown, Chamberlain & Hanselick, Cedar Rapids; James D. Mortimer,* North American Company, New York City.

Utah, Colorado, Idaho, Wyoming, Montana, Washington and Oregon.—F. T. Griffith, Portland Railway, Light & Power Company, Portland; M. H. Aylesworth,* Utah Power & Light Company, Salt Lake City; G. W. Talbot, Pacific Power & Light Company, Portland.

*Asked to assume responsibility of organizing committee.

California and Nevada.—J. A. Britton,* Pacific Gas & Electric Company, San Francisco; Paul Shoup, Pacific Electric Railway, Los Angeles.

Virginia.—George J. Seay,* Government Federal Reserve Bank, Fifth District, Richmond; B. B. Ferguson, Portsmouth Gas Company; J. W. Hancock, Lynchburg Traction Light Company, Lynchburg; T. S. Wheelwright, Virginia Railway & Power Company, Richmond.

Georgia.—R. C. Congdon, Atlanta Gas Light Company; J. S. Bleeker, Columbus Electric Company; P. S. Arkwright,* Georgia Railway & Power Company, Atlanta.

STATE COMMITTEES.

Alabama.—J. S. Pevear, Birmingham Railway, Light & Power Company.

Arizona.—R. G. Arthur, Douglas Traction & Light Company.

Arkansas.—C. J. Griffith, Little Rock Railway & Light Company.

Delaware.—T. W. Wilson, Wilmington & Philadelphia Traction Company.

Florida.—C. I. Day, Southern Utilities Company, Jacksonville.

Hawaii.—L. T. Peck, Honolulu Rapid Transit Company.

Kentucky.—Donald McDonald, Louisville Gas & Electric Company.

Louisiana.—D. D. Curran, New Orleans Railway & Light Company.

Mississippi.—H. E. Brandli, Meridian Light & Railway Company.

New Mexico.—W. S. Townsend, Las Vegas Transit Company.

North Carolina.—R. L. Lindsey, Durham Traction Company.

North Dakota.—R. B. Griffith, Grand Forks Street Railway.

Oklahoma.—J. W. Shartel, Oklahoma Railway.

Philippine Islands.—C. N. Duffy, Manila Electric Railway & Light Corporation.

Porto Rico.—O. M. Sewall, Porto Rico Railway, Light & Power Company, San Juan.

South Carolina.—William Elliott, Columbia Railway, Gas & Electric Company.

Tennessee.—T. H. Tutwiler, Memphis Street Railway.

Texas.—L. C. Bradley, Stone & Webster Management Corporation, Houston.

Washington, D. C.—Howard Reeside, Washington Gas & Light Company.

West Virginia.—J. O. Watson, Monongahela Valley Traction Company, Fairmont.

In its announcement the National Committee on Public Utility Conditions calls attention to the recent public expressions by President Wilson, Secretary of the Treasury McAdoo and Comptroller of the Currency Williams in which these important officials made clear their understanding of the serious needs of the properties. The committee adds:

The officers of the national associations believe the reasons that actuated those government officials in sounding public warning of the necessity for liberal and sympathetic treatment of utilities should be brought to the attention of regulatory commissions and local authorities by the national associations interested, not from the standpoint of particular corporation or utility and not affecting the interests of any one company or group of companies, but solely with regard to the broader national interest involved in the relation of the utilities to the general war program and the whole financial structure. Something more than the preservation of these utilities themselves is at stake.

While new construction and extensions will during the period of the war be held down to necessary requirements, it is absolutely impossible to refuse arbitrarily to make additions or extensions. The direct war program or the general welfare of the public will require in most sections of the country some additional service. This, of course, requires funding of extensions to plants which can

be asked to assume responsibility of organizing committee.

only be consummated by the rehabilitation and preservation of the credit of the utilities. The rapidly rising line of increasing operating costs has in some instances already crossed the horizontal line of inflexible rates—rates that were fixed on a pre-war basis and that are totally inadequate to meet existing conditions.

The securities of public utilities have long been a favorite form of investment for both small and large investors, savings banks, insurance companies and trustees, and are to be found as collateral for loans in every national and state bank. Their depreciation accordingly threatens the whole financial structure. If relief cannot speedily be had and the companies are forced generally to adopt the practice of suspension of dividends, the nation's ability to subscribe for Liberty bonds, and one of the government's chief sources of supply for income taxes, will be seriously diminished.

The conclusion reached by the officials of the government in Washington, from their study of the situation, was that the really fundamental solution of the problem lay in a speedy increase of rates to absorb the increased costs of doing business brought about by war conditions. It is equally clear that they were satisfied that the ordinary procedure for an increase of rates was utterly inadequate to meet the emergency.

It is the belief of the national associations that if the general public utility situation can be presented to the state commissions and municipal authorities along the same general lines on which it was presented to the authorities in Washington they must inevitably come to the same conclusion. Accordingly, the national associations are undertaking to have the general public utility situation brought to the attention of the state commissions and municipal authorities in conference entirely dissociated from any individual rate case, in the hope that the matter of increased rates may be approached from the broad point of view of the vital general public and community interest and the interest of the nation itself, rather than solely from the viewpoint of a controversy between a local utility and its patrons.

Apparently several of the commissions do not realize that the whole principle of regulation is now receiving its supreme test. If it is found to be too inelastic to respond promptly to abnormal conditions, it will have failed to justify its existence. It is vastly more important that the regulatory system should demonstrate its ability to preserve the efficiency and comprehensiveness of the service than it is to demonstrate that it is able to prevent here and there an occasional exorbitant rate, all of which have long ago been corrected.

Every one will agree that no public utility ought to make any additional profit by reason of the war, but this is an entirely different proposition from the suggestion that their profits should be cut during the war. Utility profits at all times are limited to a reasonable return on the investment. Anything less than that becomes permanent loss, for it can never be recouped from profits always limited to a reasonable return. The result is sure to be impairment of utility credit and reduction in the efficiency of its service.

If a utility's "assuming its share of the burdens of the war" means that officers and employees of public utilities must furnish more service with fewer facilities and equipment to work with than under normal conditions; that they must find a way to continue these services, notwithstanding increasing costs of materials and labor; that they must work harder to overcome extraordinary obstacles and handicaps in order to accomplish more than ever before, then of course the public utilities should bear their share of the burdens of the war, and they are doing it now and will continue to do it gladly. But if it is intended to suggest that the utilities should furnish these services at less than the cost of production and that these services should in part be rendered gratuitously, this is asking them to carry more than their fair share, it is neither just nor in the public interest, for the result must be impairment of credit, shrinkage of value and securities, reduction in dividends and a consequent reaction upon the many thousands of investors holding these securities which will diminish their capacity to subscribe for government loans and ultimately threaten the foundations of the general credit structure of the entire country.

EXTENSIVE DEVELOPMENT IS URGED IN CALIFORNIA

Railroad Commission, Studying Increased Demands for Power and Necessity of Fuel Conservation, Recommends \$20,000,000 Expenditures

Recommending extensive hydroelectric developments in southern California, at an expenditure of perhaps \$20,000,000 within the next two years, to meet increasing demands for power and light and for the conservation of fuel, the California Railroad Commission issued on March 19 a decision in its investigation of the construction and operation of electric utilities during the emergency created by the war.

The commission recommends that the Southern California Edison Company take immediate steps for carrying out of a comprehensive plan for financing approximately \$15,000,000 for building power plants, that the Southern Sierras Power Company construct its Rush Creek-Bishop line, and the San Joaquin Light & Power Corporation insure the building of additional plants for the increases of facilities, or, by purchase agreement, the maintenance of an adequate power supply for agricultural and industrial needs.

The commission investigation was State-wide, but the present decision deals only with the territory south of Merced, the northern part of the State to be considered later. The decision says that, though considerable economy of oil would result from more complete interconnection and co-operation of hydroelectric plants, yet the war emergency demands that the corporations take immediate steps to build additional power plants to meet the constantly growing need for power made by the normal increase of manufacturing and agriculture and the special needs of war industries, which are rapidly multiplying in California.

The southern part of the State which is considered comprises that portion of the San Joaquin valley south of Merced and served by the San Joaquin Light & Power Corporation and the Mount Whitney Power & Electric Company, and southern California, which is served by the Southern California Edison Company, the Southern Sierras Power Company, the San Diego Consolidated Gas & Electric Company, the Los Angeles Gas & Electric Corporation and the city of Los Angeles.

The power produced by these companies in 1915 was approximately 930,000,000 kw.-hr., in 1916 1,010,000,000 kw.-hr., and in 1917 1,146,000,000 kw.-hr. Of this latter amount, 911,000,000 kw.-hr. was produced by hydroelectric plants, and the remainder by steam, requiring a total oil and natural-gas consumption amounting to an oil equivalent of 1,316,000 barrels of oil. It is estimated that the growth in business due to the normal developments and the special war industries will approximate 140,000,000 kw.-hr. a year and a requirement of plant capacity of about 25,000 kw.-hr., and that in order to keep down the oil consumption of electric utilities to that existing in 1917 will require that amount of development each year.

The report shows that considerable economy will result from the interconnections now existing and those contemplated by the companies, but that even with this saving it will be necessary to increase the hydroelectric facilities at least 20,000 kw. of useful capacity a year and increase the energy output approximately 140,000,000 kw.-hr. under ordinary rainfall conditions.

Consideration was given to existing and proposed developments of the city of Los Angeles in connection with the aqueduct, where it appears that at a cost of between \$2,500,000 and \$3,000,000 the city would produce an additional peak capacity of 36,000 kw.-hr. and an output of at least 115,000,000 kw.-hr. a year, resulting a reduction of oil consumption of 600,000 barrels a year.

The commission states that the development by the city could be largely completed within twelve months if priority orders were obtained for equipment, but that difficulties exist which apparently make it impossible at this time to count on the development of the plan. These difficulties arose from the fact that the city of Los Angeles contends that it cannot utilize bonds already authorized for the development of hydroelectric plants, but that this money must be used for the construction of distribution systems. The city believes that if a satisfactory agreement could be entered into with the Los Angeles Gas & Electric Corporation whereby that company would lease to the city its entire system, such agreement to contain an option for purchase, the money could be used for hydroelectric plants.

The Los Angeles Gas & Electric Corporation, however, declined to consider the plan, which it contends constitutes a complete surrender of the possession of its distribution system to a competitor, and also that its true provisions make such a plan a legal impossibility.

ACTIVITIES OF THE NATIONAL COMMITTEE

Work of the National Committee on Gas and Electric Service for the Utilities in Connection with the War

The National Committee on Gas and Electric Service, of which J. W. Lieb is chairman, has issued a report on its recent activities, saying in part:

Replies have been received by the committee from various public utilities requested to furnish information showing the output of either electric energy or gas to be used by manufacturers turning out war material. The data have been turned over to Dr. Garfield. Some of the reports show an amazingly high percentage of output furnished for this purpose. The committee is working with the conservation department of the Fuel Administration Bureau on several plans to conserve the consumption of coal.

The War Department has recently asked the committee to obtain information as to the possibility of taking over 200,000 kw. in turbine units which have been ordered by central stations from the large electrical manufacturing companies. This does not necessarily mean that the turbines will be commandeered, but a survey of these conditions has been thought necessary by the department, and the committee has been used as the avenue for procuring this information.

This machinery is to be put to use in connection with the various nitrogen fixation plants, power and explosive plants, chemical and gas manufacturing plants which it is proposed to establish throughout the United States. In perfecting arrangements for the construction of these various government plants it has been found that through tying-in of some of the near-by electric systems a sufficient amount of electrical energy can be secured to make it unnecessary to put up isolated electric plants. This applies however only to the smaller operations. Several of the large operations it is estimated will require approximately 90,000 kw. or 100,000 kw. of electrical energy, and as it is proposed by the government to erect several such plants it can be seen that the necessity for turbine equipment is rather alarming.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

J. Robert Crouse Addresses Lamp Works Employees.—J. Robert Crouse, in charge of the thrift stamp campaign in Cleveland and Cuyahoga County, Ohio, addressed 1000 employees of the National Lamp Works of the General Electric Company on March 15.

Government Transmission Line.—Application has been made to the Northwestern Ohio Railway & Power Company by the United States government for figures on the cost of erecting a transmission line from a point about 70 miles south of Camp Perry. It is understood that the government is to furnish all material and attachments for this line and also to pay the entire cost of installation, the line remaining government property when completed.

Cannot Install Additional Lights in Toledo.—Henry L. Doherty has informed the Toledo City Council that, owing to requests from the government that no additional demands be made for electric equipment, the Toledo Railways Light Company will be unable to install the 100 arc lamps the city has requested. He also denied that the city had been overcharged for the service rendered in street lighting, as indicated by a report made by Toledo University teachers.

Electrical Engineer Wanted at Albany.—The Civil Service Commission of New York State, Albany, announces an examination on April 27 for a position as electrical engineer in the office of the state architect, salary \$1,800, as follows: "The duties of the position include the preparation of plans and specifications for the installation of electric wiring and fixtures in both new and old buildings and for the installation of central electric generating plants and feeder systems. Candidates must have had five years' satisfactory experience in electrical work, two years of which must have been directly in the drafting of electrical plans."

Instruction for Soldiers in Kansas.—L. A. Potter, dean of the division of mechanical engineering of the Kansas State Agricultural College, who has been lecturing to soldiers at Camp Funston, near Manhattan, Kan., has invited the men to take short courses at the college in the lines of work which they are studying at the camp. The present plan is for about 300 men to be assigned for two or three weeks to attendance at the college. These men will be distributed through the departments in which they are interested and will have work and instruction every day, their classes to be arranged so as not to interfere with regular college classes. Besides the instruction, the college plans recreation for the men.

Automatic Hydroelectric Station Operating Satisfactorily.—The 1500-kw. automatic hydroelectric generating station of the Iowa Railway Light Company at Cedar Rapids, Iowa, which was described in the ELECTRICAL WORLD of Dec. 1, 1917, has just completed six months of entirely satisfactory operation. In that time it has delivered about 2,500,000 kw.-hr. It is the opinion of John M. Drabelle, electrical engineer of the Iowa Railway & Light Company, that the station in this six months' period has seen exceptionally severe service and has met every emergency in an entirely satisfactory way. No changes in the station have been made since it was described.

Heating Service Curtailed in Springfield, Ill.—A. D. Mackie, general manager of the Springfield (Ill.) Gas & Electric Company, in announcing that heating service to several customers now on its mains will be discontinued with the beginning of the next heating season, says in part: "If all our electrical service customers went over to the municipal plant, it would then be necessary for us to abandon entirely our heating service. By the same rule, if one-half of our electric service customers went over to the municipal plant, it would cut down our available heating service by one-half and compel us to discontinue heating service to one-half our heating customers. In lesser degree this is the situation that now confronts us, one in which we believe our customers readily will see the justice of the proposition that those that aid in producing heating service should be able to retain that service, rather than those that do not aid in producing it."

Montana Power for Ferromanganese Manufacture.—The Anaconda Copper Company of Montana is entering into the ferromanganese business. John D. Ryan, in a letter to Secretary of the Interior Lane, says that ferromanganese is to be manufactured through the utilization of low-grade manganese ores in the Butte mines that have never been worked before. His letter reads in part: "In ordinary times these ores would have no value, and to transport them in the raw state and manufacture the ferromanganese in the East, even under war conditions, is impracticable on account of the cost, shortage and difficulties of transportation. To manufacture these low-grade ores into an 80 per cent ferromanganese product within a very short distance of where they are produced by the use of hydroelectric power that is available without taking it from any other use seems to me in itself a matter of much interest in these times, but the greatest accomplishment in doing this will be the release of the equivalent of ten ships of 5000 tons each now used in bringing manganese from Brazil. The power is available from the Holter development, completed within a month by the Montana Power Company as a reserve and in advance of its market requirements. This plant is capable of furnishing 40,000 kw. twenty-four hours daily the year round."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Flooding State Lands.—The code authorizing the State land commissioners to grant right of flooding state lands for power purposes, etc., precludes condemning the right to overflow State lands by one whose application to the commissioners had been rejected and the right granted to another, especially where both parties are seeking to make the same use of the land, the Supreme Court of Washington held in *Mason County Power Company versus Superior Court for Mason County* (169 P. 994).

Powers of Commission.—The Public Service Commission act does not deny to public service corporations the common-law right to make regulations nor vest such power in the Public Service Commission in the first instance, but said commission may, on finding such regulations unjust, unreasonable, insufficient or unjustly discriminatory, annul them and substitute others for them, according to the Supreme Court of Appeals of West Virginia (94 S.E. 545). If a regulation prescribed by such corporation is just, reasonable and fair, even though it is discriminatory, the discrimination it makes resting upon a classification of subjects based upon substantial differences in situation and circumstances, this power to annul does not vest in the commission. In so far as the contracts of public service corporations conflict with public duties imposed upon them by law, they are not within the protection of the constitutional provision inhibiting impairment of the obligations of contracts.

Shutting Off Service.—In a consumer's action against a gas company for wrongfully and without just cause shutting off his supply of gas, the burden was on plaintiff to offer evidence legally sufficient to show that he was not indebted to the gas company for gas supplied to the premises at the time the supply was shut off, for unless such evidence was offered there was a failure of proof to support the allegations of the declaration that the supply was wrongfully and without just cause shut off, the Court of Appeals of Maryland held (102 A. 465). Where a consumer of gas used approximately \$23 worth during a month, but his meter contained only about \$11 in quarters in payment, so that he was indebted to the gas company in about \$12 for gas consumed on his premises, and the meter was removed by the company without unnecessary force or disturbance after his failure to pay by a fixed date on notice, the company was not liable for wrongfully shutting off the consumer's supply of gas and was acting within its legal rights in removing the meter.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Synchronous Club of Los Angeles.—S. J. Keese presented an illustrated lecture on "Light and Color Waves" before the Synchronous Club of Los Angeles on March 22.

Electric Club-Jovian League of Chicago.—"Wireless Communication with Airplanes" was the title of an interesting address given before the Electric Club-Jovian League of Chicago on March 21 by Prof. F. A. Rogers of Lewis Institute, Chicago.

San Francisco Electrical Development League.—Prof. B. M. Woods, president of the Academic Board, School of Military Aeronautics, University of California, spoke at a luncheon on March 13 before the San Francisco Electrical Development League on "How Americans Are Trained to Fly."

Cleveland Electrical League.—A spectacular review entitled "Wake Up, America," was produced by John H. Patterson, president of the National Cash Register Company, for the Cleveland Electrical League on March 14. On March 21 A. C. Gilbert, of the Cleveland Trust Company, addressed the Electrical League on "German Influences in South America—One Bloody Battle the Kaiser Lost."

Spring Meeting of American Electrochemical Society.—During the week of April 28 the American Electrochemical Society will hold its spring meeting by making a tour through Tennessee and Alabama and stopping at important electrochemical centers and water-power developments in these States. Arrangements will be made for visiting Johnson City, Kingsport, Knoxville, Sheffield, Muscle Shoals, Chattanooga, Anniston and Birmingham. A special train will be provided.

Ohio Electric Light Association New-Business Men's Section.—On March 20 the New-Business Men's Section of the O. E. L. A. held a lively meeting at Columbus, in which new-business getting and money raising for public utilities were discussed. In an address on "Contracts and Their Legality" A. Eastman said that the law under which the interstate commission acted and the Ohio law were practically the same in reference to contracts, and that all contracts must contain the published rate and be filed with the interstate commissions. A paper presented on "Domestic Refrigeration" brought out the fact that a special rate should be created on this kind of energy-consuming device, as the load obtained by it was very desirable. The next meeting of the New-Business Men's Section will be in Cleveland on May 6.

Los Angeles Jovian Electric League.—At the March 13 luncheon of the league Seward A. Simons spoke on "The Bright Side of the War." P. C. Ensley, of the Graham-Reynolds Electric Company, acted as chairman of the day.

Philadelphia Section, A. S. M. E.—On March 23 Major W. P. Barba and Major A. F. Cushman discussed subjects relating to the corrosion of boiler tubes before the Philadelphia Section of the American Society of Mechanical Engineers.

Wisconsin Electrical Association.—The annual convention of the Wisconsin Electrical Association was held on March 27-28 at the Hotel Pfister, Milwaukee, in joint session with the Wisconsin Gas Association. Some of the important papers presented were as follows: "The Utilities and the War," by M. C. Ewing, secretary-treasurer of the Wisconsin Valley Electric Company, Wausau; "Metal Electrode Welding," by Dean Treat, manager Wisconsin Railway, Light & Power Company, La Crosse; "Increasing the Efficiency of Hydroelectric Plants," by Daniel W. Mead, of Mead & Seastone, consulting engineers of Madison, and "Three-Phase Four-Wire Distribution," by George E. Wagner, superintendent of plant, Madison Gas & Electric Company. The feature of the meeting was an address by W. N. Fitzgerald, State Fuel Administrator for Wisconsin.

A. I. E. E. Section Meetings.—John B. Taylor, consulting engineer, Schenectady, N. Y., talked on "Vibrations" before the Boston Section on March 19. E. A. West, chief engineer of the Denver Tramway Company, gave a talk on "Power House Efficiency" before the Denver Section meeting on March 16. W. T. O'Connell spoke on "Design of Outdoor Substations" before the Panama Section recently. The subject of indoor versus outdoor substation in the Canal Zone was discussed by the members. A. O. Austin, chief engineer of the Ohio Insulator Company, Barberton, Ohio, gave an interesting talk on "Improvements in Design, Manufacture and Use of Porcelain Insulators" before the Rochester Section March 22. The lecture was well illustrated by numerous slides showing insulators. "The Economic Basis of Industrial Activity" was discussed by D. B. Rushmore, engineer of the power and mining department of the General Electric Company, before the Schenectady Section on March 20. "A Little Light on Lighting" was a subject discussed by J. J. Curran, Curran Sign Company; V. H. Griesser, electrical engineer, W. W. P. Company, and T. E. Holsey, illuminating engineer, W. W. P. Company, before the Spokane Section meeting recently. H. M. Leathers, of the Cutler-Hammer Manufacturing Company, delivered an address before the Toledo Section on "The Measurement of Gas by Electricity" on March 20. The lecture was supplemented by lantern slides showing parts of the apparatus and typical installations.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Inefficiency Penalized.—The Illinois Public Utilities Commission decided, in a recent case, that it will not allow as high a rate of return where the business of a utility has been conducted upon an unsystematic basis as it will in a case in which the business has been efficiently managed.

Competing Franchises and Steam Reserve Stations.—The New York Public Service Commission, Second District, holds in a decision affecting the Lockport Light, Heat & Power Company that when a city grants franchises to two different corporations enabling them to compete for the electric light and power business in the community, and the companies are afterward merged or consolidated, the city cannot successfully urge that the owners of the property which was installed for the benefit of the people of the city shall not be allowed to earn a fair return upon the value of all the property employed in the public service. The fact that there may be a duplication of property is due to the situation which was created by the city when it granted two franchises to two separate corporations, and the owners of the property must be allowed a reasonable opportunity to work out of the difficulty. In regard to the necessity of a steam reserve station the decision says: "It is a well-known fact that a concern like the Lockport company cannot always be assured that it will have a never-failing supply of hydroelectric power, even though it does come from the mighty Falls of Niagara. Delays and interruptions are a necessary incident to the business of transmitting electric energy from the source of supply to the point of distribution over long transmission lines; they are in most instances inevitable. When this happens, all the industries dependent upon this power are subject to serious loss and inconvenience, even if the interruption in the service is only of brief duration. There is hardly an electric light and power company of any consequence in the State purchasing hydroelectric energy for distribution which has not some sort of steam reserve to back it up for the purpose of taking care of interruptions as well as to cut down the peak, inasmuch as hydroelectric power is usually sold on the basis of the peak-load demand. It may be that the steam plant will not be called on for weeks at a time to supply electricity because of the failure of the hydroelectric energy, but when it is needed it is there ready for use, and it enables the company to continue to supply its customers and reduce losses which might otherwise result."

Frank W. Hall, recently appointed commercial manager of the Sprague Electric Works of the General Electric Company, dates his connection with the company from the year 1895, when he



F. W. HALL

joined the student engineering course of the Sprague Electric Elevator Company at the Bloomfield factory. During the ensuing five years Mr. Hall was occupied in superintending installation work on Sprague elevators, in special work in the factory engineering department, and later in the traveling engineering inspection of elevators. After the Sprague Elevator Company was merged with the Interior Conduit & Insulation Company and the Sprague Electric Company was formed, Mr. Hall was actively engaged with Robert Lundell in the development at the Bloomfield factory of the split-pole type of direct-current generators. In 1900 Mr. Hall joined the commercial engineering department at the New York office of the Sprague Electric Company, and in 1902 he became district office engineer at Chicago. In 1903 he became assistant to the manager of the hoist sales department in the New York office. In 1905 he left the company to become sales manager for the Hammerschlag Manufacturing Company, returning in 1909 to the Sprague Electric Works as manager of their Philadelphia office. In 1911 he returned to the general office in New York City as manager of the hoist sales department. In 1912 he became apparatus sales department manager, and in 1914 sales manager of all of the products of the Sprague Electric Works. Mr. Hall has taken a large part in electrical manufacturing association work and is at present vice-chairman of the newly formed Electric Hoist Manufacturers' Association, chairman of the outlet-box section and secretary of the fan section of the Associated Manufacturers of Electrical Supplies.

Leon O. Hart has been elected treasurer and director of the Driver-Harris Company at Harrison, N. J. Mr. Hart was born in Hoboken, N. J., in 1885, and received his education at the Stevens Institute of Technology, from which he was graduated in 1907 in me-

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

chanical engineering. After graduation he was a cadet engineer with the Public Service Gas Company of New Jersey for about a year, when he became associated with the Driver-Harris Company as electrical engineer, serving in this capacity until March, 1917, when he became assistant treasurer.

Obituary

Edward K. Patton, for the last eighteen years Western manager of the Bryant Electric Company, died of apoplexy at his home in Chicago on March 23. Mr. Patton, who was born in Chilli-



E. K. PATTON

cothe, Ohio, about fifty-eight years ago, first became associated with the electric supply business in 1888, when he was appointed Western manager of the Perkins Electric Switch Manufacturing Company. When, in 1900, that company passed into the control of the Bryant Electric Company, he continued with it in a similar capacity.

John Porterfield Sparrow, who, as reported in these columns last week, died March 18, was born in Portland, Me., March 17, 1860. Mr. Sparrow was an engineer by inheritance and education, his father, John Sparrow, having been well known in the engineering field. His early education was obtained in the public schools of Portland. In 1880 he entered the Portland Company's locomotive and marine engine works as an apprentice, leaving this company in 1888 to work for the Sprague Electric Company. During the next two years he acted as superintendent for the Sprague Electric Company in charge of construction of electric railways in various parts of the country. He went

to New Orleans in 1890 for the New Orleans Electric Company on construction work and two years later joined the construction staff of the Edison General Electric Company and was employed in building lighting and power plants for it and the Canadian General Electric Company until 1895, when he joined the staff of the construction department of the Edison Electric Illuminating Company of New York. In 1898 he became superintendent of construction, having charge of all of the construction which included the new Waterside station, at that time the largest and most important construction of its kind which had been attempted. He became chief engineer of the New York Edison Company in charge of construction and operation in 1906, and held this position at the time of his death. Mr. Sparrow was an active member of the various societies to which he belonged. At the time of his death he was chairman of the committee on standardization of flanges and pipe fittings of the A. M. E. S. and had just finished the completed report on that subject. On Feb. 1 last he was appointed chairman of the advisory board of the power test committee of that society. In the Association of Edison Illuminating Companies he was a member of the committee on steam plants in 1906 and the following years, and he was chairman in 1910, 1912 and 1913. In this work his most valuable contributions were those in connection with coal testing and burning. In the National Electric Light Association he was a member of the committee on prime movers for a number of years and was a frequent contributor to the question box. Shortly after the United States entered the war he made a number of tests for the Naval Consulting Board in connection with smoke abatement on ships as a protection against submarines. Mr. Sparrow's valuable work in the photomicrography of lamp filaments is well known. In later years he turned to metallography in connec-



J. P. SPARROW

tion with the ever present subject of the corrosion of condenser tubes and assisted in the settling of important questions of heat treatment in the manufacture of this material.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

ACUTE SHORTAGE OF TIN MAY CAUSE HIGHER PRICES

Manufacturers of Apparatus, Wire and Cable
Express Uneasiness—Cost of the Metal
Advancing

A sharp shortage of tin is not only freely acknowledged now, but it has been in evidence for several months. The supply at the present time is less than ever. Prices have been climbing in harmony with the depleted stocks of the metal in this market. A number of manufacturers were waited upon by the *ELECTRICAL WORLD* to ascertain the true state of affairs in so far as tin and its various alloys and amalgams affected the output and prices on electrical products. At the office of one prominent concern the acute curtailment in tin stocks was frankly admitted and it was stated that the condition of the market is giving rise to a feeling of justifiable uneasiness.

Reserve supplies of tin in the hands of manufacturers of electrical apparatus, wire, cable, dry batteries and other lines are not large. One wire and cable producer said the company had recently bought 5000 lb. of Straits tin at 84 cents, or approximately four times the pre-war normal price. While all metals have appreciated in value, owing to several causes, according to this informant, whose company always carries a large stock in self-protection, tin commenced to jump in price when a number of vessels carrying large shipments were sunk by German commerce raiders early in the war. The *Emden*, which operated in East Indian waters for a long time until sunk by the Australian war cruiser *Sydney*, destroyed a number of cargo carriers, all of which had important invoices of tin aboard.

Prices jumped immediately and have been going up since. The shortage of tin is not occasioned by less of the metal being mined and smelted—to accept the explanation of an important factor in the trade—but the curtailment of tonnage or bottoms for transportation facilities is responsible. On the other hand, to quote another well-informed concern, the main cause of the advances is the great uncertainty with which the whole situation is surrounded and the difficulty of securing reliable information as to output and shipment. Late last week importers were advised by cable of "limits" on Straits tin for May or June shipments; but there were more buyers than sellers. Another source of trouble is that shipping permits are not being readily granted by the British government.

Some consumers, reports say, have been placing orders for more than their real requirements, and it is estimated that if a quarter or even a half of these purchases are held up by permits enough will come through to keep them supplied. As it stands, there is neither Straits nor Banca spot tin in the market, and very little Chinese, with sellers holding out for the highest possible price. All that can be bought is on shipments which are likely to arrive several months hence.

Tin plays a very important part in the electrical and allied supplies market. Condensers are either coated with tin or they are made of an amalgam of tin and copper. Boiler tubes are also tin-lined, and if a substitute equally good were not made this would cause a serious predicament for central stations. All copper wire to be rubber-covered is first coated with pure tin. If this metal continues to be scarce and high, an early advance in the price of rubber-covered wire must naturally follow, in the opinion of a prominent manufacturer. At present, to use the statement of the same authority, the entire cost to the producer is from 3 to 5 per cent. So far this increased cost has not been passed along to the jobber, dealer or consumer.

Were tin to become still more expensive or to be unattainable, a coat of pure Para rubber, said an expert, could be used on the copper wire, but this process would increase the price of rubber-covered fully 50 per cent. As yet that branch of the industry has not been called upon to meet this emergency. The concern in question supplies a majority of the rubber-covering factories with tinned wire. For lack of sufficient tinned stock a number of these plants have already been obliged to close down. Tin is also extensively used in certain grades of trolley wire. For weatherproof wire employed in the neighborhood of acid or other factories, where the presence of sulphur fumes corrodes and destroys the insulation, the core is likewise submitted to a tinning bath, as in the rubber-covered variety.

Wherever solder is utilized, as in the manufacture of dry batteries, tin is an important element. So far the consumption is not so great as to affect prices on the finished goods. The metal is also employed in everything of brass, bronze, phosphor-bronze, babbitt metal for journal bearings, and in other alloys known in the trade. It is the general belief, therefore, among producers of merchandise in which tin is a factor that, while current prices have not yet been revised on account of the shortage, discussion along these lines is arousing unusual interest and serious attention.

DIFFERENTIAL BASIS OF COPPER-WIRE PRODUCTS

Reason Why Manufacturers with Accumulated
Copper Stock Are Quoting Lower Prices—The
Jobber's Position in the Market

Lower prices have been looked for by the trade on all copper-wire products for some time. This belief was founded on the quotations for base, which have been gradually receding to present quotations of 27 to 30 cents. When a large wire manufacturer was asked why the price was growing lower in the face of the government or officially established selling figures of 23.50 cents for car lots and 27.67½ cents for less than car load—prices which still prevail and have been extended by the War Industries Board to June 1—he said that the causes were various.

First, quite a stock of copper had been accumulating in the hands of primary buyers, and the market was therefore softening. Then commercial manufacturers who had a stock of high-price copper on hand had gradually worked it off. Conditions had been about equalized. Therefore it was possible on special business to sell wire on a 27-cent base.

Small sizes of wire and cable were still figured and sold on a 30-cent base. Where 27 cents was quoted it was either to meet competition or because of a desire to secure business. In transactions of this kind the credit standing of the customer is the principal factor. On some contracts taken at 27 cents base it is a matter of discounts. Orders at this figure have been accepted at 60 per cent off; others at 60 and 5, and again still others at 60 and 10 to large buyers. Orders for more than \$10,000 are figured from cost and a margin of profit ranging from 10 to 25 per cent. Purchasers of large quantities of signal wire, like the prominent railroads, buy on a 23-cent base.

The general average, however, to quote this and other authorities, is a 30-cent base. This figure is quoted to jobbers buying from manufacturers, with a discount of 60 per cent. On orders under \$2,500 the usual discount is 50 per cent. It depends very much upon the commercial rating of the buyer. Sometimes an additional profit may be added for carrying the customer. Rubber-covered, lead, varnish, cambric and paper-insulated materials are sold on a cost

basis plus a profit, which, of course, varies with the customer. There is no regular or hard and fast rule. Weather-proof is selling on an established pound basis, which is now 27 cents. One manufacturer states that all list prices are based on lengths of 250 ft. of one size and kind. For shorter lengths add to list price 20 per cent on lengths up to 100 ft., 10 per cent on 100 ft. to 250 ft.

Large sizes of wire are now selling almost to the exclusion of the small sizes. The sale of the latter has fallen off on account of the almost total suspension of building operations. The government is taking the greater portion of every manufacturer's output. Originally these purchases were made by the wire cable committee of the Committee of National Defense. Within the last four months the shipyards have been buying direct on a competitive basis. They are now the most important outlet for wire products.

STEADY DEMAND DEVELOPING FOR COAL-CRUSHING APPARATUS

Manufacturers Meet a Necessity Occasioned by the Acute Fuel Situation—Cogent Reasons Pre- sented for the Existing Demand

Manufacturers report that coal-crushing apparatus is enjoying a steady demand of considerable volume. There are several reasons for this. First, attention has been called to the very serious waste of fuel unless it is properly sized to burn on ordinary stokers. Second, the acute coal situation has made it necessary for coal buyers to take any kind of coal they could get, whereas in the past they might demand some particular grade or size of coal. This makes it necessary to install crushing apparatus at the plant of the consumer. Third, the manufacturers of crushing apparatus have ceased to devote their energies to trying to convert the coal mines themselves to the necessity of crushing coal and have turned their energies toward the more fertile field of the coal user. All these factors have contributed to build up a healthy demand for coal-crushing apparatus.

METAL MARKET SITUATION

Copper Deliveries Are Causing More Anxiety than Price—Shortage of Tin Prevails

Views on the copper market differ widely. Professional commentators are inclined to be pessimistic and urge an increase of the official price. Consumers, particularly in the industrial field, are calmly awaiting developments and buying as they need. As one wire manufacturer of high reputation says, copper is not so easy, in fact, is difficult, to obtain. That is to say, the metal can be bought, but the question is when will it be delivered. This company never buys less than 500,000 lb. at a time and frequently five times that quantity, and it usually keeps in reserve 2,000,000 lb. No change of price has occurred in rubber-covered cable or weatherproof wire. Tin is the shining mark in the metal market and a shortage that may be serious is imminent.

NEW YORK METAL MARKET PRICES			
	March 18		
	£	s	d
Copper:			
London, standard spot.....	110	0	0
Prime Lake.....	Govt. price	23.50	
Electrolytic.....	Govt. price	23.50	
Casting.....	Govt. price	23.50	
Wire base.....	26.25 to	26.75	
Lead, trust price.....	7.25		
Nickel, ingot.....	50.00		
Sheet, zinc.....	†15.00		
Spelter, spot.....	7.55		
Tin, Straits.....	*\$5.00		
Aluminum, 98 to 99 per cent.....	Govt. price	32.00	
			Govt. price 32.00
OLD METALS			
Heavy copper and wire.....	21.50 to	22.00	
Brass, heavy.....	14.00 to	15.25	
Brass, light.....	10.00 to	11.00	
Lead, heavy.....	6.25 to	6.50	
Zinc, old scrap.....	5.25 to	5.75	
			21.50 to 22.00
			14.00 to 15.25
			10.00 to 11.00
			6.25 to 6.50
			5.50 to 5.75

*Nominal. †F.O.B. smelter.

THE WEEK

IN TRADE

MAMMOTH orders for electrical equipment, accessories and supplies are the notable feature in this week's trade. This means the government is the buyer for the various enterprises turning out war material. Shipyards, cantonments, munition factories and similar auxiliary plants are being fitted up electrically, and the result is something of a scarcity of goods for strict commercial purposes. The demand is heavy for motors, wire, cable, conduit, lamps, etc. Eastern factories report a shortage of material for the Western trade.

Deliveries may be slightly better, but many complaints of car facilities are mentioned. This is partly explained by an official report, which, while covering the Eastern territory, is evidently applicable to other parts of the country. The statement says the poor supply of both open-top and box cars is becoming very serious. More than 10,000 carloads of material has been manufactured and is waiting transportation, being held up on account of an insufficient car supply. The situation during the last week has become more acute.

On Monday the War Industries Board put the final crimp in building operations. All new construction work, by the order promulgated, will have priority assistance withheld in the supply and shipment of material of every description unless it contributes to winning the war. The action of the board brings into existence the expected division of industries into essentials and non-essentials.

Collections are being looked after closely, with the general average rated from fair to prompt. Credits receive close attention, and extensions are placed on a short schedule.

NEW YORK

With the milder weather and freight conditions improving, the trade in general is responsively submitting reports of greater activity. To be sure, this applies to the dominating market influence—namely, government requirements—in which jobbing houses of recognized stability and standing are participating. On commercial sales jobbers report business a trifle quiet, but the factory situation is excellent. It may be described as a steady movement on electrical goods, especially in household specialties. New price lists on a higher level become effective in some lines April 1.

Financial obligations are being met with commendable promptness. Credits are tightening.

FRACTIONAL-HORSEPOWER MOTORS.—The demand for these goods is strong, and to meet the requirements of the market one widely known manufacturing company is devoting the entire facilities of one of its large plants exclusively to the production of fractional-horsepower motors. The average size is 0.5 hp., with 86 to 90 per cent special types, coming as small as 0.02 hp.

SOCKETS AND RECEPTACLES.—An advance of from 10 to 20 per cent was made this week in several types of standard porcelain sockets and receptacles. The revised prices become immediately effective.

PORCELAIN.—Knobs, cleats, bushings, rosettes, tubes, insulators and all other porcelain lines will go out under a revised price list, probably on higher quotations, April 1, according to a preliminary notice to this effect transmitted to the jobbing trade last week by a manufacturer who operates a chain of plants. This attitude is reflected by local conditions, bearing out the belief of a marked shortage.

COLLECTIONS AND CREDITS.—With every allowance for dealers being disinclined to settle accounts until goods held up by embargoes are actually delivered, collections are stated to be satisfactory. Credits, however, are tightening up quite generally.

CROSS-ARMS.—The situation has not bettered to any great extent, deliveries interfering greatly with filling orders. On an order for 40,000 cross-arms 16,000 were delivered, the remainder being in transit. A distributor of prominence recently circularized central stations advising them to place orders early for spring requirements out of stock. Recently an advance of from 12 to 15 per cent was announced, due to an increase in the workmen's wages.

GLASS INSULATORS.—As predicted, the government's tremendous quantity specifications have absorbed stock and shortened production for general sale. Manufacturers report no anticipated price increase.

MOTORS.—No lessening is noted in the call for motors of medium sizes, and the second-hand market is looked over for needed machines. As an instance of this a correspondent writes the *ELECTRICAL WORLD* as follows: "About two years ago we bought a certain 75-hp. slip-ring (280-volt) motor in Philadelphia for \$550. Three months ago our customer sold this to a dealer in our city for \$1,425, who in turn sold it for use in Trenton, N. J., for \$1,675, the customer paying an additional fee for trucking from Newark."

TELEGRAPH AND WIRELESS INSTRUMENTS.—An unusually brisk demand by the government is in evidence for these instruments. A manufacturer who is also a leading jobber reports that his factory has been running overtime on orders.

BELLS AND GONGS.—Sales are increasing, but no change in price has occurred or is looked for. Eastern jobbers are in a favorable position for goods.

CONDUIT.—Conduit continues to be extremely short. As previously observed, quantities are in transit but their whereabouts is simply guesswork. Consequently shipments arrive in the most erratic manner and not in sufficient quantities to ease the market. There is a strong demand for export, but of types unknown to the American trade. Jobbers say it is puzzling to grasp what is actually wanted.

CHICAGO

Orders are coming in in good volume. Prices are firm. Buying is of a steady nature, such as is to be expected in a market where the prices of basic commodities are staple. Deliveries in some lines are not so good as might be desired, but on the whole this situation is improving. Observers believe that better business may be expected as spring comes on.

In Chicago the electrical permits for the week ended March 20 aggregated 573 permits, amounting to 8598 lamps and 1717 hp. This is an increase over the previous week, with 543 permits, amounting to 6810 lamps and 1208 hp. It is less than the same week last year, in which 826 permits were issued. The record of building permits follows: Week ended March 20, 59 permits, \$692,800; same week year ago, 180 permits, \$2,473,600; previous week, 51 permits, \$256,100.

CONDUIT.—Deliveries are still in a state of "no promise." Jobbers who have complete stocks are lucky. There are probably not more than three complete stocks in Chicago. Nearly all have some ½-in. conduit, but the larger sizes are in strong demand with a very limited supply. Manufacturers in quoting deliveries to jobbers say, "We will ship in two weeks if we can get the cars," or "if there is no embargo." Prices are steady.

WIRE.—Weatherproof wire is showing activity, indicating some improvements and extensions by central stations. While there have been no actual changes in prices, an advance is expected on account of the high price of cotton. One wire manufacturer recently could have sold his stock of cotton at a price to net him more than he could have made on the wire it would insulate. He refused because he has customers to supply. It is reported that the American Electrical Works have changed their way of basing weatherproof wire. Formerly the common practice was to include all sizes from No. 8 to No. 4/0 as base sizes. This company, it is said, now includes sizes No. 6 to 4/0 only as base sizes. This is in effect an increase in price, since now 1 cent is added to the base for No. 8 and 2 cents for No. 10, whereas No. 8 was formerly included in the base.

CROSS-ARMS.—Cross-arms have taken an advance that amounts to about 25 per cent. The large amount of fir being used in aeroplane manufacture is given as the cause for the increase.

POLES.—All sorts of wooden poles are reported to be slackening in demand. Some pole producers are turning their attention to getting out large quantities of piling, which is in strong demand.

VENTILATING FANS.—The demand for ventilating fans and blowers has increased greatly in the last few months, especially for use in industrial plants. The demand, however, has not been so great in new building operations as it has been in old ones. A large number of the orders coming in to manufacturers in the city ask for immediate shipment, and the manufacturers are taking steps to have an extra supply of equipment on hand.

BOSTON

War industries continue to absorb the output of electrical energy and manufactures to a degree hitherto unknown. The shock of the great conflict in France produces fluctuations in security quotations, but seems only to stimulate New England business and productive resources to a more intense determination to do everything possible to rid the world of autocratic militarism. Stocks of equipment suited to factory and shipyard service are low in comparison with house and mercantile establishment reservoirs. Prices are holding firm, with no recorded changes of moment in this district in the past week. Labor conditions are more settled than for some time. Collections are closely followed, and the trade acceptance plan is now being utilized by some of the more progressive jobbing interests to the great advantage of the trade. Labor-saving appliances are moving well.

The Central Maine Power Company has just purchased a 2000-kw. generating unit for use in a new hydroelectric plant which is under construction in the Waterville district. The demand for power in the Maine shipyards is now much in excess of former requirements. Central stations in general continue to maintain a conservative policy regarding extensions, but if a way could be found to secure material at somewhat lower cost this practice of "sitting on the lid" might perhaps be replaced by one of greater enterprise. Deliveries are still conditioned largely upon the railroad situation, which improves gradually, though hardly fast enough to suit the Eastern buyer.

HOUSEHOLD APPLIANCES.—Considerable interest is displayed by the public in washers, flatirons and vacuum cleaners. One Boston retailer states that the first quarter of 1918 will show a sale of the lighter equipment, including flashlights, lamps and dry batteries, within 20 per cent of the best three months' sales in the past decade. Transient trade is good in retail circles. Toasters are moving well at Portland, Me., considering the size of the territory.

SECOND-HAND MACHINERY.—Trade continues brisk. For the moment some motors of larger size are on the market, and a prominent house reports a good stock of transformers.

STORAGE BATTERIES.—A heavy government business is being handled, and stocks are below normal for the general trade. Prices remain steady. Orders have been booked for portable, hand-controlled battery-lighting sets for trench service, for auxiliary lighting on destroyers and other government service of great importance. Industrial electric truck applications are now quite a factor in the battery business.

PORCELAIN.—Despite the protracted lull in house wiring considerable shipments of porcelain fittings are going into the smaller cities.

CONDUIT.—Stocks are running lower and the railroad situation, combined with other demands upon the mills, is giving local distributors many uneasy hours. A Portland jobber recently shipped conduit to New Haven, Conn., and to New Jersey from a stock accumulated before the present disturbed conditions became fully felt. The government appears to be getting the lion's share of the pipe at this time.

ATLANTA

The tone in building circles is decidedly more cheerful, despite the unusual and in some respects unprecedented handicaps under which construction operations are now carried on. There is, of course, much construction of an absolutely necessary character that will be done this year, which will include increased facilities at military establishments, shipyards and long-delayed residential work. Approximately \$1,000,000 will be expended at Montgomery, Ala., to build and equip a plant for repairing aeroplanes. This will further stimulate the demand for staple electrical supplies, which have been put on a standard basis owing to the past activity in this class of material. The necessity for greater economy in textile production is evidenced by the fact that a number of mills are discarding heavy group drive for more refined equipment in the way of four-frame and individual motors. Contracts for equipment of this nature have been closed this week by W. A. Handley Mills, Roanoke, Ala.; Woodruff Mills, Woodruff, S. C., and Brandon Mills, Greenville, S. C.

HEATING CORD.—While the market was more active during the past few months, jobbers report, however, that trade is holding up fairly well. Deliveries are good.

TAPE.—The volume of sales is very heavy, and the rising price of cotton, which is reflected in the price of this material, does not appear to deter buying. Stocks are in good shape to handle the situation.

CONDUIT.—A stimulated trade in both the black and white rigid products over the last few weeks, together with a decline of approximately four points in price, are the main features to be noted in this line. Shipments show a marked improvement, dropping back to three to four weeks.

ARMORED FLEXIBLE CABLE.—Trade in this line has lagged appreciably, owing to the fact that speculative building in apartments, etc., and old-house wiring have slowed up. No difficulty is experienced in supplying isolated requirements, as a substantial stock of this material is on hand. Prices are off slightly.

STAMPED STEEL BOXES.—This line has shown sluggish tendencies of late, as the present activity in conduit for industrial purposes, as compared with other building construction, precludes the call for outlet boxes. Prices remain firm and deliveries have been comparatively good.

AUTOMOBILE SUPPLIES.—Answers to inquiries for this line indicate a big business, with an ever-increasing volume of sales, the only difficulty being to deliver the goods. Charging outfits and spotlights are going fine, the delivery in these being fair. The activity in miniature lamps shows no abatement, but they are exceedingly hard to get and the demand for deliveries is very discouraging. Jobbers are doing their utmost to satisfy requirements by shipments that are in short supply.

SEATTLE

The volume of business during the week was heavy, but not marked by any startling developments. Sales to shipyards showed a slight increase, particularly in the Portland field, where buying is being completed for the new plants. Government buying is noticeably lighter. Several jobbers report the arrival of delayed shipments of schedule materials and domestic appliances. Sewing machines especially continue moving rapidly and stocks are very low. Recent shipments were used to fill long-standing orders. Several projected concrete shipbuilding plants in the Puget Sound territory are commanding considerable attention. Inquiries for electrical equipment for the proposed plants were recently received. The Alaska engineering commission of Seattle on March 25 opened bids for the largest order it ever placed for rubber-covered wire, insulators, cable, conduit, condensers, etc.—eighty-five classes of material in all.

Seattle's building records for the first three months of the year, if maintained, will result in the construction of three times as many homes this year as last, and will equal, if not pass, the record of 1909, when permits for nearly 4000 homes were issued. Portland reports state that building has taken a sudden spurt.

Authorities at the American Lake cantonment, Tacoma, forwarded recommendations for new construction totaling \$1,146,000 to Washington, D. C. The proposed extensions include barracks, storage and other buildings, etc. Secretary McAdoo wired the Chamber of Commerce and the Commercial Club that he would do his best to have Pacific Coast car builders bid on car requirements. A record yield of wheat is predicted in eastern Washington. Elevators are being erected in large numbers equipped with electric lighting systems and operated by electric equipment. The present shortage of farm labor is expected to become acute. Lumber mills have advised the spruce production bureau that unless freight cars are furnished to move the surplus lumber the mills will have to close down.

Electrical jobbers report extreme difficulty in securing materials except those used for government contracts, unless priority certificates are secured. Even priority certificates do not insure prompt delivery, as certificates must come in order. Jobbers report heavy orders for sewing machines, washers and like domestic appliances en route. Large-size wire and circular-mill cable orders are heavy from shipbuilding concerns, and materials are difficult to obtain. Eastern factories are making slow deliveries. Government orders have decreased noticeably in the last two weeks. Prices are holding up well with stocks poor.

The consumption of lamps is increasing, with no proportionate increase in the output. All sizes are in demand, and jobbers are having difficulty in filling more pressing orders. It is hoped the new daylight saving law and the completion of the addition to the Oakland Lamp Company's plant in California, which supplies Pacific Coast jobbers, will afford a measure of relief. There is an extreme shortage of a certain type. Shipyards and government orders predominate, although orders for new residence construction and remodeling are large. There is a noticeable increasing demand for porcelain cleats and tubes for shipyard and residence work. Stocks are maintained better than could have been expected under present freight conditions.

SAN FRANCISCO

For the first time in many weeks building reports show a return to normal conditions in that they principally consist of private construction and alterations. Bungalows, houses and apartment buildings replace the now familiar industrial work. There is little improvement in deliveries from the East, the average time required for a carload being close to fifty days, which time was formerly halved with ease. Nor is this the only source of delay. Eastern factories report a shortage of material and inability to get cars. Once a car is started westward it seems to get caught in a sort of whirlpool in the great transfer points, such as Chicago and Kansas City, and disappears from its tracers for days at a time. Naturally on the Pacific Coast, which is at the end of the government's transportation system and a jobbing instead of a manufacturing district, this congested condition is felt keenly by contractors and dealers. Private building has been practically at a standstill for many weeks and electrical contractors in the larger cities have been depending upon industrial work or on pumping plant business. In the interior the dry winter has not been detrimental to them.

Central stations, the Pacific Gas & Electric Company and the Great Western Power Company have petitioned the railroad commission for its authority to increase their rates about 15 per cent, claiming that the increased cost of labor and material and the need of auxiliary forces to offset the decreased rainfall render it absolutely necessary to increase their receipts. A prominent power company recently estimated an average increase of 60 per cent in cost of material used for pole-line construction. The result is that new construction is practically non-existent. Medical apparatus dealers everywhere report an increased sale for such devices as vibrators, medical batteries and even violet-ray machines, but are unable to agree on its cause. More intensive advertising and sales efforts are partly responsible, but an unusual amount of sickness created by a peculiar winter is the chief reason. Hospital equipment manufacturers report many inquiries.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List per 1000 Ft.
No. 14 solid	\$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor	
No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
No. 14 Solid	
Less than coil	List to \$61.00
Coil to 1000 ft.	10% to 59.17
No. 12 Solid	
Less than coil	List to \$71.00
Coil to 1000 ft.	10% to 68.87

Twin-Conductor	
No. 14 Solid	
Less than coil	List to \$105.00
Coil to 1000 ft.	\$70.00 to 10%
No. 12 Solid	
Less than coil	List to \$135
Coil to 1000 ft.	10% to \$130.95

DISCOUNT—CHICAGO

Single-Conductor	
No. 14 Solid	
Less than coil	15% to + 20%
Coil to 1000 ft.	5% to 20%
No. 12 Solid	
Less than coil	15% to + 20%
Coil to 1000 ft.	5% to 20%

Twin-Conductor	
No. 14 Solid	
Less than coil	15% to + \$10
Coil to 1000 ft.	10% to \$80
No. 12 Solid	
Less than coil	15% to + 20%
Coil to 1000 ft.	5% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to \$24.00
1/5 to std. pkg.	20% to 19.80
Std. pkg.	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to 12%
1/5 to std. pkg.	20% to List
Std. pkg.	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3175-.3195	.3215-.3295
Barrel lots	.2875-.2895	.2915-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil		Coil to 1000 Ft.
3/8-in. s. stp.	Net to \$75.00	—15% to \$69.75
3/8-in. d. stp.	+10% to 75.00	List to 72.00
1/2-in. s. stp.	List to 100.00	—15% to 93.00
1/2-in. d. stp.	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil		Coil to 1000 Ft.
3/8-in. single strip	\$75.00	\$63.75
3/8-in. double strip	78.25-78.75	71.25-71.75
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60	\$60 to \$150
7/32-in.—	List	List
\$25.00-\$55.00	\$20.50-\$24.50	\$20.00-\$21.50
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00
		\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60	\$60 to \$150
7/32-in.—	List	List
\$36.00-\$55.00	\$25.00	\$22.50
1/4-in.—	\$40.00-\$66.00	\$27.00
		\$25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

Size, In.	Couplings, List	Elbows, List
1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	1/4 in. to 1/2 in.	1/2 in. to 3 in.
2500 to 5000 lb.	4% to 10%	7% to 12%
	6% to 9%	9% to 15%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

Less than 2500 lb.	1/4 in. to 1/2 in.	1/2 in. to 3 in.
2500-5000 lb.	2.8% to 8.9%	4.8% to 10.9%
	5.8% to 11.9%	7.8% to 13.9%
(For galvanized deduct six points from above discounts.)		

FLATIRONS

NEW YORK

List price	\$5.00 to \$6.00
Discount	30%

CHICAGO

List	\$5.00 to \$6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	1.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00 to \$5.75
1/5 to std. pkg.	4.50
Standard packages, 500.	List, each, \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard packages, 500.	List, each, \$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B.	100	\$0.30
60-watt—B.	100	.35
100-watt—B.	24	.70
75-watt—C.	50	.70
100-watt—C.	24	1.10
200-watt—C.	24	2.20
300-watt—C.	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4 3/8 in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$24.90 to \$31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$29.00 to \$30.00
Coil to 1000 ft.	21.50 to 22.50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	\$20.00 to \$29.00
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CHICAGO

Net per 100	\$19.17 to \$25.75
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, AX, 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2.	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%-37%	20%-32%
\$10.00 to \$50.00 list.	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS

NEW YORK

	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N.C.		

	Std. Pkg.	List
Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N.C.		

	Std. Pkg.	List
Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets.	500	\$0.33
1/4-in. cap keyless socket.	500	.30
1/4-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	24%
1/5 to std. pkg.	30%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

	Std. Pkg.	List
High Grade:		
30-amp. S. P. S. T.	500	\$0.80
60-amp. S. P. S. T.	500	1.20
100-amp. S. P. S. T.	500	2.25
200-amp. S. P. S. T.	500	3.48
300-amp. S. P. S. T.	500	5.34
30-amp. D. P. S. T.	500	1.20
60-amp. D. P. S. T.	500	1.78
100-amp. D. P. S. T.	500	3.38
200-amp. D. P. S. T.	500	5.20
300-amp. D. P. S. T.	500	8.00
30-amp. 3 P. S. T.	500	1.80
60-amp. 3 P. S. T.	500	2.68
100-amp. 3 P. S. T.	500	5.08
200-amp. 3 P. S. T.	500	7.80
300-amp. 3 P. S. T.	500	12.00
Low Grade:		
30-amp. S. P. S. T.	500	0.42
60-amp. S. P. S. T.	500	0.74
100-amp. S. P. S. T.	500	1.50
200-amp. S. P. S. T.	500	2.70
30-amp. D. P. S. T.	500	0.68
60-amp. D. P. S. T.	500	1.22
100-amp. D. P. S. T.	500	2.50
200-amp. D. P. S. T.	500	4.50
30-amp. 3 P. S. T.	500	1.02
60-amp. 3 P. S. T.	500	1.84
100-amp. 3 P. S. T.	500	3.76
200-amp. 3 P. S. T.	500	6.76

DISCOUNT—NEW YORK

Less than \$10 list.	List to + 5%
\$10 to \$25 list.	11%
\$25 to \$50 net.	14% to 15%

Low Grade

Less than \$10 list.	5% to 10%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24% to 25%

DISCOUNT—CHICAGO

Less than \$10 list.	+5%
\$10 to \$25 list.	11%
\$25 to \$50 list.	14%

Low Grade

Less than \$10 list.	+5%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap

Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List, Each
Union and Similar—	
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.		
\$2.00 to \$10.00 list.	10% to 20%	5%
\$10.00 to \$50.00 list.	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25%	15% to 20%
\$2.00 to \$10.00 list.	25%	20%
\$10.00 to \$50.00 list.	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.44 1/4
No. 18, full spools.	0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.65
No. 18, full spools.	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	
11..	\$15.00-\$18.00	\$13.00	\$10.25-\$11.50	
12..	23.25- 25.41	21.30- 21.78	15.97- 19.35	
10..	32.40- 35.21	29.70- 30.18	22.13- 27.00	
8..	45.70- 49.12	41.90- 42.12	30.88- 38.00	
6..	72.40- 77.84	66.35- 66.72	48.93- 60.30	

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14..	\$18.00	\$13.00	\$11.50
12..	25.33-\$26.28	22.02-\$25.33	18.35-\$20.40
10..	30.49-36.54	27.94-31.26	22.86-29.23
8..	42.54-51.57	38.99-44.13	31.90-41.36
6..	66.46-88.38	56.15-75.61	50.53-70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

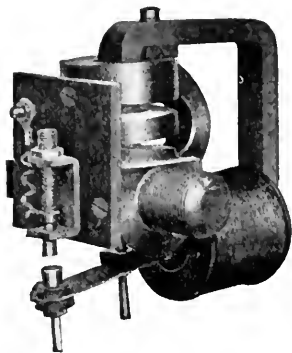
	Per 100 Lb. Net
Less than 25 lb.	\$35.42 to \$40.35
25 to 50 lb.	34.42 to 39.35
50 to 100 lb.	33.42 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Reverse Current Relays for Circuit Breakers

A reverse-current relay that will open either upon reversal of current or with zero current at abnormally low voltage is illustrated herewith. The relay

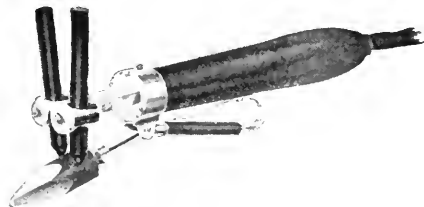


REVERSE-CURRENT RELAYS FASTENED TO
REAR OF CIRCUIT-BREAKER PANEL

is closed and held closed by a shunt polarizing coil. A high resistance is connected in series with the polarizing coil to limit the current in holding the relay closed. To close the relay, a push-button switch is provided which temporarily short-circuits the high resistance. These relays are designed for mounting on the rear of circuit-breaker panels and are manufactured by the Automatic Reclosing Circuit Breaker Company of Columbus, Ohio.

Contact-Resistance-Heated Electric Soldering Iron

The Clemens Electric Corporation, Buffalo, N. Y., has improved its electric soldering iron, which was described in the June 23, 1917, issue of the *ELECTRICAL WORLD*. One of the principal changes has been the provision of an



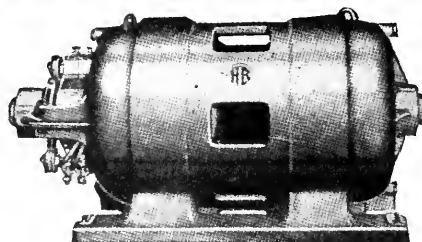
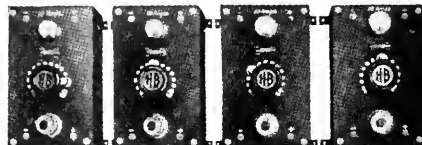
INSULATED HANDLE PREVENTS BURNING
OF WORKMEN'S HANDS

insulated handle on the movable lever which is employed to close and open the circuit. The copper-pointed iron is held against the two carbon contacts shown in the accompanying illustration by a steel strip spring. The heat is produced

by the contact resistance where the carbon electrodes touch the iron. The device is efficient, it is claimed, because it heats only when the iron is in contact with the work and then heats almost instantaneously.

Battery-Charging Outfit

The Hobart Brothers Company of Troy, Ohio, has recently brought out the large-size battery-charging outfit shown in the accompanying halftone. The unit is rated at 2 kw. and is capable of charging thirty-two batteries at one time. The load box, shown in the illustration, will permit any load from minimum to maximum rating and will take care of any intermediate values necessary. The machine, which is self-starting, can be used to charge differ-



OUTFIT CAPABLE OF CHARGING DIFFERENT-
VOLTAGE BATTERIES AT THE SAME TIME

ent-voltage batteries at the same time. It is fool-proof, and no special electrical or mechanical knowledge is necessary to operate it.

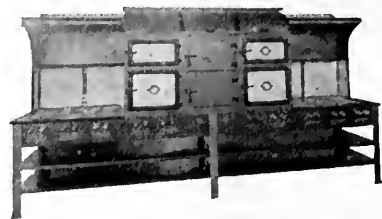
Large Electric Range

The Rutenber Electric Company of Marion, Ind., has built the range shown herewith, which it is said is one of the largest single-section ranges ever built. The Rutenber double cloverleaf type of air-cooled terminal heating unit or hot plate is used throughout this range. There are twelve of these hot plates, of which eight are rated for 1000 watts and four for 1500 watts. All hot plates are equipped with three heat switches. These hot plates are placed six on each side of the ovens.

There are two large ovens, each 14 in. by 16 in. by 18 in. (35.6 cm. by 41.6 cm. by 46.7 cm.), and two smaller ovens 10 in. by 16 in. by 18 in. (25.4 cm. by 41.6 cm. by 46.7 cm.). Each of the

ovens has two heating elements, one above and one below. The upper ones are rated at 375, 750 and 1500 watts. The lower ones are rated at 200, 400 and 800 watts, giving fifteen different combinations of heat in each oven.

The ovens are lined with aluminumized steel and are equipped with a



EACH UNIT IS INDIVIDUALLY FUSED AND
EASILY ACCESSIBLE

Rutenber standard door catch and thermometer. The range has each unit individually fused, the fuses being easily accessible. There is a designation strip between the fuses and the switch which shows the unit that the set of fuses or switch controls. There are two lamp-socket attachments on the range. Three warming closets and one large warming oven with two doors are furnished. This range has a maximum connected load of 23,200 watts.

Safety Inclosed Switches

The Krantz Manufacturing Company of Brooklyn, N. Y., is manufacturing a line of safety auto-lock switches for use as main-circuit switches and wherever the knife switch is ordinarily needed. The accompanying illustration shows the working side of the switch, which consists of brush-type contacts and an operating switch handle. The use of this brush-type contact prevents the surface becoming welded together owing to slow closing and therefore increases safety to the circuit. The brush contact is made directly with the incoming terminal block and fuse terminal block, thus elimi-



SAFETY SWITCH PREVENTS CONTACT WITH
LIVE TERMINALS

nating all splices, soldering, joints and unnecessary connections. When it is desirable to replace the fuses in the switch the handle is locked shut.

When the front door of the box is opened it is impossible to come in con-

act with the live parts of the circuit. The advantage of this feature is apparent when it is considered that non-electrical men are usually employed in steel mills or industrial plants. The stationary contacts are of hard-drawn copper, and the fuse block terminals are mounted on a plate base.

The double-ended brushes cause a double break in each circuit, dividing the arc between the two ends. Each end is provided with a separate arcing tip. In the closed position the switch is held in positive contact by a toggle over the center. In opening the switch a spring provides very quick break, the mechanism working independent of the operating handle. It is claimed that these switches will carry their 150 per cent rated current without undue heating. The device has been approved by the National Board of Fire Underwriters.

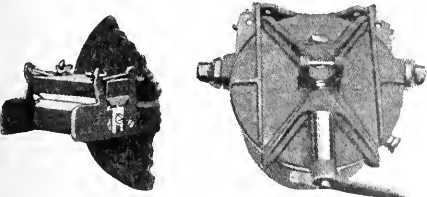
Projectors

The Luminous Unit Company of St. Louis, Mo., has developed a projector equipment which is designed for use on standard type "C" lamps. A simple focusing arrangement is provided by means of which it is possible to adjust the beam of light from a narrow search-light beam to a wide flood, as conditions may require. This adjustment is external and may be made in a moment's time. The reflector is of metal, highly polished and permanent. The units are ventilated and waterproof under any conditions, it is claimed. The front lens is of polished wire plate glass.

Three sizes are available, from 200 watts to 1000 watts rating, which range provides for ordinary requirements. The projectors are arranged for mounting on $\frac{3}{4}$ -in. (1.9-cm.) iron pipe.

Oil-Submerged Compression Cut-Out

A re-fusable cut-out which combines both the compression and the oil-submersion principles is illustrated herewith. The cut-out is adapted for both overhead and subway service and can be used on lines operating at 2000 volts to 4000 volts with a 10-amp. to 200-amp. duty. The fuse element is held between compression blocks which are



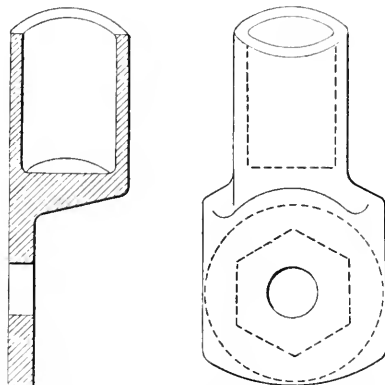
COMPRESSIVE ACTION OF REFRACTORY BLOCKS "SNUFFS OUT" FUSE ELEMENT

made of refractory material. When the fuse element becomes overheated it will soften, and as it yields the compression action of the blocks tends to extinguish the arc. All of the working parts are immersed in oil and therefore an arc,

if formed, will be choked off by the action of the oil and also chilled and extinguished by the contact of the compression blocks. The explosive action of the arc is also greatly reduced. The box is held tightly closed by four heavy claws, which can be drawn in around the rim or released by a handle. The plug member can then be removed from the cut-out box when it is desired to replace the fuse element. The device is being marketed by the G. & W. Electric Specialty Company, 7440 South Chicago Avenue, Chicago.

Cold-Flowed Cable Terminals

The Mutual Electric & Machine Company of Detroit, Mich., has placed upon the market a cable terminal or soldering lug that is made by the "cold-flowed" process from a solid copper rod. The accompanying illustration of two different views of the completed terminal shows clearly the construction of the lugs. The terminal is made by cutting the solid copper bar into slugs and placing them in a machine which causes



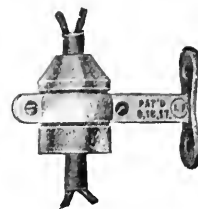
CABLE TERMINAL MADE OF ONE PIECE

the material to flow into the upper half of the terminal while cold. Then the remaining solid portion is flattened or spread out and pierced. These operations are performed while the material is cold, and therefore the material is not ruptured. For this reason the terminal cannot leak when it is filled with solder. The bottom portion of the hole is flat, so that a minimum amount of solder is used. After the socket is filled with solder and the cable inserted a positive joint is assured between the cable and the terminal. At the present time the lugs are constructed to carry currents up to and including 200 amp.

Wire Supporter and Insulator

The accompanying illustration shows a wire supporter and insulator manufactured by the L. F. Manufacturing Company of 426 Hoboken Avenue, Jersey City, N. J. These wire supporters and insulators are made of soft malleable iron and are designed to support and clamp duplex or single-wire alongside of poles and other surfaces. They are especially adapted for service wires and cut-ins for buildings, lamp

services, etc. This device eliminates the use of tie wires and does not injure the original wire insulation. The fittings are interchangeable, as only a few parts have to be in stock to cover a wide range of work. The insulators,

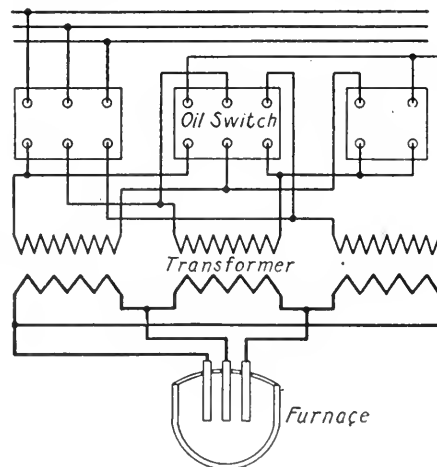


INSULATOR THAT AVOIDS USE OF TIE WIRES

which are made with either conical or round ends, shed water, snow or ice readily.

Automatic Control for High-Rated Electric Furnaces

The accompanying diagram shows an arrangement whereby variable voltage operation of three-phase electric furnaces can be accomplished by changing the high-voltage connection. The high melting voltage is obtained by connecting the high-voltage windings in delta and the lower refining voltage by connecting them in star. During the melting period variable voltage is obtained by means of high-voltage taps and external reactance is provided to be cut in during this melting period. The furnace is equipped with a three-section control panel containing three shunt relays and three contactor groups. Contact-making ammeters are also provided with dash-pots to prevent hunting of the electrode motor, and the coils are provided with taps which are used to vary the amount of power supplied to the furnace. Each contactor group consists of three units all mechanically interlocked, two contactors being normally open and the other being nor-



DIFFERENT HEATS OBTAINED BY CHANGING HIGH-VOLTAGE CONNECTIONS

mally closed. The motor for operating the electrodes is dynamically braked so that all moving parts may be stopped instantaneously. The installation as described is manufactured by the General Electric Company.

Trade Notes

J. D. BARNHILL, INC., has changed its name to the Dodd-Dubosque Company, Inc., with offices as before at 110 West Thirty-fourth Street, New York City.

THE GREENLEAF COMPANY of Boston, Mass., announces the occupancy of an entire floor in the new Christian Endeavor Building, 41 Mount Vernon Street.

J. H. SROUFE and S. C. Jaggard of Portland, Ore., have organized the Jaggard-Sroufe Company and have opened offices in the Pittcock Block as electrical contracting engineers. Special attention will be devoted to marine and mill work.

FRED B. DUNCAN has been appointed manager of the Chicago office of the Packard Electric Company of Warren, Ohio. Mr. Duncan was formerly assistant chief engineer of the power and light plant of the International Harvester Company.

F. W. JESSOP, formerly works manager of the Electric Controller & Manufacturing Company, Cleveland, Ohio, has formed the Ohio Electric & Controller Company, 5900 Maurice Avenue, Cleveland, to manufacture lifting magnets and controlling devices.

THE H. W. JOHNS-MANVILLE COMPANY of New York City has opened a new branch office at 1015 A Street, Tacoma, Wash. There is carried a complete stock of asbestos packings, molded and in sheet form, and other well-known Johns-Manville power-plant specialties.

THE AMERICAN CHAMBER OF COMMERCE of the city of Mexico has issued the first number of the *Journal of the American Chamber of Commerce*. It is illustrated and contains information of interest to manufacturers desiring to market their products or better their trade connections in Mexico.

THE GLOBE ELECTRIC COMPANY of Milwaukee, Wis., announces the opening of an office of its company at 106 North La Salle Street, Chicago, to take care of its electric farm lighting and storage-battery business. W. R. Patton, sales manager of the company, has announced that this office will be in charge of G. M. Gardner.

THE INTERNATIONAL TEXTILE, INC., of Bridgeport, Conn., announces that the business heretofore known under the name of Alb. & E. Henkels, Inc., will hereafter be conducted under the name of International Textile, Inc. H. A. Philips will remain as general manager. The company recently supplied the government with a quantity of insulating tape.

ARTHUR ORGAN of New York City has taken the agency of the "Laun-dry-ette," an electrically operated washing machine manufactured by the Home Specialty Company of Cleveland, Ohio. Mr. Organ, whose office is at 114 Liberty Street, will inaugurate a sales campaign to assist dealers and central stations, whereby his salesmen will help in creating consumer demand.

WALDEMAR D. HERRMANN, for the past two years special representative of the C. J. Netting Company of Detroit, Mich., has joined the forces of the Holophane Glass Company as district agent for Michigan, northern Ohio and New York. Mr. Herrmann was special representative for the Johns-Manville Company for four years, and also was with the Sunlight Company.

THE WAR TRADE BOARD JOURNAL of Washington, D. C., will hereafter be issued regularly on the first day of the month. From time to time, however, as occasion may warrant, special issues will be published devoted to particular phases of the work of the board. In the middle of March it was proposed to bring out a special number, which was to include live matter of interest to exporters and importers.

THE DINGLE-CLARK COMPANY has been organized with offices at 536 Engineers' Building, Cleveland, Ohio. This corporation will handle a complete line of motors, transformers, controllers and turbo-gears. Howard Dingle and W. W. Clark were, up to Feb. 1, respectively district manager and assistant manager of the Crocker-Wheeler Company in Cleveland. Both have been in the Ohio territory for the past ten years.

THE BATTERMAN-TRUITT COMPANY, formerly of 18-20 East Kinzie Street, Chicago, has removed its offices and factory to 736-738 West Monroe Street. The new factory is about three times as large as the old one. The reason for the move was mainly for more room for stocking up equipment for immediate shipment. This company manufactures ventilating fans,

blowers, etc. H. E. Batterman is president, E. Ackerman vice-president, and J. E. Truitt secretary and treasurer.

THE STANDARD ELECTRIC & ELECTRIC COMPANY of Baltimore, Md., is completing a new and larger plant at 118-120 East Pratt Street. When finished it will have floor space of about two acres. An exhibition and salesroom, with shipping department in rear, will occupy the first floor. The entire second floor will be devoted to the offices. The coil-winding department is on the third floor, with the "baking" room and blueprint sections, and the machine and repair shops are on the fourth floor.

Trade Publications

GUY-WIRE ANCHORS.—W. N. Matthews & Brothers, Inc., of St. Louis, Mo., is circulating a post card describing the Matthews "Scrulix" anchor.

METAL STATISTICS.—The eleventh annual edition of "Metal Statistics" is ready for distribution by the American Metal Market Company of 81 Fulton Street, New York.

METAL PRODUCTS.—The American Steel & Wire Company has issued a daily desk calendar, one side of every page being devoted to notices regarding products made by this company.

TAPS, DIES AND REAMERS.—W. L. Brubaker & Brothers of 50 Church Street, New York, have issued catalog No. 4, entitled "Taps, Dies and Reamers." The book is well illustrated and also contains price lists.

LIGHTING FIXTURES.—The title of catalog No. 20 issued by the Indesco Lighting Fixtures Company of 47 Warren Street, New York City, describing its lighting fixtures, shades, floor and portable lamps.

PRESSURE GAGES.—The Ashton Valve Company of 161 First Street, Cambridge "C," Boston, Mass., is distributing circular No. 100 on "master-pilot" pressure gages. The bulletin describes the double-illuminated pressure gage.

SAFETY INCLOSED SWITCHES.—The Kranz Manufacturing Company has issued a circular covering its safety auto-lock inclosed switches. A clear description of the switch, showing its advantages, together with illustrations, is given in the circular.

AIR COMPRESSORS.—The Ingersoll-Rand Company of New York City has published a vest-pocket booklet describing its products and giving a list of the uses of compressed air. Valuable engineering data and information are also presented in the booklet.

BOILERS.—The Engineer Company of 17 Battery Place, New York, has issued two bulletins, Nos. 16 and 18, on balanced draft. The booklets give the theory and application of balanced draft to practice with descriptions of apparatus manufactured by the Engineer Company.

TELEPHONE SYSTEMS.—The Swedish Electric Telephone & Manufacturing Company of Chicago has issued catalog No. 32 of the apparatus that it manufactures. The catalog is well illustrated and shows switchboards of various types and other necessary apparatus for complete telephone systems.

RAILROAD ELECTRIFICATION.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is circulating a bulletin entitled "The Further Prospect of Railroad Electrification." A discussion of the cost and advantages of railroad electrification is made in the bulletin.

PORTABLE ELEVATORS.—The New York Revolving Portable Elevator Company of 343 Garfield Avenue, Jersey City, N. J., is distributing a 1918 calendar referring to its revolving portable elevator, called the "revolator." Illustrations showing applications of this mechanism are produced on the calendar.

INCLOSED SWITCHES.—The Trumbull Manufacturing Company of Plainville, Conn., is circulating a booklet describing its "Circle T" inclosed switches. This bulletin shows the inclosed knife switches, both externally and internally operated, in bent-up steel and cast-iron boxes. Prices of the switches and their parts are listed.

PIPE TOOLS.—The Greenfield Tap & Die Corporation of Greenfield, Mass., has issued catalog No. 38, showing its complete line of pipe tools. The booklet also contains miscellaneous tables of information that are very valuable for pipe and drill-size calculations. The corporation is also circulating

ing a booklet which gives the history of the company.

WIRE SUPPORTERS AND INSULATORS.—The L. F. Manufacturing Company of Jersey City, N. J., is distributing a catalog describing its duplex wire supporters and insulators. The booklet is well illustrated and shows pole-type and house-type brackets, wire supporters and insulators for supporting wire along the sides of poles and other surfaces.

FARM LIGHTING PLANT.—The Sackett Company of Columbus, Ohio, in a bulletin on the "Sackett Hyrax Farm Lighting Plant" illustrates a farm lighting unit it is making. Photographs of various houses lighted by the Sackett system are shown, and the lighting fixtures and appliances that complete the installation are also illustrated in the catalog.

ELECTRIC HEATING DEVICES.—The Simplex Electric Heating Company, 85 Sidney Street, Cambridge, Mass., is distributing a bulletin and price list of its electric heating devices. The bulletin includes bake ovens, boilers, chafing dishes, circulating-water heaters, curling-iron heaters, disk stoves, fry kettles, glue pots, griddles, heating pads, hot closets, hot plates, heater cord, immersion coils and various other heating devices.

INDUSTRIAL RESEARCH AND DEVELOPMENT.—Esterline & Angus of Indianapolis, Ind., have issued a booklet giving a record of some engineering and industrial research and development work that they have carried out. The title of the booklet is "A Unique Service by a Unique Organization." A few suggestions showing why an independent consulting engineering organization is better than the ordinary engineering department are given.

New Incorporations

THE MUNICIPAL ELECTRIC LIGHT & POWER COMPANY of Henderson, Ill., has been incorporated with a capital stock of \$1,000 by Jesse H. Baker, Edna M. Baker and A. S. Button.

THE NORTHWOOD-KENSETT ELECTRIC COMPANY of Northwood, Iowa, has been chartered with a capital stock of \$50,000. E. H. Dwells is president and M. H. Kepler secretary.

THE ATWATER (OHIO) LIGHT & POWER COMPANY has been incorporated by E. P. and P. W. Whittlesey, C. A. Cummings and N. W. Brockett. The company is capitalized at \$10,000 and proposes to construct and operate an electric-light plant.

THE OHIO ELECTRIC COMPANY of New York, N. Y., has been incorporated by J. Milburn, Jr., D. E. Masten and W. J. Nelson, 1463 Broadway, New York, N. Y. The company is capitalized at \$100,000 and proposes to deal in electric and mechanical appliances for household use.

THE DOUGLASS (PA.) TOWNSHIP ELECTRIC COMPANY has been chartered with a capital stock of \$5,000 to furnish electrical service in Douglass. The incorporators are: Theodore M. Dame of Boyertown, Clinton H. Miller and William Maulmeasy, both of Philadelphia, Pa.

THE WASHINGTON (PA.) TOWNSHIP ELECTRIC COMPANY has been chartered by William Maulmeasy and Clinton H. Miller, both of Philadelphia, Pa., and Theodore M. Dame of Boyertown, Pa. The company is capitalized at \$5,000 and proposes to furnish electricity for lamps, heaters and motors in Washington.

THE INTERNATIONAL ENGINEERING & MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$1,000,000 to install electric-light and power plants. The incorporators are: S. B. Howard, George V. Reilly and A. W. Britton, all of New York, N. Y.

THE COLEBROOK TOWNSHIP ELECTRIC COMPANY of New Berlinville, Pa., has been granted a charter with a capital stock of \$5,000 to supply electricity for lamps, heaters and motors in New Berlinville. The incorporators are: Theodore M. Dame of Boyertown, William Maulmeasy of Philadelphia, Pa., and Clinton H. Miller of Philadelphia, Pa.

THE OHIO ELECTRIC & CONTROLLER COMPANY, 5900 Maurice Avenue, Cleveland, Ohio, has been incorporated with a capital stock of \$200,000. The company proposes to manufacture lifting magnets immediately and controlling devices later. The officers are: T. W. Jessup, president; W. B. Greene, vice-president, and A. D. Walter, secretary and treasurer.

New England States

CONCORD, N. H.—The Contoocook (N. H.) Electric Light Company has applied to the City Council for permission to erect electric transmission lines through the city of Concord from the town of Hopkinton to the town of London. If given permission to enter the town the company agrees not to furnish electricity in this city or to bid for the local lighting contract.

CLINTON, MASS.—Contracts have been awarded by the State Commission for the installation of gates and motors to utilize the waste water running over the spillway of the Wachusett dam to develop additional power.

FALL RIVER, MASS.—The stockholders of the Fall River Electric Company have voted to petition the Gas and Electric Light Commissioners for permission to increase the capital stock of the company from \$1,400,000 to \$2,100,000. The proceeds are to be used to take up outstanding indebtedness and also for the new high-tension transmission system that is to be erected over the Taunton River.

SPRINGFIELD, MASS.—Contracts have been awarded by the Undertakers' Supply Corporation, Stearns Building, Springfield, for the erection of a new power house, 25 ft. by 30 ft., in connection with a large new plant at East Springfield. Gour Brothers, 20 Woodmont Street, are the contractors.

WORCESTER, MASS.—Surveys, it is reported, are being made by the New England Power Company of Worcester for the erection of the proposed high-tension transmission line from Millbury to Webster.

BRIDGEPORT, CONN.—Contract has been awarded by the Remington Arms Union Metallic Company for an addition to one of the buildings, 61 ft. by 417 ft., at its cartridge plant.

Middle Atlantic States

BUFFALO, N. Y.—The Frontier Water Steam Supply Company, 667 Main Street, has increased its capital stock from \$40,000 to \$150,000, the proceeds to be used for expansion purposes.

BUFFALO, N. Y.—The plant of the Western Electric Equipment Company, 66-70 Broadway, was damaged on March 14 by fire, causing a loss of about \$40,000. The company manufactures electrical supplies, etc.

BUFFALO, N. Y.—The Delaney Forge & Iron Company, 300 Perry Street, Buffalo, is planning to make extensions to its forge plant at Perry Street and the Lehigh Valley Railroad, including the erection of a large building, 130 by 300 ft., and a machine shop, 100 by 250 ft., one story.

DUNKIRK, N. Y.—Arrangements are being made by the Board of Water Commissioners and the City Council for the installation of an ornamental street-lighting system in a portion of the business district, standards carrying a single lamp instead of cluster lamps. It is understood, will be used. W. O. Peck is superintendent of the municipal electric-light plant.

LOCKPORT, N. Y.—The Public Service Commission has authorized the Lockport Light, Heat & Power Company to issue \$106,700 in capital stock, the proceeds to be used to take up outstanding indebtedness.

NEW YORK, N. Y.—The Public Service Commission has granted the Union Railway Company permission to build an extension of its Fordham Road-205th Street cross-town line to Dyckman Ferry.

NEW YORK, N. Y.—The Interborough Rapid Transit Company is planning to build a new one and three-story transformer station on Seventy-fourth Street, near Avenue A, to cost about \$12,000.

NEW YORK, N. Y.—The Mexican Telegraph Company has purchased a site on Broad Street from South William to State Street. The company, it is said, will erect a building on the site, at a cost of about \$400,000.

NEW YORK, N. Y.—Plans have been filed by George H. Pegg, chief engineer of the Interborough Rapid Transit Company, for the erection of a three-story transformer station, 40 ft. by 41 ft., on Seventy-fourth Street, east of Avenue A, to cost about \$12,900.

PEEKSKILL, N. Y.—The Weehawken (N. J.) Dry Dock Company has acquired about 760 acres at Verplank's Point, formerly owned by the Hudson River Brick Manufacturing Company, the C. I. Bleakley Company and others. The company, it is understood, will erect a shipbuilding plant on the site, to cost about \$3,000,000, to be equipped for the construction of steel, concrete and wooden ships. The company now has a plant at the foot of Baldwin Street.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ROCHESTER, N. Y.—The Wheeler-Greene Electric Company, 31 St. Paul Street, Rochester, has increased its capital stock from \$100,000 to \$500,000, the proceeds to be used for extensions to its plant.

ROCHESTER, N. Y.—The Public Service Commission has granted the Rochester Railway, Light & Power Company permission to issue \$2,000,000 in capital to cover the cost of recent improvements in the equipment of its Genesee River hydraulic plant. The company has also petitioned for authority to issue \$4,000,000 additional capital stock.

SAND LAKE, N. Y.—The McLaren Knitting Company has applied to the Town Board for a franchise for the erection of an electric transmission line to enable it to secure electricity from the Albany Southern Railroad Company to operate its mills in Sand Lake.

SYRACUSE, N. Y.—Plans have been filed by the Crouse-Hinds Company, Seventh, North and Wolf Streets, Syracuse, for the erection of a new two-story plant, to cost about \$800,000. The company manufactures electrical goods.

SYRACUSE, N. Y.—Plans have been filed by the Swan & Finch Company, 416 Tracey Street, for the construction of an addition to its power station. Contract for the work has been awarded to Frank M. Kimmey, 1007 West Onondaga Street.

WATERTOWN, N. Y.—The Northern New York Utilities, Inc., has petitioned the Public Service Commission for permission to issue \$480,000 (par value) in bonds and \$223,000 in capital stock, the proceeds to be used for the proposed 5000-hp. development at Black River and 1800-hp. at Effley Falls on the Beaver River, to provide power for war and munitions purposes, already covered by contracts.

YONKERS, N. Y.—Plans have been filed by the National Sugar Refining Company for the erection of a new power plant, 90 ft. by 140 ft., at its works at the foot of Main Street.

BRIDGETON, N. J.—The installation of a new municipal electric-light plant is under consideration by the City Council.

JERSEY CITY, N. J.—The General Storage Battery & Repair Company is planning extensions and improvements to its plant.

JERSEY CITY, N. J.—The proposed plant to be erected by Henry Ford on the meadows near Jersey City for the construction of submarine chasers will consist of a fabricating shop, a fitting-out shop and three assembling plants. The cost of the plant is estimated at about \$3,000,000, and it will adjoin the works of the Ford Automobile Company.

PATERSON, N. J.—The Ordnance Department, Washington, D. C., is negotiating for the property at Clay Street and Madison Avenue, Paterson, on which it proposes to erect a number of buildings for the use of the Ordnance and Quartermaster's Departments, to cost about \$2,000,000.

TRENTON, N. J.—Plans have been completed by the city for the erection of a new power house in connection with another building to be located at the Municipal Colony in Hamilton Township. William Kleman of Trenton is architect.

HARRISBURG, PA.—Application has been made to the Public Service Commission by the Bernville Light, Heat & Power Company, the Penn Mills Light, Heat & Power Company and the Jefferson Light, Heat & Power Company for approval of their incorporation and for permission to begin the exercise of rights, power, franchises and privileges within the boundaries of Berks County.

PHILADELPHIA, PA.—Contract has been awarded by the estate of B. Jones for the construction of a new boiler plant at Sixty-fourth and Lebanon Streets.

PITTSBURGH, PA.—Plans have been filed and contract awarded by the South Pittsburgh Water Company, Carrick, for the construction of a new power plant, 45 ft. by 115 ft., to cost about \$35,000. The Walker & Curley Company, E. E. Trust Building, Pittsburgh, is contractor.

PORTERSVILLE, PA.—Plans have been prepared by the Fox Coal Company of Brannan, near Portersville, for the construction of a new power house at its works. Charles D. Hall, Jenkins Arcade, Pittsburgh, is engineer.

READING, PA.—Notice has been filed with the Public Service Commission by the Metropolitan Edison Company of an issue of \$25,000 in bonds, the proceeds to be used for improvements, etc., to its plant and system.

BALTIMORE, MD.—The Baltimore Manufacturing Company is planning to erect a power plant and cooper shop at Central Avenue and Bank Street, Baltimore.

BALTIMORE, MD.—The Sapero Box Company, 220 East Grindall Street, Baltimore, is planning to establish a wood-working factory at 2501 Boston Street. About 300 hp. in motors, it is understood, will be installed.

BALTIMORE, MD.—The City Council has passed the ordinance authorizing the Washington, Baltimore & Annapolis Electric Railway Company to build additional connecting tracks for the operation of an extension to its freight terminal facilities.

BALTIMORE, MD.—Plans are being prepared by the Baltimore Manufacturing Company, Monument and Constitution Streets, for the erection of a new power station at Central Avenue and Bank Street, in connection with other extensions at its works.

HAVRE DE GRACE, MD.—The Havre de Grace-Taneytown Electric Railway Company, recently incorporated, is contemplating the construction of an electric railway from Havre de Grace via Towson, Finksburg and Westminster to Taneytown, a distance of about 65 miles. C. Stanley, 423 Calvert Building, Baltimore, is president.

MORGANTOWN, W. VA.—The court has authorized the issue of \$60,000 in receiver's certificates for repairs and improvements on the Morgantown & Wheeling Railway.

ALEXANDRIA, VA.—Final plans and specifications have been prepared by Frederick T. Ley, Springfield, Mass., for the construction of a shipbuilding plant at Jones Point for the American Shipbuilding Company. The work will include the construction of six shipyards, fabricating shop, 212 ft. by 400 ft., one story; machine shop, 75 ft. by 200 ft.; blacksmith shop, two stories, 60 ft. by 125 ft.; joiner shop, two stories, 60 ft. by 125 ft.; tin and copersmith shop, 50 ft. by 125 ft.; carpenter shop, 60 ft. by 150 ft.; storehouse, 75 ft. by 250 ft.; water and sewer system; power for six shipyards, trackage, etc. The Fred T. Ley Company, 495 Main Street, Springfield, Mass., are engineers and contractors.

PINCASTLE, VA.—The Roanoke & Botetourt Telephone Company has filed notice with the Public Service Commission of an increase in capital stock from \$10,000 to \$15,000, the proceeds to be used for extensions, etc.

WASHINGTON, D. C.—Contract has been awarded to the Turner Construction Company, 241 Madison Avenue, New York, N. Y., by the United States government for the construction of a new underground distributing system and power plant at G and Twenty-fifth Streets, to cost about \$550,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 8 for furnishing and installing exciters, switchboards, cell structures, cell equipment, wiring, transformers and other miscellaneous electrical power plant equipment in power plant at the navy yards at Norfolk, Va., and Philadelphia, Pa. Drawings and specifications No. 2762 may be obtained at the above bureau or of the commandant of the navy yards named.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 1748—7000 ft. leaded and armored, soft-steel galvanized, 32-conductor interior-communication cable; 15,000 ft. plain, single-conductor lighting and power wire. Hingham, Mass., Schedule 1752—one 2-ton electric truck. Philadelphia, Pa., Schedule 1751—two motor-driven, back-sawed 16-in. extension-base shapers. Application for proposal blanks should give the schedule desired by number.

WASHINGTON, D. C.—A bill has been reported to the House of Representatives asking for appropriations for the naval service for the year ending June 30, 1919. The work contemplated includes improvements to the power plant at the navy yard, Portsmouth, N. H., at a cost of \$150,000; improvements to the central power plant at navy yard, Boston, Mass., \$75,000; improvements to the central power plant at Philadelphia, Pa., \$300,000; improvements to central power plant and distributing system, Norfolk, Va., \$300,000; central power plant and distributing system at the Naval Academy, \$325,000; improvements to the central power plant and distributing system at the naval station,

New Orleans, La., \$280,000; Improvements to central power plant and distributing system at navy yard, Mare Island, Cal., \$100,000; Improvements to central power plant and distributing system at the navy yard, Puget Sound, Wash., \$200,000, and the installation of telephone and transmission system at naval station, Guantanamo, Cuba.

North Central States

DEARBORN, MICH.—Plans are under way for the construction of a large plant for manufacturing and assembling of Fordson tractors at Dearborn. The cost of the plant is estimated at \$3,500,000, and when completed it will employ about 100,000 men. Among the buildings to be erected are: A foundry, 120 ft. by 225 ft.; stock room, 30 ft. by 100 ft.; heat treating room, 40 ft. by 145 ft.; assembling shops, 44 ft. by 165 ft. and 44 ft. by 105 ft.; pattern shop, 50 ft. by 105 ft.; gas producer plant, 54 ft. by 45 ft.; power plant, 70 ft. by 45 ft.; two machine shops, 75 ft. by 285 ft. and 90 ft. by 225 ft., respectively. The plant is located across from the Ford blast furnaces.

GRAND RAPIDS, MICH.—The Grand Rapids Salvage Company, it is reported, is furnishing structural steel and reinforcing for power house for the Haskolite factory at Fuller Station.

IRON MOUNTAIN, MICH.—Contract has been placed for the installation of a complete electrically-operated pumping plant for the water-works system. The city has entered into a contract with the Peninsula Power Company for electrical energy.

KALAMAZOO, MICH.—The Leonard Tractor Company is reported to be contemplating the construction of a plant in Kalamazoo, to cost with equipment about \$300,000.

AKRON, OHIO.—Plans are being prepared by the Northern Ohio Traction & Light Company for the erection of new warehouses, laboratory, club house and other buildings in Akron, to cost about \$200,000.

AKRON, OHIO.—In a decision recently handed down by the Supreme Court of the United States the city of Akron is given the right to build a dam across the Cuyahoga River and divert water from the stream for power purposes. The city was opposed by the Cuyahoga Power Company.

COLUMBUS, OHIO.—Improvements are being made to the municipal electric-light plant involving an expenditure of about \$365,000. The city is changing all arc lamps except magnetite to 400-cp. nitrogen-filled lamps and is installing 700 additional 400-cp. nitrogen-filled lamps at a cost of about \$60,000. New equipment includes two 500-hp. water-tube boilers and one 5000-kva. Allis-Chalmers two-phase, 2200-volt turbo-generator. The city is also erecting two substations. Lewis Rowe is acting superintendent.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company, it is reported, has awarded contract for two 500-hp. Babcock & Wilcox boilers, to be installed in the new addition to its plant.

YOUNGSTOWN, OHIO.—The Trus Con Steel Company is planning to build an addition to its plant. The main building will be 30 ft. by 400 ft. Considerable new equipment, it is understood, will be required.

GRAHAM, KY.—The W. G. Duncan Coal Company of Greenville is planning to build a power house, 75 ft. by 100 ft., and erect from 4 to 5 miles of transmission line, to connect Greenville, Luzerne and Depoy. All material and equipment, it is understood, has been purchased.

ATTICA, IND.—The municipal electric-light and water plant was destroyed by fire on March 9.

BLOOMINGTON, IND.—Bids will be received by the board of trustees of the Indiana University, at the office of R. F. Daggett & Company, architects, Lemcke Annex, Indianapolis, until April 8 for the construction of two buildings as follows: (1) Building for the Indiana University School of Medicine; (2) power house and laundry for Indiana University School of Medicine. For building, separate bids will be received on general contract, heating, ventilating, plumbing, elevator, electrical work and vacuum cleaning apparatus. For power house and laundry, separate bids will be received on general contracts, electrical equipment, ice-making and refrigerator machinery, radial brick stack, plumbing, including tunnel between the buildings, wiring, piping, etc. Plans and specifications are on file in the office of the architects and at the office of John W. Cravens, secretary of board of trustees, Bloomington.

HAWTHORNE, ILL.—Plans are being prepared by the Western Electric Company of Chicago, Ill., for the construction of a new factory building, 211 ft. by 675 ft., six

stories high, at Forty-second Avenue and Twenty-second Street, to cost about \$1,000,000.

HOMER, ILL.—The Homer Electric Light & Power Company is contemplating extending its electric transmission lines to Fairmount. The company recently made connections with Sidney.

ROCKFORD, ILL.—The proposal to issue \$500,000 in bonds for the purpose of establishing a municipal electric-light plant will be submitted to the voters at the April election.

ROCKFORD, ILL.—Contract has been awarded by the Rockford Motor Club for construction of power house and pumping station, in connection with the erection of a new club house.

EAU CLAIRE, WIS.—Plans have been prepared by Foeller & Schober, Green Bay, for the construction of a boiler house and laundry plant, 40 ft. by 95 ft., for the Sacred Heart Hospital at Eau Claire.

MADISON, WIS.—Bids will be received by M. E. McCaffrey, secretary of the University of Wisconsin, Administration Building, University of Wisconsin, Madison, until April 15 for the construction of the Mary Cornelia Bradley Memorial Hospital and Infirmary Buildings of the University of Wisconsin. Plans and specifications may be obtained at the office of secretary upon deposit of \$10 for each building.

MILWAUKEE, WIS.—Bids, it is understood, are being asked by the Fraser Company, 667 East Water Street, Milwaukee, for the construction of an elevator and storehouse at Oregon and Hanover Streets, to cost about \$200,000, for the L. Tewels Seed Company, 113 Clybourn Street, Milwaukee. New equipment, including electric motor, conveying machinery and tank, etc., will be required.

CROSBY, MINN.—At an election he'd recently the proposal to issue \$76,000 in bonds for the installation of an electric-light and power plant was carried.

HINCKLEY, MINN.—The Hinckley Electric Lighting Company, it is reported, is planning to rebuild its lines between Hinckley and Sandstone.

IONA, MINN.—The installation of a municipal electric-light and power plant, to cost \$10,000, is under consideration.

WILLMAR, MINN.—The contract for electrical work in connection with alterations and additions to the high school building has been awarded to Sterling Electric Company, 33 South Fifth Street, Minneapolis.

BOYDEN, IOWA.—The Board of State Railroad Commissioners has granted Veen-schoten Brothers of Boyden a franchise to erect and operate electric transmission lines on certain roads and highways in Sioux County for a period of 25 years.

DUBUQUE, IOWA.—Improvements will be made to the power plant at the local railroad shops of the Chicago, Milwaukee & St. Paul Railroad Company, involving an expenditure of about \$50,000.

HAMBURG, IOWA.—Orders have been placed by the Hamburg Electric Light Company for material and equipment for the installation of an entire new street-lighting system, including a new tub regulator, transformer and switchboard panel, all new hoods for street lamps, new poles and standards. All lamps will be hung in the center of the street intersections and all goosenecks will be removed.

GARDEN CITY, MO.—The local electric plant, owned by Kaufman & Son, is reported to have been purchased by the Green Light & Power Company of Pleasant Hill. The new owners, it is understood, will erect an electric transmission line to Garden City soon.

OSARK, MO.—The Ozark Coal & Mining Company is contemplating the purchase of power plant, coal-mining machinery, etc., to cost about \$6,000. M. V. Waterfield is secretary and manager.

GRAND FORKS, N. D.—Bids will be received by Charles Leissman, secretary of State Board of Regents, for the construction of a chemistry building at the State University at Grand Forks. Separate bids to be submitted as follows: (1) General contract; (2) steam heating and ventilating; (3) plumbing; (4) wiring. Plans and specifications are on file at the office of Charles Leissman, secretary of board, Bismarck, at the business office of the University, Grand Forks, and at the Builders' Exchange in Grand Forks, Bismarck and Fargo, N. D.; St. Paul, Minneapolis and Duluth, Minn., and Chicago, Ill.

BLACKWELL, S. D.—At an election held recently the proposal to issue bonds for improvements to the municipal electric-light plant and waterworks system was carried.

MILLER, S. D.—The City Council is considering calling an election to submit the proposal to issue \$30,000 in bonds for a

municipal electric-light and power plant and \$15,000 for water-works system to the voters.

SHERMAN, S. D.—The Village Board has granted Blm Brothers a franchise to supply electricity for lighting the streets and residences in Sherman.

FALLS CITY, NEB.—Contracts have been awarded for equipment for the municipal electric-light plant as follows: For engines to the Nordberg Manufacturing Company of Milwaukee, Wis., at \$28,000; generator and switchboard to the B-R Electric Company of Kansas City, Mo., at \$16,051. All bids on condenser equipment were rejected. Specifications will be revised and new bids called for soon.

LINCOLN, NEB.—The Board of Control has awarded the contract for construction of a new power house at the penitentiary to R. W. Stake of Lincoln, at \$3,280. The new building will replace the old structure on the west side of the prison inclosure, which will be torn down.

LINCOLN, NEB.—The State Board is considering the advisability of connecting the State House with the local electric-light plant for emergency service. The Lincoln Traction Company has offered to erect a connecting line from Twelfth and K Streets to connect with the line from the penitentiary plant if the State will pay \$250 to cover the expense of erecting the line and pay the regular rates for energy for emergency service.

LINCOLN, NEB.—The State Board of Irrigation has canceled the application of J. F. Johnson of Milford for a power site on the Blue River, south of Crete, and has allowed the petition of H. B. Babson of Chicago, Ill., for same site. The latter has filed a bond for \$1,000 to begin work on construction within six months. Mr. Babson is interested with Burdette Boyes of Seward in several power sites along the Blue River.

OMAHA, NEB.—The contract for electric wiring for the new telephone exchange of the Nebraska Telephone Company has been awarded to the Edwin C. Bennett Electric Company, City National Bank Building, Omaha.

SCHUYLER, NEB.—Preliminary plans are being prepared by the Electrical Development Company of Sioux City, Iowa, for improvements to the municipal electric-light plant. A bond election, it is expected, will be called soon.

CANEY, KAN.—Notice has been served on the Kansas Light & Power Company, which owns and operates the local plant, that unless repairs are made to its plant and the service greatly improved the city will take over and operate the system. The electric plant was burned down about a year ago and since then has been taken over by the above company.

EL DORADO, KAN.—The City Commissioners have decided to extend the ornamental street-lighting system.

GARDNER, KAN.—The City Council has under consideration the installation of a municipal electric-light plant. A statement made by Mr. Bushong, an engineer of Ottawa, concerning the cost of establishing a plant here with an electric transmission line places the cost at about \$17,000 and with a power plant at approximately \$21,000. A committee has been appointed by the Council to make investigations and report at the next meeting.

LARNED, KAN.—The City Council is considering extending the electric transmission lines of the municipal electric-lighting plant to neighboring towns to supply electrical service.

LURAY, KAN.—Preparations are being made for improvements to the municipal electric-light plant, including the purchase of new equipment and construction of new power house. Bids for the proposed work, it is understood, have been received.

RANDOLPH, KAN.—The Council has adopted an ordinance authorizing a contract with the Riverside Light & Power & Gas Company for lighting the streets of Randolph with electricity.

SALINA, KAN.—The Robinson Milling Company has awarded the general contract for construction of mill and elevator to the Eberhardt Construction Company. Two buildings will be erected, one 36 ft. by 100 ft., six stories, and the other two stories, 36 ft. by 100 ft., at a cost of about \$250,000.

SALINA, KAN.—Contract has been awarded by the Shellabarger Mill & Electric Company to the Eberhardt Construction Company for the construction of an addition to its mill, 54 ft. by 70 ft., two stories high, including electric wiring, complete refrigerating apparatus, etc. The cost is estimated at \$150,000.

WESTMORELAND, KAN.—H. Holden, representing the Riverside Light & Power Company of Abilene and of the Rocky Ford plant, has submitted a proposal to the

local business men offering to extend its electric transmission lines to Westmoreland and furnish electrical service, provided the city will pay the expense of building the proposed line.

Southern States

FOREST CITY, N. C.—The Alexander Manufacturing Company, recently organized with a capital stock of \$200,000, is planning to erect a mill to manufacture hosiery yarn. The proposed mill will be equipped with 10,000 spindles and with electrically-driven machinery. R. C. Biberstein of Charlotte, N. C., is architect.

TY TY, GA.—At an election held recently the proposal to issue \$7,000 in bonds for the installation of a municipal electric-light plant was carried.

VALDOSTA, GA.—Extensive improvements are contemplated at the Ocean Pond club house, including the installation of an electric-light plant to supply electricity for lighting the house and grounds.

COLUMBIA, TENN.—Steps have been taken by M. R. Sterns of Nashville and associates to organize a company, to be capitalized at \$200,000, to construct and operate an electric generating plant on the Duck River near Columbia. The plans provide for a 10,000-hp. development.

BIRMINGHAM, ALA.—The Birmingham Tidewater Railway Company is contemplating extending its railway from Pratt City to Ensley, a distance of 3 miles.

CHICKASAW, ALA.—The Chickasaw Shipbuilding Company is planning the construction of an electric generating plant, to cost about \$750,000, in connection with its \$10,000,000 shipbuilding plant now under construction.

COLUMBIA, ALA.—Work has begun on the enlargement of the Omsussee plant of the Columbia Power Company, to cost about \$500,000. The company, it is reported, is contemplating establishing a plant at Kelson, to cost approximately \$500,000. Tucker & Laxton of Charlotte, N. C., have charge of the work at the Omsussee.

VICKSBURG, MISS.—A 1500-kw. turbine, it is reported, is being installed in the plant of the Vicksburg Light & Traction Company.

DELIGHT, ARK.—The Council has granted B. F. Ryon of Texarkana a franchise to construct and operate an electric-light plant in Delight.

HELENA, ARK.—Extensions, including the installation of additional machinery, it is reported, are under consideration by the Helena Gas & Electric Company.

STUTTGART, ARK.—The erection of a grain elevator is reported to be under consideration by the Stuttgart Flour Mills.

TEXARKANA, ARK.—The city of Texarkana is planning to equip a sewage disposal and pumping plant, to cost about \$140,000. L. T. Peden of Houston, Tex., is consulting engineer.

JENNINGS, LA.—Extensions to the electric-lighting system are under consideration by the City Council.

BRISTOW, OKLA.—At an election held recently the proposal to issue \$6,000 in bonds for the purchase of the local electric-light plant and installing an ornamental street-lighting system throughout the city was defeated.

FERGUSON, OKLA.—The Elaine County Salt Company, it is understood, will require considerable electrical equipment in connection with a new salt plant.

LAVERNE, OKLA.—The city has taken over the plant of the Laverne Light, Power & Ice Company, to be owned and operated by the municipality.

MIAMI, OKLA.—Local business interests, it is reported, have subscribed \$200,000 toward the construction of the proposed electric railway from Miami to Picher and other mining towns.

MUSKOGEE, OKLA.—Contract for the construction of the long-discussed Grand River dam, it is reported, has been awarded to L. S. Skelton of Oklahoma City. The proposed hydroelectric power plant will generate electricity to be distributed in Muskogee and other cities within a radius of 50 miles.

OKMULGEE, OKLA.—Plans are being prepared by Burns & McDonnell, Kansas City, Mo., Interstate Building, for improvements to waterworks and pumping plant and sewage disposal plant, to cost about \$150,000.

RYAN, OKLA.—Plans are being considered for the installation of a crude oil engine in the municipal electric light and water plant.

SAPULPA, OKLA.—The contract for the electrical work for the new high school building has been awarded to the Electrical Contracting Company of Tulsa. The cost of the building complete is estimated at \$200,000.

DENISON, TEX.—The installation of a municipal electric-light plant in Denison is under consideration.

FORT STOCKTON, TEX.—The Pecos & Rio Grande Telephone Company is contemplating extending a telephone line into Loon Valley, on which work will begin as soon as material can be procured.

FORT WORTH, TEX.—The Missouri, Kansas & Texas Railway Company, it is reported, will rebuild its local coal chute, recently destroyed by fire. F. Ringler of Dallas is chief engineer.

GRAND SALINE, TEX.—The three buildings being erected by the Grand Saline Salt Company will be equipped with vacuum pans, pumps and engines for refining salt by the vacuum tank method.

McKINNEY, TEX.—The Texas Light & Power Company, it is reported, will rebuild the local electric-light plant, recently destroyed by fire, causing a loss of about \$8,000.

Pacific and Mountain States

BELLINGHAM, WASH.—The stock and equipment of the Mills & Larson electric store at 1331 Dock Street has been purchased by the Modern Electric Company, 13.2 Dock Street. Both stores will be operated at present, but later the retail store will be removed to the location formerly occupied by Mills & Larson and the store at 1322 Dock Street will be converted into a battery station and electric repair shop. The contracting business of Mills & Larson will be continued.

CHENEY, WASH.—Preparations are being made by the F. M. Martin Grain & Milling Company for the construction of an 800-barrel flour mill to replace its present mill. A five-story building, equipped with a 15,000-bushel elevator, to cost about \$85,000, will be built.

SEATTLE, WASH.—The Rothert Process Steel Company is contemplating an addition to its smelter (100 ft.) and the installation of a 10-ton electric furnace. The offices of the company are located at 622 Harriman Street, Seattle.

SPOKANE, WASH.—Negotiations will soon be under way for a new general street-lighting contract. It is proposed to replace the present arc-lamp lighting system with nitrogen-filled lamps.

TACOMA, WASH.—The City Council has decided to submit the proposal to issue \$4,000,000 in bonds by which the city of Tacoma will secure a new power plant at the city election to be held on April 16. The ordinance provides that the Council shall select the site for the plant, the work to be done by either the "cost plus 10 per cent" plan or by force account; it also provides for offers from holders of power sites for the sites and completed power stations, together with transmission lines to the city. No bid will be considered on a site and station that will not develop 22,000 kw. regularly and 30,000 kw. in a six-hour stretch every day. Several offers have been submitted to Commissioner H. F. Gronen, including the Lake Cushman site and the Packwood Lake site in Lewis County. Portland parties have offered to build a plant at an unnamed site for \$3,900,000.

IONE, ORE.—The Jordan Elevator Company of Corvallis is contemplating the construction of an elevator at Ione, with a capacity of 100,000 bushels, to cost about \$35,000.

KLAMATH FALLS, ORE.—The California-Oregon Power Company of Klamath Falls has been appointed by the federal authorities as agency to make a survey of southern Oregon and northern California. A military map is being prepared to outline the company's work in this section.

PORTLAND, ORE.—A permit has been granted to the Northwestern Electric Company, Pittock Building, for the erection of a building at the foot of Lincoln Street, to cost about \$15,000.

LOS ANGELES, CAL.—Arrangements, it is understood, have been made by the City Council for financing the project and awarding contract for the installation of the new ornamental lighting system for Broadway.

SAN DIEGO, CAL.—An appropriation of \$750,000 has been made by the United States government for the construction of a naval aeronautical academy at North Island, San Diego. The plans provide for a department for building and repairing aeroplanes, etc. The cost is estimated at about \$2,000,000.

GRANGEVILLE, IDAHO.—Work is under way on the construction of a large dam on Clearwater River, 8 miles from Grangeville, which when completed will double the output of the present plant. The dam is in circular form, 400 ft. long and 20 ft. high, and, it is estimated, will develop about 1600 hp.

SALT LAKE CITY.—Application has been filed with the State Engineer by G. R. Corey of Salt Lake City for permission to use 125 ft. of water from Price River to develop about 1600 hp. The proposed plant would be located within a few miles of Helper and would involve the construction of a concrete dam, 3 ft. high and 40 ft. long, the water to be conducted in a ditch for a distance of 1½ miles, passing two 4-ft. wheels, under an 85-ft. head.

HARLEM, MONT.—The contract for the installation of the new ornamental lighting system in Harlem has been awarded to the Electric Construction Company of St. Paul, Minn., at \$4,550.

MANVILLE, WYO.—The installation of a new electric-light plant in Manville is reported to be under consideration. The cost is estimated at \$30,000.

WHEATLAND, WYO.—The contract for the new equipment for the municipal electric-light plant has been awarded to the Fairbanks-Morse Company. A new 150-hp. fuel oil engine and a 120-kw. generator, directly connected, and a new switchboard will be installed.

MONTROSE, COL.—The ordinance granting the Western Colorado Power Company a new 20-year franchise to operate in Montrose has passed its first reading in Council.

COLUMBUS, N. M.—The Columbus Electric Light & Power Company, it is reported, contemplates the construction of an electric-light and power plant to supply electricity in Columbus and Camp Furlong. The cost of the proposed plant is estimated at about \$30,000.

Canada

PINCHER CREEK, ALTA.—The town of Pincher Creek is considering the installation of an oil-burning engine and a 50-kw. generator in the municipal electric light plant, provided it can dispose of the present equipment, which is too large for the size of the town. H. Bossenberry is chairman of light committee.

MURRAYVILLE, B. C.—The British Columbia Electric Railway Company has begun work on equipping the new Laking mill for electrical operation and will extend its service in this section, installing lighting systems in several residences and large ranches.

VANCOUVER, B. C.—The contract for electrical work in connection with remodeling the Wallace shipyards has been awarded to the Mudy, Rowland Company. The entire power system will be reconstructed.

COBDEN, ONT.—Plans are being considered to raise the storage dam of the Cobden light and power plant about 2 ft., to enable the plant to furnish a 24-hour service during the dry season. G. A. Parr is treasurer.

OTTAWA, ONT.—Tenders will be received by John A. Pearson, architect, and J. O. Marchand, associate, Center Block, Parliament Buildings, Ottawa, until April 11, for electric wire and cable for the reconstruction of the Parliament buildings. Specifications and other information may be obtained at the office of P. Lyall & Sons Construction Company, Ottawa.

GRAND'MERE, QUE.—The construction of an electric railway from Grand'Mere to Shawinigan Falls, to cost about \$100,000, is under consideration by the business men of both places.

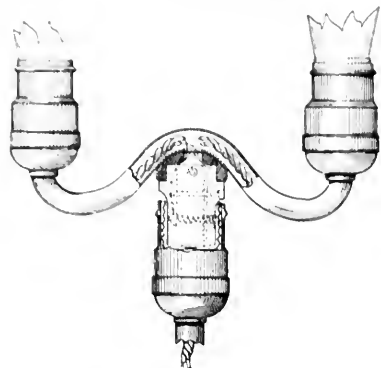
Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 11, under Circular 1206, for furnishing electric elevators, scales, etc.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until April 11, for furnishing electric elevator, scales, copper, pipe covering. Blanks and further information relating to this circular (1208) may be obtained from the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

(Issued Feb. 26, 1918.)

- 1,257,664. RECEIVER OF ELECTRICAL OSCILLATIONS; Roy A. Weagant, Roselle Park, N. J. App. filed June 18, 1911. Wireless telegraph.
- 1,257,663. RELAY; Alfred A. Ziegler, Boston, Mass. App. filed Jan. 8, 1913. Railway signaling apparatus.
- 1,257,669. INSULATED ELECTRIC CONDUCTOR; William L. Bliss, Niagara Falls, N.



1,257,973—Lighting Fixture

- Y. Means for increasing the efficiency of flexible insulation for electric leads.
- 1,257,672. MEANS FOR DETECTING ELECTRICAL OSCILLATIONS; Elmer E. Butcher, Interlaken, N. J. App. filed March 24, 1914. The receiving end of a wireless-telegraph system.
- 1,257,687. AUTOMATIC FIRE-ALARM SYSTEM; John H. Fleming, Seattle, Wash. App. filed Nov. 23, 1916. Small amount of heat from a fire will automatically start a phonograph and will release the cut-out on a telephone.
- 1,257,694. TIMER; William Gadke, Philadelphia, Pa. App. filed May 1, 1915. Novel form of contact-making device.
- 1,257,702. RAILWAY SIGNALING SYSTEM; John B. Harlow, Upper Montclair, N. J. App. filed April 20, 1917. Improvements.
- 1,257,715. SELECTOR SWITCH; John A. Kropp, Oak Park, Ill. App. filed Oct. 11, 1916. Two-movement type.
- 1,257,720. AUTOMATIC TELEPHONE - EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed July 2, 1917. Applies particularly to impulse-controlling systems.
- 1,257,730. ATTACHMENT-PLUG CAP; Lembert H. Moulthrop, Philadelphia, Pa. App. filed Nov. 23, 1916. Novel means for holding its fixed contacts in place.
- 1,257,743. INDICATION APPARATUS FOR RAILWAY-TRAFFIC-CONTROLLING APPARATUS; John E. Saunders, Edgewood Borough, Pa. App. filed July 12, 1917. Improvements.
- 1,257,758. BATTERY BOX AND LANTERN; Robert J. Stephenson, Auburn, N. Y. App. filed Aug. 7, 1914. Lantern is readily accessible.
- 1,257,784. STARTER FOR INTERNAL-COMBUSTION ENGINES; John A. Beirns, Detroit, Mich. App. filed Dec. 9, 1912. Apparatus for controlling the electric starting mechanism on automobiles.
- 1,257,801. MEANS FOR UTILIZING ELECTRICITY; Walter S. Burke, Cambridge, Mass. App. filed July 1, 1912. Water heated by electrical heaters.
- 1,257,828. MEASURED-SERVICE TELEPHONE SYSTEM; John Erickson, Chicago, Ill. App. filed May 5, 1911. Substation service meter.
- 1,257,821. STARTING ARRANGEMENT FOR INTERNAL-COMBUSTION ENGINES IN WHICH AN ELECTRIC STARTING MOTOR IS USED; Auguste Dutreux, Issy-les-Moulineaux, France. App. filed July 21, 1915. Electromagnet effects the coupling of the two motors.
- 1,257,832. TELEPHONE AUTOMATIC TRUNKING SYSTEM; Edward D. Fales, La Grange, Ill. App. filed Aug. 10, 1907. Automatic or semi-automatic telephone-exchange systems.
- 1,257,873. VACANT-SEAT DETECTOR FOR THEATERS; John E. Johnson, Beaver Falls, Pa. App. filed Aug. 16, 1916. Simple and efficient apparatus enabling patrons of theaters to detect vacant seats.
- 1,257,884. ALTERNATING-CURRENT MOTOR; Willem C. Korthals-Altes, Schenectady, N. Y. App. filed Dec. 28, 1915. Improved alternating-current commutator motor.
- 1,257,913. ELECTRIC TELEGRAPH; Oskar Moll and Paul Kuschewitz, Blackheath,

Record of Electrical Patents

Notes on United States Patents

- England. App. filed April 25, 1914. Eliminates disturbing influences in telephone or other lines provided with sensitive receiving instruments.
- 1,257,917. ELECTRICAL CONTACT; Arvid H. Nero, New Britain, Conn. App. filed July 24, 1917. Adapted to withstand repeated engagement with the jacks of an attachment plug without excessive deformation.
- 1,257,925. PUSH SWITCH; Johann G. Peterson, Jersey City, N. J. App. filed June 16, 1916. Cross-bar insulated from the bracket.
- 1,257,931. STORAGE BATTERY AND BOX RETAINER; Walter C. Rowell, Santa Ana, Cal. App. filed Aug. 20, 1917. Battery jar which is formed with a bottom portion within which sediment may accumulate.
- 1,257,955. OUTLET BOX; Alger E. Gibbons, Boston, Mass. App. filed Dec. 29, 1916. Special provision for clamping the spirally wound armor surrounding wires securely in its operative position.

(Issued March 5, 1918.)

- 1,257,969. BATTERY; Edmund H. Becker, Washington, D. C. App. filed June 20, 1916. Means for revivifying a dry cell.
- 1,257,971. GENERATOR FOR SUSTAINED ELECTRIC OSCILLATIONS; Joseph Bthenod, Paris, France. App. filed Feb. 17, 1917. Utilization of the properties of the cathode rays.
- 1,257,973. LIGHTING FIXTURE; August Bouchery, Brooklyn, N. Y. App. filed May 24, 1915. Adapted to carry a single lamp or a plurality of lamps.
- 1,257,977. ROTARY CONVERTER; Lewis W. Chubb, Edgewood Park, Pa. App. filed July 6, 1915. Current neutralization and heat generation distributed.
- 1,257,978. ELECTRICAL TRANSFORMING AND RECTIFYING SYSTEM; Lewis W. Chubb, Edgewood Park, Pa. Improvements.
- 1,257,983. INSULATOR; Clyde T. De Vaughn, Parkersburg, W. Va. App. filed March 8, 1917. Attachment to line without the use of tie wires or similar binding means.
- 1,257,997. ELECTRIC FURNACE; Henry A. Greaves and Harry Etchells, Sheffield, England. App. filed March 1, 1917. Method of distributing two-phase and three-phase currents to electric arc furnaces.
- 1,258,000. SIGNALING SYSTEM; John L. Hall, Schenectady, N. Y. App. filed Sept. 23, 1915. For vessels.
- 1,258,005. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Feb. 3, 1915. Polyphase railway induction motors operated from a single-phase source.
- 1,258,010. CIRCUIT INTERRUPTER; Henry D. James, Edgewood Park, Pa. App. filed April 18, 1917. Normally inclosed type.
- 1,258,019. SELECTOR SYSTEM FOR TELEGRAPH TYPEWRITERS; Edward E. Klein-schmidt, New York, N. Y. App. filed April 17, 1916.
- 1,258,022. ILLUMINATED DEVICE; John A. Kray, Lancaster, Pa. App. filed May 4, 1917. Means for illuminating the upper end of a flagstaff.
- 1,258,030. ELECTRICAL MEASURING SYSTEM; Paul McGahan, Pittsburgh, Pa. App. filed April 29, 1915. Operates correctly irrespective of the length of the pilot wires.
- 1,258,050. CONTROL APPARATUS; Karl A. Simmon, Edgewood Park, Pa. App. filed Oct. 9, 1914. Liquid rheostats.
- 1,258,051. ELECTRICAL INSULATOR; Alexander B. Simpson, Jersey City, N. J. App. filed April 21, 1914. Hollow-tube insulator having screws to clamp the insulation of the group of interconnected wires.
- 1,258,075. ELECTRIC FUSE LIGHTER; Edwin C. Wood, Denver, Col. App. filed June 17, 1916. Lighting fuses in mines.
- 1,258,098. IGNITION SYSTEM; Alfred C. De Loime, East Orange, N. J. App. filed May 18, 1917. Used in aero and hydro planes.

- 1,258,115. CLUTCH; Clark T. Henderson, Milwaukee, Wis. App. filed Feb. 1, 1913. Improved means for ventilation.
- 1,258,116. MOTOR-CONTROL SYSTEM; Clark T. Henderson and Arthur Simon, Milwaukee, Wis. App. filed May 24, 1915. Eliminates arcing upon de-energization.
- 1,258,144. ELECTRICAL SIGNALING APPARATUS; Henry E. Reeve, Brooklyn, N. Y. App. filed March 28, 1917. Electrical connections housed and protected and readily accessible for wiring and inspection.
- 1,258,154. DYNAMO-ELECTRIC MACHINE; Francis H. Shepard, New Rochelle, N. Y. App. filed Dec. 4, 1914. Electric-railway type.
- 1,258,157. WIRELESS-TELEGRAPH APPARATUS; Frederick G. Simpson, Seattle, Wash. Improvements.
- 1,258,161. THERMOSTAT; George E. Spear, Boston, Mass. App. filed March 27, 1915. Efficient and compact.
- 1,258,164. DEVICE FOR CONTROLLING VARIATIONS IN VARIOUS MEDIUMS; Charles J. Stuart, Somerville, Mass. App. filed June 2, 1914. Simple device which may be employed in connection with chart recording gage.
- 1,258,169. IGNITION SWITCH; Leo K. Werner, Newark, N. J. App. filed June 23, 1917. Duplex system.
- 1,258,176. DYNAMO-ELECTRIC MACHINE; Ernest J. Andrews, Lombard, Ill. App. filed April 18, 1914. Active conductors in the armature may be varied.
- 1,258,186. ELECTRIC FUSE; James O. Camp, New Decatur, Ala. App. filed Sept. 7, 1916. Plurality of fuse wires.
- 1,258,211. INSULATOR SUPPORT; Walter T. Goddard, Hamilton, Ontario, Canada. App. filed Aug. 25, 1915. Improvements.
- 1,258,231. ELECTRIC VAPORIZER AND HEATER; William B. Lucas, Oak Park, Ill. App. filed Nov. 30, 1917. Quickly responsive.
- 1,258,244. ELECTRICAL ORDER - TRANSMITTING SYSTEM AND THE LIKE; William John Ricketts, Brockley, London, England. App. filed March 6, 1915. Permutating means at both transmitting and receiving station.
- 1,258,254. STREET SIGNAL; William H. Robertson, Madison, Wis. App. filed Jan. 13, 1917. Adapted for actuation of conductor of the car.
- 1,258,256. ELECTRIC SWITCH; Joseph Sachs, Hartford, Conn. App. filed March 31, 1915. Snap switch.
- 1,258,257. DRY-CELL BATTERY; John H. Sangers, Cleveland, Ohio. App. filed July 31, 1917. Preserves voltage until the chemicals and the zinc are completely exhausted.
- 1,258,261. PRODUCTION OF MAGNESIUM; George O. Seward, Jersey City, N. J. App. filed July 3, 1915. Improvements.
- 1,258,265. BATTERY; Edward Sokal, Chicago, Ill. App. filed Nov. 21, 1914. Electrolyte forcibly conducted through the pores of the electrodes.
- 1,258,266. PRIMARY BATTERY; Edward Sokal, Chicago, Ill. App. filed Oct. 22, 1915. Single fluid.
- 1,258,284. MEASURING INSTRUMENT; Morris F. Weinrich, New York, N. Y. App. filed Aug. 6, 1916. Improved means for adjusting the torque.
- 1,258,304. CABLE TERMINAL; Joseph W. Bishop, Salt Lake City, Utah. App. filed Feb. 24, 1917. Cable terminal securely held to the cable strands without the aid of set screws.



1,258,304—Cable Terminal

- 1,258,305. ROTARY SWITCH; Bornett L. Borroff, Milwaukee, Wis. App. filed Jan. 26, 1917. Occupies minimum amount of space.
- 1,258,317. PEN FOR RECORDING METERS; Almon W. Copley, Wilkinsburg, Pa. App. filed March 20, 1912. Pen simple in construction.
- 1,258,335. IGNITION ARRANGEMENT FOR INTERNAL-COMBUSTION ENGINES AND OTHER PURPOSES; Herbert A. Humphrey, Westminster, London, England. App. filed May 11, 1908. Ignition effected within a considerable range of pressures.
- 1,258,346. ELECTRIC WATTMETER; Paul M. Lincoln, Pittsburgh, Pa. App. filed May 18, 1915. Measures electric power used, in approximate proportion to the real cost.

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Private Capital Needed for Water-Power Development

THAT was an admirable statement made by Secretary Lane before the House water-power committee in Washington last week. No clearer statement appears in the record of the hearings, and we might add no saner. It is necessary that there should be real development of our water-power resources, and that soon. All are agreed as to that, and all are agreed that every safeguard should be thrown around the public and the government. As for the investor, that is another matter on which there are varying opinions. In the opinion of the Secretary of the Interior, all water-power propositions are gambles, and for that reason any one putting money into a hydroelectric project has got to have very real consideration. He is a developer, a pioneer who takes a risk, and for that risk he ought to be compensated. It certainly is futile in the present emergency to enact legislation which will bring no results. If private capital is sought for hydroelectric work, those with money to invest naturally are interested in the rate of return such securities will command. If investments in equivalent enterprises bring greater returns, money will flow in that direction, and there will be no development of water powers by private capital. The rate of return which will attract capital to hydroelectric utilities is a determinable fact, and Congress should make an honest effort to ascertain it. If determined correctly, the money for these hydroelectric enterprises will be forthcoming, and if the rate is too low it will not. The only way to get results and get them promptly is to be liberal; the surest way to check development is to be niggardly. The whole question of water-power development simmers down to a choice between these two, and on the present Congress rests the decision.

Concord in War Labor Program

THE liberal labor program laid down last week by the war labor conference in its report to Secretary Wilson, if rightfully observed, will prove a boon to war industries, which now include many electrical manufacturing companies. Its vital sections should be read by every laborer and employer in the country, and we trust the fairness of these sections will commend themselves to both alike. Certainly organized labor has conceded its strongest weapon, the right to strike, and it is inconceivable that capital shall refuse to make sacrifices comparably as great. If maximum production is to be obtained, and nothing short of that will

suffice to win the war, there must be no lingering reservations in the mind of either labor or capital. By and large, employers have co-operated whole-heartedly in every movement suggested by the national government for the successful prosecution of the war. Labor has not been one whit less patriotic, although there have been honest differences between labor and capital on the means for effecting the end. Now that a working agreement between them has been reached, greater outputs should accrue, and who can tell but that the beneficent work of co-operation will extend for a period long after the war has ceased?

Conservation Versus Efficiency in Lighting

THE paper by A. L. Powell on lighting curtailment in the industries is one deserving very serious consideration. It is a sad fact that in many instances the Fuel Administration has been raising a lamentable cloud of smoke for a very little effective fire. It seems to have traveled on the theory that to produce the requisite psychological effect conservative statements should be abandoned in favor of scare headlines. The unfortunate results of this policy are very clearly shown in Mr. Powell's presentation of the case. The effect has been in certain instances to produce frantic attempts at economy which have seriously cut down the efficiency of some of the very plants on which the government is depending for its war needs. It is progressively more difficult to persuade the plant manager to light his works properly for the purposes of their use because of the noisy flurry raised by the Fuel Administration. Of course, one cannot suppose that such an unfortunate result was intended.

Mr. Powell's investigations bring to light a condition which must be remedied. In point of fact in a vast number of industrial establishments engaged on government work, where improvement in the lighting installation would not only actually save coal but considerably increase the efficiency of the workmen, and where, as in one of the instances cited here, the lighting cost is a minute proportion of the labor cost, a very small increase in the efficiency of labor would justify a considerable proportionate increase in the amount actually spent for electrical energy. The vital matter is to install lighting enough to bring the efficiency of production to a maximum and to produce this lighting at as small an expenditure of energy as the required result permits. Modern lamps in proper shades, installed in clean and bright surroundings, give illumination at a surprisingly small cost. Electrical energy is in fact about the cheapest of our necessities,

and the only one of which the cost has not risen outrageously. To curtail its use beyond the point which permits of the most efficient work is bad economy from every point of view, and particularly bad when the product is one of which the government is in dire need. It might save a few tons of coal to dispense with artificial lighting in shipbuilding plants, but the petty economy would not go far toward replacing the tonnage sunk by the U-boats.

We are not putting in a brief for the lighting companies, but we are asking in the name of common sense and sound patriotism that a check be put on the silly camouflage now altogether too common, and that every effort be made to drive directly at that larger conservation which produces big results instead of pitifully small ones.

Improving Synchronous-Motor Starting Qualities

THE synchronous motor possesses, as is well known, a great advantage over the induction motor in that it can be operated at a high power factor at any load, whereas the ordinary induction motor is characterized by a relatively low power factor, particularly at light loads. On the other hand, the synchronous motor, operated within the range of rated-load current strength, has a relatively feeble starting torque and prefers to start without load, whereas the induction motor has an excellent starting torque.

Various plans have been either adopted or proposed for modifying the synchronous motor so as to incorporate in it the advantageous qualities of induction motors. For example, copper grids, resembling portions of a squirrel-cage winding, have been applied to the stator pole faces of a synchronous motor, with the object of suppressing oscillations in angular velocity and also of increasing the starting torque.

Prof. Theo. Schou presents an article on the subject this week in which he suggests various changes in design for improving the starting qualities of synchronous motors. Among them it is proposed to utilize skin effect in squirrel-cage conductors. As a rule, the extra resistance in a conductor due to non-uniform distribution of alternating-current density over the cross-section is a pure detriment, calling for minimization and obviation. The higher the frequency of alternation, the greater the skin effect and the greater the extra resistance in the conductor due to skin effect. At starting the frequency in the squirrel-cage conductors is line frequency. At synchronism it becomes vanishingly small. In order that a strong starting torque may be combined with a strong synchronizing torque in a squirrel cage it is desirable that the resistance of the squirrel cage should be relatively large at standstill and relatively small at synchronism. This is just the condition that tends to be produced automatically by skin effect in the squirrel-cage conductors, if they are of such dimensions as to make the skin effect prominent. This property of skin effect in aiding the torque qualities of squirrel cages applies not only to synchronous motors, but also to induction motors. Consequently even so objectionable a property as the skin effect in alternating-current conductors is capable of being utilized under certain conditions. One is thus reminded that it is an ill wind which blows nobody good.

Industrial Load Relation to System Load Curve

IN THESE days when central stations are so actively engaged in ministering to the needs of industrial plants the character of their various load curves becomes a very important item in reckoning with the electrical supply problem. J. E. Mellett's paper in the current issue is particularly instructive as summarizing the actual results obtained from a large number of industries, many of them gathered from a group large enough to give something like a fair average for the particular work involved. The Georgia Railway & Power Company covers a large territory, and its experience may be regarded as rather typical.

Looking over the charts which represent the experience obtained, one is immediately struck by the necessary element of uniformity introduced by the customary hours of labor. Integration of the load from all these industries over the period from 8 in the morning to 6 at night would show a remarkably steady load factor over this period. Calls for more energy during the night come from comparatively few of the works served. Refrigeration in its various forms shows about the only case of increasing night load, although a few other industries work on a twenty-four-hour basis and consequently have about the same demands day in and day out. From the standpoint of load factor the addition of a twenty-four-hour load raises the day maximum about as much as it raises the night maximum, taking industrial plants as a whole.

Of course, the lighting load is intrinsically a night load, and it would be very interesting to know what this particular network is doing in the way of lighting load toward building up its all-day output into something like uniformity. So little work is done at night which is not also continued through the day that lighting, and particularly public lighting, becomes almost the sole outlet for energy during half the hours of the twenty-four. Taking the whole service as it comes, there is the usual heavy drop during the noon hour, a seasonal drop in the late afternoon, and a minimum between dawn and the time at which the industrial work starts up. These hollows in the load curve one cannot reasonably hope to fill.

The effect of the daylight saving program upon the situation cannot be neglected. It will undoubtedly decrease the minimum in the early evening and tend to raise the minimum in the early morning, particularly since the present regulations carry through the month of October. But until some one discovers industries which can with great advantage be pushed hard during the night the present inequalities will continue.

Some efforts have here and there been made to stimulate night consumption of energy by lowered rates, as yet without any considerable result. It is possible that certain work in which very cheap power is demanded, as in some electrochemical industries, may be able to furnish this greatly to be desired load. It is quite conceivable that certain processes which normally are carried on continuously could take advantage of a lowered night power rate to lessen the average cost of energy by pushing the production during the ordinary hours of darkness. Meanwhile our readers will find much of value in the experiences which Mr. Mellett relates.

Pushing the Output of Turbo-Generators

INABILITY to obtain generating equipment to care for increasing loads, not to mention the ever-soaring price of the equipment itself, lends new interest to the possibility of increasing the output of existing apparatus through purely mechanical means, notably ventilation. On this point we published in the issue of March 16 a very timely contribution from L. H. Parker and J. J. Preble, which gave a lively idea of the dependence of generator output on the conditions of ventilation.

With the immense output now frequently obtained from single units has come a very large amount of energy generated per cubic foot in the turbine room, and since the output in modern machines finds its limitation in heating, the difficulty of keeping a plant and its contents cool has rapidly increased. Efficient as these big units are, the loss of energy quantitatively converted into heat is astonishingly big in the total, and provisions for disposing of the heat and keeping the operating temperature of the machine down to safe limits have to be on a correspondingly liberal scale. For example, a 20,000-kva. turbo-generator requires under ordinary practice for its necessary ventilation the passage of about two and a half tons of air per minute. Were clean and cool air steadily available the necessary cooling, despite the large amount of air to be dealt with, would be relatively simple. It is an unpleasant fact, however, that air carries dirt with it, and it is estimated that under the conditions just cited the air will ordinarily carry something like one one-hundred-millionth part of its volume of dirt, which would figure up to nearly a cubic foot of dirt per day passing through, and in part lodged in, the machine.

The ventilating air passages in a turbo-generator are necessarily somewhat contracted, and when coated with dirt the effect is not only to lessen the air supply but to lessen its effectiveness by putting a non-conducting covering over the hot surface. Messrs. Parker and Preble, therefore, very reasonably put in a plea for proper cleaning of the air used for ventilation, both to help the efficiency of the process and to avoid the necessity of elaborate cleaning at not very infrequent periods. In addition, they lay considerable stress on the desirability of cooling the air artificially as part of the process of cleaning and conditioning it, so that its effectiveness in carrying off heat for the machine will be duly increased. If the ventilating air could be kept down to a winter temperature, 40 deg. to 50 deg. Fahr., the output of the machine for a fixed heating limit could be increased something like 20 per cent. Air washing accomplished thoroughly by spray or similar

means actually does cool the air by not inconsiderable amounts, varying with the temperature and degree of saturation of the air treated. Using spray treatment to clean the air, our contributors show that a cooling effect of roughly something like 10 deg. Fahr. is easily obtained, particularly in hot weather, when it is needed most. From these data they figure that the average increase in output capacity due to the use of clean and cooled air will amount under ordinary circumstances to at least 5 per cent, and on this basis they show that such treatment of the entering air is a paying proposition. The fact that several hundred stations are already equipped in this way is sufficient evidence that the importance of the matter is being practically appreciated.

Work of Outdoor Substations

WE PRESENT in the current issue an instructive little account of a California outdoor substation by L. J. Moore which is worth a careful reading on account of the simplicity of the equipment. It gives a very good notion of the line along which substation design is now drifting. The plant considered is for a 66,000-volt transmission, lowering the tension to 11,000 for distribution circuits. The construction is a little out of the ordinary in the use of wood poles with suspension-type insulators. The high price of steel on the Pacific Coast and the ease with which first-class wooden poles are obtained make the use of the latter rather attractive, particularly as the company operating the substation already maintains an open-tank creosoting plant for treating its poles. High-tension switches, both oil and air-break, are used in the 66,000-volt lines connecting with the bus at the same voltage which loops around the substation. The spacing employed is rather greater than usual, 7 ft. (2.1 m.), to lessen the danger of arcs, and the transformer bank is likewise connected to the high-voltage bus through air-break and oil switches of the outdoor type.

A variation of the usual practice is introduced in the construction of a small corrugated-iron substation house for the 11,000-volt oil switches which handle the seven feeders and for the metering equipment. It was found that for this amount and class of apparatus the difference in cost between the outdoor and indoor types was sufficient to cover the cost of the house, which also provided shelter for the station operator in bad weather. The course thus followed was probably a wise one, since it is much easier to make the smaller apparatus for indoor use.

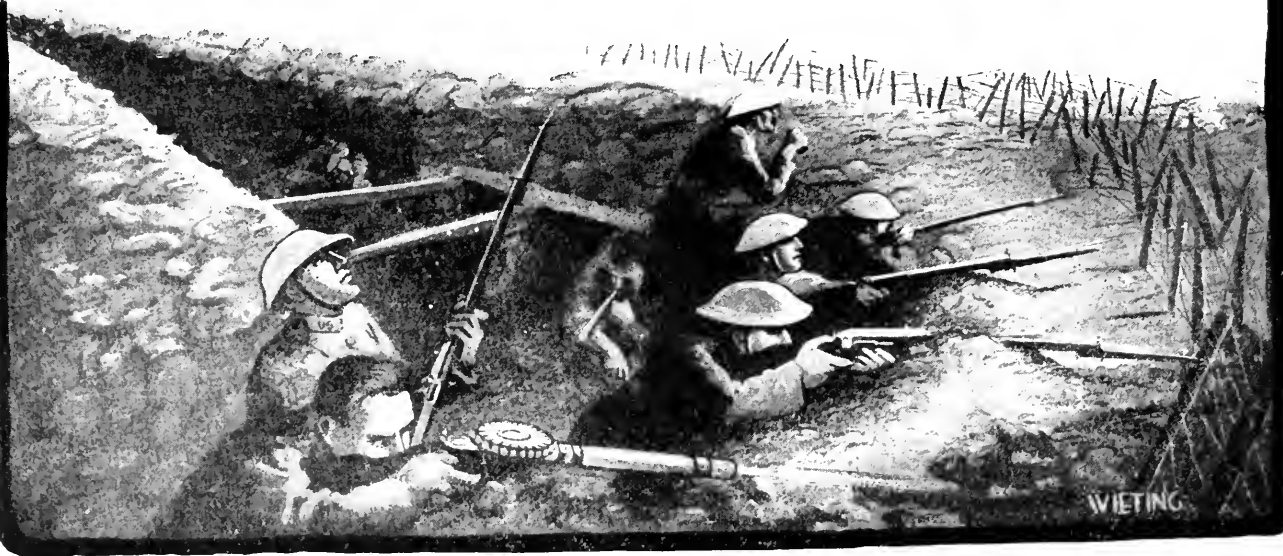
THE application of incandescent lamps to purposes hitherto served by carbon arc lamps has been considerably extended by the development of gas-filled incandescent lamps. Until recently, however, it was thought that incandescent lamps would never entirely replace arc lamps for projection lighting. In an early issue of the *ELECTRICAL WORLD* an article will be presented pointing out how the obstacles have been overcome. Since the safety of considerable apparatus and the reliability of

The Coming Issues

service depend so directly on the proper action of transformer fuses, an article which will be presented soon on methods of assuring satisfactory results therefrom should be of interest to most of our readers. Among other subjects which will be discussed in coming issues are results of tests to determine the advisability of grounding series lighting circuits, advantages of flywheels with certain wood-working machine drives, standardization of distribution construction, and rate determination.



The Buying Line OVER HERE Helps the Firing Line OVER THERE



Lighting Curtailment in the Industries

Situation Is Serious, and Wide Publicity Must Be Given to the Truth that Adequate Lighting Is Absolutely Essential to Safety of Factory Workers and to Maximum Production

BY A. L. POWELL

THE question of coal conservation is most timely and is receiving consideration by the entire engineering profession. Preston S. Millar has recently discussed its relation to electric lighting in a paper before the Illuminating Engineering Society. A portion of this excellent presentation was devoted to industrial lighting, but this subject is of such importance that it warrants further expansion.

As the result of an extended, well-applied propaganda on the part of the Illuminating Engineering Society and manufacturers of lamps and lighting equipment, the managers of industrial plants have begun to realize the importance of correct lighting. Industrial lighting codes have been adopted by some states and are under consideration in a number of others.

WRONG IMPRESSIONS HARD TO OVERCOME

The nature of the writer's work leads him to call on many manufacturing establishments. A few months ago it was not extremely difficult to convince the shop superintendent that good lighting is an asset rather than an unavoidable expense. Since wide publicity has been given to the apparent necessity for curtailment of lighting a very different attitude is encountered. Now when one is making a recommendation covering the adequate lighting of a plant he has an initial incorrect impression to overcome. If he argues that the saving in reality is ridiculously small, he seems unpatriotic in view of the warnings sent out by the Fuel Administration and others.

The situation is far more serious than it seems on the surface, and wide publicity must be given to the truth of the matter. The writer recently inspected a shop which was formerly illuminated excellently by medium-sized efficient lamps with well-designed reflectors. To his amazement these lamps had been removed, a considerable amount of additional wiring installed, and bare, inefficient lamps hung directly in the line of view over each machine. On inquiry the writer was informed that the management was very patriotic and desired to do everything to help the government in its emergency. The plant electrician had a false impression that it was essential to hang the lamps near the work and had removed the reflectors because, as he stated, "they absorbed light!"

There are a number of reasons why we need better lighting in industrial plants.

First—It is recognized universally that there is a demand for maximum production of a thousand and one articles essential in the war. Lighting does have an effect on output. This fact has been generally recognized for a long while, yet we have never before had figures to prove it. With much interest we read in Mr. Millar's paper:

Recent tests made in a machine shop of one of the large Chicago concerns under the direction of the lighting committee of the Commonwealth Edison Company showed from

8 to 27 per cent increase in production when the lighting intensity was increased from 4 to 12 foot-candles. These figures cover eight different operations which averaged a 15 per cent increase. For each intensity a carefully designed system with deep-bowl steel reflectors was used, and every precaution was taken to insure fair results.

Second—Adequate lighting reduces spoilage. Spoilage has a multiple effect on coal consumption:

(a) The coal used to heat that part of the plant where the particular article was made has been wasted.

(b) Most products are not made completely from raw materials; therefore the energy expended on the parts of the spoiled article before it reached the shop where it was damaged is also of no value.

(c) The coal used to transport the raw material and partially manufactured goods is a dead loss.

Third—Proper lighting reduces accidents. Absolute data are to be found in technical literature on this question. It is no mere theory. Skilled labor is at a premium, and the situation will be even worse in the future. An injured man is a loss to the community. When an accident occurs in a shop not only is the production of the injured individual lost but the demoralizing effect on the other operators materially slows up production.

MAXIMUM ILLUMINATION WITH MINIMUM ENERGY

We are therefore confronted with two facts: Proper and adequate lighting *must* be supplied, and coal *must* be conserved. What must be done to get the maximum illumination with minimum energy expenditure?

Efficient lamps must of necessity be employed. We have three conditions: (a) Insufficient light with inefficient lamps in use; (b) adequate illumination but inefficient lamps supplying this; (c) efficient lamps used but inadequate illumination provided.

(a) The substitution of efficient lamps giving from three to six times the light for the same power consumption easily solves this condition.

(b) Suppose we have a shop where sufficient light is now being obtained on the work, using carbon or "gem" lamps. In order to produce the same amount of light with "mazda" lamps as with carbon lamps, a 25-watt "mazda" lamp could be substituted for each 60-watt carbon lamp, with a saving of 35 watts. Although there is a difference in price of lamps, this is much more than offset by the great power saving. A rough calculation, using list prices on lamps and power at 5 cents per kilowatt-hour, shows a net saving of \$1.55 per socket per 1000 hours. The coal saving would be that required to produce 35 kw.-hr. When one multiplies this by the number of sockets in a plant some really effective results are shown.

Even greater savings may be made where general illumination is used, for in the case of a carbon installation the lamps are usually grouped in clusters of from four to six lamps in a flat reflector. A much more

efficient unit consists of one medium-size "mazda C" lamp and proper reflector. One 100-watt "mazda C" lamp in a well-designed reflector will give more light and distribute it much better than six 60-watt carbon lamps in an old-style fixture. Figuring on the same basis as above, there is a saving of over \$13 per 1000 hours (68 per cent) for each outlet. In addition to this monetary saving there is the saving of coal to produce 260 kw.-hr. per outlet per 1000 hours' burning.

The writer has just returned from a trip to a medium-sized plant in the Middle West. At these works a total of 1200 60-watt carbon lamps were in use. There was absolutely no reason why 25-watt "mazda" lamps could not be substituted for these. In this plant it was estimated that every lamp burned on an average fifteen hours per day 365 days per year. Simple calculations reveal that in this case alone 230,000 kw.-hr. per year could be saved by the substitution of efficient lamps. Figuring on a basis of 3 lb. of coal per kilowatt-hour, this means a saving of 345 tons of coal.

Any one who stops to analyze the matter cannot understand why carbon lamps are still used in industrial plants. Even if there were a difference in strength in favor of the carbon lamp, the great difference in efficiency and resultant saving in power (35 watts) will pay for the increased first cost of the "mazda" lamp. To make up the difference in cost the "mazda" lamp has only to live the following hours:

At 1 cent per kilowatt-hour.....	350 hours
At 2 cents per kilowatt-hour.....	175 hours
At 3 cents per kilowatt-hour.....	117 hours
At 5 cents per kilowatt-hour.....	70 hours
At 10 cents per kilowatt-hour.....	35 hours

(c) Efficient lamps are used, but there is not sufficient light to carry on the work effectively. It is obvious that we can make no material saving in power or coal, but there is no doubt that one is justified in increasing the power consumption to gain increased output.

Suppose each workman has a 25-watt "mazda" lamp as a local light over each machine. This is probably the minimum that could be supplied. Experience indicates that exceptionally good general illumination can be obtained if one 100-watt "mazda C" lamp in suitable reflector is provided for each workman. This does not mean that one of these units is placed in front of or above each individual operator, but represents the average covering the entire shop. At 5 cents per kilowatt-hour there would be an increased total operating cost of roughly 0.5 cent per hour. The skilled workman in the machine shop receives at least 50 cents per hour, hence the difference in cost between inefficient lighting and very excellent illumination is less than 1 per cent of the wage expense.

Efficient lamps being in use, they should be equipped with proper reflectors to direct the light effectively to the work. Every one familiar with the subject realizes that the distribution of light from a bare lamp is not suitable for effectively illuminating a workbench or machine. Practically half the light is in the upper hemisphere and must be reflected from the ceiling before it reaches the workbench. Although a regrettable condition, it must be admitted that in many industrial plants the side walls and ceilings are not good reflectors.

Suppose a factory of 40,000 sq. ft. was to be lighted with medium-sized "mazda C" lamps to an average intensity of 3 foot-candles; walls and ceilings are moderately light in color. Using generally accepted constants, it is seen that if lamps were used without reflectors 26 kw. would be required. If efficient, well-designed industrial reflectors were used, 15 kw. would give the desired intensity of illumination—nearly a two to one ratio.

Efficient lamps being in use, equipped with suitable reflectors, what is the next step in coal conservation? Paint the upper part of the walls and the ceiling a white with high reflective power. The writer had always appreciated that this factor was important, but recently conducted a test which indelibly stamped the effect of this on his mind. Illumination readings were taken in a new factory building before the machinery was installed. Walls and ceiling were painted a special matte white with an unusually high coefficient of reflection. The floor was of light-colored wood. More lumens were effective on a 30-in. (76.2-cm.) plane than were generated by the lamps. When the problem is carefully analyzed it is seen that an effect similar to that which occurs in the Ulbrich sphere is produced, and multiple reflections give the paradoxical result.

Not only do white walls and ceilings help out the artificial lighting by actually increasing the intensity, giving better diffusion to the illumination and making the lighting more uniform, but they also benefit the natural illumination.

IMPORTANCE OF CAREFUL MAINTENANCE

When due consideration has been given to all these factors what further can be done to keep the lighting system at its maximum efficiency? Maintain it carefully. After lamps have been burned a considerable length of time they become blackened and reach a certain critical point where it is good economy to remove them, even though they will still burn. Dust, oil and dirt of all sorts accumulate on the lamp bulb and reflecting surfaces. It is most important to have a well-supervised, carefully planned system of cleaning lamps and reflectors. Under fairly clean conditions the illumination from an installation of dome-shaped enameled steel reflectors, the least susceptible of all equipment, will depreciate at least 10 per cent in a period of twelve weeks. In many cases the depreciation is far greater than this.

In conclusion, it may be well to mention one point which is only indirectly connected with the question of artificial lighting; that is, the cleaning of windows. If the maximum light is admitted from out-of-doors at all times, then the hour for turning on artificial lights is delayed. One does not fully realize the effect of dirty windows. To obtain some definite figures on this question the writer recently made a rough test. The windows in a certain factory office had not been cleaned for a considerable period of time. One pane was carefully cleaned. Photometric tests of this and adjacent dirty panes showed absorption values as high as 50 per cent. This free light was being wasted.

Give your industrial lighting problem careful consideration; save where possible; make every bit of power or pound of coal do its maximum work; but do not stint at those places where the effectiveness of your organization will be reduced.

What Substitution of Oil for Coal Can Do

Account of Some Actual Experiences in New England, Where Use of Fuel Oil Has Increased Economy, Reduced Operating Expense and Attendance Necessary, and Afforded Other Benefits

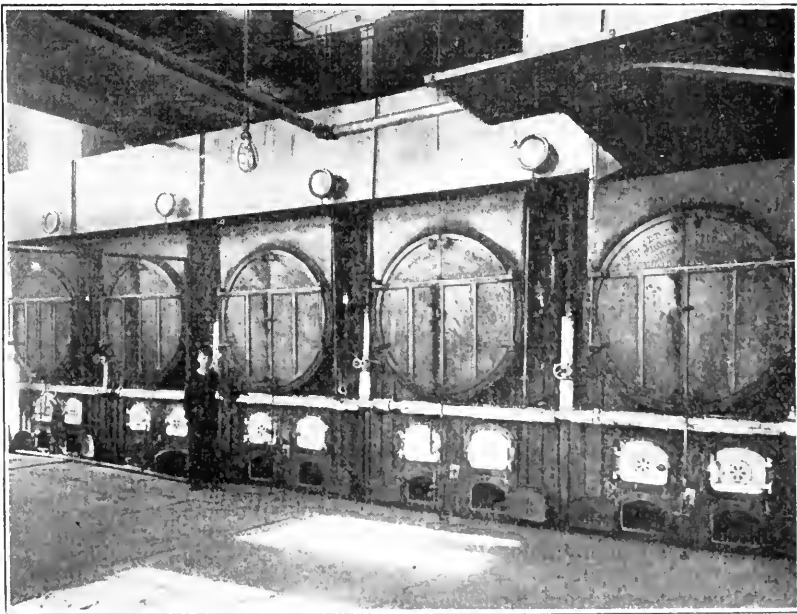
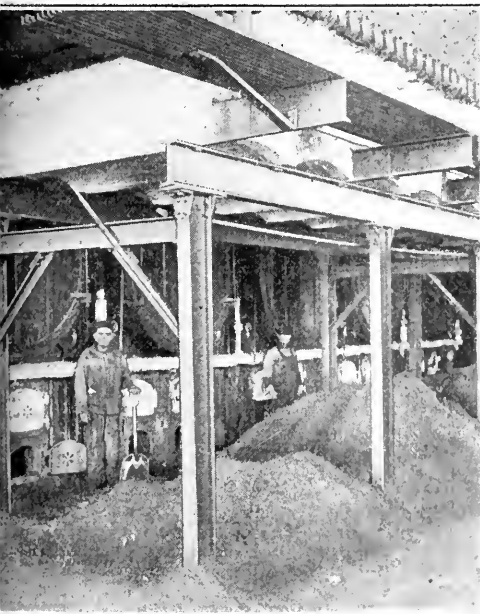
PLANTS in New England with a combined rating of nearly 100,000 hp. are to-day operating on fuel oil or have lately contracted for equipment which will do away with the use of coal in these installations. This movement toward accepting standards of fuel engineering practice long successful on the Pacific Coast began before the present coal shortage hit New England. It was accelerated, of course, by the scarcity of coal, but there is every indication that it will become a permanent development. Most of the installations are in industrial plants, but they are indicative of what can be done in central stations of a similar size or perhaps even larger.

Owing largely to the lack of normal shipping facilities by water carriers, the supply of fuel oil at present available is insufficient for development on a scale to be expected in times of peace, but even under the handicap of war conditions the growth of fuel-oil service in New England during the past two or three years has been remarkable. Aside from its use in steam-power plants, it is rapidly coming into favor as a fuel for heating boilers in office buildings, libraries, large stores and similar structures. This should be of particular interest in central-station companies which have been considering the best methods of providing heating service where an isolated electric plant is displaced.

The oil now being distributed in New England for

of coal. Expressed in gallons, 150 gal. (567.8 l.) of oil is the equivalent of about one ton of coal. Fuel oil, as used in New England, is known as crude oil in some circles. In reality it is a residuum from which the gasoline, benzine, kerosene and other light products have been removed. It does not emit an inflammable vapor below 150 deg. Fahr. and is therefore an unusually safe fuel for handling in the boiler room. It burns clean under proper operating conditions, insuring smokeless combustion, and can be handled so easily that a large shoe-manufacturing plant in Boston is planning to operate its boiler plant by women. The ease of control, speed of application and adaptability to changing load conditions attendant with oil burning are virtually revolutionizing fireroom practice in many former coal-burning plants. The absence of standby losses inseparable from the use of coal is perhaps the chief source of economy in the use of fuel oil.

Providence, R. I., and Boston, Mass., are the two principal oil ports of New England. Oil is distributed from these cities by automobile trucks and by tank cars serving boiler plants in the city districts and the interior. The price per gallon has varied from 2.5 cents in 1915 to a maximum of 6 or 7 cents, a fair present average being from 4 to 5 cents. The automobile trucks used in this service carry about 1500 gal. (5678 l.) each and can be emptied by gravity in six minutes. In the Provi-



FIGS. 1 AND 2—COAL HAD TO BE PILED IN FRONT OF THE BOILERS AND MORE FIREMEN WERE REQUIRED BEFORE FUEL-OIL BURNERS WERE INSTALLED

steam plant service is largely the so-called "topped" oil from Mexican or other southern wells and has a heating value of from 18,300 B.t.u. to 18,500 B.t.u. per pound (10,100 cal. to 10,250 cal. per kg.). About 1600 lb. (725.7 kg.) of oil furnishes the heating equivalent of one ton of New River coal, or about 4.5 barrels of oil per ton

dence district one truck delivers ten or twelve loads per day, or the heating equivalent of 100 tons of coal. There is no question that a continuous supply can be relied upon despite the distance of New England from the oil fields.

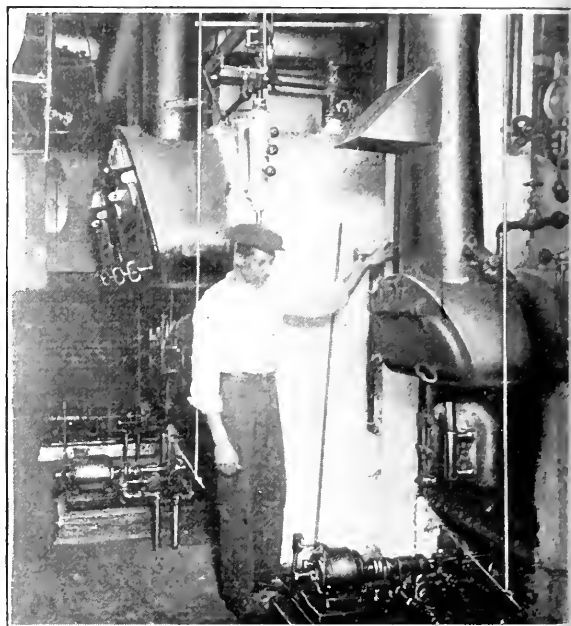
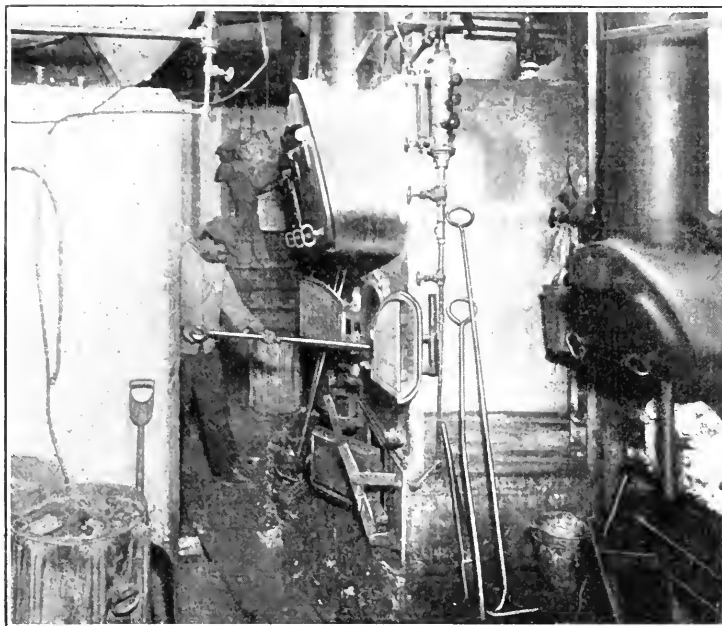
Many advantages attend the use of fuel oil. Higher

efficiency at the boiler results, owing to more perfect combustion with less excess air and, accordingly, less heat lost up the stack. A more equal distribution of heat in the combustion chamber is secured, as the fire doors do not have to be opened, and more heat is absorbed because of the clean condition of the tubes. As no cleaning of fires is required, boilers can be operated at their maximum capacity continually if necessary. There is a reduction in the cost of handling fuel, as this is done mechanically or by gravity. No expensive conveying or elevating systems are necessary, as fuel oil is delivered either by pumping or by running under gravity into storage tanks. This means economy in first cost of a plant designed new, as well as in handling fuel.

No firing tools or grate bars are necessary; but if the supply of oil should be threatened, which is unlikely, the withdrawal of the burner equipment and installation of

ing any productive work. In a representative New England power plant two 500-hp. boilers were carried banked for two months, ready to be cut in on the line at a moment's notice; but as the demand for a sudden increase in output did not arise all the coal used in this way was wasted. The cost of banking these boilers was \$300 a week.

With fuel oil only one fireman is required to handle ten to fifteen boilers. In a New England station equipped with fifteen Babcock & Wilcox boilers, aggregating 5500 hp., and operating three eight-hour shifts daily, sixty-three men were employed in the fireroom when burning coal. After the plant was converted to oil only seven firemen were required. Depending on the grade of coal used and the draft conditions, from 10 to 75 per cent increase in boiler capacity can be obtained in many cases by using fuel oil. As the stack area re-



FIGS. 3 AND 4—THE UNTIDY BOILER ROOM, WITH ITS DIRTY FLOORS AND ASH CANS WHICH HAD TO BE EMPTIED, WAS AVOIDED BY BURNING FUEL OIL.

grate bars in the boiler furnace is a simple matter. Increased life of furnace linings and brickwork follows the use of oil, and damage to the brickwork from tools used in removing clinkers is eliminated. The absence of coal dust, dirt and ashes enables the boiler room to be kept clean, reducing the wear on pumps and other machinery, while the cost of handling and removing ashes is also entirely eliminated.

In New England plants, as elsewhere, the use of fuel oil enables the engineer to leave his boilers without any fire under them to within a short time before they have to be cut in on the line. The burners are then lighted, and in a few moments full working pressure is attained. Fluctuation in boiler loads can be handled on a moment's notice by turning the supply valve equipment, and this can be and is made automatic in many installations. As soon as the demand ceases the fire can at once be turned down to normal or extinguished entirely, as the occasion requires. This represents a large saving in plants which are operated only twelve hours per day and carry their fires banked the rest of the time.

On a 200-hp. return-tubular boiler about 3000 lb. (1360.8 kg.) of coal is used weekly for banking fires at night and making new fires in the morning without do-

quired for oil burning is only 50 per cent of that needed for coal, 40 per cent more power can be developed from the same chimney. The increased attention given to smoke laws by public authorities has made the production of smoke in city plants a serious question. In a properly handled oil-burning station smoke is eliminated entirely, except in a few cases where the stack will smoke for a short time while the burners are being started.

Tests were recently conducted on two 140-hp. horizontal-return tubular boilers in regular service, operated under the usual plant conditions, with coal firing and when burning fuel oil. Each test covered a period of one week, starting with cold boilers Monday morning and continuing until Saturday noon, when the mill closed down. A summary of the test is printed on page 713.

Using coal, one head fireman, two day firemen, two night firemen and one ash handler were required. With oil only one head fireman and one night fireman are needed. To the fireroom labor cost, with coal, must be added the cost of one team and one man working six days per week hauling coal from the pocket to the fire room, about 200 yd. (182.9 m.), and also the cost of

handling and disposing of ashes. Fuel oil has eliminated this handling. Deliveries are made by tank car to the mill siding, and the oil flows by gravity into three steel storage tanks holding 587 barrels each. From this storage the oil is drawn by a duplex service pump set on the boiler-room floor and is discharged by these pumps through a circulating-pipe system to the boilers, which are equipped with the Hammel oil-burner system.

Normally the mill closes down at 5.30 p. m. When coal was the fuel it was the practice to bank the entire in-

RESULT OF TESTS ON TWO 140-HP. HORIZONTAL-RETURN TUBULAR BOILERS

	Using	
	Fuel Oil	Using Coal
Hours generating steam	125	126
Average steam-pressure range (lb.).....	107.8-127.2	88.5-126.9
Average feed-water temperature range (deg. Fahr.)	83.9-150.2	80.9-150.6
O ₂ in flue gas (per cent).....	14.0	Not taken
Fuel-gas temperature (deg. Fahr.).....	449	Not taken
Moisture in steam (per cent).....	1.75	1.75
Heating value of fuel (B.t.u. per lb.).....	18,700	14,600
Total boiler-hp.	300	300
Boiler-hp. developed	285	202
Percentage of builder's rating.....	95	67
Feed to boilers (lb.).....	1,089,536	794,742
Evaporation corrected for moisture in steam (lb.)	1,070,224	778,423
Evaporation from and at 212 deg. (lb. water per lb. fuel).....	15.55	10.31
Boiler efficiency (per cent).....	80	68

stallation of twelve boilers for the night. Consequently the standby losses were high. With fuel oil the fires under all but one or two boilers are turned out and the boilers closed. It is noteworthy that when the fires are lighted the next morning the steam pressure has dropped only about 12 lb., and only about five minutes are required to bring the boilers back to full working pressure.

Another notable plant which is operating on fuel oil is that of the Jenckes Spinning Company, Pawtucket, R. I., which has an installation of 1700 boiler-hp. At the end of eighteen months' service a statement was issued by George Fish, mill manager, to the effect that the company had found the oil system much easier and cheaper to use, with a saving in maintenance over coal. The steam capacity was increased from 40 to 70 per cent over the boiler rating, which saved the company an expenditure of at least \$15,000 on new boiler equipment which would have been required if it had continued to use coal. Fuel oil permitted a saving of \$2,100 per year in labor, \$600 on ashes removal and about \$6,000 on fuel under normal conditions. This record led to the equipment of the affiliated Tamarack Company's No. 2 mill power plant with oil. This station is one of the largest oil-burning electric power plants in New England. At present it contains a 2500-kw. General Electric turbine delivering three-phase energy at 550 volts for miscellaneous power service in the establishment. In a test made at the first Jenckes plant with coal and fuel oil relative efficiencies of boilers of 66.6 and 81.5 per cent were obtained, with evaporation of 10.02 lb. (4.5 kg.) of water from and at 212 deg. when burning coal and 15.21 lb. (6.9 kg.) with oil.

Since the middle of August, 1915, eighty-nine installations have been made in New England of the Fess system of oil burning, both rotary and fixed burner outfits being in service. In this system, where the rotary burner is used, the fuel oil is forced into a turbine burner

and discharged in atomized form into the furnace, the pressure being furnished by a rotary pump in the supply pipe line, both pump and burner head being driven by a constant-speed electric motor. In practice the motor usually requires from 1/8 hp. to 3/4 hp. according to conditions. The standard speed is 1750 r.p.m., and the burner head revolves at 3500 r.p.m. Many of these outfits are in service in institutional boiler plants, office buildings, newspaper plants, and similar places. A number of small isolated power plants are also using fuel oil, and the advantages outlined above in connection with industrial power plant service from oil apply equally to buildings of considerable size. The saving of labor effected by eliminating stand-by losses is accompanied by the fuel economy resulting from the same cause. Boiler rooms have been transformed from dingy, unclean places to places which are as clean as the modern turbine room. Furthermore, the flexibility of control and automatic features of fuel-oil service have proved very valuable. Automatic control of the inflow of oil can be effected by the connection of the damper regulator with the supply valve, enabling the plants to be left alone sometimes for hours.

At the plant of the Almy Water Tube Boiler Works, in Providence, illustrated herewith, a 45-hp. boiler of the company's make is equipped with a Fess fuel-oil burner of the rotary type. This is driven by a 1/2-hp., 550-volt Holtzer-Cabot induction motor and is equipped with the usual damper regulator control of the oil valves. In two years' operation the use of oil has saved the company from 18 to 23 per cent on the basis of coal at \$4.50 per ton. This boiler delivers steam within ten

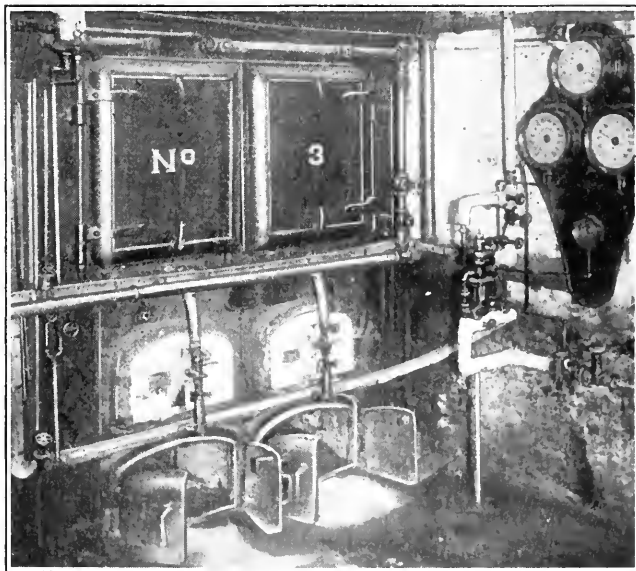


FIG. 5—FUEL-OIL BURNERS APPLIED TO OLD COAL-BURNING BOILERS

minutes of starting at 200 lb. pressure, and the automatic regulation holds the pressure constant within a pound through wide fluctuations of load. The evaporation is from 12 lb. to 14 lb. of water per pound of oil.

The block plant known as the Lauderdale plant in Providence is now being fully equipped for fuel-oil service. In this case there are four 125-hp. Babcock & Wilcox boilers equipped with stationary burners. Atomization is by steam jet; an 8000-gal. tank stores the necessary fuel and a duplex pump of the steam-driven

type forces the oil into the furnace. An automatic regulator is provided, operating on a balance between the steam and the oil pressure, to control the oil supply to the furnaces. At present from 1200 gal. to 1700 gal. (about 5500 l.) of oil per day is burned with two boilers equipped. Eight buildings are supplied with steam, water or electric service from this plant, which has a generator rating of about 190 kw. The load in this plant varies during twenty-four hours from 20 kw. to 500 kw., yet the automatic control of the steam pressure through the governing of the oil supply is so close that practically no change is observed in the steam pressure.

It is customary to install rotary burners for plants up to 100 hp. to 125 hp. per boiler; above these ratings the fixed type of burner with steam-jet atomization is generally required. The average oil pressure in rotary

burner plants is about 15 lb. per sq. in. (1.06 kg. per sq. cm.). No pressure is carried on the tanks in such plants. The oil is warmed by steam or hot-water coils surrounding the main supply line from the tank to the pumping outfit, and a by-pass pipe to the tank provides for the convenient return of unused or unrequired oil from the pumping set and related piping. In the large fuel-oil plants installed for industrial power service the oil is warmed by steam coils in the storage tank itself.

Careful study of the supply conditions indicates that there is no ground for serious apprehension as to the situation which may be expected when the world war becomes a matter of history. Meanwhile a steady development of fuel oil in the boiler plant is likely to be witnessed, its magnitude depending upon the possibility of increasing the present supply of this most valuable source of heat energy.

Improving Synchronous-Motor Starting Features

Lines Along Which Improvements Can Be Made in the Design of These Motors, with a Brief Record of the Results That Were Derived from Some Investigations Made Concerning the Effectiveness of the Methods Employed

BY THEO. SCHOU

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WHILE valuable improvements that widen their field of application have been made in synchronous motors, the self-starting feature has not been developed as far as it could be. Probably the reason is that designers and manufacturers desire to use the same patterns, tools and dies for both generators and motors and hence cannot incorporate features in the motors which would give them better characteristics as such. In what follows the author proposes some changes or slight modifications that should give synchronous motors better starting and operating characteristics and then goes on to explain some experiments which were conducted to test the effectiveness of

chronous type. The slip that is inherent with the induction motors is, of course, eliminated in the case of synchronous motors. It is, therefore, possible to design a synchronous motor that has starting characteristics (*i. e.*, ratio of starting torque to kva. input) as good as or even better than a similarly rated induction motor. If, however, a synchronous motor is called upon to pull into synchronism with a heavy load, then the design of the squirrel-cage winding must be modified at the expense of starting torque, so as to enable the synchronous motor to run as an induction motor with a small enough slip to effect pull-in with the respective load.

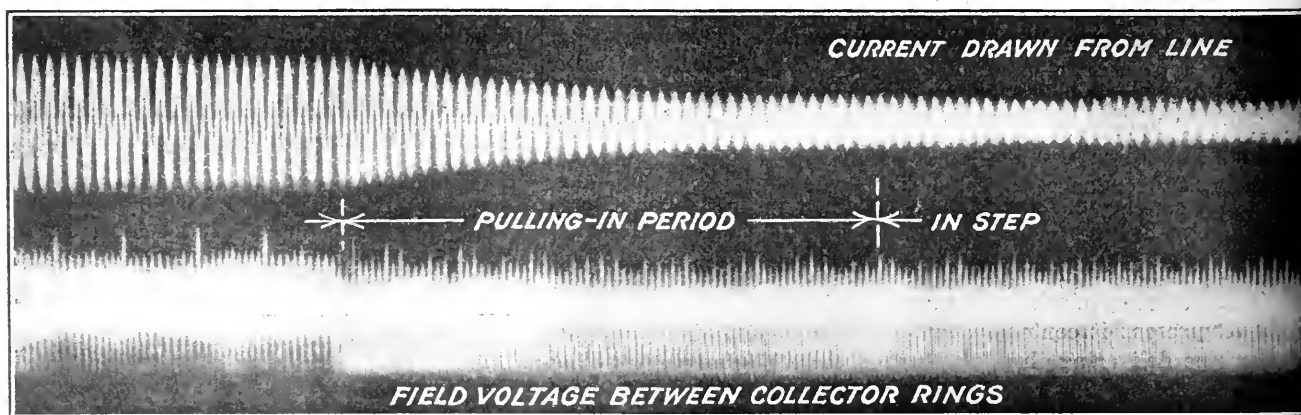


FIG. 1—PULLING-IN CHARACTERISTICS OF A SYNCHRONOUS MOTOR WITH SELF-EXCITATION

the construction suggested. The results of this investigation are given in the form of oscillograms and plotted curves.

While the calculation of the squirrel-cage winding, in case of induction motors, is based on running as well as starting conditions, only starting and pull-in characteristics need be considered with motors of the syn-

As the frequency in the squirrel-cage winding changes from normal at standstill to zero at synchronous speed, it is suggested that advantage be taken of materials having pronounced skin effect in designing squirrel-cage windings for synchronous motors. In this manner high resistance with large torque at starting and low resistance with small slip at pull-in, which

ould be very desirable, can be obtained. A synchro-
us motor can be made to pull in full load or more if
e applied voltage is high enough. The objection to
roviding over-potential taps on the auto-transformer
the large current which the motor would draw from
e line at pull-in. This condition, however, can be
mewhat improved by using auxiliary reactance, thus

rent is applied to its terminals, has less reluctance the
smaller the air gap between the stator and the rotor.
Therefore the magnetizing current which a motor draws
from the line to establish a certain flux is smaller the
less the air gap, other conditions remaining unchanged.
Furthermore, the slots in the stator and rotor increase
the reluctance of the rotating field, more or less, de-

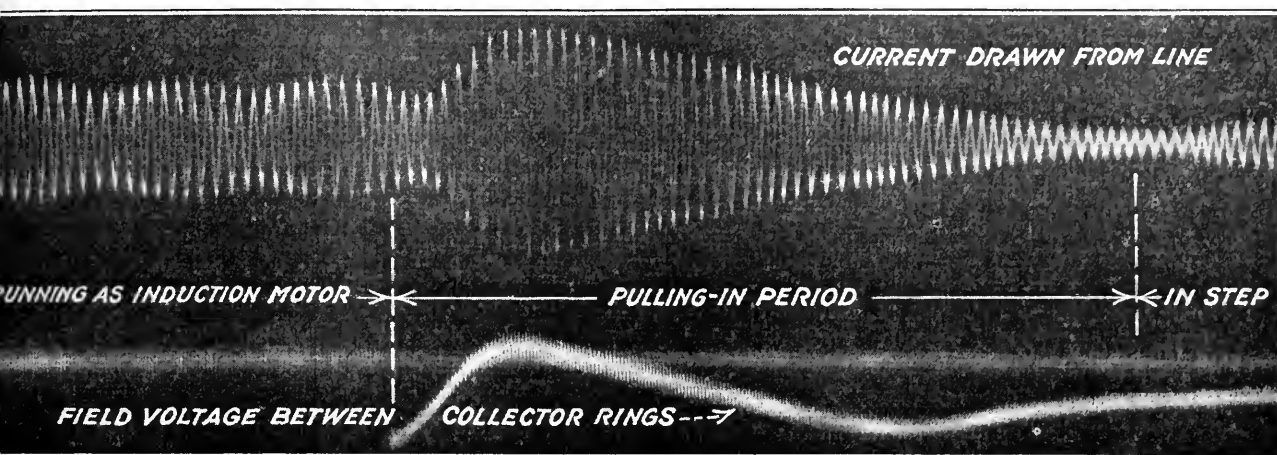


FIG. 2—PULLING-IN CHARACTERISTICS OF SYNCHRONOUS MOTORS WITH SEPARATE EXCITATION

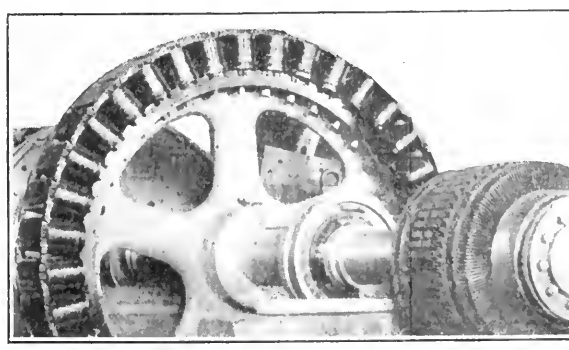
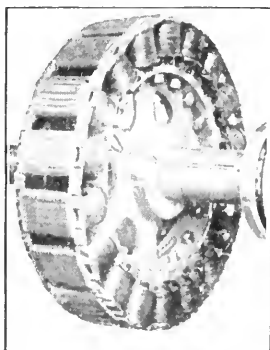
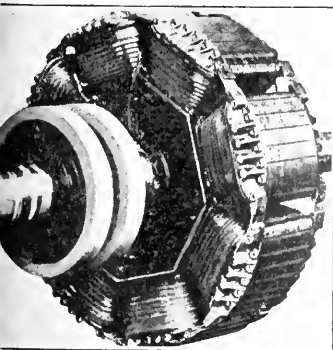
olonging the time-factor element and reducing the
urrent during the pull-in period.

Different pull in characteristics are obtained, de-
ending on the method of excitation used as shown by
gs. 1 and 2. The oscillograms refer to a 62½-hp.,
00-volt, two-phase, 60-cycle, 720-r.p.m. synchronous
otor that was designed by the writer for research
rposes. This motor is equipped for both separate
ecitation and self-excitation. The pull-in characteris-
cs were taken under exactly the same conditions—
e., same load to pull-in, same slip at pull-in and same
plied voltage. On applying separate excitation the
ll-in current is very large and excessive when the
ld circuit is closed. With self-excitation, however,
e current is not excessive and decreases gradually.

Tests on this motor also suggest that when self-
cited the motor will pull into step a larger load

pending on their shape and size, or tend to increase the
magnetizing current drawn from the line. The effect
of the stator and rotor slots is, therefore, to increase
the air-gap of the motor, electrically speaking.

Since synchronous motors are almost exclusively of
the definite pole type, the air space between poles is
equivalent to large rotor slots. The larger this air
space or the smaller the relative pole span* the
larger the magnetizing current must necessarily be.
In the case of an induction motor the air gap proper is
uniform around the entire machine. With the syn-
chronous motor the poles are more or less tapered in
order to establish a desirable flux distribution curve.
In a synchronous motor, therefore, the air gap meas-
ured at the center of the pole is smaller than that meas-
ured at the pole tips; that is, designers have to con-
sider the average air gap and then increase it enough to



FIGS. 3, 4 AND 5—SOME ROTORS IN WHICH SQUIRREL-CAGE WINDINGS HAVE BEEN EMBEDDED TO IMPROVE STARTING CHARACTERISTICS

an would be possible with separate excitation. Nor
it so sensitive to flywheel effect as the present type.
An ordinary alternator cannot be made to develop
ood self-starting, synchronous-motor characteristics
merely adding a squirrel-cage winding, for the fol-
owing reasons: The rotating field, as established in the
mature of any polyphase motor when alternating cur-

compensate for the effect of the stator and rotor slots.

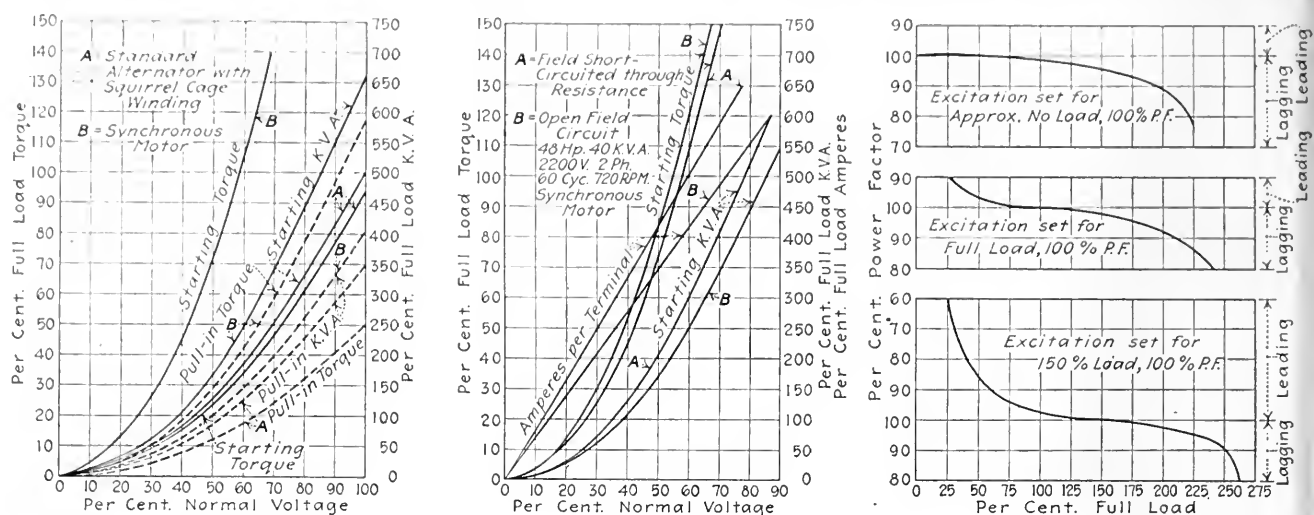
With alternators the length of air gaps is electrically
limited, because with a given rating the field strength
must be able to produce practical regulation character-
istics. Furthermore, the relative pole span* is limited

*Ratio of pole arc to pole pitch.

in order to prevent excessive field leakage, which would lower the ability of the generator to maintain voltage at low lagging power factors. For the same reason it is also desirable to design the poles with shallow and well-tapered pole tips.

With induction motors, on the other hand, it is de-

pull-in characteristics are only approximately correct owing to the difficulty of obtaining reliable meter readings at pull-in. Similar methods of making tests and readings being employed in both cases, the curves serve excellently as a comparison between the results which may be obtained with the modified alternator design



FIGS. 6, 7 AND 8—STARTING AND PULL-IN CHARACTERISTICS OF STANDARD ALTERNATOR AND SYNCHRONOUS MOTOR; STARTING CHARACTERISTICS OF SYNCHRONOUS MOTOR UNDER TWO CONDITIONS, AND EFFECT OF LOAD ON POWER FACTOR

The curves shown in Fig. 7 were plotted from data obtained with the field short-circuited through a resistance of approximately twice the field resistance. For equally applied voltage the following results were obtained in favor of starting with open field: Increase of starting torque, approximately 10 per cent; de-

crease of starting kva., approximately 17 per cent; decrease of amperes per terminal, approximately 17 per cent. At the 50 per cent voltage tap, however, the induced field voltage at starting was 2380 volts. This induced voltage is, of course, proportional to the applied voltage.

sirable to have the highest possible induction in the rotor, or in the secondary circuit, with an appropriate line current drawn by the stator. To attain this object the rotor is made cylindrical with no definite poles, the air gap being made as small as possible to decrease the magnetic reluctance for the stator field and thus decrease to a minimum the magnetizing current on which the wattless component depends. The air gap in the induction motor is, therefore, limited by mechanical conditions.

Correct synchronous motor design should take both of the foregoing requirements into consideration. To obtain practical and economical design the synchronous motor is almost always of the definite-pole construction, therefore the field leakage must be taken into account. It is not necessary to consider regulation characteristics with this type of motor; for this reason the equivalent air gap (air gap proper plus that due to stator and rotor slots) can be made smaller than would be the case with the corresponding alternator. This will decrease both the field leakage and the field copper loss and permit a larger pole span. As most synchronous motors are operating at approximately 100 per cent power factor, the problem of field leakage is not so serious as with standard alternators.

By increasing the pole span the active rotor material permits an effective and well-distributed squirrel-cage winding. Thus a machine is obtained that approaches the induction motor in design as well as in starting characteristics. Figs. 3, 4 and 5 show rotor designs of synchronous motors that will produce starting and pull-in characteristics like those reproduced in Fig. 1. In connection with these characteristics it should be noted that the starting characteristics are based on that position of the rotor with respect to the stator that gave the most unfavorable results. Furthermore, the

and what may be obtained if the design features previously mentioned have been applied.

It is very essential that a well-designed synchronous motor should start from any position of the rotor in relation to the stator when equal or approximately equal voltages are applied. If not well designed, a synchronous motor may show very good starting characteristics in one position of the rotor and very poor ones in another.

Contrary to the general opinion, the writer has noticed that the distribution of the armature winding and the nature of the material used in the squirrel-

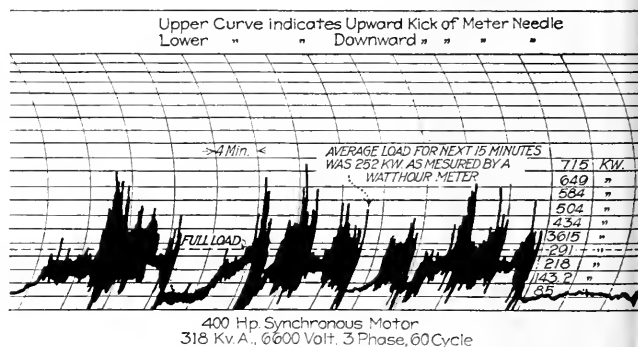


FIG. 9—PULL-OUT CHARACTERISTICS OF A 400-HP., 2200-VOLT 150-R.P.M., THREE-PHASE, 60-CYCLE SYNCHRONOUS MOTOR

cage winding have more effect on the "dead points" than the air gaps or rotor and stator slot pitch. The application of part-slot windings (discussed in detail by the writer in the ELECTRICAL WORLD of March 17, and April 21, 1917) and the use of material for the squirrel-cage winding that has non-uniform resistance such as brass, will make any synchronous motor approximately "dead-point" proof.

While it is a well-known fact that synchronous motors, especially those equipped with high-resistance squirrel-cage windings, have better starting characteristics with an open field than with a short-circuited one, the gain is so slight that it is not warranted because of the dangerously high voltage that is induced in an open field winding at starting. The voltage induced in the field windings of standard machines designed for 125-volt excitation is not only liable to puncture the field insulation but it is also dangerous for the operator, because it will exist at the field switch on the switchboard. In the case of self-excited synchronous motors the fields may be wound for low voltage, say 25 volts, which would mean few turns of large wire or strap, thus eliminating any danger of high induced field voltage. Furthermore, it would permit starting with an open field,

factor of a synchronous motor with variable load and constant field excitation, it can be determined from the phase characteristics. Figs. 8a, 8b and 8c show respectively how the power factor of one synchronous motor changes with the load when the field excitation is set for approximately no load 100 per cent power factor, full load 100 per cent power factor, and 150 per cent of full load at 100 per cent power factor. If the synchronous motor is desired to operate as a power motor at approximately 100 per cent power factor, the field should be so designed in respect to the excitation voltage that no rheostat is necessary in the field circuit. This results in greater efficiency than with a motor whose field winding is of the standard alternator design allowing for operation at low leading power factors. If operation at about 100 per cent power factor is desirable, a certain amount of energy loss is involved in the field rheostat. This should be charged against the efficiency of the motor. It should also be remembered that field rheostats, especially for large low-speed motors, when not needed represent dead capital.

The limit-of-stability curve, indicated in Fig. 10, is also of interest, as it shows the critical load that might be approached with a certain field excitation. This curve may also be termed the pull-out curve. If extended far enough, it will reach a certain maximum value and then decrease with increased excitation.

The pull-out tests being taken at half-normal voltage, the curve was replotted for normal voltage, assuming that the pull-out torque increases as the square of the voltage. Under ordinary operating conditions—i.e., approximately normal voltage and frequency and fairly steady load—the pull-out with well-designed synchronous motors need not be considered. With the excitation set for approximately full load and 100 per cent power factor and approximately normal voltage and frequency applied at the motor terminals, the pull-out torque (as much as 900 per cent full-load torque) is usually far above the heating limits of the motor. If, on the other hand, the fluctuations of voltage, frequency and load are very pronounced, the application of synchronous motors may not be desirable, owing to the danger of pull-out.

The pronounced peaks reproduced in Fig. 9 are characteristic for a synchronous motor with improper flywheel effect, supplied by a large system at approximately constant frequency and connected to a stone-crushing load. If an induction motor had been employed, these peaks would not be so pronounced, because the motor would slip on instantaneous heavy overloads and allow the flywheel effect to act. Since flywheel effect only assists during a change of speed and as a synchronous motor supplied by constant frequency current slips only a fraction of a cycle, it is obvious that the problem of securing proper flywheel effect with synchronous motor drive is quite different from that encountered with induction motor drive.

The danger of pull-out due to excessive, instantaneous load might be conveniently eliminated by installing a magnetic clutch between the synchronous motor and its load. This magnetic clutch can be set to slip at any desired fixed load and thus permit the flywheel effect to act during such peaks. No doubt in the near future the advantages that will result from the application of synchronous motors under appropriate operative conditions will justify its more extensive use.

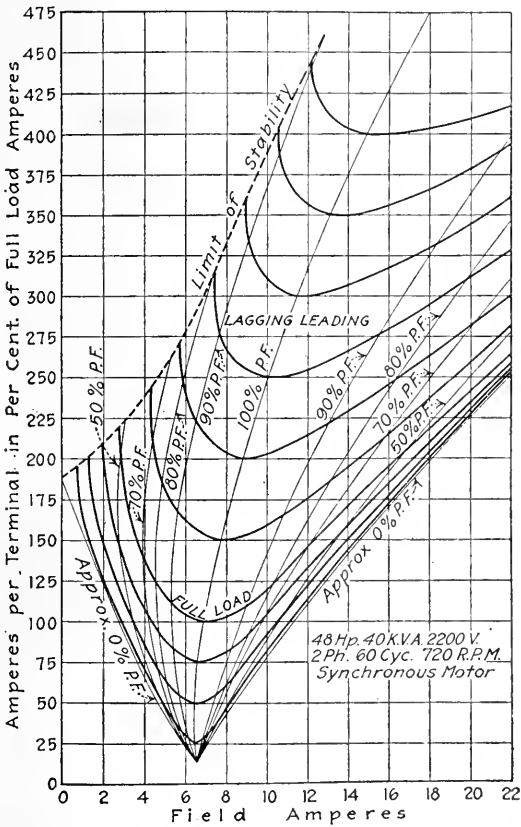


FIG. 10—LIMIT OF STABILITY AND EFFECT OF LOAD ON POWER FACTOR

with the corresponding gain in starting characteristics (see Fig. 7).

Under synchronous running conditions, with approximately constantly applied voltage, the relation of load, excitation and power factor may be very conveniently studied or computed from the phase characteristics of the motor in question. While the determination of the phase characteristics or V curves involves rather tedious and expensive tests, they can easily be constructed from the commercial test runs, using the method fully described by the writer in the ELECTRICAL WORLD of Feb. 12, 1916. The results obtained by this method check approximately with actual test results. Such curves as those reproduced in Fig. 10 are very useful and practical, as they show at a glance reliable information as to the operating characteristics of the synchronous motor at various loads and field excitations.

When it is of interest to know the change of power

Construction of Outdoor Substation at Madera, Cal.

Preference Given to Suspension Insulators and Wood Poles—Reasons Which Have Influenced the Management in Housing Some of the Equipment—Provisions Adopted for Maintaining Reliable Service

BY L. J. MOORE

Engineer San Joaquin Light & Power Corporation

THE San Joaquin Light & Power Corporation of Fresno, Cal., has an outdoor substation near Madera, in the same State, which may be of interest because of its construction and moderate cost. Suspension construction on wooden poles is employed throughout. The San Joaquin corporation has always been partial to wood poles, owing to its proximity to the Oregon and Washington supply of timber. A quite extensive open-tank creosoting plant is maintained in Fresno for the treatment of poles which are used on the system. The present high cost of steel was also a factor in determining the use of poles for this substation. Other substations which have been erected by this corporation have usually been constructed with pin-type insulators on wood poles. All future installations are to be made with suspension insulators, thus making it possible to increase the amount of insulation installed and to secure better mechanical construction than is possible on pin-type insulators. Except for the metering equipment and low-tension oil switches all the equipment in the Madera substation was placed out of doors.

The substation is connected to a 66,000-volt line which forms a loop through a number of other substations. The transformation ratio is from 66,000 volts to 11,000 volts through a Y-Y bank of transformers with both high-tension and low-tension neutrals grounded. An oil switch and an air-break switch are installed in the incoming and outgoing 66,000-volt lines where they connect with the 66,000-volt bus which loops around the substation site. A spacing of 7 ft. (2.1 m.) has been used between high-voltage wires where possible to lessen the occurrence of arcs or trouble caused by large birds flying between the wires. The transformer bank is connected with the 66,000-volt bus through an air-break switch and an oil switch. Provision is made for seven 11,000-volt feeders, two of which are carried on the transmission-line poles. All 66,000-volt air-break switches used in the station are

five-disk K-P-F switches, chosen because their construction especially fits them for use in this type of substation. A grounding switch is installed on each end of the 66,000-volt lines in order to ground either section of the line in case men have to work upon the line between this station and either one of the two stations adjacent to it. The two grounding switches are mounted on 66,000-volt pin-type insulators, which are

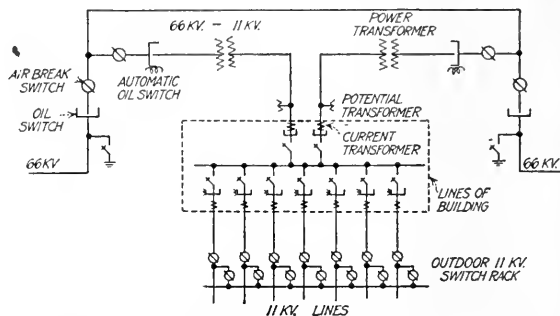


FIG. 2—ELECTRICAL WIRING LAYOUT, SHOWING CONNECTIONS

the only high-tension pin-insulators in the installation.

The transformer bus is supported on 25-ft. (7.6-m.) poles and is long enough to accommodate two banks of three 500-kva. transformers, together with one spare and the controlling switches for both banks. (See the accompanying plan). Only one bank of transformers and a spare are installed so far, however, awaiting the need for more equipment. The 66,000-volt buses are on the arms across the tops of the poles, and the 11,000-volt buses are supported in a vertical plane on the poles themselves along one side of the structure. The buses are dead-ended in the center of the structure over the spare transformer so that it may be connected in place of any transformer in either bank which might become disabled. This location was chosen for the spare unit in order to minimize delay and work in connecting it into service.

In the center of the outdoor substation site is a

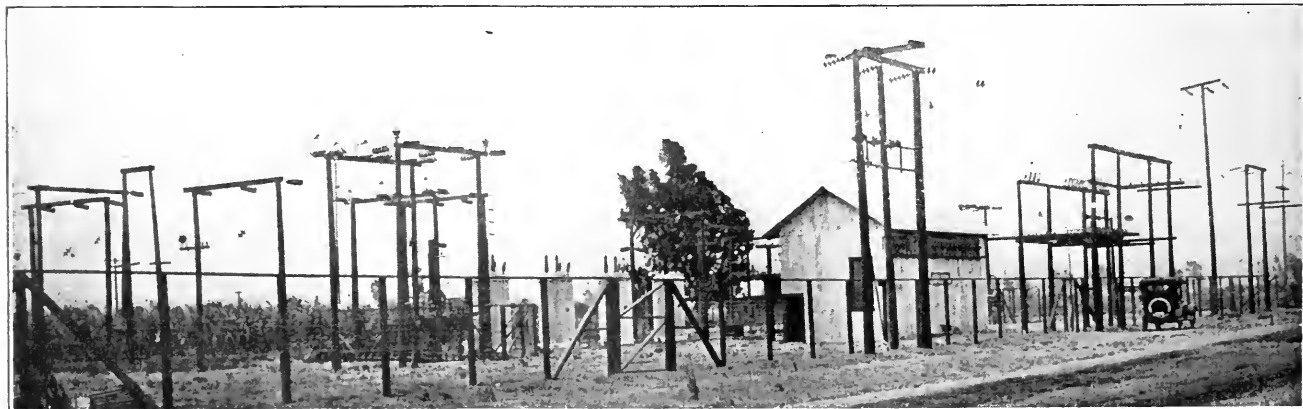


FIG. 1—GENERAL VIEW OF MADERA (CAL.) OUTDOOR SUBSTATION

corrugated-iron-covered wood-frame building which houses the metering equipment and the 11,000-volt oil switches. All the equipment in the building could and would have been purchased for outdoor installation had it not been for the fact that this type of building adds no more expense than the difference in cost of outdoor and indoor type switches and metering equipment. Also, it was thought desirable to provide a building so that the operator would be near the indicating instruments and the automatic feeder switches. If no building were provided, he would in all probability spend most of his time in his home, especially in bad weather, when line trouble would be most likely to occur.

The electrical equipment in the building consists of an 11,000-volt bus to which leads from the 11,000-volt side of the station transformers connect through a 300-amp., 15,000-volt General Electric K-12 oil switch and disconnecting switches. Similar equipment is installed on each of the seven feeders which tap off from the 11,000-volt bus. The switches and buses are mounted on pipe framework throughout. The feeder switches are automatic, but the switch on the transformer leads is not automatic. The metering equipment installed consists of three single-phase watt-hour meters, three ammeters, one Bristol recording voltmeter with a seven-day chart, and an indicating voltmeter which may be connected through a potential receptacle to any one of the three phases. This equipment is connected to current and potential transformers on the 11,000-volt transformer leads and measures the output of the transformers to the station bus. No metering equipment is installed on the individual feeders. Current transformers, however, are provided in each feeder for tripping the K-12 switches on overload

former is installed in the same manner to supply lights for the station building and grounds.

A very convenient 11,000-volt switch rack and paralleling bus has been provided outside the building, and all 11,000-volt feeders pass through this rack to the outgoing lines. A No. 1417 Pacific Electric & Manufac-

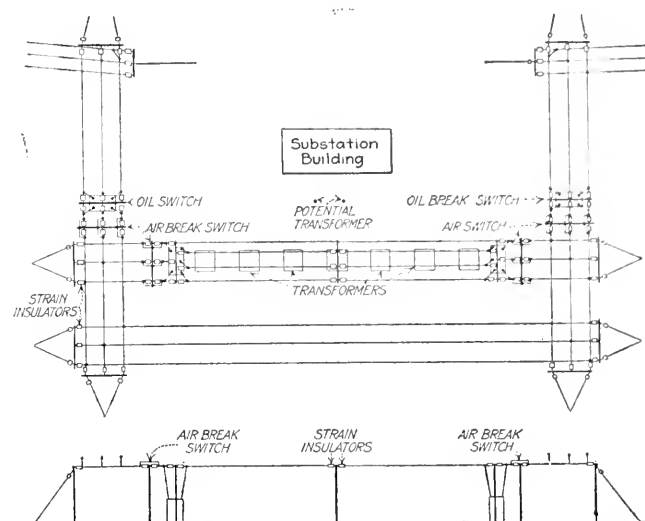


FIG. 3—ARRANGEMENT OF OUTDOOR SUBSTATION EQUIPMENT AT MADERA, CAL.

turing Company air-break switch has been installed on each outgoing feeder as a line "disconnect" to permit work on the oil switch inside the building. Each feeder taps outside this air-break switch through a second air-break switch to the paralleling bus, thus making it possible to attach any number of feeders to

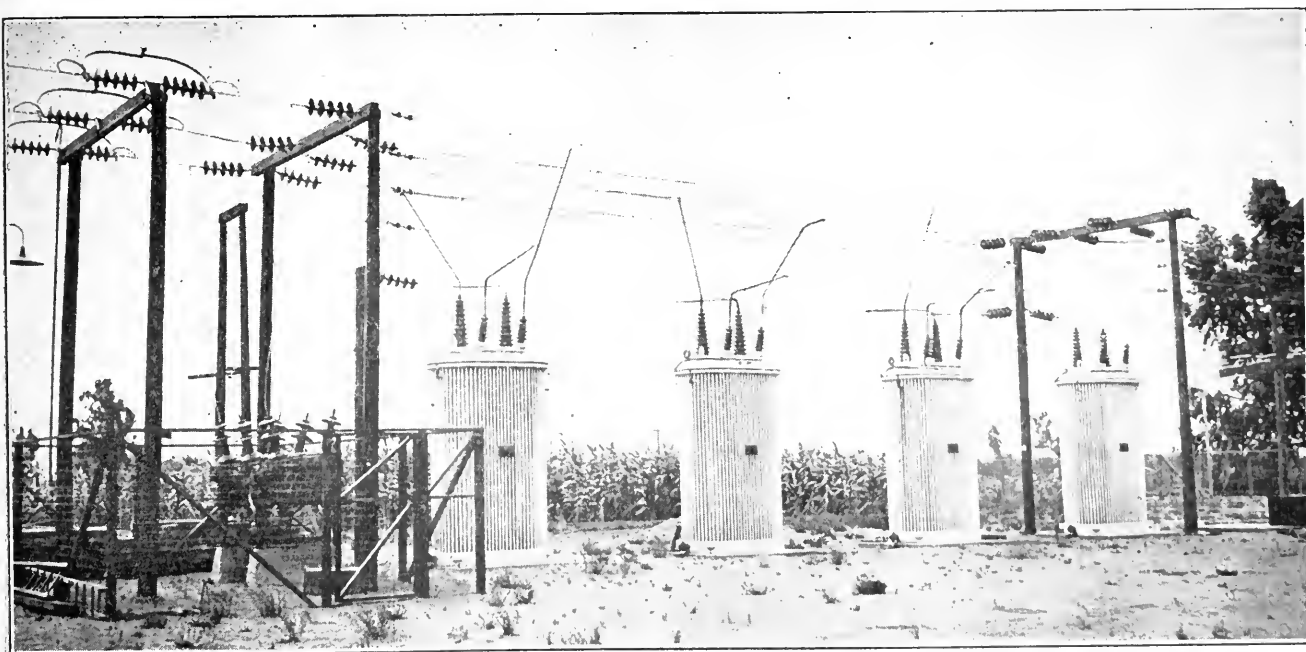


FIG. 4—METHOD OF CONNECTING 66-KV. TRANSFORMERS AND OIL SWITCHES WITH BUSBARS

or short circuit. Potential transformers for the metering equipment are installed on a pole outside the building, the secondary leads being brought into the building through conduit. This potential bank consists of three 1-kw., 6600-volt pole-line transformers which are connected in star for 11,000 volts with the neutral grounded. An 11,000-volt, 2½-kw. pole-line trans-

a single oil switch inside the building while repairs or adjustments are being made on the switches which are ordinarily connected with them. The long California summer causes all equipment to become very dusty if it is not cleaned often, so arrangements for taking apparatus out of service without interruption to it are very necessary in order to keep the equipment clean

enough to operate satisfactorily and without danger of insulator flash-over due to the heavy coating of dust.

The substation site covers two acres, thus giving ample room for the necessary electrical equipment and the cottage for the operator. Only one operator is employed, because very little switching is necessary, and all of the automatic switches are provided with

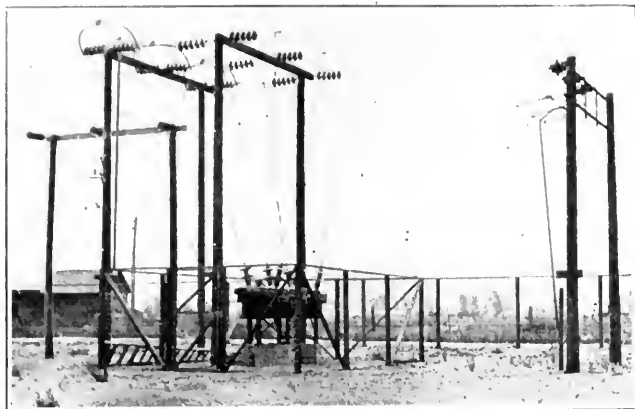


FIG. 5—METHOD OF CONNECTING 66-KV. OIL SWITCHES WITH OVERHEAD BUS

alarms so that in case one of them trips the operator is made aware of it. A 7-ft. (2.1-m.) woven-wire fence incloses the entire property, and a similar fence is installed around each of the 66,000-volt oil switches and any other equipment which might cause injury to any one coming in contact with it. The posts in the fence and the poles in the yard are painted a dark green. All cross-arms are painted yellow in accordance with a California state law.

The substation is provided with a private telephone connected with the corporation's private line, which is carried on the transmission line poles. Means for opening the telephone line and testing for trouble on it are provided. Connection to the operator's cottage is made

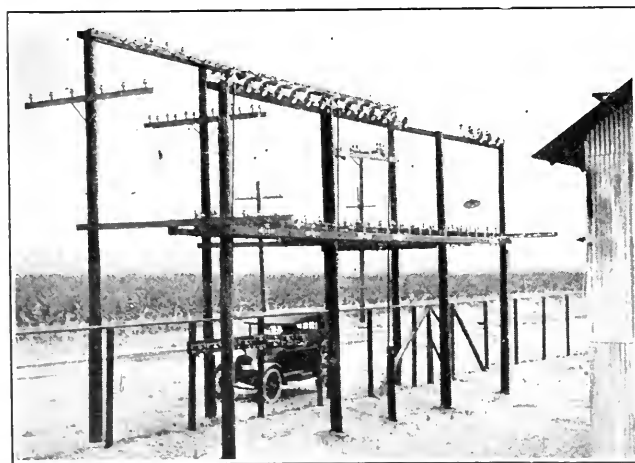


FIG. 6—TRANSFER BUS RACK FROM WHICH 11-KV. FEEDERS RADIATE

both from the private line and from the Bell system.

At the time of writing this article the details of the cost have not been compiled in full, but as far as it is possible to determine from the data on hand the cost of the substation complete, including operator's cottage, well, fences and all details, will be in the neighborhood of \$15 per kilowatt of ultimate capacity.

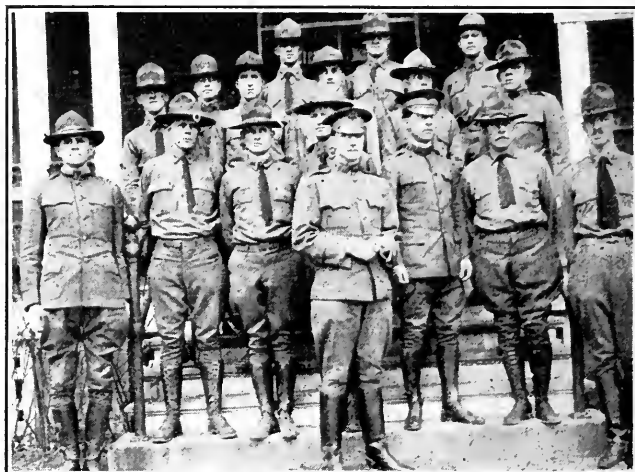
The substation was designed and constructed by the writer, who is engineer for the San Joaquin Light & Power Corporation under the direct supervision of E. A. Quinn, general superintendent of the corporation.

ELECTRICAL MEN IN THE THIRTY-SEVENTH ENGINEERS

Regimental Mobilization Almost Complete—Two Battalions, Six Companies and 1500 Soldiers Compose the Personnel

The Thirty-seventh United States Engineers, which has been organized for electrical-mechanical service and trained at the old officers' training camp quarters at Fort Myer, Va., just outside Washington, has practically completed its mobilization, although there are some vacancies still open for enlistment to men beyond the draft age. The officers for the regiment, who have been taken mostly from the Engineers' Reserve Corps, have all been selected, and most of them are now assisting in putting the men through military training, one company at a time being now at work on the rifle range.

The regiment, which is under command of Col. Theodore H. Dillon, U. S. A., and consists of two battalions



COLONEL T. H. DILLON AND MEMBERS OF HIS STAFF, THIRTY-SEVENTH UNITED STATES ENGINEERS

of three companies each—a total of 1500 men—will be occupied with the construction, operation and maintenance of electrical and mechanical equipment. Included in the regiment are linemen, wiremen, general electrical repairmen, armature winders, oxy-acetylene welders, chauffeurs, automobile mechanics, machinists, boiler-makers, pattern-makers, molders, plumbers, pipe-fitters, carpenters, handy-men and cooks. These are rated as privates, and the promotion from that rank is to private, first class; corporal; sergeant; sergeant, first class, and from that to the higher engineer corps ratings.

Major Arthur B. Kratz, one of the officers of the regiment, made trips around the country for recruiting purposes in gathering that regiment, and upon one occasion he obtained in Chicago alone 400 men for the regiment within five days. In addition to the assistance rendered by the Illinois State Council of Defense in recruiting, the officers of the regiment received assistance from the American Electrical Committee for France and from the N. E. L. A.

Industrial Load Characteristics

A Study of Typical Daily Load Curves, with Demand and Load-Factor Figures for a Varied List of Industries and Institutions Ranging from Laundries to Federal Prisons

BY J. E. MELLETT

Power Sales Engineer, Georgia Railway & Power Company, Atlanta, Ga.

TAKEN as a whole, the central stations at the present time are probably serving electrical energy to every type of active industry. While most of the large power companies serve industries of wide diversification and secure a resultant diversity factor, some are geographically situated in so-called specialized industrial centers with predominant industries, such as steel manufacturing, coal mining, textile manufacture, flour milling, fertilizer manufacture, etc., and operating load factors are consequently to some extent affected. It will be of interest along this line, then, to note the accompanying list of a few types of industries served from the high-tension lines of the Georgia Railway & Power Company, Atlanta, Ga. This group does not include a great variety of industries served from its underground system or overhead commercial alternating system, nor those served indirectly through the many municipalities and other public service companies purchasing service from the company. Although large blocks of power are being used by distinct groups, such as textile mills, fertilizer plants, barytes mining, municipal distributing systems and municipal pumping, the large number of diversified industries connected to the system offsets the effect of group load factors and creates a wider diversity factor.

The maximum demands, kilowatt-hours per year per kilowatt of maximum demand and load factors included in this list of industries are based on the data for one plant in each class of industry. Observations of a number of load curves covering a wide period of time show that, while the maximum kilowatt demand varies with each plant in certain classes of industries, the general characteristics of load curves and load factors show very little variation.

A case in point was demonstrated by utilizing a composite of seven fertilizer-plant load curves. Each curve followed very closely the outlines of the others for each hour of the day and the variation in monthly kilowatt-

est number of warm carcasses are prepared and delivered to storage in the early evening.

Barytes mining requires a large volume of water to wash and assist in disintegrating the ore, and the load at night, of course, depends to a large extent on how badly production is needed. The same holds true with other mining.

Normally the load curve of a cottonseed-oil mill is flat, with a high load factor covering the period of operation, which runs anywhere from four to twelve months, depending on the location of the mill and its ability to secure seed. The peak at 6 o'clock, as shown on the curve, is not characteristic but is caused by a cake mill becoming clogged. Theoretically a cotton-lint bleaching plant should have a uniformly flat load curve, but there are times when trouble is experienced in removing lint from the steam-heated caldrons. This in turn affects the delivery of lint to the dryers and cleaning machines. The final product has a very fine snow-flaky appearance. It is ground still finer and used for gunpowder. The cotton-oil refinery load is usually flat for nine or ten hours and sometimes runs as long as twenty-four, depending on the production desired. Ammonia compressors are used to congeal the hot refined cottonseed oil, which is later compressed through weighing machines and sold as vegetable compound lard.

The accompanying chart of a cotton-gin load is an exceptionally good one and is much better than the average. This business is not desirable, as the load factor is very low and the return on the capital invested per kilowatt is small.

Cotton-delinting plants operate twenty-four hours per day, and the average load conditions are much better than the illustration. Briefly the process consists of beating the lint from cottonseed hulls. These beaters are usually arranged in batteries requiring a 200-hp. motor for each battery.

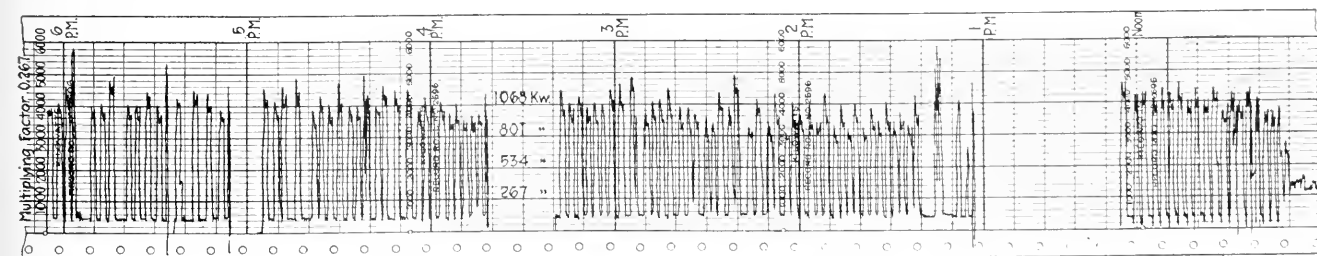


FIG. 1—GRAPHIC CHART OF A BILLET-MILL LOAD

hour consumption. A typical load curve of a fertilizer plant is shown herewith.

The load curve on the abattoir plant shows a gradual rise from 10 p. m. to 11:30 p. m. This is explained to some extent by the fact that a refrigerating machine is used to keep the meat storage boxes cool. The large-

The electric oven load, as shown, is somewhat erratic owing to the fact that the oven is controlled thermostatically to maintain a certain temperature in drying car bodies sprayed with enamel paint.

Limestone crusher peaks come on when large pieces of rock are dropped from cars or incline to the large

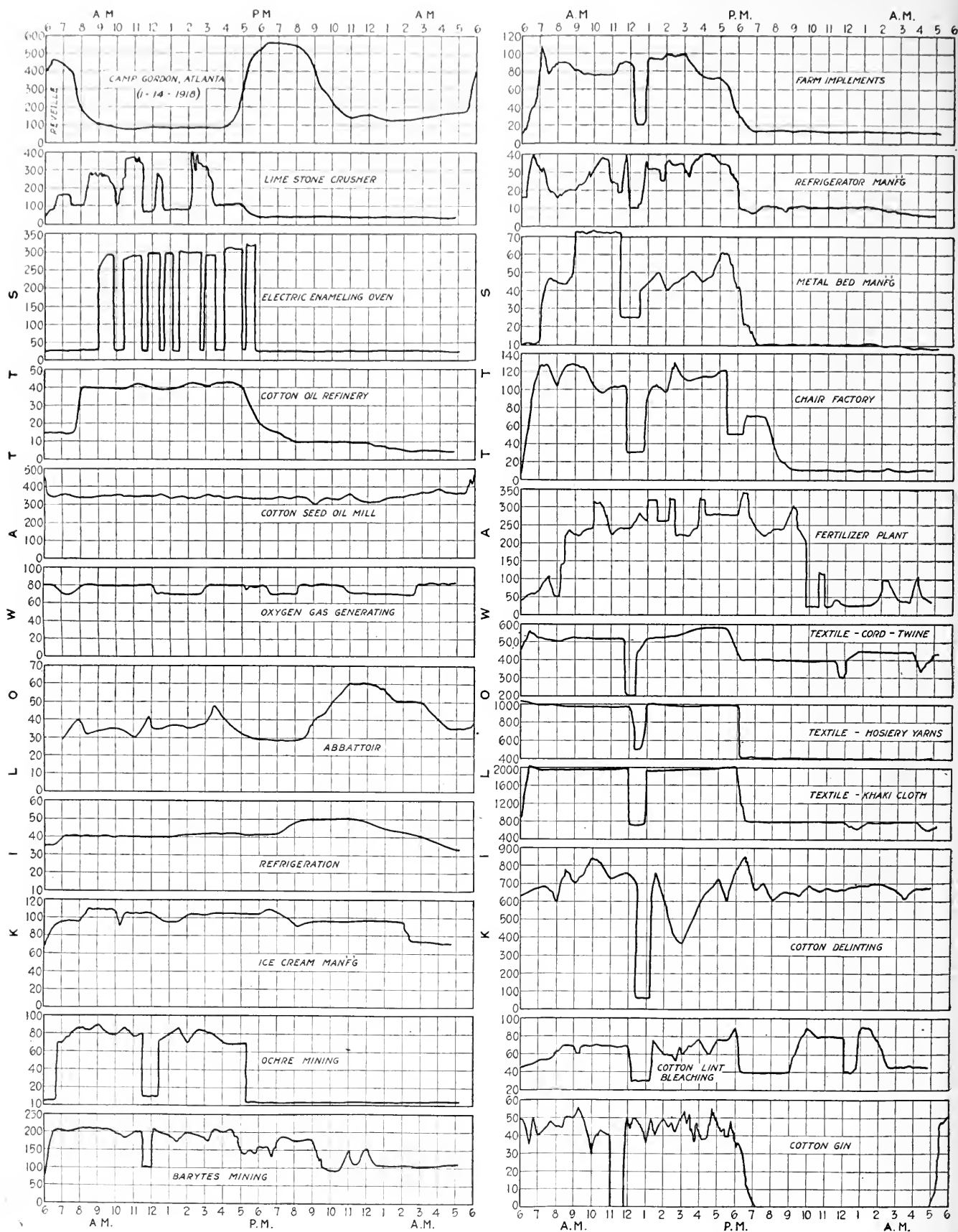


FIG. 2—REPRESENTATIVE DAILY LOAD CURVES

The peculiar features of each class of load are here brought out in comparison with other loads and tend to show the effect of peak building and load diversity on any system. Most of the loads, of course, drop off in the evening. Certain of the loads have a very high load factor; for instance, the cottonseed mill, the

oxygen-gas generator, ice-cream manufacturing and refrigeration. Others, like the cotton gin, have a poor load factor. The similarity of the load curves in the textile industry, though for different operations—cord and twine making, hosiery yarn spinning, khaki cloth manufacture—is noticeable.

crushers. The yearly load factor depends on the outside weather conditions.

The generation of oxygen gas for welding and other purposes is a very desirable load with a high load factor.

The graphic chart for a billet mill indicates a very irregular load, which compares well with average

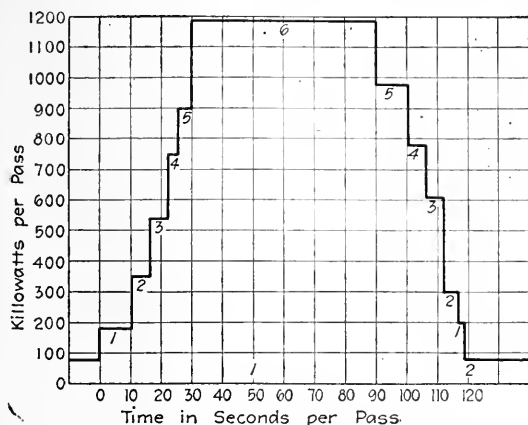


FIG. 3—LOAD CYCLE OF A BILLET GOING THROUGH ALL SIX PASSES

conditions. The bloom and billet mills are usually timed to promote continuous operation, but there are periods when some delay is caused at the bloom mill which in turn affects the load on the billet mill. If a new billet is not received in the first pass of the billet mill before the cold end leaves the sixth pass, it naturally follows that the load on the billet mill motor will drop off to friction load only.

Average conditions covering a number of records taken show that the demand on a 1600-hp. motor for one minute on cold steel is 1725 kw., on hot steel 1200 kw., an average load of 600 kw. and a friction load of 75 kw. doing the work as specified on the accompanying chart.

The average billet requires thirty seconds to reach the sixth pass, remains sixty seconds in the sixth pass, and the cold end requires twenty-nine seconds to leave the mill, thus consuming a total of 119 seconds for the entire number of passes. Numerous observations show a consumption of 30 kw.-hr. per completed billet. As several synchronous motor-generator sets are operated at this plant, no power-factor trouble is experienced.

The load curve as shown for a national army cantonment may be considered as typical for this class of business, especially at reveille and early evening. The valley between 8 a. m. and 5 p. m. is probably more pronounced at this camp than at others, owing to the fact that water is received from the city of Atlanta and then pumped to standpipes to secure proper fire pressure, where, on the other hand, the direct pumping load would be slightly heavier at camps isolated from a similar source of water supply. A load factor of 40 per cent is fairly good, however, when the preponderance of connected lighting load is taken into consideration.

As stated above, load curves taken on a number of plants in the same line of manufacture or of a similar nature show the same tendency, as illustrated by the accompanying charts of textile loads—on khaki cloth, hosiery yarns, cord and twine. The load factors vary with the load operated after 6 p. m.

The refrigeration curve as shown here represents the

load on a plant refrigerating peaches and other perishables during the summer months. This load is very desirable, as it is practically steady all the year round, dropping off slightly in the winter months. Another type of industry with a high load factor is the ice-cream business. The load shows very little change during the winter months in this section, the demand for this delicacy remaining fairly steady.

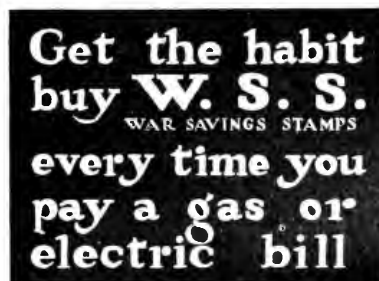
The manufacture of farm implements may be considered seasonal business, and while the load does not drop off abruptly like other types, the curve follows

CHARACTERISTICS OF ONE PLANT OF EACH CLASS OF BUSINESS
(LOAD FACTOR CALCULATED ON BASIS OF THIRTY-MINUTE YEARLY DEMAND)

Class of Industry	No. of Customers	Maximum Demand, Kw.	Kw.-Hr. per Kw. of Maximum Demand	Load Factor, 8760 Hours, per Cent
Abattoir and packing houses	2	76	6100	69.5
Asbestos grinding	1	51	468	5.4
Metal-bed manufacturing	1	144	2260	25.8
Brick plant	1	151	3180	35.2
Car wheels	1	67	1760	20.2
College, technical	3	56	2140	24.4
Cotton-lint bleaching	1	115	4350	49.5
Cotton-hull delinting	1	900	3810	51.8
Cotton gins	18	2100	5230	59.6
Cotton mills	19	45	550	6.25
Cottonseed-oil mills	10	410	3900	44.4
Cottonseed-oil refineries	1	60	3500	39.8
Electric furnaces	1	400	5000	57.2
Electric enameling ovens	1	300	1600	18.3
Farm implements	1	66	3640	41.4
Feed mills	2	75	4000	45.5
Fertilizer plants	13	330	2280	25.8
Flour mills	3	75	4260	48.5
Furniture factories	3	134	2260	27.7
Grist mills	9	15	1130	12.9
Harness factories	4	29	2760	31.3
Knitting mills	2	43	3500	40.2
Laundries	1	25	1400	16.0
Machine shops (munitions)	4	350	4850	53.5
Military camps	1	560	3450	39.5
Mining—ocher and barytes	14	210	2850	32.5
Municipalities	18	190	3800	50.2
Oxygen gas	1	103	6020	68.5
Potash extraction	1	125	3840	43.7
Printing and bookbinding	1	35	3430	40.2
Prison (federal)	1	200	4750	54.0
Pumping (industrial)	2	100	1800	20.5
Pumping (municipal)	21	490	6110	69.9
Quarries (granite)	1	430	2790	31.8
Quarries (limestone)	3	350	2290	26.0
Refrigerators	1	35	2860	32.5
Refrigeration	1	30	2500	24.4
Railway shops	2	125	3840	43.8
Railroad (steam) signal	2	31	3220	36.8
Shoe factories	1	90	1670	21.2
Steel mills	1	2500	3200	36.5
Tanneries	2	150	3330	37.9
Woolen mills	1	210	3240	36.9

the spring and fall demand for this class of goods. Although not illustrated in the chart shown herewith, the chair plant at times attains undesirable peaks of five to eight minutes' duration, which pulls the load factor down.

New York Lighting Companies Push Their Campaign



Bonds to Bind the Industry

Opportunity Presented by the Third Issue of Government War-Financing Obligations to Gather Together and Work Shoulder to Shoulder in Democracy's Cause—The Utilities' Chance to Aid

FOR the third time in a year the government is asking its people to lend their money to the cause of world freedom from the oppression of the Hun. To-day begins the national campaign for subscription to the third Liberty loan. At a higher rate than in the two previous issues—4½ per cent—the present loan is very attractive. It is so attractive that every home should have its bond.

To the electrical industry the third loan offers an especially attractive opportunity to help the government. The separate branches of the industry are talking more to-day of the necessity of working with the other branches—of strengthening the house from within, so to speak. The manufacturers, central stations, jobbers, dealers and contractors are beginning to look at one another now from a somewhat different angle and to recognize one another's strength in the industry's edifice.

One way to bring about better understanding is by gathering around a table for free exchange and interchange of thought and ideas. Another way is by working shoulder to shoulder to promote a cause that has no selfish attachments. Both of the ways are open in the Liberty bond campaign and naturally suggest themselves.

In each of the three weeks of the campaign there should be a meeting of the electrical men of the community for the purpose of seeing that every member of the industry subscribes for at least one fifty-dollar bond. For these meetings the local Liberty bond committee will gladly furnish speakers and literature and tell how to and how not to sell the bonds.

To do this a simple organization will suffice, but an organization of some kind will be necessary. It should be so worked out that there will be assurance that every electrical man will be called on by some one. Those who do not subscribe during the first call can be placed in a separate group to be called on during the third week by one person after another until the subscription is forthcoming.

It has been found during the two previous campaigns that efforts to secure subscriptions at meetings are futile. That the meetings are valuable is not denied, but their value lies in gaining the attention of those

attending and giving them something to think about when they get home.

The best way, as pointed out in previous issues of the ELECTRICAL WORLD, is by personal solicitation. Therefore to have the maximum of success every member of the electrical industry must be approached individually.

For this purpose it might be best to give to each member branch of the industry the task of securing the subscriptions of its members. Those not secured in the

first attempt can then be concentrated upon. The New York committee in this connection expects to secure maximum results from the contractors through the electrical inspectors. It is believed that a contractor will find it difficult to tell an inspector that he does not intend to subscribe.

One section of the electrical industry that has a greater opportunity to help the sale of bonds than any other is the electric light branch. Because of its contact with so many homes and business houses it has a chance to help the local committee. For the most part the campaign probably started at too late a date to allow of envelope stuffers with the bills for

March energy consumption. There is an opportunity, however, to send out Liberty loan literature with all bill receipts besides using the windows for display.

A large number of central stations in the two previous loans were of considerable assistance to the local committees. While a good many merely used the posters sent out by the publicity committee, there were a number of very original displays which attracted considerable attention.

One in particular, which drew mention by the local press and illustrates what can be done by lighting companies, was worked up by the Indiana Railways & Light Company. In this display a Liberty Bell about 2 ft. by 2 ft., made of heavy cardboard and painted in exact reproduction of the original, was made to ring by means of a cord running over large wooden pulleys painted to represent silver dollars, the device including a small pulley with a cord to which was suspended a "sack of money." The weight of this sack was necessary to cause the bell to return properly to the upright position when it had been tipped.

Third Liberty Loan

\$3,000,000,000

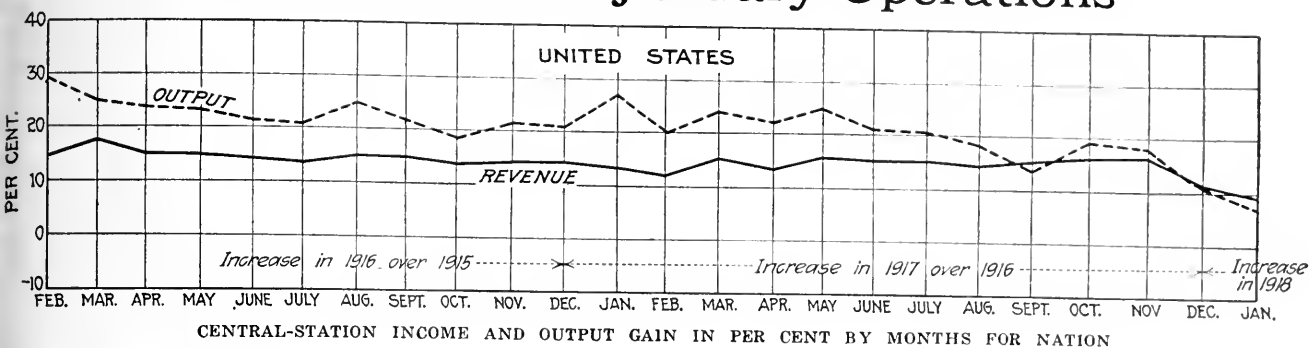
4½ Per Cent

Denominations \$50 Up

Three Weeks in Which to Subscribe

Wanted:
100 Per Cent Participation

Central-Station January Operations



CENTRAL-STATION statistics for January give precise data on the effect of lightless nights and the Garfield order closing industries. Revenues of properties reporting to the ELECTRICAL WORLD show an increase of 9.4 per cent over January, 1917, and the output in kilowatt-hours gained 7.1 per cent.

These figures indicate that the Fuel Administration regulations, while undoubtedly curtailing both output and gross revenue, had no large effect upon these production totals. The question of the effect upon net revenue is one with which the compilation does not deal.

It is apparent that, as might have been expected, the normal gain in output was affected more heavily than the normal gain in gross revenue; that is to say, consumption by heavy power users was curtailed more than consumption by smaller consumers. Heavy power users evidently took more than their normal amount of energy on days when the regulations were not in effect; if their factories had not been thus stimulated, the decline in the rate of increase would have been still larger.

It is noteworthy that in spite of the influences operating to curtail production the necessity for central-station energy is so keen that increases are still maintained over the large gains of the last few years.

If the activity of some industries is arrested by changes due to the war, the demand upon other indus-

tries is increased by the national requirements. The net result, so far as central-station production is concerned, is that every kilowatt-hour which can be generated is needed.

Based on the statistics reported for 50 per cent of

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	REVENUE FROM THE SALE OF ENERGY			Kw.-Hr. OUTPUT		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
Feb.	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March....	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April....	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May....	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,453,000	25.3
June....	63	23,279,000	20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July....	63	22,768,000	19,680,000	15.8	1,397,482,000	1,159,410,000	20.5
August....	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept....	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
Oct....	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.0
Nov....	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.1
Dec....	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.3
January..	50	1918	1917		1918	1917	
		21,165,000	19,344,000	9.4	1,393,917,000	1,298,824,000	7.1

the industry, the ELECTRICAL WORLD estimate for the entire industry for January is: Revenue, \$42,330,000; output sold, 2,778,000,000 kw.-hr.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States		
		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase
February..	64	\$3,039,000	\$2,686,000	13.1	65	\$10,249,000	\$9,021,000	13.6	55	\$7,471,000	\$6,530,000	14.4	86	\$4,284,000	\$3,926,000	9.2
March....	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
April....	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	7.0	86	4,282,000	3,821,000	12.1
May....	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
June....	64	2,641,000	2,290,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
July....	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
Aug.st....	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	12.9
September.	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
October....	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
November.	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
December.	64	3,483,000	2,999,000	16.1	58	10,834,000	9,919,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6
January...	54	1918	1917		45	1918	1917		42	1918	1917		75	1918	1917	
		3,056,000	2,707,000	12.9		7,605,000	7,439,000			6,466,000	5,496,000	17.6		4,038,000	3,702,000	0.9
February..	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
March....	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
April....	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
May....	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
June....	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
July....	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
August....	64	105,848,000	85,113,000	24.5	65	514,251,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
September.	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
October....	64	121,666,000	94,853,000	28.5	66	539,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
November.	64	130,311,000	108,561,000	20.0	65	532,301,000	415,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,381,000	357,535,000	6.1
December.	64	135,708,000	111,342,000	21.8	58	548,416,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,055,000	4.8
January...	54	1918	1917		45	1918	1917		42	1918	1917		75	1918	1917	
		110,133,000	98,192,000	12.1		328,168,000	337,148,000			510,282,000	461,565,000	0.15		445,364,000	401,919,000	10.7

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

KEEPING BOILERS GOING IN SEVERE CONDITIONS

Inability to Get Repair Parts Owing to Congested Freight Conditions Leads to Adoption of Temporary Makeshifts That Prove Worth

During the cold weather of the winter months several of the power houses of the state institutions of the State of Illinois had to adopt makeshift repair methods to maintain steam heat in the radiators and electric service on the lines. Repair parts which were intended to keep the plants in operating condition were lost or delayed in transit. These plants were confronted with a problem similar to that of a public utility in that it was necessary to give continuous service, as the shutdown meant suffering and privation to the occupants of the institutions.

At one of these plants a 400-hp. water-tube boiler to which fuel was being fed by a chain-grate stoker went out of service owing to the gate of the stoker hopper becoming disabled. The gate tile had burned out, thereby permitting the gate to drop on to the chain grate and be carried over the fire, where it was completely destroyed. The emergency was met by constructing a new gate from material at hand, as follows: Some 12-in. by 24-in. (30-cm. by 60-cm.) tiles, used ordinarily for constructing the bridge wall, were drilled at one end to receive a U-bolt, the bolts being clamped over a piece of pipe so as to provide a continuous line of tile. The assembled tiles were then dropped into the gate guides and held in place by a strut fitted over the top of the coal hopper. The depth of the fire was regulated by placing shims under the pipe or removing them to raise or lower the improvised gate. This gate was used until the repair parts arrived.

Put Your Savings in the Trenches

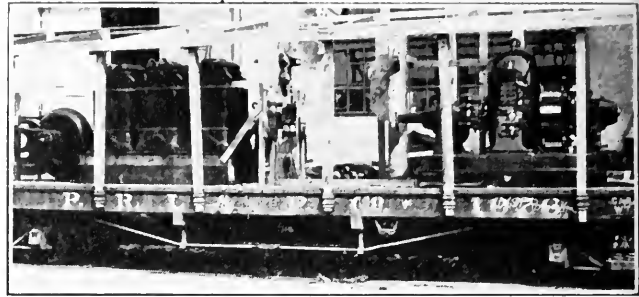
PORTABLE SUBSTATION FOR SERVING EMERGENCY LOADS

Central Station in Northwest Stands Ready to Supply Electric Service to Industrial Plants When Isolated Plants Break Down

The Portland (Ore.) Railway, Light & Power Company has equipped a flat car with a converter, air-blast transformers and the necessary auxiliary equipment so that it can dispatch it to any industrial plant in its territory which has a railroad siding when a sudden demand for electric service is made. This portable substation is used to supply energy temporarily until permanent equipment can be installed. It has been found especially useful in serving factories when their isolated plants break down.

The equipment carried on this flat car includes a 400-kw. rotary converter, three 11,000/440-volt air-

blast transformers, a 28-in. (71.1-cm.) motor-driven blower and the necessary switching and measuring apparatus. The arrangement of this equipment on the flat car is shown in the accompanying illustration.



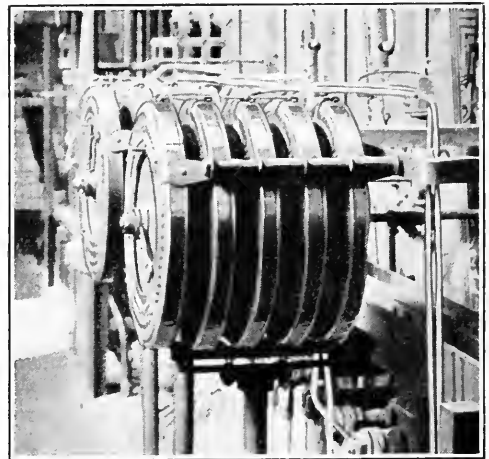
AIR-BLAST TRANSFORMERS AND ROTARY CONVERTER MOUNTED ON FLAT CAR

Over the equipment is built a wooden framework which can be covered with asbestos and tar paper to protect the apparatus from the weather. After the car is hauled to the place where it is to give service the weight is taken off the springs by jacking up the body, thus preventing excessive vibration during operation.

THREE-POINT MOUNTING OF FIELD RHEOSTATS

Ventilation Is Facilitated and Wiring Is Arranged So as Not to Interfere with Accessibility of Other Circuits

A convenient mounting employed in a New England generating plant for a five-section field rheostat is



VENTILATION FACILITATED BY THIS CONSTRUCTION

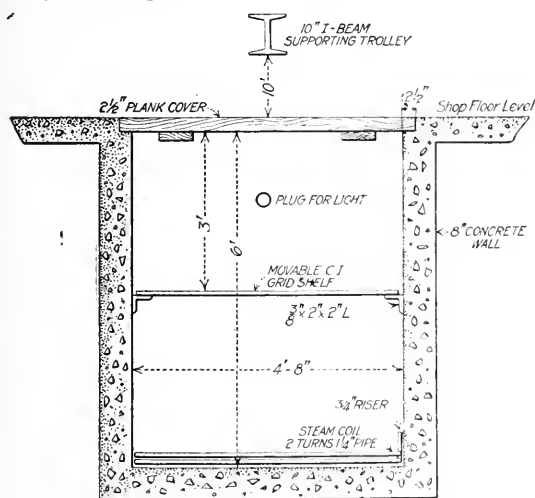
shown herewith. The resistors are in five parallel planes, with the central operating rod directly in line with the control handle on the switchboard panel in front. Each set of resistors is tied together by three

horizontal pipes bolted to strap-iron, the lower strap being fastened to a pedestal of wrought-iron pipe, the two upper ones being seated in a U-strap carried to a firm support on the switchboard panel. This construction affords excellent ventilation and enables the wiring to be carried behind the resistors and down past the buses and heavier cables at the rear of the board without any obstruction by small conductors of the aisle space between the board and the plant windows.

DRYING PIT DESIGNED FOR ELECTRICAL REPAIR SHOPS

Found to Be Especially Useful in Drying Apparatus Damaged by Floods—Details of Construction Given

A drying pit for electrical apparatus will be found useful in motor, transformer or other electrical repair shops, especially by central stations operating in districts susceptible to flood damage. The first cost of a drying pit with equipment is not excessive and will soon be saved if much repair work is under way. Drying apparatus in a heated container is cheaper than making a dry-out run on each appliance. Among the advantages of a drying pit is that it may be floored over and hence occupies no useful space. Furthermore, heavy machines may be lowered into a pit more easily than they can be placed in an oven.



CROSS-SECTION OF DRYING OUT PIT

PIT IN WHICH ELECTRICAL APPARATUS CAN BE DRIED OR BAKED AFTER BEING REPAIRED

A typical pit for a small shop may be constructed as shown in the accompanying drawing. Such a pit may be heated by any form of radiator. The pit referred to is equipped with a steam coil consisting of two complete turns of 1 1/4-in. (3.1-cm.) pipe placed at the bottom. To each side of the pit, 3 ft. (0.9 m.) below the floor level, is attached a 2-in. by 2-in. by 3/8-in. (5-cm. by 6-cm. by 0.95-cm.) angle, 9 ft. (2.7 m.) long. These support a movable gridiron 4 ft. (1.2 m.) long extending across the width of the opening. The gridiron forms a platform useful in supporting small motors, coils or other apparatus less than 3 ft. (0.9 m.) high, and serves the double purpose of increasing the storage space and holding the apparatus in the hottest part of the pit.

Ten feet (3 m.) above the pit and along its center line is a 10-in. (25.4-cm.) I-beam on which runs a trol-

ley and a 1-ton chain block, by means of which apparatus to be dried may be readily raised from a truck and lowered into any part of the pit. At one end of the pit a plug outlet is provided for lighting or testing purposes.

The pit is maintained at an average temperature of 85 deg. C. (185 deg. Fahr.). Small motors are ordinarily dried after rewinding for twenty-four hours, twelve before and twelve after dipping. Transformers are dried from twelve hours up, depending on the results of insulation tests.

Bonds—Uncle Sam's or the Kaiser's?

COMBINATION LOAD BOX AND CALIBRATOR SAVES LABOR

Arranging Meter Tester's Apparatus in a Compact Single Unit Practically Doubles the Number of Tests One Man Can Make per Day

The best average record which meter testers of the Crawfordsville (Ind.) Electric Light & Power Company could make formerly, using the ordinary type of testing apparatus, was thirty-five single-phase meters

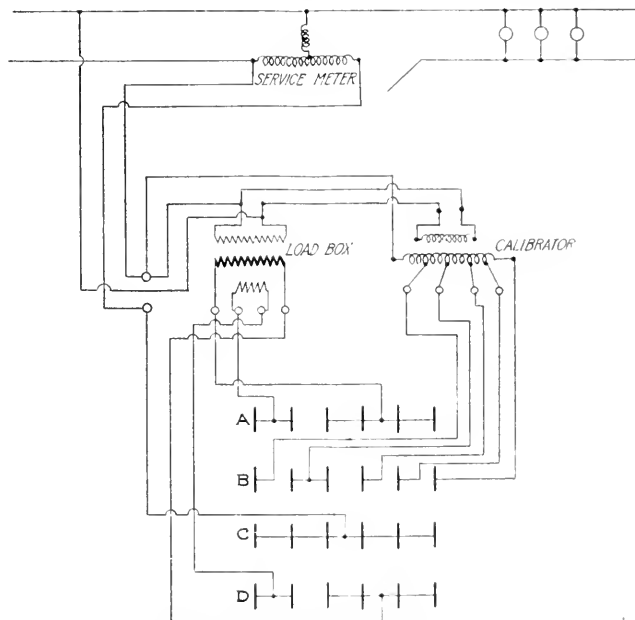


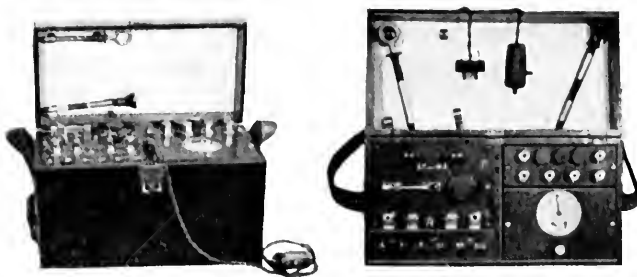
FIG. 1—WIRING DIAGRAM OF COMBINATION LOAD BOX AND CALIBRATOR

per day. After rearranging all of the apparatus into a single compact unit the meter tester was able to average sixty meters a day for a period of ten days. The single-unit set, which is shown herewith, included the load box and calibrator and all of the connections. F. H. Miller, manager of the Crawfordsville company, said that considerable time is saved by the use of this set because connections do not have to be changed frequently, only about one minute being required to prepare the outfit for testing.

Details concerning the construction of the set follow: The outfit complete weighs 30 lb. (13.6 kg.) and measures 15 in. (38.10 cm.) long by 7.5 in. (19.05 cm.) wide by 10.5 in. (26.67 cm.) high. It consists of a phantom-load box of the type made by the Eastern Specialty Company under the Herman & Mills patent, a Fort Wayne type M2 calibrator and the necessary con-

nections and switches. The load box has a range of 0.25 amp. to 50 amp. of non-inductive load. The calibrator has a range of 1 amp. to 100 amp. There is a 5-amp. light-load and a 5-amp. heavy-load adjustment.

To use the calibrator alone plug No. 1, shown in the lid of the outfit, is inserted to connect points *B* and *C* on the wiring diagram. To use the load box and the calibrator together plug No. 2 is inserted to connect



FIGS. 2 AND 3—SIDE AND TOP VIEWS OF COMBINED CALIBRATOR AND LOAD BOX

points *A* and *B* and *C* and *D*. The plugs are inserted through the holes marked 1 to 100, which correspond to the load desired. Spring switch clips are used for making contacts at the points *A*, *B*, *C* and *D*.

To conduct a test with this set, binding posts *A* are first connected with the service meter, a three-conductor cable composed of one potential wire and two current wires being used for all load conditions and tests. The potential connection is made at *P* and the calibrator control switch is connected at *S*. Iron connectors are used at *P* and *S*. By pushing the plug in the side of the pendent switch used with this outfit continuous operation is permitted. Pushing the end plug, which presses against a spring, causes the calibrator to assume the zero position.

Lend or Pay Higher Taxes, Which?

HOW TO REDUCE STRAINS ON PIN INSULATORS

Limiting Corner Angles for Pin Insulators and Other Requirements to Observe in Turning Transmission-Line Corners

Side strains on pin-type insulators and steel pins should be avoided when possible, but it is obvious that the various methods of turning corners without putting side strains on pins (such as the use of strain

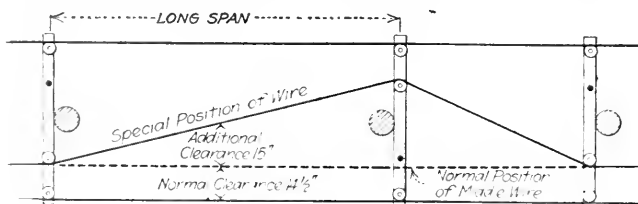


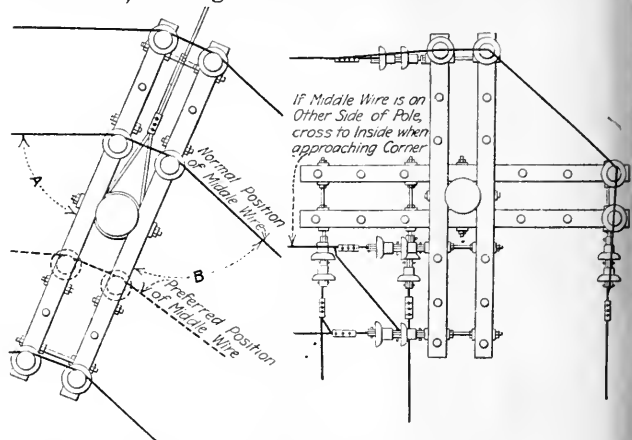
FIG. 1—CONSTRUCTION WHICH INCREASES MID-SPAN CLEARANCE

insulators or other forms of dead-ends) cannot always be adopted owing to the expense of such special construction. With each type of line it is necessary to determine a limiting corner angle beyond which it may be considered unsafe to turn on pin-type insula-

tors. This angle will depend on the type of pin, the size of conductor and the length of adjacent span.

On 11-kv. suburban lines one company makes practice of turning corners on pins (double-armed) where the adjacent spans are no greater than 300 ft (91.4 m.), the wire not larger than No. 4 and the angle not more acute than 135 deg. Where the wire larger strain-insulator dead-ends are employed, and if the angle is sharper, either buck-arm construction or a vertical corner (with strain insulators attached directly to the pole) is installed. It has been found by experience that a side strain greater than that obtained with the angle specified will in time bend the steel pins. In turning corners of this type care should be taken to "split" the angle with the cross-arm; that is, angles *A* and *B* (Fig. 2) should be equal.

Pins having wide bases are to be preferred as they afford a greater bearing area on the cross-arm to resist bending. If that type of pin is used which has a malleable-iron top with a split thimble, it should always be set with the thimble slot parallel to the cross-arm. If set otherwise, the side strain will close the slot and the diameter across the threads will be reduced, causing the insulator to become loose.



FIGS. 2 AND 3—METHOD OF SPLITTING THE ANGLE AT THE CROSS-ARM; CROSSING OVER THE WIRE SAVES PINS

In approaching a corner of this type, where the three wires of a three-phase line are carried on a four-pin or six-pin arm, if normal position of the middle wire would carry it on the outside, it is sometimes advisable to cross over at the corner pole and take the inside position, as shown in Fig. 3. This not only reduces slightly the side strain on the pins holding the middle wire by increasing the angle, but tends to hold the arm more securely in position. When approaching a buck-arm corner under similar conditions the middle wire should be crossed over as shown. This procedure saves four pins and insulators (which would otherwise be necessary to carry the line around the outside of the pole) and is neater and safer.

Occasionally where one or more especially long spans are installed and it is undesirable to employ larger cross-arms to give greater clearances between conductors, staggering the middle wire will permit the same result, giving maximum clearance in the center of the span where it is most required. For instance, assuming the use of arms having the standard four-pin N. E. L. A. drilling, by this scheme the clearance between wires in the center of the span is increased from 14 1/2 in. (36.8 cm.) to 29 1/2 in.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

OBJECTIONS TO INSISTING UPON CUSTOMERS' DEPOSITS

Discussion on Rule of Illinois Commission Covering
Methods of Handling Customers' Accounts
Shows Differences of Opinion

In a discussion of the tentative rule of the Public Utilities Commission of Illinois covering credit and customers' deposits, a few objections were voiced. It was noted that the rules were too definite in requiring that a company ask a deposit from every customer. There was considerable discussion also on the question of requiring customers' deposits at the end of twelve months. The discussion developed that there was practically no objection to following this policy with residential customers, but that there was an objection to it in connection with commercial customers. Certain classes of commercial customers are notoriously unstable, and while they may pay regularly for a considerable period of time they are entirely unscrupulous in the matter of paying final bills. In connection with establishing the amount of a deposit, the utilities contended that the deposit should amount to at least twice the amount of the estimated monthly bills, since collection methods employed usually permitted the customer to remain on the line for two months before being cut off.

PUBLIC UTILITIES' POINT OF VIEW

The Commonwealth Edison Company and the Public Service Company of Northern Illinois, presenting a brief on the rules, made the following comments on the rule for establishing credit:

The rule as drawn requires every new customer who does not own the premises in which the service is desired, or who owns real estate within the county, either to furnish a guaranty or who owns real estate within the county or to make a deposit. It gives the customer no other alternative, and gives no discretion in the utility, and actually operates to discriminate against the vast majority of customers whose credit is unquestioned and who are known to be well able to meet their bills promptly, irrespective of whether they own any real estate or not. In the first place, in a large city like Chicago, for instance, only a comparatively few people own any real estate, and in the second place, a great many people who are not owners of real estate are very well financially and have unquestioned credit with commercial houses, and a utility company in affording them the same means of establishing their credit that are adopted by other business concerns will, as experience has shown, take very little risk, and will in the long run give better satisfaction to its customers. It would be manifestly unfair and unnecessary, for instance, to ask a customer living in an expensive rented house or apartment, whose credit is unquestioned, to pay a deposit of \$5 in order to secure his monthly bills merely because he happens not to own any real estate and perhaps has not used the service of the company before. The fact that such a customer could easily afford to make the deposit is beside the issue. It is human nature to object at doing an unnecessary act and to regard any attempt to require the doing of such an act as an unjust intrusion upon one's rights. Long experience in dealing with hundreds of thousands of customers has clearly demonstrated

this to the credit departments of the Commonwealth Edison Company and the Public Service Company of Northern Illinois.

It is particularly necessary that a public utility company maintain good relations with its customers and with the public at large. Friction occurs often enough as things are, and utilities are already sufficiently subjected to the charge, unjust though it may be, of using arbitrary methods of dealing with their patrons. Any further cause of friction should be avoided if possible, and yet Rule 8 as drawn will operate to require the utilities of the State to put every new customer who does not own real estate, no matter how responsible he may be otherwise, to the inconvenience of furnishing a deposit or guaranty, as a condition to service, instead of taking such deposit or guaranty as at present only in the few exceptional instances where a customer's credit is shown to be poor or questionable. Rule 6, therefore, is not fair either to the public or to the utilities.

It is interesting to note, and directly bears out the foregoing criticism of Rule 8, that the Commonwealth Edison Company, after pursuing for years a policy of careful investigation of all new customers' credit, in 1917 required deposits from only 5 per cent of the customers connected to its mains during the year, the average amount of the deposit being \$9. This company has approximately 347,000 customers and now holds only about 17,000 deposits. The policy of the company in passing credits on applications for service in residences and flats has always been extremely liberal. It promptly turns on the light for any who send in written or telephone requests for service, the operator who turns on the light obtaining the signature to an application and this application being then passed through the credit department. If the customer has used the company's service before and has paid all his bills, he is not asked to make a deposit. If he gives satisfactory references or is employed in a permanent position paying only a moderate salary, his credit is passed without question. It is in general only those living in questionable places or women without any stated occupation or references who are required to pay a deposit. In the year 1917 131,718 applications for service in residences and flats passed through the company's credit department, and out of this number only 4047 deposits were required, or 3.25 per cent. In the case of applications for service in places of business it is the company's policy to require deposits in general only where the customer is just starting in business, or is unknown, or has no rating, or can give no references other than personal references. The location and character of the business govern the matter of deposits to a large extent. For instance, the experience of the company has demonstrated the advisability of requiring deposits from motion-picture theaters, saloons, restaurants, barber shops and other places of business subject to frequent change in ownership. In the year 1917 45,753 applications for service in business premises passed through the credit department of the company, and out of this number only 4541 deposits were required, or just about 10 per cent. The total number of deposits taken in the year 1917 from both residence and business customers was therefore 5.4 per cent of the total number of applications for service received in the year. On the other hand, the company's losses from unpaid accounts amounted in 1917 to only 0.36 of 1 per cent of the total amount billed during the year.

Cases were also cited before other commissions and courts to substantiate the fairness of the company's contentions in this matter.

Join the Army of Bondholders

POSTAL CARDS FOR BILLING

Oklahoma Properties Using Them Find Space Also for Advertising Purposes

In many ways government postal cards present a means of saving in billing. For one thing, the stock costs nothing. A number of central stations have come around to the use of postal cards for bills. The Oklahoma Gas & Electric Company at Kiefer and the Sapulpa (Okla.) Electric Company, under the management of H. M. Bylesby & Company, use similar cards,

TO OKLAHOMA GAS & ELECTRIC CO. DR KIEFER OKLAHOMA		SEC. _____ LINE _____
ELECTRIC CURRENT FOR DECEMBER 1917		DEC 1917 KIEFER OKLA
Our Wish for You A Very Prosperous New Year	OFC READING _____ KWH	
	NOV READING _____ KWH	
	CONSUMPTION _____ KWH	
	DISCOUNT 10 PER CENT IF PAID ON OR BEFORE JAN. 10 1918	
	NET AMOUNT	
	MINIMUM BILL, NO DISCOUNT	
	DELINQUENT BILL, NO DISCOUNT	
	TOTAL	
BRING THIS CARD, PLEASE, TO BE RECEIPTED <small>FAILURE TO RECEIVE BILL DOES NOT ENTITLE CONSUMER TO DISCOUNT JENNINGS POC CO SAPULPA</small>		SEND THIS STUB WHEN YOU REMIT BY CHECK

POSTAL CARD BILLS HAVE THEIR OWN ADVANTAGES

one of which is shown. Dates and the space to the right are in red and are changed each month, and the space at the left is used for advertisements and announcements.

Send Your Dollars to the Front

GRANTING CREDIT UPON HOUSE-WIRING CONTRACTS

Method Employed by Middle Western Company in Cases Where Applicant Is Not the Full Owner of Property

In taking house-wiring contracts the credit standing of the customer should receive careful attention, for much of this business is done on other than a cash basis. The method used by one of the Middle Western companies in this connection is as follows:

On receipt of a house-wiring contract the name and location are entered in the receiving book, and a number is given as a means of identification. The location is then looked up through a firm employed for this purpose to see if the applicant's claim of ownership can be verified, the credit data are checked, and references are investigated as in commercial and residence contracts. If the investigation shows the applicant to be a good credit risk, holding title to the premises where the work is to be done, and the relation of the encumbrance to the valuation is not excessive, the contract is approved. If, however, the applicant is found to be buying the premises on contract of recent date and his equity therein is not sufficient to warrant the installation, the holder of title is urged to sign the contract jointly with the applicant. Should the records show the applicant to be buying the property on contract which has extended over a period of years and upon which a substantial sum has been paid, the owner of record is requested to sign a rider giving date of the contract of sale, the amount involved in the

contract, the amount the applicant has paid on same to date, and permission to the company to install the wiring, which permission carries the stipulation that all bills are to be paid by the applicant. Contract of this nature handled by this company average in price, including fixtures, from \$60 up, most of them being around \$200, but occasionally single contract amount to \$2,000 and more.

Help the Cause of Liberty

REDUCING THE EXPENSE OF HANDLING CUSTOM ACCOUNTS

Combination Gas and Electric Billing and Use of Billing Machines Effects Saving and Is More Satisfactory

The Central Illinois Light Company of Peoria, Ill. has worked out a system for handling customers' accounts that it believes is particularly adapted to fit its conditions. The system contains features, however, that seem also adaptable to the plans of other companies as measures of conservation. The features of the system lie in the combination gas and electric bill and in the machines for handling ledger work.

The company began using its present combination bill in January, 1917, although combination gas and electric billing went into effect in July, 1916. J. H. Thomas, chief clerk for the company, writing concerning this bill, said: "The advantages of the combined bill as I see them are, first, elimination of the sorting of meter-read slips and bills, thus allowing meter readers to give all their time to meter reading and bill distribution; second, ledger keepers are enabled to post credits, make delinquent notices and draw off balances in one-third less time than formerly; third, cashiers are able to handle customers faster, as it is no longer necessary for them to add the gas and electric amounts when the bill goes to the consumer with the net amounts extended. Also the cashiers require one-third less time in adding the coupons than formerly."

Mr. Thomas continued:

In January we replaced our long-hand billing with machine billing, and I consider this a real conservation measure, as our billing force was reduced to one-half of that formerly required. One operator and one stamping clerk now handle 29,000 meters per month. Part of our bills are extended by machine and part by rubber stamps. By test we have proved that extensions may be stamped twice as fast as they could be entered by machine. By analyzing our bills for several months we found that if we used 300 stamps we could stamp about 75 per cent of all extensions; hence our bill design is such that when the consumption in kilowatt-hours or in cubic feet is in excess of fifty (the limit with the stamps) the extension can be completed by machine. From our experience with machine billing we find that a saving of about 30 per cent has been effected in billing expense. The other advantages are a much neater bill and a reduction in the time required between reading and bill delivery.

Our bill is made out directly from the meter-read slip. We do not make a recapitulation sheet or use a carbon-copy ledger; therefore, of course, do not add meter readings, etc., it being the writer's opinion that this checking is a sort of "tail wagging the dog" proposition.

On Jan. 1, 1918, we also changed to machine-entered ledgers, and with these were further able to reduce our force. I am of the belief that this ledger installation is the first of its kind. We have used it but a short time, but a thorough preliminary test was given it. Actual working has maintained the results of the test. By its adoption we have been able to reduce ledger costs 30 per cent.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

White River Development in Northwest.—F. SCHMIDT.—Description of the hydraulic features of the White River development of the Puget Sound Traction, Light & Power Company, in which a 23,000-hp. water turbine is being installed. In order to prevent excessive variations in speed and voltage of the power system, it was necessary to use a very sensitive governor to control quickly the gates of the turbine. After a careful analysis of all precautionary methods employed was made it was decided to use (1) a surge reservoir, (2) pressure regulators, (3) air-cushion tanks. A combination of these three devices, together with an adequate fly-wheel effect in the revolving parts of the generators, made it possible to attain very satisfactory speed regulation. The article goes on to give details regarding different parts of the plant.—*Journal of Electricity*, Feb. 15, 1918.

Generation, Transmission and Distribution

Parallel Operation of Transformers.—F. KADE.—Transformers generally operate satisfactorily in parallel if their percentage ohmic and inductive drops are equal. In most cases it suffices if the short-circuit voltages are equal. There are, however, cases in which this condition is not sufficient; e.g., where two transformers are loaded differently, one each side of the circuit. Then the division of the loads between the two transformers varies with the relative magnitude of such loads. A number of such cases are described and the conclusion is reached that satisfactory parallel operation does not depend solely on the design of the transformers, but that the method of connecting them in circuit has an important effect.—*Science Abstracts*, Section B, Jan. 31, 1918 (abstracted from *Elektrotechnische Zeitschrift*, Oct. 11, 1917).

Electric Power Supply in England.—In this article the council of the Incorporated Municipal Electrical Association presents its views regarding the improvement of electric power supply in England. The statement reads, in part, as follows: "To insure that there shall be an adequate and economical supply of electric power it is necessary that the areas of supply should be selected according to the demand and facilities for obtaining suitable sites for generating stations. Generation should be on a large scale and extend over a considerable area, whereas distribution, which includes dealing with individual consumers, may conveniently be organized in smaller areas. The new areas of both generation and distribution should be continuous and will in many cases include within their limits places which at present are without supply. It is expressly emphasized that the best use possible should be made of existing systems of generation, transmission and distribution and also of the local knowledge obtained by the established undertakings. In many cases a joint board might be established for the generation of

all energy required in a large area and for the transmission of such energy by means of trunk mains, leaving the distribution to be effected locally. Some alternatives which have been adopted with excellent results in the supply of water and gas were suggested. Suitable provision should be made with regard to the rights and obligations of existing undertakings if the whole or any portion of an existing undertaking is transferred to a larger authority. The opinion was expressed that it would be a fatal mistake to put the supply of electricity entirely in the hands of public authorities. As regards having the control of the electricity supply vested in a central government authority, it was thought desirable that this authority should be strong on technical and inspectorial qualifications and should be responsible to Parliament.—*London Electrical Review*, Feb. 22, 1918.

Traction

Ventilated Motors During a Strenuous Winter.—R. E. HELLMUND.—The excessive troubles and breakdowns experienced during the past severe winter season with car equipments suggest the following questions with regard to the motors: (1) To what extent is the introduction of the ventilated type of railway motors responsible for breakdowns? (2) What can be done with regard to operation and maintenance to avoid a recurrence of the recent experiences in connection with the motors? (3) Is the ventilated motor a practical proposition and is it destined to survive? The following conclusions were the ones reached: That a certain amount of damage is done to the motor equipment owing to the dampness within the motor caused by snow and water conditions. The older so-called inclosed motors suffered more than the ventilated motors. Much of the snow causing the damage to the motor entered through the top commutator opening on account of missing or badly fitting commutator covers. Ventilated motors for a given continuous rating weigh less than non-ventilated motors and absorb less heat. Under ordinary operating conditions this is of little consequence, but under emergency conditions such as obtain while cars are bucking snowdrifts, pulling disabled cars home, etc., the ventilated motor, if worked to the limit of its continuous rating, is more liable to roast out than the old non-ventilated type. The extra weight of the latter and the larger mass can temporarily absorb, during heavy overloads of short duration, a certain amount of heat which tends to prevent overheating. A number of failures of ventilated motors have also occurred where the cars have been overmotored.—*Electric Railway Journal*, March 16, 1918.

Installations, Systems and Appliances

Standardization in South African Electric Supply Systems.—JOHN ROBERTS.—The author proceeds to consider the subject under the following heads: System—(1) Class of current, alternating or direct; (2) period—

city; (3) number of phases; (4) generating pressure; (5) transmission pressure; (6) supply pressure of distribution; (7) system of distribution network. Materials and Plant—(a) Sizes of bare and covered conductors for overhead work; (b) insulators; (c) system of cable laying for underground mains; (d) sizes of cables; (e) street lamp brackets; (f) meters; (g) plugs for heating appliances.—*London Electrician*, Feb. 8, 1918.

Improvement of Power Factor.—F. SCOUMANNE.—The first methods used in the improvement of power factor in large central stations applied only to the receiving apparatus; the idea of using the reactive current for this purpose by means of special appliances is a recent one. In the first part of an extended discussion of this subject the author, after a brief history of the problem and a statement of its present status, studies particularly the overexcited synchronous motor and the condenser equipped with a solid dielectric. He gives the complete theory of these two kinds of apparatus and compares their characteristics, coming to the conclusion that from almost every point of view the static condenser has considerable advantages over the synchronous condenser. The high price of the former and the lack of experience in its use are objections that time will overcome.—*Revue Générale de l'Electricité*, Feb. 9, 1918.

Electrophysics and Magnetism

Calculation of the Non-Sinusoidal Effective Emf. of an Alternator.—H. PÉCHEUX.—The calculation of the effective emf. of an industrial alternator in terms of the maximum emf. is laborious and necessitates calculating the coefficients of the Fourier series which represents the instantaneous emf. of the alternator. This article gives a method of attaining the desired result using only elementary mathematical processes.—*Revue Générale de l'Electricité*, Feb. 9, 1918.

Nature of the Ultimate Magnetic Particle.—ARTHUR H. COMPTON and OSWALD ROGNLEY.—In the opinion of the authors the ultimate magnetic particle is neither a group of atoms such as the chemical molecule nor the atom itself, which is the elementary magnet. "We must look rather to the atomic nucleus, as suggested by Merritt, or to the electron, as proposed by Parson, for the ultimate magnetic particle."—*Physical Review*, February, 1918.

Phenomenon of Voltage Surge in a Circuit Without Self-Inductance.—H. CHAUMAT.—In a note communicated to the Académie des Sciences the author described a phenomenon which at first sight appears paradoxical and which he thought had not previously been observed. The phenomenon consisted of a voltage surge in a direct-current circuit containing no self-inductance and including only condensers and resistors. It took place while the circuit was closed and all the connections remained unchanged. A mathematical demonstration of the phenomenon is given.—*Revue Générale de l'Electricité*, Feb. 9, 1918.

Units, Measurements and Instruments

Measurement of Small Inductances and Power Losses in Condensers.—ALBERT CAMPBELL.—The measurement of very small self-inductances in circuits having only two terminals is not difficult if the resistances are not high. One of the simplest ways of doing this is by

Heaviside's method, in which comparison is made with a known mutual inductance. It is easy to build a mutual inductometer of almost any desired lowness of range by stranding the windings of the coils. It is shown that the inductances of such resistances can be determined by the addition of the Kelvin double bridge to the Heaviside bridge. The author proceeds to describe the methods involved for the measurement, giving valuable data with mathematical calculations pertaining thereto.—*London Electrician*, Feb. 8, 1918.

Telegraphy, Telephony and Signals

Radio-Telephony.—ALFRED N. GOLDSMITH.—Thirteenth article of a series intended to direct university extension work. The author describes a system of radio-telephony control involving both an Alexanderson alternator for the direct generation of the radio-frequency energy and one or more pliotrons for the modulation and control thereof. Ferromagnetic control systems are also described.—*Wireless Age*, January, 1918.

Miscellaneous

Present Status of Insulator Depreciation.—C. E. OAKES.—Numerous experiments have proved that porcelain rapidly becomes an electrolyte with an increase in temperature. When it is also considered that porcelain which has absorbed more or less water is already an electrolyte, failures are to be expected. There are reasons for believing that a large percentage of the total failures are due to cracking of the porcelain in the insulators. The many factors which contribute to the mechanical stresses to which an insulator is subjected complicate the problem of ascribing causes to a given failure. Among the factors which cause undue stresses can be named: (1) Faulty design of the insulator, (2) use of materials having widely different temperature coefficients (that of porcelain is about one-half that of steel), (3) the stresses set up in the insulator due to the change in volume of cement under varying weather conditions, and (4) the gradual increase, with time, in volume of the cement. Investigations to determine the change of volume with temperature, variations, breaking strength of porcelain, etc., were outlined and useful information presented.—*Journal of Electricity*, Feb. 15, 1918.

Switchgear Standardization.—C. C. GARRARD.—In regard to knife switches, the author says that a standardization of the length of break, distance between the poles, sizes of terminals, current density and construction details is very necessary. When installing an oil switch on a large system the maximum power in kilovolt-amperes which it will have to rupture has to be considered. Large motors may be protected by a small choking coil. The time taken to blow a fuse depends upon the size and the degree of overload. The normal fusing current can best be ascertained by plotting a curve. For the construction of starters and regulators the copper-nickel alloys are suggested. Starters should be standardized as regards rating. Cellular compartments are especially favored by the writer for high-tension switching and busbar equipment. The horn gap in combination with lightning arresters should be standardized, as should choking coils. Of late, two methods for the protection of large systems have come to the front, namely, the static condenser system and the electrolytic.—*London Electrician*, Feb. 22 and March 1, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

DAYLIGHT SAVING MAY

LEAD TO HIGHER RATES

President Edgar of Boston Edison Company Says
that Yearly Daylight Saving Would Influence
the Peak

President Charles L. Edgar of the Boston Edison company briefly commented upon the probable effect of daylight saving on the central-station industry at a hearing April 1 before the Massachusetts Gas and Electric Light Commission. The company's general rate schedule is under investigation.

Mr. Edgar said that if daylight saving were in effect all the year around it would have a decided influence upon the peak, and at the end of two or three years would not affect the central station unfavorably. The use would go down in the same proportion as the peak. "But if the peak is to remain the same by having the ordinary time in the winter the central station will lose in the seven months and not recoup any of the loss during the winter," said Mr. Edgar.

The speaker stated that the general theory is that with daylight saving the year around the peak would be reduced. This seems to be the effect in Detroit, which is the only place fairly comparable to Boston. England is so much farther north (London being in the latitude of Labrador and Boston of Italy) that British conditions furnish little assistance for comparisons with Boston data. English children have always gone to bed by daylight and have done so no more this year than before. Furthermore, England has lightless nights on account of air raids, and is "long" of coal whereas Massachusetts is "short" of coal.

Mr. Edgar said further, in part:

We have no idea what effect the daylight saving will have on us. All I can say is that, taking yesterday's output, there was a falling off of about 15 per cent. Of course, that was simply one day, and a Sunday, and we cannot yet tell what the result here is going to be. But if conditions here were similar to what they have been in England, we might have to raise prices 25 per cent and still lose money. When I say "we" I don't mean the Boston Edison company, but the industry as a whole. I cannot, however, conceive of conditions here being as bad as that, though there has already been an appalling falling off.

On the darkest winter nights we turn on our street lights at 4.40 o'clock. New York turns them on at 5.05 o'clock, because New York is further west. Both cities have the same general habit of storekeepers closing their stores at 5 o'clock. It has been very noticeable that our investment is tremendously higher than that of New York because of that fact. We have a peak in proportion to the business very much higher than they have. Now, that would be overcome if we had the daylight saving in winter, provided that people did not change their habits. There are people who will want to close their stores just about dark, regardless of whether it is 5 o'clock or 6 o'clock. Nobody knows what the psychological effect of that will be. That is not true in summer, because the darkness comes so late that it is after business hours, anyway; but if stores continue to close a few minutes after dark daylight saving will not be saving at all, it won't have any effect.

But, on the theory that stores close at 5 o'clock and that we won't turn on the street lights till 5.45, our peak, which would be ordinarily 95,000 kw., might not be over 85,000 kw. Therefore the industry, while bowing to the demand of the public for daylight saving, wishes that it might be done for the year, and there has been quite a tendency in Washington to make it for the year. But it hasn't been done yet. So, instead of having it a seven-month law, we would like to see it made a twelve-month law. But I have no idea what the effect is going to be, and I am free to say that I don't think anybody has any idea. It has never been tried in this latitude.

Detroit has tried it, and the situation there is rather curious. It is halfway between middle and central time. They have been half an hour out one way, and they will now be half an hour the other. Of course, that has a tremendous effect on them. And they have tried it a year. The effect in winter is even more pronounced. As a matter of fact, the Detroit curves show that their morning peak is greater than their evening peak, which is phenomenal. That has never happened in this country—has never happened anywhere.

As a matter of fact, one can read a newspaper in London at 10 o'clock at night anywhere, and where the necessity for lighting comes from 10 to 11 naturally there is not the same situation or the same effect as where it comes from 7 to 8. As far as Buffalo would be concerned, the situation would be much the same in some respects as in Detroit. Buffalo is on the ragged edge. It has been going according to Western time, and is now changed to Eastern time. It has been half an hour one way, and now will be half an hour the other way. But I don't think Buffalo has tried it.

We will not have any data on daylight saving until about May 20. It takes us two or three weeks to get our data for a month. It is not only a question of what the drop has been, but what the drop has been in any particular price. Unfortunately, the drop seems to be all coming on the 10-cent rate, because it is that kind of service that is affected by daylight and darkness. If the effect yesterday is any criterion, it would seem as though it was going to be equivalent to 2 or 3 cents on our retail price.

Liberty Bonds Are Safe and Sure

Working to Conserve Fuel in New York State

At a second conference of representatives of various state associations and light, power and heat companies of the State, held with the New York Public Service Commission, Second District, Albany, it was decided to co-operate with State Fuel Administrator Wiggins in the conservation of fuel in connection with the production of light, heat and power.

Those present were Chairman Hill, Public Service Commission; Gerritt Y. Lansing, Fuel Administrator, Albany; R. M. Cox, Middletown, representing the State Conference of Mayors; A. E. Cluett, Troy, representing New York State Manufacturers' Association; J. T. Hutchings, Rochester; Stuart Wilder, Mount Vernon, and H. W. Peck, Schenectady, representing power companies, and E. J. Cheney, engineer light, heat and power division of the Public Service Commission.

It was decided to begin a campaign to bring about conservation of fuel, and committees were appointed.

Fuel Administration for Water-Power Law

In Hearing Before Committee of Congress Charles E. Stuart, Technical Representative of Fuel Administration, Points to Necessity of Conservation in Fuel and Power

CHARLES E. STUART, technical representative of the United States Fuel Administration, made an extended argument in favor of the proposed House of Representatives' substitute for Senate bill 1419 during the recent hearings before the House joint power committee at Washington. These hearings have been reported in some detail in the *ELECTRICAL WORLD*. Mr. Stuart's argument dealt with the great importance of saving fuel and power and avoiding waste. It urges that there be a complete perspective of the entire power situation at some centralized point, as at Washington.

WATER POWER AND THE COAL PROBLEM

The coal problem, said Mr. Stuart, is one which calls for effective conservation measures to prevent a continued shortage of coal during the next twelve months. To avoid or alleviate this shortage, three alternatives are possible. These are, briefly, as follows:

(1) Direct curtailment of consumption of fuel; (2) increased efficiency in use of fuel, and (3) replacement of fuel power by other power.

Under the conditions existing during last January the first alternative was the only practical resort, Mr. Stuart continued. "Every effort is being made by the Fuel Administration, however," he said, "to avoid the necessity of similar recourse to this alternative in the future by securing increased efficiency in the use of fuel (and of power) and through the replacement of fuel by other power."

At the present time the efforts of the Fuel Administration along the lines of the first alternative are directed largely toward the curtailment of non-essentials, added Mr. Stuart. Its efforts toward securing increased efficiency in the use of fuel may be divided, first, into those for securing increased efficiency in combustion and in steam applications in heating and power plants of all kinds, and, second, into those for securing increased economy through greater centralization in the production of electric power.

"This latter method," Mr. Stuart said, "depends for its results upon the fact that the average small isolated plant will consume from 6 lb. to 10 lb. of coal per kilowatt-hour, whereas the consumption of the average central station will usually range from 2½ lb. to 5 lb. of coal per kilowatt-hour.

"The work of conserving fuel by the centralization of power is handicapped in some localities, such as Philadelphia and Pittsburgh, by the fact that the central power stations are already fully loaded and are thus not able to carry the increased load which would result from the addition of the loads now carried by isolated plants. In such cases there is sometimes an additional method of securing results by interconnecting power stations. Owing to the fact that the maximum loads on different stations usually occur at different hours, two plants, if interconnected, can usually supply a greater output than if operated separately.

"It may be stated in respect to these localities that

the question of conserving fuel is secondary to that of conserving loads of the vitally important war-material manufacturing plants. To do either in those sections which are short of power it will obviously be a case of enlarging the central stations, building isolated stations to handle individual loads or utilizing a third means, namely, the interconnection of power systems. The building of isolated stations should be absolutely discouraged, as a general rule, to which rule we consider there are important exceptions. The rule is based on the fact that the money spent in constructing an isolated station will usually develop a far greater generating capacity where used in the enlargement of an existing modern generating plant."

Mr. Stuart argued that the interconnection of power systems possesses far greater merit than does the enlargement of existing plants. Greater use is made of the equipment already installed, the cost of interconnecting for increased capacity should be less, and the class of material and of labor required to effect interconnection is less competitive with war-material requirements, both as regards the character of material used and as regards the labor requirements.

The average load factor, which in this case means the ratio of average load to maximum load of the plants of the United States, probably does not exceed 25 per cent, declared Mr. Stuart. This means that during certain hours of the day a large part of the capacity of the central stations of the country is not used. "It is our prime object to lay emphasis on this fact and on a means by which relief can be had expeditiously, and that is by interconnections of power systems," the Fuel Administration representative said. "Such interconnections through the diversity of load carried by different stations will render available considerable quantities of power and at a cost which would be negligible as compared with building new central-station plants or of increasing the capacity of those stations already built.

"At the same time, we do not want to underestimate either the cost or the difficulties incident to interconnections. There will usually be an amount of expenditure involved which, under the conditions resulting from our war finance requirements, would either represent a burden that the central stations cannot under present circumstances carry or else would necessitate government aid in such financing that would be impossible or would conflict with the efforts of the government."

INTERCONNECTIONS EAST AND WEST

Mr. Stuart remarked with respect to interconnections that the West has already gone a great deal further than the East, particularly in the case of California. The opportunity for interconnections in the East is equal to that which in the past has existed in the West, and the necessities of such interconnections to-day are far greater than those that existed in the West.

"There is the third alternative, which is the question of replacing fuel power by other power," said Mr. Stuart in resuming his argument. "In the case of hydroelectric development, such replacement would, of course, give a maximum saving of fuel, but only at a maximum expenditure of capital where it means the constructing of new works.

"It is questionable whether a great deal of saving as a result of the construction of new works will be possible while the war lasts; in fact, it is doubtful whether great outlays in such directions will be wise in view of the fact that such expenditure would conflict with other work of a more vital character to the conduct of the war.

"On the other hand, there exists an enormous field in the enlargement of plants now operating; for example, 750,000 barrels of fuel oil is being consumed by auxiliary steam plants serving the city of Los Angeles, Cal., and adjacent territory. The city of Los Angeles owns a hydroelectric system which furnishes the bulk of the power requirements, the deficiency being made up by the auxiliary steam plants. The hydroelectric development is capable of enlargement simply by the increase of additional generating machinery and transmission lines. Thus, at a relatively small cost, this fuel consumption could be saved, or, conversely, a considerable additional generating capacity would be developed. There are many examples throughout the country corresponding to the Los Angeles situation.

"Coming to the question of the aid which the government could most advantageously extend, we believe as follows:

"First—Assistance should be rendered the power systems wherever interconnections may be deemed practicable and advisable.

"Second—Financial aid should be rendered for the enlargement of central-station systems wherever such need is deemed essential in order to produce increased power, a radical fuel saving, or where there will be obviated what practically amounts to a duplication of investment, as in the case of the construction of isolated plants at this time.

"Third—There should be the necessary help to enable a complete systematization of the power situation of the entire country. Duplication of investment should be rendered impossible as a measure of conservation not only of capital but also of materials, labor and fuel.

"There should be at some centralized point, such as Washington, a complete perspective of the entire power situation which would prevent any of the now recognized errors or abuses such as exist in duplication of investment, fuel wastages, etc."

ADDITIONAL TESTIMONY ON THE BILL

C. F. Kelley, counsel for the Montana Power Company, said that the bill, while necessarily a compromise, was a subject for mutual congratulation and appeared to afford a workable measure upon which those who were desirous of developing this unused asset could meet the government.

Mr. Kelley agreed that unappropriated surplus accumulated from earnings in excess of a fair return on the investment should be deducted in computing the net investment, but suggested that such portion of such funds as had been reinvested in improvements and betterments should not be so excluded. He said that

inasmuch as the prospective applicant would be at a great deal of expense in making examinations and surveys, preparing maps, plans, specifications, estimates, etc., a preliminary permit should be exclusive to its holder.

A. P. Morrison of the Electro Metallurgical Company, Niagara Falls, spoke from the point of view of the user of power, to whom stability of service and of rates were of the first importance. No power can be developed on a franchise revokable at will, and a revokable contract is of no use to the user of power. He suggested an amendment to the bill to prevent existing projects coming in under the law having a chance to raise rates. Considerable capital has been driven to Canada and Norway on account of the more favorable conditions and greater assurance of more power there. Tariff considerations and the fact that the water powers of America are distant from the coast have a bearing upon the situation, also the fact that our streams are seasonal and intermittent.

What Does Liberty Ask?—Buy Bonds

DEFINITE AGREEMENT MADE ON WATER-POWER LEGISLATION

Special Joint Water-Power Committee of House of Representatives Will Incorporate in Shields Bill Features of Administration Bill

It is understood in Washington that the special joint water-power committee of the House of Representatives has agreed to incorporate in the Shields water-power bill passed by the Senate some time ago all the features of the so-called "administration" water-power bill agreed upon by the committee.

Senators are expressing satisfaction that a way has been found out of a legislative difficulty by the decision of the special committee of the House not to bring in the so-called "administration" bill as a separate measure. Some senators have entertained the idea that as the Senate has dealt with water-power matters recently and officially expressed itself in the Shields bill, there would be little opportunity for substituting the so-called "administration" bill from the House for the Shields bill in the Senate. The plan now is for the House to amend the Shields bill by incorporating the features of the so-called "administration" bill.

ELECTRICAL CONTRACT FOR NEW ARMY AND NAVY OFFICES

Work to Be Done by Lord Electric Company Under Sub-Contract—Largest Office Building in the World

A sub-contract for the electrical work on the proposed new office building in Washington for the War and Navy Departments has been let by the Turner Construction Company to the Lord Electric Company, New York. The building will be 1860 ft. in length and will have seventeen wings, with a depth of 560 ft. There will be 20,000,000 cu. ft. in the building and 10 miles of corridors. The structure will be the largest office building in the world.

It is better to loan your money than to lose it—as you are likely to do if the Germans win.

CALVERT TOWNLEY,

Assistant to the President Westinghouse Electric & Manufacturing Company.

NATIONAL PROGRAM FOR OUR LABOR AND CAPITAL

Comprehensive Plan Formed by the War Labor Conference Board—No Strikes or Lockouts
During the War

A comprehensive report and recommendations have been presented by the War Labor Conference Board, representing employers and employees, appointed in accordance with the suggestion of Secretary of Labor William B. Wilson to aid in the formation of a national labor program for the period of the war. In its letter the board says to Secretary Wilson, in part:

The commission presents, as a result of conferences, the following program:

That there be created for the period of the war a National War Labor Board of the same number and to be selected in the same manner and by the same agencies as the commission making this recommendation:

That the functions and powers of the national board shall be as follows:

1. To bring about a settlement by mediation and conciliation of every controversy arising between employers and workers in the field of production necessary for the effective conduct of the war.

2. To do the same thing in similar controversies in other fields of national activity delays and obstructions in which may, in the opinion of the national board, affect detrimentally such production.

3. To provide such machinery, by direct appointment or otherwise, for selection of committees or boards to sit in various parts of the country where controversies arise, to secure settlement by local mediation and conciliation.

4. To summon the parties to the controversy for hearing and action by the national board in case of failure to secure settlement by local mediation and conciliation.

If the sincere and determined effort of the National Board shall fail to bring about a voluntary settlement, and the members of the board shall be unable unanimously to agree upon a decision, then and in that case and only as a last resort an umpire appointed in the manner provided in the next paragraph shall hear and finally decide the controversy under simple rules of procedure prescribed by the national board.

The members of the national board shall choose the umpire by unanimous vote. Failing such choice, the name of the umpire shall be drawn by lot from a list of ten suitable and disinterested persons to be nominated for the purpose by the President of the United States.

The national board shall refuse to take cognizance of a controversy between employer and workers in any field of industrial or other activity where there is by agreement or federal law a means of settlement which has not been invoked.

In the appointment of committees of its own members to act for the board in general or local matters, and in the creation of local committees, the employers and the workers shall be equally represented.

The representatives of the public in the board shall preside alternately at successive sessions of the board or as agreed upon.

The board in its mediating and conciliatory action and the umpire in his consideration of a controversy shall be governed by the following principles:

THERE SHOULD BE NO STRIKES OR LOCKOUTS DURING THE WAR.

Right to Organize.—The right of workers to organize in trade unions and to bargain collectively, through chosen representatives, is recognized and affirmed. This right shall

not be denied, abridged or interfered with by the employers in any manner whatever. The right of employers to organize in associations of groups and to bargain collectively, through chosen representatives, is recognized and affirmed. This right shall not be denied, abridged or interfered with by the workers in any manner whatsoever. Employers should not discharge workers for membership in trade unions nor for legitimate trade union activities. The workers, in the exercise of their right to organize, shall not use coercive measures of any kind to induce persons to join their organization nor to induce employers to bargain or deal therewith.

Existing Conditions.—In establishments where the union shop exists the same shall continue and the union standards as to wages, hours of labor and other conditions of employment shall be maintained. In establishments where union and non-union men and women now work together and the employer meets only with employees or representatives engaged in said establishments the continuance of such condition shall not be deemed a grievance. This declaration, however, is not intended in any manner to deny the right or discourage the practice of the formation of labor unions, or the joining of the same by the workers in said establishments, as guaranteed in the last paragraph, nor to prevent the War Labor Board from urging, or any umpire from granting, under the machinery herein provided, improvement of their situation in the matter of wages, hours of labor or other conditions, as shall be found desirable from time to time. Established safeguards and regulations for the protection of the health and safety of workers shall not be relaxed.

Women in Industry.—If it shall become necessary to employ women on work ordinarily performed by men, they must be allowed equal pay for equal work and must not be allotted tasks disproportionate to their strength.

Hours of Labor.—The basic eight-hour day is recognized as applying to all cases in which existing law requires it. In all other cases the question of hours of labor shall be settled with due regard to governmental necessities and the welfare, health and proper comfort of the workers.

Maximum Production.—The maximum production of all war industries should be maintained and methods of work and operation on the part of employers or workers which operate to delay or limit production, or which have a tendency artificially to increase the cost thereof, should be discouraged.

Mobilization of Labor.—For the purpose of mobilizing the labor supply with a view to its rapid and effective distribution, a permanent list of the number of skilled and other workers available in different parts of the nation shall be kept on file by the Department of Labor, the information to be constantly furnished by the trade unions, by state employment bureaus and federal agencies of like character, by the managers and operators of industrial establishments throughout the country. These agencies should be given opportunity to aid in the distribution of labor, as necessity demands.

Custom of Localities.—In fixing wages, hours and conditions of labor regard should always be had to the labor standards, wage scales and other conditions prevailing in the localities affected.

The Living Wage.—The right of all workers, including common laborers, to a living wage is hereby declared. In fixing wages minimum rates of pay shall be established which will insure the subsistence of the worker and his family in health and reasonable comfort.

The report is signed by the following: Loyall A. Osborne, L. F. Loree, W. H. VanDervoort, C. E. Michael, B. L. Worden, William H. Taft, Frank J. Hayes, William L. Hutcheson, Thomas J. Savage, Victor A. Olander, T. A. Rickert and Frank P. Walsh.

An invincible morale in our fellow countrymen is of the highest importance in winning the war. One of the surest ways to develop and maintain morale is to furnish unstintingly the sinews of war. Buy Liberty bonds and be an upstanding citizen.

L. K. COMSTOCK,
of L. K. Comstock & Company, New York.

BOSTON ELECTRICAL MEN IN LIBERTY LOAN PARADE

Edison Electric Illuminating Company Employees,
to Total of 1000, Expected to Take Part in
Starting the Campaign

To signalize the start of the third Liberty loan campaign at Boston on April 6 a great parade was planned in which it was expected that the electrical industry would be largely represented. President Charles L. Edgar of the Edison Electric Illuminating Company of Boston announced his intention to march, and it was expected that at least 1000 Edison employees would take part, with the company band of forty pieces leading the contingent and the company service flag with 300 stars flying as the contingent marched through the streets. Charles H. Parker, superintendent of the generating department, was appointed marshal of the company forces.

J. W. Cowles, superintendent of installations, has been made chairman of the company's Liberty loan committee. On the first and second loans the 2000 employees of the company subscribed to \$158,000 bonds, and the company in its own name for \$530,000. T. K. Cummins, treasurer, addressed groups of employees in the earlier campaigning, and in the main the loans were placed through the Wildey Savings Bank, Boston.

The general plan was for one representative from each department to collect the subscriptions and make the deposits. The Boston company did not purchase bonds on behalf of employees, but co-operated fully with all local banking agencies in regard to the loan and devoted considerable editorial and reading space in the company publication, *Edison Life*, to the cause. This paper emphasized the desirability of the slogan "Invest in a bond," in preference to the popular "Buy a bond" war-cry.

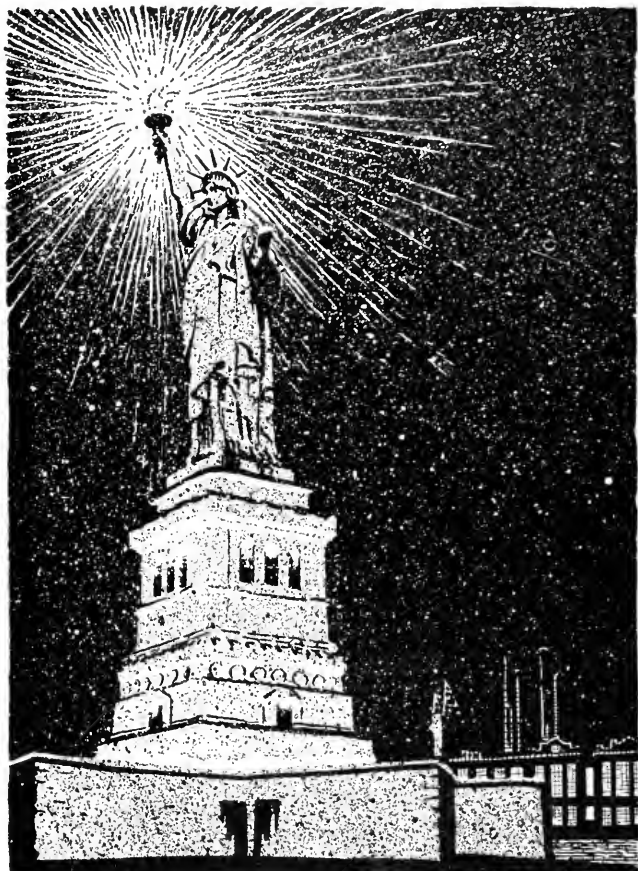
Prior to the second Liberty loan the company paper said editorially under "Automatic Saving": "It is not the rich man who will help the most by investing, for the rich always save, and, furthermore, the money he has is of more importance in helping to keep alive the industries, such as farming, railroads and factories, for they are as vital to the war as the men who fight. The man who spends his salary on himself is the kind that must change his ways. He must ask for less personal service, for service is labor, and labor counts now. The saving that is necessary is the new saving, not turning the old saving into new channels."

Electrical men should be the most progressive people in the country, and, as the paramount war problem is to supply the government with all the funds needed, every electrical man should show the progressiveness and the effectiveness of the fraternity as a whole by the quantity and quality of the work he does to make the third Liberty loan a pronounced success.

HENRY L. DOHERTY,
President Cities Service Company.

Liberty's Light Is Electric

The Army and Navy Guard It, the Nation Stands
Back of Them



DO YOUR PART—BUY A BOND

War Training Course

A war training course for electricians and telephone men needed for the United States Army has just been published by the federal Board for Vocational Education. It consists of thirty-six lectures and four classroom, field and shop units on electric wiring, testing, motors and generators, and telephone work. The instruction book is known as Bulletin No. 9 and may be had free on application to the federal Board for Vocational Education, Ouray Building, Washington, D. C.

Some Offer Lives—Lend Your Money

MIDDLE WEST INTERESTED IN FINANCE CORPORATION BILL

Going Rates for Money the Principal Point of Concern with Executives—Typical Loan Costs About 10 per Cent

Middle Western central-station executives are watching with considerable interest the steps in the passage of the finance corporation bill.

The prices which are being paid for money are shown in the typical case of the Louisville Gas & Electric Company. Bankers are now selling the notes of this company on an 8 per cent basis and the money costs the company close to 10 per cent. Notes now being sold will care for another note-issue maturity and add about \$900,000 cash to the treasury. The company has \$10,000,000 of bonds falling due July 1. The banking syndicate which is selling the notes has offered to finance either bond or note issue for refunding, but the cost of new money would be so great that the officials believe the federal government will assist as soon as the finance corporation act is passed. The company must either pay at least 10 per cent for short-term money or contract to pay 6½ per cent, perhaps more, over a long term of years.

Another and interesting sidelight on public utility financing recently came out in Indiana when fire destroyed the municipal light and water works at Attica. The loss was only about \$40,000, but the city was already bonded so nearly to its lawful limit that funds could not be provided to rebuild the plant. To get out of the difficulty private capital was added to what capital the city could raise so that the station is now being replaced. On the other hand Tacoma, Wash., is getting ready to vote on a five-million-dollar bond issue for public utility extensions which include in their scope even the purchase of the street railway property.

The conference agreement on the war finance corporation bill has been presented to Congress. Several important changes have been made in the measure and they represent a compromise between the Senate and House views.

Never Too Old to Buy Bonds

COLONEL P. JUNKERSFELD RESIGNS FROM ASSOCIATION

Executive Committee of Association of Edison Illuminating Companies Accepts Resignation of President with Regret

The executive committee of the Association of Edison Illuminating Companies held a brief meeting at association headquarters, New York, on March 21.

A communication from President Peter Junkersfeld, under date of Feb. 14, 1918, was read, in which he tendered his resignation as president of the association, the reason given being that his increasing military duties prevented him from giving his proper attention to the affairs of the association. Mr. Junkersfeld has been serving at Washington as major in the Quarter-

master's Corps of the National Army for over a year, and was promoted recently to the rank of lieutenant-colonel. The committee was very loath to lose his leadership, but realized that no other course was open but to accept his resignation with great regret.

As the general business conditions which made it desirable to dispense with the customary convention last year have not materially changed in the interim, it was decided by the committee that the association would hold a business meeting only this year. This will be held in New York on Sept. 10, and will be similar to the brief meeting held in September of last year, unless the plan now contemplated is changed at a later date.

Win the War—Lend for Liberty

WESTERN RED CEDAR MEN MEET IN SPOKANE

Demand in 1917 About Normal, but Production Below Normal, Owing Largely to Labor Trouble
—O. S. Hanson Elected President

The thirteenth annual meeting of the Western Red Cedar Association was held in the Davenport Hotel, Spokane, Wash., on March 21. The meeting was called to order by O. S. Hanson, vice-president, in the absence of F. C. Culver, president.

A general discussion took place relative to market conditions prevailing during the last year. It was the consensus of opinion that the demand for Western red cedar poles during 1917 was about normal, but that production was considerably below normal owing largely to shortage of labor and trouble experienced in connection with the I. W. W. agitation. It was generally agreed that the actual cost of production has increased at least 50 per cent during the last year.

W. M. Leavitt, as chairman of a special committee in charge of the matter of arranging and conducting a series of comparative strength tests of the various kinds of poles, reported that nothing had been done in the way of actually carrying on the experimental tests contemplated. The committee gave the matter careful consideration and was unanimous in the opinion that it was not a good time to conduct the proposed tests, making this recommendation to the association. The matter will be taken up for consideration at a more opportune time.

A motion was made and unanimously carried that the new president send a telegram to Glenn A. Clark, formerly secretary-treasurer of the association, now serving in the Quartermaster's Corps at Camp Joseph E. Johnston, Jacksonville, Fla., regretting the fact that it was necessary to accept his resignation and sending from the entire membership best wishes for his success and early return.

Officers were elected as follows: President, O. S. Hanson, Spokane, Wash.; vice-president, R. G. Jones, Ione, Wash.; directors, E. T. Chapin, Spokane; L. A. Page, Jr., Minneapolis; J. M. Montgomery, J. E. Seaman, Spokane, was appointed secretary and treasurer.

Back Up the Bullets—Money Talks

ACTIVITIES OF THE NATIONAL COMMITTEE

Report of Work of the National Committee on Gas and Electric Service in War-Time Conditions

In last week's issue of the *ELECTRICAL WORLD*, page 688, a partial report of the National Committee on Gas and Electric Service, of which J. W. Lieb is chairman, was published. Other matters were discussed in the report as follows:

The committee has received a communication from the War Industries Board in reference to a possible demand for various government plants, to the effect that the public utilities may feel assured they will be given a full hearing on the subject before any of their machines are requisitioned. The committee is consulted by the various branches of the War Department when it is necessary to requisition machinery that may be under order for the electric light and power companies. In this way if machines must be taken they will be taken where their withdrawal will cause the least disturbance to operating conditions. In several cases where the War Department had planned to take machinery for the purpose of installing its own plants, the committee has been able to show where there was already available power, thus making it unnecessary to construct any new individual plants.

A recent situation arose which was called to the attention of the committee concerning a supply of electrical energy for a large munition manufacturer in Alliance, Ohio. It was represented that the power was not available in Alliance and negotiations had been entered into for the building of a transmission line from a neighboring city, approximately 14 miles distant, to serve this manufacturer. This action was strongly protested against by the Alliance Gas & Power Company, and while the committee could not take any position as favoring one or the other utility, it brought the representatives of the two utilities together, with the result that arrangements were satisfactorily perfected for abandoning the proposed expensive transmission line and securing the available service in Alliance.

The Fuel Administration is about ready to issue its plan for the zoning of coal, that is, assigning certain zones of production to certain zones of consumption. In this way a great deal of cross-hauling will be avoided. It has been found, however, that it would be almost impossible to zone the gas coal output, and it is proposed to issue special permits or licenses for this class of fuel. It is very doubtful if the situation as at present existing will be greatly disturbed, especially in the eastern part of the United States, and it is proposed to furnish New England with approximately two-thirds of her coal supply by water.

As a very large percentage of coal contracts expire about April 1, there is some confusion or doubt as to their renewals, and some of the public utilities are experiencing difficulty in arranging for their coal for the current year. After the zone system has been established by the Fuel Administration, this matter will no doubt clear itself up.

At the request of Dr. Garfield, the committee is endeavoring to secure from the central stations the location and names of isolated plants in their communities. This information is sought by the conservation department of the Fuel Administration, which is making a careful analysis of the fuel condition throughout the United States with a view to preventing a repetition of the dangerous condition in which the country was placed during the last memorable year and winter, due to the shortage of coal. It is extremely important that the electric light and power companies send in these lists as early as possible.

The committee is working in close co-operation with the Fuel Administration and information is being procured from the public utilities as to their requirements for the coming year. It is the intention to take care of the full requirements of the public utilities at as early a date as possible.

The committee is receiving from the public utilities applications for help in obtaining relief from embargoes and assistance in procuring express deliveries of electrical material.

The Quartermaster's Department and the aviation division of the Signal Corps have sought the assistance of the committee in obtaining information from public utilities in communities where they are about to establish large warehousing and other projects as to amount of power available for their purposes. In all the communities thus far considered there is a sufficient supply of energy, thus making unnecessary the installation of any governmental isolated plants.

Lend Freely for Liberty's Sake

OPERATING PROBLEMS AT WISCONSIN CONVENTION

Increasing Hydroelectric Plant Efficiency, Better Distribution Systems, Co-operating with Contractors and Solution of War Problems Are Topics

The program of the first day's session at the convention of the Wisconsin Electrical Association at Milwaukee March 27 and 28 included papers mainly on rates and rate increases. On the second day all papers except that of M. C. Ewing of Wausau dealt with operating problems.

Daniel W. Mead, consulting engineer, of Madison, speaking on "Increasing the Output of Hydroelectric Plants," divided his topic into subjects, "Saving Head" and "Saving Water." Under the former he discussed losses that occur in the headrace due to velocities above 3 ft. (0.9 m.) per second in low-head plants, to racks without specially designed bars, to improperly designed tailraces and to leakages through dams. From the latter cause enough water has been known to escape to cause a loss of \$75,000 a year. He criticised severely the policy of many waterwheel manufacturers who have been in the habit of selling wheels which are considerably underrated.

L. M. Burch, president of the Electrical Supply Company, Madison, presented an able explanation of the aims and purposes of the new association of Wisconsin electrical contractors and dealers, and solicited the co-operation of central-station executives in carrying out the plan for better merchandising.

George E. Wagner, superintendent of plant for the Madison Gas & Electric Company of Madison, Wis., pointed out the advantages of three-phase, four-wire distribution as compared with the ordinary 2300-volt delta-connected system. In the discussion of this paper A. J. Geodjen pointed out that an opportune time to investigate the advisability of changing from delta to star connection is when additional feeder capacity is needed.

M. C. Ewing, secretary-treasurer of the Wisconsin Valley Electric Company, Wausau, Wis., in a paper entitled the "Utilities and the War," discussed the urgent need for rate increases and closer study of labor.

The paper on "Metal Electrode Welding," by Dean Treat, manager of the Wisconsin Railway, Light & Power Company, La Crosse, Wis., pointed out the savings which can be made by using electric welders in laying street railway track and in repairing machinery and apparatus in the company's shops.

Officers elected for the ensuing year were: President, John St. John, Madison; first vice-president, Raymond Smith, Oshkosh; second vice-president, W. C. Lounsberry, Superior; third vice-president, A. G. Babson, Watertown; secretary, J. P. Pulliam, Green Bay.

THE ILLINOIS COMMISSION SUSPENDS FREE EXTENSIONS

Customers of Chicago Companies Must Pay for Lines During Period of the War—Companies Com-mended for Patriotic Stand

On Nov. 24, 1917, the Commonwealth Edison Com-pany and the Public Service Company of Northern Illinois filed with the Public Utilities Commission of Illinois a petition for the suspension during the period of the war of Rule 31 of the rules establishing stand-ards of service for gas and electric utilities. Rule 31 provides for free extension to prospective customers, provided that the line extension does not require more than twice as many poles at standard spacing as there are individual applicants. It also provides for charging for extensions above the free limits. The petition was contested by attorneys for several real estate boards in the territories of the petitioning utilities.

In its order on this case issued March 19 the commis-sion found:

That present conditions warrant a modification of the rules of the commission governing the making of exten-sions for serving new business, and that by the modified rules the petitioners may require a deposit from custom-ers who desire an extension of the petitioner's circuits in the amount of the cost of such construction, but that such a cost used as the basis for deposit would not include any amount for distribution transformers, for service connec-tions of ordinary lengths extending from the pole lines or underground conduits to consumers' premises, or for con-sumers' meters, and that service should be rendered to any consumer complying with these deposit conditions unless an individual case is of such character that it appears that the revenue anticipated from the extension will not pro-vide at the expiration of five years an adequate return upon its cost.

The commission further finds that in the case of exten-sions made for power service repayment of the deposits collected should be instituted immediately upon the cessa-tion of the war, and that the amount of such monthly re-payments should not be less than 25 per cent of the net bill for service, and that in the case of extensions made for lighting service repayment of the deposits collected should be made monthly at a rate of 25 per cent of the monthly bills, and that such repayment should be instituted with the first bills for service rendered.

The commission further finds that interest should be paid at the rate of 5 per cent per annum upon that portion of the deposit held by the petitioners which exceeds the cost of a free extension as defined by the original Rule 31 until such a time as the repayment shall have amounted to the cost of such free extension, and that interest at the rate of 5 per cent per annum should be paid upon the entire deposit until such time as repayments are instituted in accordance with the conditions herein set forth. In securing interest due in order to avoid the complication of interest computa-tions on various amounts, such interest after repayments have been started may be computed over the entire period for which it is to be paid upon one-half of the gross amount of the excess deposit.

It should be noted in connection with this decision that the requiring of the utilities to refund the amount of the line extensions to the customers is in line with what have been the policies of both the Commonwealth Edison Company and the Public Service Company of Northern Illinois in the past.

It is of further interest to note that the commission in its comments upon the case said:

In their petition the applicants appear to be governed by patriotic motives to an extent fully as great as by any pecuniary advantage which might result from deferring ex-tension until a more advantageous time. From the stand-

point of personal interest, the extension of utility service involves the payment of larger sums of money for lines and station capacity and other necessary improvements than would be necessary for the development of the systems under normal conditions. From a patriotic standpoint it involves the employment of material and labor of which the country faces a scarcity, and the utilization of capital which may be necessary for governmental needs in the prosecution of the war.

Buy Bonds, Still More Bonds

COMMITTEE'S TRIBUTE

TO JOHN P. SPARROW

Prime Movers Committee of the National Electric Light Association Pays Respect to Memory of Old Associate

In the issues of March 23 and 30, 1918, the ELEC-TRICAL WORLD referred to the death of John P. Spar-row, chief engineer of the New York Edison Company. The members of the prime movers committee of the Na-tional Electric Light Association have passed resolu-tions on their old associate, a copy of which has been received from J. M. Graves, the chairman, as follows:

John Porterfield Sparrow, for many years chief engineer of the New York Edison Company, in charge of construc-tion and operation, a member of the prime movers com-mittee of the National Electric Light Association in 1911, 1916, 1917 and 1918, died March 18, 1918. Mr. Sparrow was one of the most eminent designing and oper-ating engineers in the world, having been the son of a distinguished engineer, through whose efforts he received a thorough theoretical and practical training in his pro-fession both in the United States and Europe. He had been identified about thirty years with the electrical indus-try, in which he had become an influential figure.

As a member of the prime movers committee Mr. Spar-row was an enthusiastic and untiring worker, revealing wonderful foresight in anticipating operating and construc-tion problems and indicating rare ingenuity in devising methods for obtaining efficiency in power-generating sta-tions. His intimate scientific knowledge and his long prac-tical experience ripened his judgment and gave his opinions judicial weight. His was a delightful personality, lovable, courteous, patient, admired and respected. His death has been a severe personal loss to the members of the com-mittee and it will leave a vacancy which time alone may fill.

Do Your Fair Share—Buy Bonds

COMBINATION EXPORT TRADE

BILL IS UP TO CONGRESS

Conference Report on Webb Measure Presented to Both Houses and Quick Action Is Now Expected

The conference report on House bill No. 2316, known as the Webb bill, for the promotion of export trade, has been presented to both houses of Congress. Only minor changes are made in the bill by the conference report, and it will be adopted and signed by the President soon.

Some of the minor amendments to the bill pre-sented in the conference report have the effect of ex-cluding from the comprehensive definition given in the section of "export trade" the selling of goods, wares and merchandise for resale as well as for consumption within the United States or any territory thereof.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Report on Taunton Plant.—William Plattner has completed an extensive report on the operations of the Taunton (Mass.) municipal lighting plant.

Rate Increase in Oklahoma.—The Oklahoma Gas & Electric Company has been granted authority by the State Corporation Commission to increase electric rates approximately 10 per cent.

John Fritz Medal.—J. Waldo Smith will be awarded the John Fritz medal on April 17 at the Engineering Societies Building, New York, for his achievement as an engineer in construction of the Catskill aqueduct for New York City.

Dayton Company Earnings.—The annual report of the Dayton (Ohio) Power & Light Company shows gross earnings in excess of \$1,880,000, an increase of 16 per cent over the previous year, and operating expenses of more than \$1,266,000, an increase of 26 per cent. Net earnings were \$624,407.

Special Electrical War Courses.—Special electrical war courses for enlisted men are being given at the Carnegie Institute of Technology, Pittsburgh. Instructors are wanted to teach in the necessary subjects. The Carnegie Institute especially desires to hear from a few who could come for periods of two to six months.

Workman's Compensation.—The *Workman's Compensation Law Journal* is now issued monthly by the C. C. Mine's Sons Company, New York. It contains all current decisions of all courts relating to workmen's compensation, the federal cases appearing first and the state court cases following. There are now thirty-seven states and three territories in which workmen's compensation statutes are in force, and the number of awards and rulings by the various state boards and commissions which are being passed upon by the appellate courts is constantly increasing.

Milwaukee May Defer Public Improvements.—Oliver C. Fuller of the Wisconsin Trust Company, Milwaukee, who is also the Milwaukee member of the auxiliary committee of the capital issues committee of Washington, D. C., recently addressed the members of the Public Debt Commission, the city officials and the members of the finance committee of the city council on the inadvisability of floating bonds for public work and improvements that are not absolutely necessary. The aim of the government, according to Mr. Fuller, is to eliminate such work and to create a condition whereby all men in all lines of work can apply their ef-

forts to government activities and to the war industry. Milwaukee has about \$6,000,000 in bond issues to be voted on this spring, and it is said to be the opinion of some of the city officials that not all of the work to be carried on from the proceeds of the sale of these bonds is imperative. One item in the proposed bond issue is \$500,000 for electric street lighting. The other items are sewers, schools, bridges, grade crossings, park improvements and city building.

Tokio Plans Electric Exposition.—The first electric exposition in Japan will be held in Ueno Park, Tokio, this spring, as part of the commemoration of the quarter-century anniversary of the Japanese Electrical Industrial Association. Ueno Park is one of the greatest attractions of Tokio to visitors in cherry-blossom time, and the date has been selected so as to give to several million Japanese a practical education in electricity and its many varied applications. Among the special displays to be shown is a large-sized working model of a modern hydro-electric plant, with glass-covered Pelton wheel to show the interior working; electromagnetic demonstrations in loading heavy materials and in resisting a tug-of-war by a crowd of athletes; electric blooming and withering of flowers, and floating bodies by electric induction. Actual demonstrations of lightning, its effects and prevention, of welding of metals and separation of ores will be given. Besides these, special "electric days" will be set aside by the city authorities, during which all the electric lights in the city will be kept burning late into the night.

Value of Columbus Electrical Property.—The value of the property used by the Columbus Railway, Power & Light Company in electrical operation, except for street railway and district heating, is \$7,105,808, according to an appraisal filed by the company with the Ohio Public Utilities Commission. The appraisal was ordered by the commission in June, 1915, after the company had appealed a rate ordinance. Engineers representing the commission have their appraisal almost completed, and when they are ready hearings will be begun. Company figures follow: Land, \$219,014; building and structures, \$373,033; power station equipment and coal, \$1,437,030; distributing system, \$1,896,802; miscellaneous, \$168,034; total physical property, \$4,067,237; property not used in electrical operation, \$11,429; total physical property used in electrical operations, \$4,055,808; collateral: preliminary expense and cost of financing, \$400,000; administration and general, \$1,000,000; cost of attaching business, \$400,000; working capital, \$250,000; miscellaneous, \$1,000,000; total collateral, \$3,050,000; total property used in electrical operations, \$7,105,808. The rate fixed by ordinance for a five-year period, beginning on Dec. 27, 1915, was 5 cents net or 6 cents per kilowatt-hour, with 16 2/3 per cent discount if paid before the tenth of the month. The old rates are 8 cents gross and 7 cents net.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Low-Hanging Wires.—Negligence in the maintenance of a telephone wire across a public highway is sufficiently established when it is shown that the wire hung so low as to interfere with a customary use of the highway, the Supreme Court of Kansas held (169 P. 197). When a plaintiff has proved that he sustained injuries through the dangerous situation of a telephone wire hanging across a public highway the burden passes to the defendant to show that the dangerous situation of the wire was not due to the act of the defendant and had not existed for such length of time as to charge the defendant telephone company with notice of its defective condition.

Damages Resulting from Failure to Furnish Service.—It is the duty of a company duly chartered to furnish electric energy for domestic consumption within a reasonable time after due application and compliance with its proper regulations to extend its lines and furnish service, failing which it is liable to the applicant for the proximate pecuniary loss thereby caused, the Supreme Court of Alabama held, in Birmingham Railway, Light & Power Company versus Littleton (77 S.S. 65). If an electric service company, after due application and compliance with regulations, fails to extend lines and render service, the prospective customer is entitled to have considered as an element of damage the inconvenience and annoyance to which he was subjected by being denied the service. In action by an applicant for electric service arising for a company's failure to extend its lines, the certificate of the city electrician was competent evidence to show that plaintiff had complied with his obligation to make ready his premises for the use of electricity. Applicant for electric service to whom service was denied may recover cost of wiring his dwelling. Public service corporations are obliged to treat fairly and without discrimination all members of the community which they serve. The duty of public service corporations to serve the public fairly and without discrimination exists independently of statute and is independent of contract with a municipality or an individual. An electric power and light company is not bound to furnish energy to an applicant in the absence of performance by him of conditions precedent which it may establish, such as tendering prepayment for service. To entitle an applicant to receive electric energy from a public service corporation he must ask service at a proper time and place, in proper form and in proper manner.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 755 of this number.

A. I. E. E., Denver Section.—The work of the Bureau of Standards will be discussed at the Denver meeting of the American Institute of Electrical Engineers on April 16.

San Francisco Electrical Development League.—At the March 20 meeting of the league Dr. Charles Cestre, University of Bordeaux, France, told of "Social and Economic Effects of the War on France."

A. I. E. E., Ithaca Section.—Some practical hints on illumination design were presented by Prof. F. K. Richtmyer on March 29 before the Ithaca Section of the American Institute of Electrical Engineers.

Electrical League of Cleveland.—Prof. H. E. Bourne of the Western Research University addressed the Electrical League of Cleveland on Thursday, March 28, on the subject of "Some Consequences of the Collapse of Russia."

American Association of Engineers, New York Chapter.—Garrett P. Serviss will address the New York Chapter of the American Association of Engineers on "The Glory of the Engineer" on Wednesday, April 10, at the Hotel McAlpin.

American Society of Heating and Ventilating Engineers.—"Fuel Conservation" will be the subject of discussion of the American Society of Heating and Ventilating Engineers on April 15 at the Engineering Societies Building in New York.

A. I. E. E., Chicago Section.—A joint meeting of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers was held March 25 in Chicago. Charles S. Burgess gave an interesting talk on "Some Possibilities in Electrochemical Industry."

Engineering Societies of St. Louis.—J. A. L. Waddell, consulting engineer of Kansas City and New York, delivered an address entitled "The Engineering Profession Fifty Years Hence" at a meeting of the Collimation Club, at which the Associated Engineering Societies of St. Louis were guests.

American Association of Engineers.—The fourth annual convention of the American Association of Engineers will be held at Chicago on May 14 for the election of officers for the ensuing year. The present officers of the association are: Edmund T. Perkins, president; W. H. Finley, first vice-president; Isham Randolph, second vice-president; A. H. Krom, secretary; E. B. Miller, assistant secretary, and John Ericson, treasurer.

Electrical Conference of Philadelphia.—W. J. Canada of the International Shipbuilding Corporation, formerly of the Bureau of Standards, spoke on "The National Electrical Safety Code" before the electrical conference of Philadelphia on March 22.

Buffalo Engineering Society, A. S. M. E. Section.—"Water Power on the Pacific Coast" was the subject of an address given by Prof. D. S. Kimball, University of Cornell, before the American Society of Mechanical Engineers section of the Engineering Society of Buffalo.

Association of Iron and Steel Electrical Engineers, Philadelphia Section.—"Electricity as Used in Modern Shipyards" is the title of a paper to be presented to-day by C. M. Hensen, chief electrician of the shipbuilding plant of the Bethlehem Steel Company, Sparrows Point, Md., before the Philadelphia Section of the Association of Iron and Steel Electrical Engineers.

American Society of Mechanical Engineers, New York Section.—On April 9 there are to be joint afternoon and evening meetings of the Metropolitan student branches and the New York Section of the American Society of Mechanical Engineers. There will be short addresses by the prominent speakers in all branches of engineering on how engineers are helping to win the war on land and sea and in the air.

A. S. M. E. Spring Meeting.—"Fuel Economy" will be the important subject for discussion at the spring meeting of the American Society of Mechanical Engineers, which was announced previously in the March 23 issue of the ELECTRICAL WORLD. Topics upon which discussion is solicited are as follows: What are the economic effects of impurities in coal? To what extent is fuel oil likely to be used as a substitute for coal? How can soft coal be burned without smoke in marine boilers? What are the possibilities in the direction of the utilization of anthracite wastes? What instruments are useful and desirable in the boiler room as aids in saving coal? What is essential to the economical operation of hand-fired boiler furnaces when using soft coal? To what kinds of plants and coals are the different types of mechanical stokers respectively adapted, and what is the limiting factor to their use in the small plants? What experience have you had in the use of wood as fuel? To what extent is wood available as fuel? What coal economies can be effected in residence heating? What coal economies can be effected in small steam plants? What experiences have you had with the storage of coal? While the above topics are all that can be suggested for discussion, additional short papers on any fuel topic are desired for publication. Items of interest on fuel performance should be sent to the secretary of the association. The meeting will be on Thursday morning, June 6, at the Worcester Polytechnic Institute at Worcester, Mass.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Village Franchise Not Controlling.—The New York Public Service Commission, Second District, answering a complaint of trustees of South Glens Falls against the United Gas, Electric Light & Fuel Company of Sandy Hill and Fort Edward on gas rates, holds that the condition in the franchise granted by the village is not controlling so as to prevent the commission from authorizing an increase in the rate in the event that the company can justify such increase on the ground that it is failing to earn a fair return upon the value of its property employed in the public service. It appearing from the record in this case that the complainants do not propose to contest the increased rate if the decision is adverse to them, the complaint is dismissed.

Rate Increases in Illinois.—The Illinois Public Utilities Commission has acted on a large number of petitions for increases in electric rates, in some cases allowing the increased rates and in others postponing final decision until more complete and detailed investigation could be made. Among the companies allowed to make increases were the Illinois Northern Utilities Company of Dixon, affecting Amboy, Lee Center, Shaws, Sublette and Polo, effective March 20; the Southern Illinois Light & Power Company, affecting Raymond, Donnelson, Palmer and Troy, effective March 28; a 13 per cent increase of the Alton Gas & Electric Company, affecting Alton, and the Little York Electric Company, affecting that town only, dating from Feb. 21. Among the cases suspended was the petition filed by thirteen subsidiary companies of the Illinois Traction System, affecting a wide number of towns and cities in northern, central and southern Illinois, these increases being asked on electric light, gas, power and street railway service. This petition was suspended until July 28, 1918. Other suspensions included the Saline Electric Company, involving Duquoin and St. Johns, postponed until July 14, 1918, and the DeKalb-Sycamore Electric Company, affecting cities named, this petition being held in abeyance until July 28, 1918. A number of petitions for increases were also received by the commission. Among these were the petition of the Central Illinois Utilities Company, affecting Paxton and twenty-six other towns; the Rockford Electric Company, asking permission to increase lighting rates and also asking suspension of the rule of the commission which compels companies to pay for electric service extensions, this last request to be effective only for the period of the war.

Stephen C. Pohe has resigned as manager for the Electric Bond & Share Company of the Columbia & Montour Electric Company and the North Cumberland Gas & Electric Company at Bloomsburg, Pa., to become manager for H. B. Walbridge & Company, former owners of the Bloomsburg property, of the Penn Public Service Company at Clearfield, Pa. Mr. Pohe was born in 1885 and on graduation from the Potts Business College, in 1902, entered the office of the Berwick (Pa.) Light Company, in time becoming assistant to the manager and later, in 1907, manager. In 1909, when this company was merged into the Columbia



S. C. POHE

Power, Light & Railway Company at Bloomsburg, Mr. Pohe was made superintendent of new business, which position he held until 1910, when he was appointed general superintendent. In 1912 the Walbridge interests gained control of the gas and electric properties, which were reorganized under the name of the Columbia & Montour Electric Company, the railway properties being also reorganized, under the name of the North Branch Transit Company. Mr. Pohe became general manager for both companies. Mr. Pohe has been very active in association work in the state, having been elected president of the Pennsylvania Electric Association in 1915.

Charles H. Tenney, head of Charles H. Tenney & Company, public utility managers and engineers, Boston, has been commissioned lieutenant-colonel in the Ordnance Department of the United States Army and has been placed in charge of the financial department. Mr. Tenney was born at Everett, Mass., in 1868, and began his business career with N. W. Harris & Company, bankers, Boston and New York, later becoming a member of the firm of Thompson, Tenney & Crawford, bankers, with offices in New York. About fifteen years ago he went to Boston and began to build up the organization bearing his name, which has become one of the best-known and most highly reputed syndicates in the Eastern public utility field. His brother, Albert B. Tenney, vice-president of the company, is also active in war work.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

H. A. Price has been appointed local manager for the Alabama Power Company at Jasper, Ala.

W. B. Emmert has been appointed a vice-president of the United Gas & Electric Engineering Corporation.

Wayne Warfield has been appointed lighting superintendent of the Savannah (Ga.) Electric Company, succeeding J. L. Alexander.

R. M. Obergfell, assistant electrical engineer at the Underwriters' Laboratories, Chicago, has entered the engineering division of the Signal Corps of the National Army.

Walter R. Moulton, illuminating engineer of the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., who recently resigned, has joined the staff of the Robertson-Catact Electric Company of Buffalo as industrial lighting engineer.

H. M. Byllesby, president of H. M. Byllesby & Company, who has devoted his time to government service since November, 1917, as a major in the aviation section of the Signal Corps, in charge of national recruiting, has been commissioned lieutenant colonel in this service.

Clarence P. King, after an administration of more than six years, retired as president of the Washington (D. C.) Railway & Electric Company System, including the Potomac Electric Power Company, on March 21, and will make his headquarters in New York City for the present in order to give attention to personal interests.

B. W. Cowperthwait of Faribault, Minn., the president-elect of the Minnesota State Electrical Association, was born at Danbury, Conn., and received his early education in the schools of that city. Upon finishing school he entered the service of the Danbury & Bethel Gas & Electric Light Company. Leaving that position in 1901, he assumed the management of the Faribault (Minn.) Gas & Electric Company for C. A. Coffin, who was then owner of the property. In 1909 this company was purchased by H. M. Byllesby & Company and together with properties in adjoining towns was made the Consumers' Power Company. Later the name was changed to the Northern States Power Company, Mr. Cowperthwait being made manager of the Faribault division, comprising thirty-four communities. About a year ago, when the principal office of the Northern States Power Company was moved to Minneapolis, Mr. Cowperthwait was appointed assistant general manager, which position he still holds.

E. C. Deal has been appointed general manager of the Springfield Gas & Electric Company, and also general manager of the Springfield Traction Company, of Springfield, Mo. He is a Georgian by birth and gained his early experience with the lighting company of Atlanta, Ga., which he served in various capacities from 1894 to 1898, except for short periods when he was superintendent of the Light & Water Company at Brunswick, Ga., and engaged in special engineering work for the government in Key West during the Spanish-American War. He then entered the organization of Stone & Webster of Boston, where he filled dif-



E. C. DEAL

ferent positions of responsibility, resigning in 1894 to become connected with the Gas & Electric Company of Bergen County, New Jersey, as chief engineer in charge of the operation of the company's properties in more than forty municipalities in northern New Jersey. When that company was absorbed by the Public Service Corporation of New Jersey Mr. Deal became superintendent of the latter company's electric properties in central New Jersey. In 1908 he joined W. N. Coler & Company, New York, as manager and engineer of public service properties of theirs. On the reorganization of the Augusta-Aiken properties Mr. Deal was appointed the general manager of the Augusta-Aiken Railway & Electric Corporation, the successor company in Augusta. This was in April, 1911. In April, 1913, he was elected vice-president of the company in addition to general manager. He was also made vice-president and general manager of the Georgia-Carolina Power Company, controlled by the same interest. He resigned in 1914 to become connected again with W. N. Coler & Company as vice-president and general manager of properties. He resigned in 1917 in order to become the general manager of the Trinidad (Col.) Electric Transmission Railway & Gas Company, with which property he has been connected up to the present time. Mr. Deal is a past-president of the Southeastern Section of the N. E. L. A., also past fourth vice-president of the parent body.

TRADE & MARKET CONDITIONS

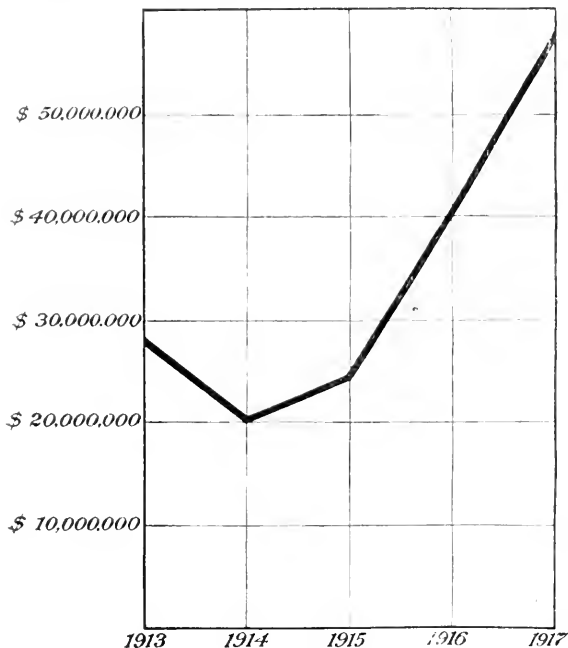
News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

TOTAL ELECTRICAL EXPORTS

FOR 1917 AMOUNT TO \$55,478,079

December Establishes a Record of \$5,726,376 for a
Single Month's Exports—Large Shipments
of Wire and Cable and Motors

Electrical exports for 1917 reached a total of \$55,478,079, the largest total ever registered in any twelve-month period. This figure was made possible by a number of record-



FIVE-YEAR GROWTH IN ELECTRICAL EXPORT TRADE

breaker months, the greatest of which was December last, when a total of \$5,726,376 worth of electrical goods was exported from the United States. As will be noticed from

Thus in 1917 the exports were a little short of twice those of 1913, which was supposed to be the best export year for electrical goods prior to the war. To what extent the exports of electrical goods have grown in value in the last five years is shown in the accompanying curve. As will be noted, in 1914, owing to the war in the last half of the year, exports fell off considerably. They picked up a bit in 1915, owing to the increase in industrial activities the latter part of the year, and from then on forged rapidly ahead until the record total of 1917 was reached.

The Baby Bond—The Man's Choice

AIDING CONSERVATION IN SUPPLY JOBBING HOUSES

Discussion of Means for Eliminating Waste in Jobbing Organizations as They Exist and Operate To-day

A Middle Western jobber concluded after a study of several jobbing houses in his neighborhood that the average electrical jobbing house has two very apparent failings—first, too much red tape; second, inefficient clerks. In a paper before a recent convention this jobber cited instances to substantiate his conclusions. Some of these instances follow:

One company which has an elaborate system of handling orders is so far behind in maintaining the system as to render one of the prime objects of the system worthless. Another has elaborate files containing many copies of the same information. Another concern does not segregate its filing by months or years, but leaves dead filing to become mixed with that of recent date. Yet another firm has changed its system of accounting three times in two years and has changed its arrangement of information from towns in its territory from an arrangement by towns to an alphabetical arrangement, then to a classification by states, then to a numerical system. Another jobber spends \$3,120 a year wastefully entering invoices from manufacturers on a manufacturer's ledger accounts and rendering state-

DETAILED FIGURES OF EXPORTS OF ELECTRICAL MERCHANDISE

Articles Exported	December		Twelve Months Ended		December
	1916	1917	1915	1916	1917
Batteries	\$212,457	\$370,486	\$1,364,999	\$2,025,250	\$3,624,222
Carbons	178,567	178,567	178,567	178,567	736,717
Dynamos or generators	305,759	138,450	1,872,191	1,867,565	2,356,780
Fans	23,422	73,106	374,649	313,771	622,731
Heating and cooking apparatus	58,701	58,701	58,701	58,701	256,533
Insulated wire and cables	630,732	676,651	2,761,609	4,943,577	7,187,951
Interior wiring supplies, including fixtures	110,750	134,398	882,891	901,657	1,405,772
Arc lamps	1,146	1,534	23,983	15,467	16,418
Carbon-filament lamps	16,297	27,172	158,815	124,776	187,876
Metal-filament lamps	128,394	341,086	865,188	1,420,309	2,884,675
Magnetos, spark plugs, etc.	328,527	328,527	328,527	328,527	1,757,848
Meters and measuring instruments	102,832	191,539	657,129	884,241	1,213,278
Motors	526,952	730,585	3,278,413	4,932,831	6,484,972
Rheostats and controllers	21,641	21,641	21,641	21,641	93,612
Switches and accessories	221,022	221,022	221,022	221,022	1,025,003
Telegraph apparatus, including wireless	15,654	44,644	136,890	209,343	555,703
Telephones	301,107	278,162	910,623	1,813,969	2,212,237
Transformers	86,370	213,243	737,680	1,051,168	1,747,884
All other	2,284,965	1,696,862	10,316,528	19,740,151	21,107,867
Total	\$4,746,837	\$5,726,376	\$24,341,588	\$40,244,075	\$55,478,079

the accompanying table, the exports of motors and insulating wire and cable for last December were particularly large because of the activity in troop movements:

The year of 1917 compares with previous years as follows:

1917	\$55,478,079	1914	\$19,963,115
1916	40,244,075	1913	28,197,363
1915	24,341,588		

ments of its monthly and annual purchases. Still another jobber spends over \$2,400 a year in wages for extra help who make journal entries of business before posting the ledger.

Such concerns have too much system. Others have not enough. For instance, one concern permits orders to be

taken over the telephone, a single memorandum going to the shipping room without any registration or number. If it is lost, the merchandise is not paid for. Simplicity and accuracy should be the features of any system for handling business, with consideration for expanding the system with growth of business. The business of one concern with such a system has grown from \$50,000 a year to \$1,000,000 a year, without necessitating a change in the system.

A Bond for Freedom's Cause

GOVERNMENT PRACTICES

IN PURCHASING SUPPLIES

The Delivery, Packing and Wire-Reel Charges Formerly Customary Are Not Acceptable to the Buying Officials

Jobbing houses are busier now than ever before, government and industrial demands making almost the entire market. Government demand is particularly heavy and exacting. When the government wants anything it is for immediate delivery. Frequently the orders clean out the stock on hand or else reduce it far below a working amount.

In addition, the government in asking for quotations is not inclined to follow trade practices that have prevailed for years, but rather imposes its own standards. Thus the government in buying wire will not pay an extra charge for reels. The practice has been for the buyer actually to make a deposit on all reels, to be returned on the return of the reel. These reels are by no means an inconsiderable element in the cost of a reel of wire.

Also, the government refuses to pay packing charges as such. This is an item of cost that has generally been considered an extra.

In addition, the government does not pay delivery charges. For that reason all quotations must necessarily be f.o.b. point of delivery instead of shipping point. When the frequency with which shipments must be made by truck is considered, it can be appreciated that this is no small item.

METAL MARKET SITUATION

Prices on Iron and Steel Products Continued by an Official Order—Copper Deliveries Slow

Very little if any change has occurred in copper. There seems to be an ample supply of the metal available to meet and satisfy the requirements of the industrial manufacturer, but it is being released very cautiously by the committee in charge. The jobbing lot price is being slightly shaded. Deliveries are still back, and freight conditions have not bettered appreciably. The decision of the President continuing the present scale of prices for iron and steel products for another three months from March 31 has been announced. The only change is on basic pig iron and heavy melting steel scrap, which was reduced \$1. Tin is in no better supply, with prices nominal but exceedingly high. Old metals remain practically unchanged.

NEW YORK METAL MARKET PRICES

	March 25			April 1		
	£	s	d	£	s	d
Copper:						
London, standard spot	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	*26.25	to 26.75		*26.25	to 26.75	
Lead, trust price	7.25			7.25		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter	15.00			15.00		
Spelter, spot	7.30	to 7.42½		7.17½		
Fin. Straits	*85.00			*85.00		
Aluminum, 98 to 99 per cent.	Govt. price	32.00		Govt. price	32.10	

OLD METALS

Heavy copper and wire	21.50	to 22.00	21.50	to 22.00
Brass, heavy	14.00	to 15.25	14.00	to 15.25
Brass, light	10.00	to 11.00	10.50	to 11.00
Lead, heavy	6.25	to 6.50	6.00	to 6.25
Zinc, old scrap	5.25	to 5.75	5.00	to 5.62½

*Nominal.

THE WEEK

IN TRADE

ACCOUNTS received from various sources indicate that the electrical industry is enjoying a period of unusual activity. Sales of equipment and material in increasing quantities, chiefly for government war activities, directly and indirectly, are keeping stocks of staples at a comparatively low stage. The demand for house-wiring devices of all kinds is heavy. Poles and pole-line material are moving briskly. Motors of various sizes, new and second-hand, large transformers, switching apparatus, etc., are reported as enjoying a strong sale. Jobbers are stocking up liberally with electric fans in anticipation of an active season.

Deliveries are weak and uncertain, both freight and express. In some sections labor is scarce and the demand for skilled workmen is far beyond the supply.

Collections are improving with manufacturers, jobbers and dealers, and payments are being promptly net. Credits continue to receive careful attention.

NEW YORK

Jobbers are very busy. Most of them are selling merchandise for government requirements, which, together with industrial work, compose almost the entire market. Building operations are down to practically nothing. Jobbers are having difficulty in obtaining labor as well as stocks. Almost no local houses have complete stocks. Wire and conduit especially are in uncertain supply.

Where license certificates can be obtained from the traffic committee the export trade is excellent, but for lack of tonnage the refusals are more plentiful than those favorably acted upon. Locally collections are reported as making a good showing; in fact, are said to be in the main prompt.

PORCELAIN.—The demand is strong, with deliveries the chief obstacle. Shipments are being made by express where possible, but they are not always dependable. The new price list said to be on the way had not appeared by April 1.

SOCKETS.—An unusually brisk call for export is reported in sockets. The kind of goods called for is not familiar to the trade here, presenting peculiar sizes and models.

POLES.—Sizes of about 35 ft., the popular length, of chestnut are difficult to obtain. The demand is steady. Shipments are checked by embargoes. Power houses and central stations are in the market for their spring requirements in replacement and maintenance work.

CONDUIT.—Stock is still short, government work taking about all the available pipe in sight for industrial plants. Deliveries remain backward, the mills having shipments detained for lack of cars.

COLLECTIONS AND CREDITS.—Collections in this territory are reported as quite satisfactory. The Moral Risk Club, which held its meeting last Friday, considered conditions favorable. Credits, however, are dealt with firmly.

FUSES.—Refillable fuses are reported to be in brisk demand, according to leading jobbers. On inclosed fuses a shorter discount was announced by a large distributor.

HEATING APPLIANCES.—With the active sales campaigns now being carried on by manufacturers, distributors and jobbers, sales of these goods are expanding rapidly. Toasters, electric irons, grills, pads, percolators, chafing dishes, etc., are receiving special attention in the large department stores, and dealers are also "doing their bit" to boost trade, with commensurate results.

SWITCH BOXES.—A leading distributor recently increased his discounts sharply on sectional conduit switch boxes. Black, that had ruled net for a long time, is now

quoted at 40 per cent off on the \$2 list; \$2 to \$10 list, before 20 per cent, is now 50 per cent off; \$10 to \$50 list, formerly 30 per cent, is now 64 per cent off. For galvanized the discounts are now 30 per cent, 40 per cent and 52 per cent off, as against net, 5 per cent and 15 per cent.

CHICAGO

The trade is continuing in good volume, with little change in the condition of stocks. Central stations are buying very little, and some jobbers see little chance of business opening up in this line. Industrial plants, however, are active and give promise of becoming more so. The word that more government business is to be shifted to the Chicago district is hopefully received and is believed, since there appears every good reason for following such a course and no good reason for not doing so. As yet the railroads have not opened up very strongly on buying. That there will shortly be a change here is expected. So while the market continues spotty there appears no reason to complain about present volume and every reason to expect increases. What is true in the jobbing field holds also for the manufacturers' agents and smaller manufacturers. Many of these report 1918 business well ahead of the same period for 1917 in point of gross sales.

It is possible that there may be a change in the buying methods in connection with material used for the city of Chicago. The city electrical department has been attacked by the politicians, and threats are made to reduce its strength to one lone man and to do all city electrical work by contract. This may never get further than talk, however. The contractor-dealer movement for better merchandising is gaining headway, as is evidenced by the fact that more than 100 concerns have actually joined the Illinois association and about 75 paid members have been secured in Wisconsin. Central-station support of the plan is gaining.

Building activities continue to gain. The number of building permits issued in the week ending March 22 was 672, as against 767 for the same week last year.

PINS AND BRACKETS.—An advance of about 10 per cent on pins and brackets has been scheduled. Shortage of material is given as the cause for the increase.

VACUUM CLEANERS.—Dealers report that the greatly increased price of brooms is making for a much better cleaner market. Brooms which formerly cost 25 cents are now quoted at \$1 to \$1.50 each.

BELL-RINGING TRANSFORMERS.—In spite of curtailed building activities manufacturers are showing a good volume.

WIRING ACCESSORIES.—Lock nuts, toggle bolts and sundry metal accessories of the same sort, which are used in wiring, are reported not to be moving rapidly. Some of the Chicago jobbers have very large stocks on hand. One concern is reported to have in its warehouses more than 1,000,000 lock nuts.

BOSTON

The volume of trade continues heavy, especially in industrial lines related to government needs, and there is, of course, no let-up in direct war orders. There are minor fluctuations among jobbers with respect to orders, but on the whole the industry is very active. Collections are fairly good, and in some cases payments are being made within ten days of delivery from the jobber's stockroom. More punctual train service on the railroads is now being enjoyed, and this has a far-reaching effect on the efficient transaction of business in all lines. Sporadic house-wiring contracts are being handled by contractors. Throughout the industry active preparations are being made to insure the success of the third Liberty loan. Uncle Sam's needs come first, and new enterprises are at a low ebb. Labor is exceedingly scarce, and the demand for skilled workmen for industrial plants is far beyond the supply.

Governmental assistance announced recently in connection with the financing of the New York, New Haven & Hartford Railroad appears certain to improve the business outlook

in New England, and the electrical industry naturally will share in better conditions on this important property. The retail trade appears to be in a healthy condition, and a large volume of summer business is expected by central stations in touch with shore and interior vacation resorts, both in the sale of energy and through appliance merchandising.

FANS.—Jobbers are stocking up well in anticipation of a substantial summer business. Although the returns depend in large degree upon the weather from year to year, last year's fan shortage made such an impression locally that there is a decided disposition not to be caught short again. One jobber, for instance, sold 200 fans of a single make last year and will start the present season with a stock of 400.

TRANSFORMERS.—Central-station power engineers are anxious about the long deliveries now being quoted on power transformers. In some cases it has been found expedient to rearrange the locations of transformers on factory service, grouping different establishments together in an effort to cut down idle capacity and to offset the long delays necessary in getting new equipment. Recent quotations run up close to a year on units of 100 kw. and over.

LAMPS.—Manufacturers are now finding it possible to stock up somewhat at the factories. The supply of glass is on a better basis than at this time last year. Comparatively little night work is being handled at present in a large New England plant which confines itself to above-miniature sizes. Easier conditions should prevail for the next few months.

SECOND-HAND MOTORS.—Trade is very brisk, and dealers report a scarcity in the larger sizes. Up to and including 10 hp. motors are fairly plentiful. The larger motors sell for practically as much second-hand as new, so great is the demand. Inquiries for motors are very responsive to the publication of news relative to government contract distributions.

SWITCHES AND ALLIED EQUIPMENT.—An enormous demand exists for switching apparatus, and the accumulation of factory stocks seems practically out of the question at present. The high cost and shortage of labor is probably the most serious factor in handling this class of production at present. Raw materials are becoming more plentiful and one manufacturer is buying steel plate for switch-box use on five weeks' delivery, carload shipment. Reduced prices on both steel and copper are now being obtained. Central stations are heavy switch buyers for motor installation work. Price advances of two months ago do not appear to have cut down orders much if any.

STORAGE BATTERIES.—Deliveries are improving somewhat, owing to enlarged factory accommodations. Prices are firm and government business predominates.

ATLANTA

There is little change to record for this week. All lines seem to be strong, with the exception of a few items that have shown a tendency to slow up. The development of water powers for nitrate production is the main topic of conversation, indicating that the government has other projects in view besides the Muscle Shoals development. The preliminary expenditures for this plant have been definitely decided upon, to be made up as follows: \$5,000,000 for synthetic-process nitrate plant, \$20,000,000 for hydro electric plant, \$30,000,000 for cyanamide nitrogen fixation plant. A new five-million-dollar plant is contemplated for Kingsport, Tenn. The product to be manufactured is not for publication at this time. The White-Park Mitts Company, Concord, S. C., has been incorporated for \$2,000,000 for the manufacture of cotton cloth.

With the exception of a few lines it is apparent that factory conditions are much better and stocks show slight gains. Although this state of things is conducive to better promises of shipments, this section has not been able to feel its effect or to reap any benefits, especially where embargoes and transportation conditions work in adverse ratio, offsetting any direct advantage that might have been attained.

CREDITS AND COLLECTIONS.—Collections have slightly improved within the last few weeks. There is no doubt that more pressure is being brought to bear along the

entire field, with a corresponding stiffening in credits and extensions. The trade acceptance is looked upon with more favor of late by the jobbers, but a few of the manufacturers are taking an ultra-conservative view of the situation, apparently awaiting the trend of conditions.

MOTORS.—The direct sale of fractional horsepower types has been limited in this section, owing to the fact that they are usually shipped with machinery they are meant to operate. Manufacturers report that shipments are improving on direct-to-consumer sales. There is no cessation in the demand for motors up to 10 hp., but the trouble is to get them shipped. Factory stocks are accumulating, while local stocks are becoming depleted. Orders for capacities up to 75 hp. are coming in briskly, but shipments are the same as with the smaller ratings. Sales in the larger ratings up to 100 hp. always show stimulation at this season of the year, owing to anticipated requirements for seasonal industries, such as oil mills, cotton gins, fertilizer plants, etc. Factory conditions show considerable improvement, as evidenced by better shipment promises, the only deterrent factor being poor freight movements. Prices have been steady and no change is expected soon.

METERS.—The slowing up of building operations is reflected in the demand for residence-type watt-hour meters, which shows a slight decline during the last few weeks. Stocks are in good shape and very well distributed throughout the Southeast. Factory shipments are improving. Activity continues in the polyphase type.

FANS.—A big business is expected during the coming season. Ceiling fans are especially active at this time, owing to government requirements for hospitals and mess halls at the various cantonments. Jobbers have placed substantial orders.

SEATTLE

The volume of business transacted by both jobbers and retailers continues very heavy, war industries dominating trade, although home building continues to increase, augmenting the sales of house-wiring devices. The feature of the last week's business was the award of a contract by the United States Shipping Board for miscellaneous electrical supplies for government work in Aberdeen and a heavy movement of power apparatus, including large-size motors and generators. Sales of flood-lighting outfits over the past several weeks show a decided increase. The movement of washing and sewing machines, particularly the latter, is very brisk. Stocks of domestic appliances have been replenished and are in fair condition. The recent arrival of several cars of conduit served to relieve the strained condition temporarily.

Sales to Seattle and Tacoma shipyards are heavy, but no particular increase over last week is noted. Business with yards in the Gray's Harbor and Portland territory shows a heavy increase, especially in Portland. An Astoria (Ore.) firm has secured contracts for installing machinery and fully equipping all government vessels constructed in the lower Columbia River district, numbering more than thirty. To care for the work the concern is erecting additional shops and housing accommodations for employees. Two-way wooden shipbuilding plants started in Everett will shortly be enlarged to six ways. A prominent Northwest contracting firm plans a concrete shipbuilding plant. A site at Vancouver, Wash., is said to be favored. The Pioneer shipbuilding and repair plant near Seattle, which has changed ownership, will be enlarged immediately, and considerable heavy electrical equipment is to be purchased.

Government buying for cantonment work shows some increase over last week. Credit managers in the Puget Sound district report March an exceptionally healthy month as regards business placed and collections, collections becoming easier as the year progresses. Money is very free. During the month a large amount of new business was received from old customers and a considerable number of new credits were placed. New war industrial plants under formation appear to have a stable backing. Government collections are prompt.

Prospective builders are being warned that in the very near future the prices of many building materials will be

advanced decisively. The home building campaign in the Sound cities is increasing. During March in Seattle permits for buildings valued at approximately \$1,000,000 were issued, as compared with slightly more than \$500,000 in March of last year. The ratio in Tacoma is nearly as large. The immediate expenditure of \$1,000,000 for buildings at Camp Lewis is authorized by the government, and ground was broken at Vancouver, Wash., for ten additional barracks. The steel shipyard in Tacoma was awarded the contract by the United States Emergency Fleet Corporation for ten steel ships of 7500 tons, in addition to three now under construction.

The lumber industry of the Northwest is imperiled by the grave car shortage, which is daily growing more acute. Efforts are being launched by government officials to break the embarrassing situation. The labor situation in cities as well as in farming areas is daily becoming more acute. The United States government employment office in Seattle reports a desperate shortage in common labor in strictly war industries. The wheat farmers east of the mountains are incessantly calling for help, and the situation is serious.

SAN FRANCISCO

This has been a busy week for the electrical industry. Shipments have been good. Once again it is possible to accumulate shelf stock as a reserve, and the fine warm weather that followed another welcome rainfall has added the last touch of optimism for the future—an optimism which even the news of the great German offensive failed to diminish. This past week Libby, McNeil & Libby let contracts for workmen's cottages at their Selma (Cal.) and North Yakima (Wash.) plants. It now appears that, as the result of an investigation by a member of the industrial commission of the National Council of Defense, from 2000 to 5000 houses for workingmen in the San Francisco Bay district are recommended for immediate construction, and a representative has left for Washington to secure the necessary federal authority for priority of attention.

STREET ELECTROLIERS.—Several communities are planning better lighting of their streets, in some cases for better protection and in others as a portion of a general scheme for greater civic beauty. In one week Alpaugh and Fresno, in the San Joaquin valley, and Santa Barbara and Los Angeles, in southern California, reported that plans and specifications for such work had been submitted to their respective city councils.

POLES.—Pole business is in a most abnormal and unsettled state, suffering from the rather unusual combination of slack demand and difficult deliveries. This situation may be explained by the shortage of available power and the present high cost of construction material. On the other hand, the pole yards are situated in the Pacific Northwest, where a great deal of government lumber is requisitioned. Cars and boats are difficult to get and labor is almost impossible to secure, and then only at high wages. One of the large pole companies states that when it is fortunate enough to secure a boat for deliveries along the Pacific Coast it is customary to load it with everything available, instead of proportioned stocks, and thus pole stocks are poorly distributed.

CROSS-ARMS.—Cross-arms, of course, are affected by the conditions noted above, with the addition that the forests in which they are cut contain lumber that is valuable for governmental purposes and demands the attention of all available labor, making slow deliveries.

POLE-LINE HARDWARE.—Hardware is a necessary link in pole-link construction, and its present sale is slack, though there is a certain amount of construction on industrial plants and mines that lie in new districts and are engaged in war service.

SCHEDULE MATERIAL.—Orders for switches, sockets, rosettes, cut-outs and other house-wiring material are heavy and surprisingly numerous, considering the big decrease in reported jobs. Local representatives of large Eastern manufacturers assign this demand to the arrival of stocks ordered last year. Porcelain sockets and receptacles are wanted for factory wiring, and each new shipment is largely sold out before its arrival.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
No. & S. Size	List per 1000 Ft.
No. 14 solid	\$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00
Twin-Conductor	
No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
Less than coil	List to \$61.00
Coil to 1000 ft.	10% to 57.25
No. 12 Solid	
Less than coil	List to \$71.00
Coil to 1000 ft.	10% to 66.75
Twin-Conductor	
Less than coil	List to \$104.00
Coil to 1000 ft.	\$97.75 to 10%
No. 12 Solid	
Less than coil	List to \$135
Coil to 1000 ft.	10% to \$126.80

DISCOUNT—CHICAGO

Single-Conductor	
Less than coil	15% to + 20%
Coil to 1000 ft.	5% to 20%
No. 12 Solid	
Less than coil	15% to + 20%
Coil to 1000 ft.	5% to 20%
Twin-Conductor	
Less than coil	15% to + \$115
Coil to 1000 ft.	20% to \$80
No. 12 Solid	
Less than coil	15% to + 20%
Coil to 1000 ft.	10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to \$24.00
1/5 to std. pkg.	20% to 19.80
Std. pkg.	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to 12%
1/5 to std. pkg.	20% to List
Std. pkg.	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3175-.3195	.3215-.3295
Barrel lots	.2875-.2895	.2915-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 1000 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/4-in. s. stp. Net to \$75.00	—15% to \$69.75
3/4-in. d. stp. + 10% to 75.00	List to 72.00
1/2-in. s. stp. List to 100.00	—15% to 93.00
1/2-in. d. stp. + 10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/4-in. single strip	\$75.00 \$63.75
3/4-in. double strip	78.25-78.75 71.25-71.75
1/2-in. single strip	100.00 85.00
1/2-in. double strip	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	2	.47
3/4	.15	2 1/4	.55
1	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$25.00-\$55.00	\$20.50-\$24.50
1/4-in.	\$25.00-\$55.00	\$20.00-\$21.50
3/8-in.	\$28.00-\$60.00	\$22.50-\$27.00
1/2-in.		\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.	\$36.00-\$55.00	\$25.00
1/4-in.	\$40.00-\$66.00	\$22.50
3/8-in.		\$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38	
Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2
Couplings, List Elbows, List	
1/4	\$0.05 \$0.19
3/8	.06 .19
1/2	.07 .19
3/4	.10 .25
1	.13 .37
1 1/4	.17 .45
1 1/2	.21 .50
2	.28 1.10
2 1/2	.40 1.80
3	.60 4.80

DISCOUNT—NEW YORK

Less than	1/4 in. to 1/2 in.	3/4 in. to 3 in.
2500 lb.	4% to 12%	7% to 15%
2500 to 5000 lb.	6% to 14%	9% to 17%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

Less than	1/4 in. to 1/2 in.	3/4 in. to 3 in.
2500 lb.	3 7/8% to 8.9%	6.7% to 11.9%
2500-5000 lb.	5.7% to 10.9%	8.7% to 13.9%
(For galvanized deduct six points from above discounts.)		

FLATIRONS NEW YORK

List price	\$5.00 to \$6.00
Discount	30%

CHICAGO

List	\$5.00 to \$6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	20% to 30%
1/5 to std. pkg.	38% to 40%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28% to 30%
1/5 to std. pkg.	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.00
1/5 to std. pkg.	4.50
Standard packages, 500. List, each,	\$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard packages, 500. List, each,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B.	100	\$0.30
60-watt—B.	100	.35
100-watt—B.	24	.70
75-watt—C.	50	.70
100-watt—C.	24	1.10
200-watt—C.	24	2.20
300-watt—C.	24	3.25
Round bulbs, 3 1/4 in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3 3/8 in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4 1/8 in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$31.00 to \$34.90
Coil to 1000 ft.	26.20 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	\$29.00 to \$30.00
Coil to 1000 ft.	21.50 to 22.50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100.	\$24.00
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CHICAGO

Net per 100.	\$19.17 to \$25.75
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.	\$30.00
102—B.A., 6200 S.E., 300, A.X., 1 1/2, 4 S.	30.00
103—C.A., 9, 4R, B 1 1/2.	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%	20%
\$10.00 to \$50.00 list.	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200. List per 1000,	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N. C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10 to \$11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets.	500	\$0.33
1/4-in. cap keyless socket.	500	.30
1/4-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	24% to 25%
1/5 std. pkg.	30% to 33%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

High Grade	
Less than \$10 list.	List to + 5%
\$10 to \$25 list.	11%
\$25 to \$50 net.	14% to 15%
Low Grade	
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24% to 25%

DISCOUNT—CHICAGO

High Grade	
Less than \$10 list.	+ 5%
\$10 to \$25 list.	10% to 11%
\$25 to \$50 list.	14%
Low Grade	
Less than \$10 list.	+ 5%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+ 20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.	List 40%	Net to 30%
\$2.00 to \$10.00 list.	10% to 50%	5% to 40%
\$10.00 to \$50.00 list.	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.	25%	15% to 20%
\$2.00 to \$10.00 list.	25%	20%
\$10.00 to \$50.00 list.	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

No.	Per Lb. Net
No. 18, less than full spools.	\$0.41 1/4—\$0.44 1/4
No. 18, full spools.	0.36 1/4—0.43 1/4

CHICAGO

No.	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.65
No. 18, full spools.	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11.	\$15.00—\$18.00	\$12.50—\$13.00	\$9.85—\$11.50
12.	23.25—25.10	21.30—21.80	15.95—19.35
10.	32.40—35.20	29.70—30.20	22.10—27.00
8.	45.70—49.15	41.90—42.10	30.88—38.00
6.	72.40—77.85	66.35—66.75	48.95—60.30

CHICAGO

Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14.	\$18.00	\$13.00	\$11.50
12.	25.33—26.68	22.02—25.33	18.35—20.93
10.	30.49—36.54	27.94—30.03	22.86—29.23
8.	42.54—57.57	38.90—44.13	31.90—41.36
6.	66.46—88.38	56.15—75.61	50.53—70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$35.42 to \$40.35
25 to 50 lb.	34.42 to 39.35
50 to 100 lb.	33.42 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

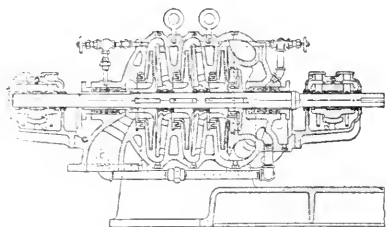
Outdoor Meter Boxes

An outdoor meter box which can be conveniently located where it can be read at any time without disturbing the consumer is being placed upon the market by the Safety Meter Box Company, 112 Hamilton Avenue, Cleveland, Ohio. It is claimed that the fire hazard of meters and fuses is greatly lessened by the use of this meter box because the box is of heavy metal which entirely incloses the meter. Another feature of the "Safety" meter box is the ease with which the meter can be installed or removed by the central station.

Multi-Stage Pump with Two Discharge Nozzles

The accompanying cross-section shows a multi-stage pump that has been developed recently by the Alberger Pump & Condenser Company, 140 Cedar Street, New York City. It is known as the Type "N" pump and differs from previous units manufactured by the same company in that the parts are more standardized. The shaft diameter of the two bearings is the same, thus permitting the customer to carry one bearing shell in stock to guard against accidents. The pump is hydraulically balanced to prevent end thrust, so no thrust bearings are required.

Leakage between the pressure and suction chambers is avoided by clearance rings placed between the rotating and stationary parts. There are two discharge nozzles, either of which may be used, as one of the openings can be closed by a blind flange supplied with the pump. The casing is of annular



CROSS-SECTIONAL VIEW OF MULTI-STAGE PUMP

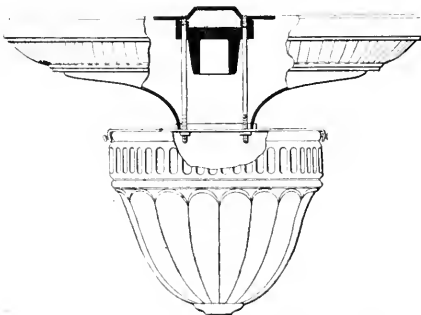
form divided along the horizontal center line so that the upper part can be removed readily without disturbing the pipe connections. The suction and discharge openings are cast integral with the lower parts. The impellers are of bronze of the inclosed type with single side-entrance opening. The pumps ordinarily are furnished with bronze fittings, but special material may be or-

dered for unusual requirements. The multi-stage pumps can be driven by a belt, electric motor or steam turbine.

Semi-Indirect Lighting Fixture

The Panama Electric Lamp Company of Chicago and San Francisco is now marketing a lighting fixture of the design shown herewith. The lower bowl is of white translucent glass and the upper reflector is of white satin-finished porcelain. The unit is made in three standard sizes, which range from 14 in. to 19 in. (35 cm. to 48 cm.) in width at the ceiling flange. They are made for mounting with the ceiling flange against the ceiling or with the unit suspended at the end of a single-chain or three-chain support.

The manufacturer points out that the unit is notable for its simplicity and small number of parts. The socket and supports are concealed inside the reflector. The saddle or upper support



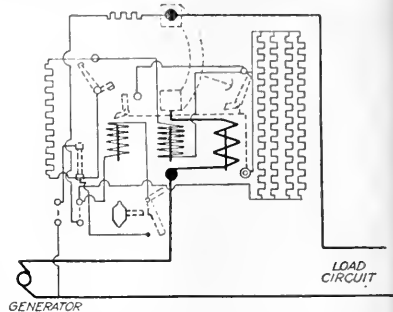
SOCKETS AND SUPPORTS CONCEALED
INSIDE OF THE REFLECTOR

can be attached to any size or type of outlet box. The bowl is ventilated at the bottom. Tests which have been made by the manufacturer indicate that one 200-watt gas-filled lamp in a "Panama-Lite" fixture will give a uniformly diffused downward intensity averaging more than 265 cp. over an arc of 110 deg. Special units of the same type are equipped with daylight glass.

Automatic Reclosing Circuit Breaker with Low-Voltage Lock-Out

The illustration which is printed herewith represents the wiring diagram of a type CN 400-amp. automatic-reclosing circuit breaker developed by the Automatic Reclosing Circuit Breaker Company, Columbus, Ohio. The switch has a low-voltage lock-out. When the breaker is opened either by an overload

or failure of voltage, the cut-out contact is held open by the main contact brush. In this position of the cut-out contact the circuit of the operating coil for reclosing can be closed only by the closing of the auxiliary contact arm. The auxiliary contact arm is closed by



AUXILIARY CONTACT ARM CLOSED BY TRIP
COIL WHEN CONDITIONS ARE NORMAL

the trip coil whenever load conditions are normal and the potential is restored to 50 per cent or more of normal value. The trip coil holds the auxiliary contact closed until the breaker has closed far enough to allow cut-out contact to assume normal position and the circuit of the trip coil to be opened by the dash-pot contact arm.

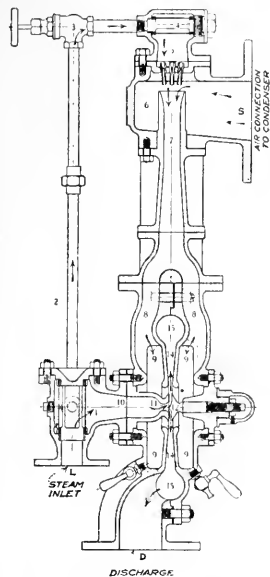
Air Pump with No Moving Parts

The C. H. Wheeler Manufacturing Company, Eighteenth Street and Lehigh Avenue, Philadelphia, has designed a "Radojet" air pump for high-vacuum condensers. The air pump operates on the dry-air principle. It has no moving parts and does not require lubrication or attention during operation. Other advantages may be summarized as follows: Low steam consumption, extreme simplicity, requires minimum space, no foundations and operates noiselessly. It starts quickly and gives continuous service with safety in operation. The principal characteristic of the "Radojet" is the use of steam jets for the removal of air. The "Radojet," as shown in the cross-section reproduced herewith, consists of two steam ejectors working in series, the upper ejector called the first stage and the lower the second stage.

Live steam is delivered to the first stage through opening L to pipe 2, auxiliary steam valve 3, expansion nozzles 5, across suction chamber 6, which is in communication with the condenser through the suction opening S. The steam expands in the nozzles, leaving with a very high velocity, and while passing across suction chamber 6 en-

trains the air and vapors to be compressed.

The mixture passes into the diffuser 7, from which it is discharged at higher absolute pressure than that of the air entering at *S* into a double passage 8 communicating with the suction chambers 9 of the second stage. These two suction chambers 9 are annular, giving



SECTIONAL VIEW OF AIR PUMP SHOWING PATH OF STEAM AND AIR

the commingled fluid a large entrainment surface.

Steam is simultaneously delivered through the strainer 1 into passage 10, which communicates with the annular expansion nozzle formed between two circular disks 11 and 12. The separation of these disks can be changed by adjusting screw 13 which changes the expansion ratio of the steam. The steam delivered radially by the annular nozzle 11 and 12 expands, leaving it as a jet at high velocity in the form of a sheet. In passing across the suction chambers 9 it entrains the commingled air and steam coming from the first stage and carries them into the annular diffuser 14, thereby compressing the mixture to atmospheric pressure and discharging it into casing 15, which is connected to the discharge opening *D*.

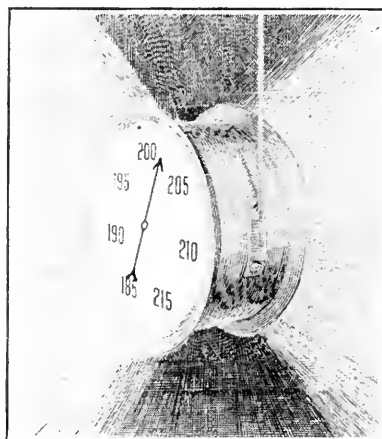
Another advantage of the air pump is that the steam contained in the mixture is condensed and the heat transmitted to the boiler-feed water, thereby raising the temperature. The air frees itself from the rising water and escapes through a vent to the atmosphere. The "Radojet" air pump can be used for surface, jet or barometric condensers. When it is used with the surface condensers it is found advisable to use separate pumps to handle the air and condensate. The condensate can be removed at approximately the exhaust steam temperature, while at the same time the dry-air pump would handle the air and vapors under the volume and temperature conditions imposed by the temperature of the circulating water. The use of this air pump with a jet condenser is advantageous because it is independent of the removal pump.

This makes it possible to vary the speed of the removal pump within a large range according to the variations of the discharge heads, thereby obtaining the most economical results.

Double-Dial Illuminated Pressure Gage

The Ashton Valve Company of 161 First Street, Cambridge "C," Boston, has placed upon the market a master-pilot pressure gage for use in large boiler and engine room installations. The gage, shown in the accompanying illustration, has a limited-pressure scale suitable for the ordinary range of working pressures. It is made with a special operating mechanism which will not turn the pointer at pressures below the minimum dial graduation.

The advantage of this special form of gage is that finer graduations may be used and that the figures can be of considerably larger size. This enables the slightest variation of pressure to be quite noticeable and the reading of the gage to be readily observed. The gage is made with single-face or double-face,



MULTIPLE-TUBE CONSTRUCTION INCREASES FLEXIBILITY

plain or illuminated dials with the usual support brackets. The multiple-tube construction employed with this gage permits increased flexibility of operation and the greatest durability, the makers say.

A Connector That Requires No Soldering

The Columbia Metal Box Company, 228 East 144th Street, New York, has placed upon the market the "Notorch" solderless connector for use in lighting fixtures, small motor leads, conduit fittings, junction boxes and cleat wiring. Fixtures can be connected with the "Notorch" connector easily and quickly by removing or loosening the screws. It is not necessary to cut or shorten the outlet wires. The connector is especially adapted for use behind shallow plates or on ornamental wall brackets where there is little room for joints. It is claimed that this connector saves time in installation, per-

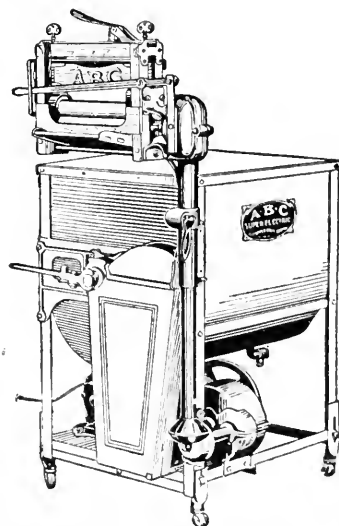
mits a quality job and eliminates the necessity of using a blow torch which blackens ceilings and floors and creates a fire hazard. The device has been approved by the National Board of Fire Underwriters for a rating of 17 amp. for fixture wiring and for motor leads up to a 4-hp. rating.

Arc Regulator

An arc regulator for motion-picture projectoscopes that fits on the rear of the lamp house is being manufactured by the Barlow Electric Specialties Company, Inc., of Yonkers, N. Y. The device is composed of a small box containing the arc-regulating mechanism, which consists primarily of a powerful spring held in check through a magnetically controlled brake. The coils of the magnets are connected with taps off of the main feed wires to the machine. The apparatus feeds the carbons so that any change in voltage at the arc will be immediately adjusted.

Washing Machine with Safety Wringer

The accompanying illustration shows a new electric washer that is made of all metal with the exception of the wringer frame and revolving cylinder. The revolving cylinder is built of 2-in. (5.1-cm.) wood staves spaced 0.25 in. (0.63 cm.) apart and perforated with 0.5-in. (1.3-cm.) holes, thus affording ample openings for the passage of the water through the clothes. The cylinder makes a complete revolution in one direction and then reverses. The wringer is provided with a safety release, which enables the operator to stop the rolls immediately. It is supported by an upright arm extending from one corner of the washer and can



SAFETY RELEASE ON WRINGER ALLOWS ROLL TO BE IMMEDIATELY STOPPED

be placed and locked in any position desired. The washing machine, which is driven by a 0.25-hp. Robbins & Myers splash-proof motor directly connected by a shaft, is made by Altorfer Brothers Company of Peoria, Ill.

Trade Notes

E. N. NOUSE is now manager of the Chicago Electric Lamp Company of 138 West Lake Street, Chicago, succeeding H. S. Kurtz.

L. K. COMSTOCK & COMPANY, contracting engineers of New York City, have changed their address from 30 Church Street to 21 East Fortieth Street.

THE DUQUESNE ELECTRIC & MANUFACTURING COMPANY, Pittsburgh, Pa., announces the opening of a branch office at 230 South La Salle Street, Chicago.

THE H. W. JOHNS-MANVILLE COMPANY of New York City states that its Memphis (Tenn.) office was removed March 31 to new quarters at 804 Exchange Place.

THE WESTERN ELECTRIC COMPANY is making a display of all the principal domestic appliances it manufactures at the Hotel Brunswick, Boston. This is open to the trade.

THE INTERNATIONAL RADIO-TELEGRAPH COMPANY is the new name of the International Signal Company. The executive office is in Pittsburgh, Pa., with the factory in Brooklyn, N. Y.

THE THOMAS WRIGLEY COMPANY, 416 South Dearborn Street, Chicago, has moved its office and plant to 504 South Sherman Street. The company manufactures toggle bolts and pipe hangers.

THE NATIONAL PLANNING BUREAU of Wilkes-Barre, Pa., has inaugurated a campaign in the interest of the building trades, architects and engineers by means of private seals to be used on mail matter.

THE FRANK H. STEHLY, JR., COMPANY is announced as the successor to the Pennsylvania Supply & Equipment Company, 421 Widener Building, Philadelphia. This change of firm name became effective April 1.

W. F. TRENARY, JR., has been named representative for the Harrison Safety Boiler Works of Philadelphia, to have headquarters in the Brown-Marx Building, Birmingham, Ala. Mr. Trenary succeeds W. R. Jennison.

THE HOTPOINT DIVISION of the Edison Electric Appliance Company, Inc., of Ontario, Cal., has sent out notice that henceforth all communications in connection with contract work should be addressed to the general office of the Hotpoint Division, 5660 West Taylor Street, Chicago.

W. O. DUNTLEY, president of the Chicago Pneumatic Tool Company of Chicago, announced his resignation March 29, to take place the same date. Mr. Duntley gave as a reason for his resignation a desire to be relieved of the work of actively managing the concern and to devote more time to private business.

THE VULCAN SOOT CLEANER SALES COMPANY of Chicago has transferred to Dubois, Pa., its general sales office, with G. L. Simonds in charge. This is only a change in location to bring the sales, factory and engineers in immediate touch, with the idea of giving better service to all; the personnel remains as before.

THE PERFECTION STORAGE BATTERY COMPANY, formerly the Dealers' Electric Lighting Company, 2909 Indiana Avenue, Chicago, will move on May 1 to its new plant at Fortieth Street and Rhodes Avenue. This company is developing a semi-automatic lighting plant. It also makes storage batteries for farm lighting sets.

THE MILLER-OWEN ELECTRIC COMPANY, INC., of Pittsburgh, Pa., dealer in used equipment, expects to enter its new warehouse about July 1. The building, which will be 250 ft. long by 40 ft. wide, is being constructed especially to house used electrical equipment. Provisions are being made among other things for an assembling and testing department.

SUPPLEMENT No. 5 to Official Express Classification No. 25, applying on express traffic covered by tariffs issued subject thereto, is now ready for distribution and becomes effective May 1. This refers to the marking requirements of packages, bundles, etc., and a copy may be had by applying to local express offices or F. G. Airy, 861 Broadway, New York City.

GEORGE E. SWETT, until recently in charge of the power and mining engineering department of the Seattle office of the General Electric Company, has resigned to become general manager of the Pacific Machine Shop & Manufacturing Company of Seattle. In his new work Mr. Swett will be engaged chiefly in carrying out contracts for providing mechanical and elec-

trical equipment for ships. Mr. Swett was for three years at the Schenectady works, then for some time at the San Francisco office of the General Electric Company, and for the past five years was in the Seattle office of the company.

Trade Publications

WASHING MACHINES.—The Crystal Washing Machine Company is distributing a circular describing its Crystal washing machine.

REAMERS.—The Cleveland Twist Drill Company of Cleveland, Ohio, is circulating a bulletin entitled "Better High-Speed Reaming" which tells the advantages of its reamers and how they are made.

ELECTRIC SPECIALTIES.—The W. A. Bonnell Company, New York City, has issued catalog No. 203A, on electrical specialties. The book is well illustrated and contains a price list of the various electric fittings.

PANELBOARDS.—"Residence Panelboards" is the title of bulletin No. 1E, issued by the Crouse-Hinds Company of Syracuse, N. Y., illustrating residence panels and parts. Actual installations of panels are shown.

LIGHTING FIXTURES.—The Panama Electric Lamp Company of Chicago and San Francisco has issued a booklet describing its new fixtures, which are known as "Panama-Lite." They are designed for illuminating interiors.

SAFETY METER BOX.—The Safety Meter Box Company, 112 Hamilton Avenue, Cleveland, Ohio, is circulating a folder showing the advantages in the use of its safety meter box, which is made to be installed on the outside of consumers' houses.

STORAGE BATTERIES.—Titan storage batteries for isolated plants are described in bulletin No. 24 of the General Lead Batteries Company, 1790 Broadway, New York City, which is being distributed. The booklet illustrates both the open-glass-jar and the steel-rubber-jar type of battery.

ROLLER CHAINS.—The Link-Belt Company, Chicago, is distributing a booklet that gives preliminary information on recent roller-chain developments. The bulletin is well illustrated, showing the dimensions and construction of the new chain and also various applications for engine, auto-truck and tractor drive.

INDUSTRIAL TRUCKS AND TRACTORS.—The Elwell-Parker Electric Company, Cleveland, Ohio, has issued catalog No. 177, illustrating its electric storage battery industrial truck and tractor system. The bulletin shows the electric trucks in use and their various applications. It illustrates the operation of the elevator truck, the crane truck, and tractors.

LIGHTNING ARRESTERS.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has issued catalog 1A, dealing with lightning arresters. Lightning is discussed in the bulletin and facts are given about the causes and effects of lightning. Various installations and arrangements of lightning arresters and fittings are shown in outline drawings. Descriptions of choke coils are also presented in the bulletin.

SOOT BLOWERS.—The Diamond Power Specialty Company of Detroit, Mich., has issued bulletin 119, referring to soot blowers for water-tube boilers. The bulletin deals with the mechanical features of the soot blower and presents a discussion of the soot removal problem from the economical point of view. A detailed record of tests of fuel saving, including actual flue-gas temperatures, charts and ledger sheets, is also produced. The book is well illustrated, showing actual installations and charts of Venturi and straight nozzles.

LINE INSULATORS.—The R. Thomas & Sons Company, East Liverpool, Ohio, has recently issued catalog No. 16, showing its transmission-line insulators for all voltages. This bulletin is well illustrated and shows applications of the insulators and types of construction used on high-tension transmission lines. It includes line drawings of various insulators for power house and substation use, including suspension insulators and strain clamps. The bulletin is really a reference book because the dimensions and conditions under which the insulators will operate are given. Prices of insulators are also listed.

COUNTRY HOME LIGHTING.—The engineering department of the National Lamp Works, Nela Park, Cleveland, has recently published bulletin 34, which deals with country home lighting. A general discus-

sion dwells on the generating plant and wiring, stress being laid upon the fact that satisfactory operation depends greatly upon the wire being sufficiently large to carry the necessary power without an undesirable voltage drop. A table is produced which facilitates the selection of wire of the proper size. A short descriptive section is devoted to Mazda lamps for country home lighting, and photographs of actual installations are used to illustrate the lighting of the home.

New Incorporations

THE ECLIPSE ELECTRIC COMPANY of Canton, Ohio, has been incorporated with a capital stock of \$10,000 by Charles Miller and N. W. Worth.

THE HERTNER ELECTRIC COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of \$100,000 by F. Treadway, Norton McGiffin, F. H. Peitz, William H. Marlatt and B. G. Morrison.

THE DETROIT (MICH.) ELECTRIC SALES COMPANY has been incorporated by Alton E. Archer, Joseph L. Freaser and Herman C. Wieland. The company is capitalized at \$20,000 and proposes to deal in gas and electric automobiles.

THE ELECTRICAL MAINTENANCE COMPANY of Wilmington, N. C., has been incorporated with a capital stock of \$10,000 by C. R. Siggs, M. C. McIntyre and J. Hobbs, Jr. The company proposes to do general electrical engineering business.

THE MUTUAL APPLIANCE COMPANY of Madison, Wis., has been chartered with a capital stock of \$50,000 by H. R. Marti, A. R. Earle and L. B. Martin, all of Edgerton, Wis. The company proposes to manufacture direction signals and similar devices.

THE PHILLIPS STEEL & WIRE COMPANY of Montreal, Que., has been incorporated with a capital stock of \$100,000 to manufacture wire, machinery, tools, etc. The incorporators are: Maurice Alexandre, Aubrey H. Elder, Felix W. Hackett and others.

THE LANE MANUFACTURING COMPANY of East Orange, N. J., has been incorporated by Edward Moley of Newark and William I. Lane of South Orange, N. J. The company is capitalized at \$10,000 and proposes to manufacture hydro-carbon burners.

THE CYNTHIANA (KY.) PLUMBING & ELECTRICAL COMPANY has been organized to carry on a general electrical wiring, plumbing and gas-fitting business, also to deal in electrical supplies and appliances, etc. J. F. Nooe is interested in the company.

THE J. S. MURPHY COMPANY of New York, N. Y., has been incorporated by E. V. McGovern, E. J. Healy and J. S. Murphy. 353 East Seventy-eighth Street, New York City. The company is capitalized at \$10,000 and proposes to do a general electrical engineering business.

THE UNION GAS & ELECTRIC IRON COMPANY of New York, N. Y., has been chartered with a capital stock of \$5,000 to manufacture electric and gas irons and other electrical devices. The incorporators are: S. Shack, M. Indender and S. Daniel. 1278 Webster Avenue, New York, N. Y.

THE PADUCAH (TEX.) ELECTRIC COMPANY has been incorporated with a capital stock of \$10,000 to construct and operate an electric plant in Paducah. The headquarters of the company will be located in Dallas. The incorporators are: J. F. Barnes, E. T. Paxton and E. M. Wise.

THE CUMBERLAND POWER COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$100,000. The incorporators are: F. D. Buck, M. L. Horton and K. E. Longfield. The principal office of the company will be located in Wilmington, Del.

THE ELECTRIC ARC & WELDING COMPANY of Newark, N. J., has been chartered with a capital stock of \$50,000 to manufacture electric cutting and welding devices. The incorporators are: Carlos W. Curtiss of South Orange, Albion D. T. Libby of East Orange, and Walter J. Murray of Newark.

THE STANLEY ENGINEERING COMPANY of Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at \$4,000,000 and proposes to install steam electric and hydraulic plants, etc. The incorporators are: N. C. L. Rimlinger, M. M. Clancey, F. A. Armstrong, local Wilmington (Del.) incorporators.

New England States

CONCORD, N. H.—Application has been made to the Public Service Commission by the Concord & Montreal Railroad Company, the Contoocook Electric Company and the Concord Electric Company. The Contoocook company wants permission to extend its transmission line through Concord from Contoocook, the railroad company asks for authority to sell energy to the Contoocook company from its plant in Franklin, the present to be delivered at Concord; the Concord Electric Company has asked the Commission for permission to draw up a joint lease with the Contoocook company, allowing the former in the future, if need should arise, to have joint use of the new lines being laid.

RUTLAND, VT.—A new contract has been signed by the Rutland Railway, Light & Power Company with the Staso Milling Company for supplying additional power for the amount of 717 hp.

Middle Atlantic States

ALBANY, N. Y.—Plans are being prepared by Frank N. Williams, state engineer, for a power plant to be built by the State Reservation Commission on Goat Island, Niagara Falls, to cost approximately \$100,000.

ALBION, N. Y.—Plans have been prepared for a new addition to the boiler plant at the Western House of Refuge for Women at Albion. William B. Dye is president of board of managers.

BROOKLYN, N. Y.—Plans are being prepared for the construction of a new power plant in connection with a large new capital building at Stuyvesant Avenue and Court Street by the Beth Moses Hospital. The cost of the entire works is estimated at \$100,000. Henry J. Nurick, 957 Broadway, Brooklyn, is engineer.

BUFFALO, N. Y.—Plans are under consideration by the Power Efficiency Corporation, 102 Clinton Street, for extensions and improvements to its plant. The company recently increased its capital stock from \$100,000 to \$350,000.

GROTON, N. Y.—Plans are under consideration by the Groton Electric Corporation for extensive additions and improvements to its system, including the construction of a large power plant at Freeville and the erection of a new transmission system, covering about 13 miles.

NEW YORK, N. Y.—The Lord Construction Company, 105 West Fortieth Street, New York City, has secured a contract for equipping 20 ocean ships with steam plant and engines.

UTICA, N. Y.—Notice has been filed with the Public Service Commission by the J. & E. Electric Company of an increase in capital stock from \$25,000 to \$50,000.

ATLANTIC CITY, N. J.—Negotiations, it is understood, are under way between the United States government and the Atlantic Electric Company, whereby the latter will furnish electricity to operate the plant of the Atlantic Loading Company at Elwood. The amount required, it is understood, is \$100 kw., which will be delivered to the plant at Elwood, a distance of 30 miles. The line will have a potential of 66,000 volts.

CAPE MAY, N. J.—Plans have been prepared by the United States government for the construction of a power house, 35 ft. by 10 ft., to be erected in connection with the proposed group of buildings.

HARRISON, N. J.—Plans have been filed and contract awarded by the General Electric Company for the construction of a new 6-story addition, 130 ft. by 245 ft., to its plant. E. M. Waldron, 665 Broad Street, Newark, has the contract.

MAYS LANDING, N. J.—Work has been begun on the erection of two large ammunition plants near Mays Landing, one by the Atlantic Loading Company, 71 Broadway, New York City, a subsidiary of the General Electric Company, to be located at Elwood, and the other the plant of the Bethlehem Loading Company, South Bethlehem, Pa., a subsidiary of the Bethlehem Steel Company. Employment will be given to about 800 persons. Arrangements are also being made for housing facilities for employees.

TRENTON, N. J.—The Crescent Insulated Wire & Cable Company, Olden and Taylor Streets, manufacturer of cables, electrical wire, etc., has recently purchased the property at 319-21 North Olden Avenue, which has a frontage of 110 ft. on North Olden Avenue and 275 ft. on Taylor Street. The company, it is reported, is contemplating extensions to its plant.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

TRENTON, N. J.—Resolutions have been introduced to the City Commissioners in connection with plans now under consideration for establishing a municipal electric-light and power plant. The first provides that J. R. Fell, director of streets and public improvements, be authorized to negotiate with the Trenton Water Power Company to set a price on its plant, and the second for engaging E. E. Brownell, electrical engineer, for the purpose of estimating the cost of enlarging the local pumping station and other extensive improvements necessary to install a municipal lighting system in Trenton.

COLLEGEVILLE, PA.—The local power station of the Reading Transit & Light Company, which formerly furnished power for one end of the Norristown Street Railway division, has been dismantled and will be converted into a substation.

INDIAN CREEK, PA.—Contract has been awarded by the Mountain Water Supply Company for the construction of a new power house, 30 ft. by 70 ft., to the Rust Engineering Company, Pennsylvania Building, Philadelphia, to cost about \$35,000.

JOHNSTOWN, PA.—The plant of the Citizens' Electric & Gas Appliance Company was recently destroyed by fire, causing a loss of about \$75,000.

LEHIGHTON, PA.—The contract for the construction of power plant and 15 concrete buildings for the Atlas Powder Company at Reynolds has been awarded to Andrew Breslin of Lehigh.

PACKERTON, PA.—The Carbon Transit Company is considering plans for an extension of its system from Packerton to Jamestown, a distance of 1 mile.

PHILADELPHIA, PA.—Plans have been filed and contract awarded by the Quaker City Iron Works, Tioga and Richmond Streets, for the erection of a boiler plant at Edgemont and Tioga Streets.

PHILADELPHIA, PA.—The Fretz Company, Ontario and Brabant Streets, has awarded the contract for the construction of a new boiler and engine house at its plant to H. E. Brocklehurst, 512 West Norris Street, Philadelphia. The cost of the work is estimated at \$19,000.

PHILADELPHIA, PA.—The Lehigh Power Securities Corporation, which operates power plants at Harwood, Hanto and Allentown, developing a total of 73,000 kw., has announced that it is considering plans for the further centralizing of power plants in the Lehigh Valley. In connection with this project extensive additions to power plants are contemplated.

PITTSBURGH, PA.—Plans have been filed by the Arrott Estate, Arrott Building, for the construction of a new power building on Barker Place, to replace a similar structure, recently destroyed by fire. Contract has been awarded to Rose & Fisher, 821 Penn Avenue, Pittsburgh, to cost about \$15,000.

BALTIMORE, MD.—Cockran, Hill & Co., Wilkins Avenue and Brunswick Street, Union Stock Yards district, are contemplating the construction of a new cold storage and packing house, to cost about \$250,000.

FAIRMONT, W. VA.—Surveys are being made by the Monongahela Valley Traction Company for the erection of a high-tension transmission line from the Speedway to the new electric power plant at Rivesville. The new line will care for the needs of all residents of the Speedway section.

KINGWOOD, W. VA.—Extensive improvements are contemplated by the Inland Fuel Company of Greensburg at the plant of the Central West Coal Company at Kingwood, recently acquired, which will include the erection of a new power plant in connection with other buildings, at a cost of about \$75,000.

NEWELL, W. VA.—The plant of the Ohio China Company of East Palestine has been leased by the Novelty Clay Forming Company, manufacturer of electric porcelain specialties. The company is planning to remove its entire works to the new location.

OLCOTT, W. VA.—The Kanawha Central Power & Supply Company of Olcott, recently incorporated with a capital stock of \$100,000, proposes to construct and operate a power plant. The incorporators are S. B. Avis, Ivory C. Jordan, N. F. Young, John A. Thayer and F. A. Avis of Charleston.

North Central States

CINCINNATI, OHIO.—The Ohio Public Utilities Commission has granted the Cincinnati Gas & Electric Company permission to issue \$2,225,000 in short-term notes and the same amount in bonds to serve as security to the notes. The proceeds are to be used to complete the power plant on the river and to make other improvements in its distribution system.

CLEVELAND, OHIO.—Contracts have been placed by the Ohio Electric & Controller Company, 822 Citizens' Building, for the erection of a new plant, 60 ft. by 80 ft., at 5900 Maurice Avenue, S. E. The company proposes to make lifting magnets.

CLEVELAND, OHIO.—Permits have been granted by the city building department for the construction of an addition to the municipal electric-light plant. The building will be located at the north end of the present plant and will be 175 ft. by 169 ft., one story high. The cost of the building with equipment is estimated at \$800,000.

DAYTON, OHIO.—The Public Utilities Commission has authorized the Dayton Electric Light & Power Company to issue \$1,750,000 in bonds, for improvements to its plant and the purchase of new equipment, etc.

HOLGATE, OHIO.—A new company known as the Pleasant Light & Water Company has been organized to take over the municipal electric-light plant. The company is capitalized at \$10,000. William Peper is president and James C. Fast is secretary and treasurer of the company.

MILFORD, OHIO.—Plans, it is reported, are being prepared by the Miami Light, Heat & Power Company for the construction of a hydroelectric power plant, which will include 14 dams. A power house, it is understood, will also be erected in Loveland. For further information address L. J. Dolle, 705 Mercantile Library Building, Cincinnati, Ohio.

SPRINGFIELD, OHIO.—Preparations are being made by the Ohio Steel Foundry Company for building an addition to its plant, 30 ft. by 120 ft., one story, to be used for core room purposes. The erection of another building, 30 ft. by 100 ft., to be used principally for a repair shop, is under consideration. Contract has been awarded by the company for the installation of an electric furnace.

YOUNGSTOWN, OHIO.—The Miller-Smythe Electric Company is contemplating the construction of a new factory in Youngstown.

MCDOWELL, KY.—The Royal Elkhorn Coal Company, Ohio Building, Toledo, recently organized to develop a coal-mining project, proposes to install a drum for incline. R. J. Thomas, 211 Twenty-fourth Street, Ashland, Ky., is manager.

MANNINGTON, KY.—The Memphis Coal & Mining Company, a subsidiary of the Memphis (Tenn.) Gas & Electric Company, it is understood, will install an all-steel tippie at Mannington, at a cost of about \$40,000.

MAYSVILLE, KY.—The boiler, engine room and the entire equipment of the coal docks of the Chesapeake & Ohio Railroad Company at Maysville were recently destroyed by fire.

NORTONVILLE, KY.—Contract has been awarded by the Norton Coal Mining Company to the Ray Lumber Company of Madisonville for construction of an addition to its power house and supply house.

SOMERSET, KY.—The Southern Machinery Exchange of Somerset is reported to be in the market for the purchase of machinery as follows: One 150-kw., 250-volt direct-current generator and engine, or a direct-connected generating unit; a 225-hp. second-hand Diesel engine and four DeLancey lathes for spokes and handles.

ATTICA, IND.—The Indiana Public Service Commission has authorized the Attica Electric & Power Company to issue \$50,000 in stock and \$50,000 in bonds, the proceeds to be used for the construction of a new electric-light and power plant to take the place of the municipal electric plant recently destroyed by fire. As the bonded indebtedness of the city would not permit of borrowing more funds, it was necessary to form a private company to secure funds to rebuild the plant, which will generate electricity to be distributed by the municipal system.

EDWARDSPORT, IND.—The Indiana Public Service Commission has granted the Indiana Power & Water Company permission to issue \$210,000 in capital stock and \$725,000 in bonds, the proceeds to be used for extensions to its central power plant at Edwardsport. The company has contracts to supply power to a number of coal mines, and it proposes to build distributing sys-

terms in seven towns during 1918. The cost of the proposed improvements is estimated at \$881,924.

DECATUR, ILL.—The Illinois Public Utilities Commission has granted the Decatur Railway & Light Company permission to take over the plant and property of the Consolidated Light Company in Dawson and operate the same.

BRODHEAD, WIS.—Plans are being prepared by the Power Engineering Company of Minneapolis for rebuilding the municipal hydraulic power plant. The present plans provide for building an entire new power house, new flume and the installation of a waterwheel and generator, the latter to be of an umbrella type.

SUPERIOR, WIS.—The erection of a 13,000-volt transmission line is under consideration by the Great Northern Power Company to furnish energy to the Listman mill.

SUPERIOR, WIS.—Bids will be received by the Board of Supervisors of the County of Douglas, Superior, addressed to W. J. Leader, county clerk, Superior, until May 13 for the erection of a new court house in Superior, separate bids to be submitted as follows: (a) For general construction; (b) heating, ventilating and controlling; (c) plumbing and sewer work; (d) steel and iron jail work; (e) electric wiring and equipment. Plans and specifications may be obtained at the office of E. S. Radcliffe, United States National Bank Building, Superior, and J. W. Kroyer, Flatiron Building, Urbana, Ill., architects, upon deposit of \$25 for general contract and \$15 each for the others.

DES MOINES, IOWA.—The contract for electric wiring the new municipal court house has been awarded to the Whalen Electric Company, Polk Building. The cost of the building complete is estimated at about \$350,000.

LANSBORO, IOWA.—At an election held recently the proposal to issue \$7,000 in bonds for the installation of an electric-lighting system was carried.

NEOSHO, MO.—The Thurman-Davis Grain Company, it is reported, will rebuild its grain elevator, recently destroyed by fire.

OTTERVILLE, MO.—The installation of an electric-lighting plant in Otterville is under consideration. Jesse Starten is reported interested in the project.

BERN, KAN.—Bonds to the amount of \$9,000 have been voted for the erection of an electric transmission line from Seneca.

LURAY, KAN.—The city of Luray has awarded contract for a 75-hp. oil engine, a 50-kva. generator and a triplex pump to Fairbanks-Morse & Co. of Kansas City at \$14,000. The contract for construction of power house has been awarded to Florea & Laird of Luray at \$2,023.

PALCO, KAN.—Bids will be received by the city clerk, Palco, until April 16 for the construction of an electric-lighting system, separate bids to be submitted as follows: (1) for material and labor for erection of distributing lines in Palco and an electric transmission line from Palco to Plainville; (2) all labor for installing above; (3) material and labor for construction of a brick substation. Plans and specifications may be seen at the office of the city clerk, Palco, and at the office of George P. Taylor, engineer, Stockton, Kan.

PITTSBURG, KAN.—Bids will be received by the board of administration, Carney Hall, Pittsburg, care of J. A. Gamble, business manager, until April 16, for electric wiring, plumbing and steam heating for the Normal School addition, now under construction.

PLAINVILLE, KAN.—Plans have been prepared by the United Telephone Company for the erection of a new telephone building to cost about \$15,000. H. B. Winter of Manhattan is architect.

ST. FRANCIS, KAN.—The business men of Bird City are negotiating with the City Council to furnish electricity in that city. If the project is carried through it will mean extensions to the municipal electric plant, the erection of a three-phase transmission line, 16 miles long, and a distributing system in Bird City. Nothing definite has been decided upon and probably nothing will be done until after the war. T. W. Roelfe is superintendent of the municipal plant.

Southern States

PINE LEVEL, N. C.—The Citizens' Power & Light Company is considering the erection of an electric transmission line, 13 miles long, connecting two towns of 2500 and 5000 population, and building a substation in each town.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is contemplating the installation of a turbine at its power house and also other improvements.

SUMTER, S. C.—The City Council is considering engaging an engineer to make investigations and prepare estimates of cost of the installation of an electric-light plant in Sumter.

DALLAS, GA.—The Dallas Utility Company, recently organized, is planning to install an electric plant on Pumpkin Vine Creek, Paulding County, to cost about \$10,000. The proposed project includes a development of about 250 hp., the erection of 5 miles of transmission line, etc. J. S. Boggs is manager.

METTER, GA.—The City Council is considering extensions to the municipal electric-light plant, at a cost of \$3,500.

BOWLING GREEN, FLA.—The Wauchula Light & Power Company is considering installing a small electric generating plant in Bowling Green for temporary use, pending the erection of an electric transmission line connecting with the Wauchula power plant.

TAMPA, FLA.—The Tampa Electric Company has been granted permission to extend its street car line on Twenty-second Street and also on Chapin Street.

ENSLEY, ALA.—The Tennessee Coal, Iron & Railroad Company of Birmingham is contemplating the installation of a 7500-kw. turbo-generator in No. 1 power station of the Ensley blast furnaces.

SELMA, ALA.—The Selma street railway system has been purchased by S. G. Adams for \$50,000. A new company has been organized under the name of the Selma Traction Company to operate the system. Improvements, including new extensions, it is understood, will be made by the new owners. J. D. Woodward of Warren, Pa., is president of the new company.

ARKANSAS CITY, ARK.—The contract for heating, plumbing and electric wiring of the new city hall has been awarded to Ellis Billings, at \$6,670.

EUREKA SPRINGS, ARK.—The installation of oil-burning engines and pumping equipment in the municipal waterworks station is under consideration by the City Commissioners.

RECTOR, ARK.—Bids, it is understood, will be received by the King Mercantile Company for a cotton gin and power plant, to replace those recently destroyed by fire. The loss on machinery is placed at \$25,000. Luther King is owner.

POTEAU, OKLA.—A movement has been started to install a new electric plant in Poteau. The promoters, it is understood, will soon ask for a franchise.

BEAUMONT, TEX.—Taylor & Dunshire of Beaumont, it is understood, are planning to construct an irrigation system and install a pumping station to irrigate about 2000 acres.

BEAUMONT, TEX.—The installation of a large pumping plant for irrigation purposes near Beaumont is reported to be under consideration by Broussard & Herbert of Beaumont.

BEEVILLE, TEX.—Work has been resumed on the construction of the municipal electric-light plant. The delay has been caused by injunctions, the first one preventing the city from building the combined water and light plant. It is expected to complete the lighting plant this year and the waterworks later.

BUFFALO, TEX.—The Dixie Girl Mining Company, Wheat Building, Fort Worth, Tex., contemplates the installation of a 10-kw. electric-lighting plant in connection with a zinc and lead mining development.

TEXAS CITY, TEX.—The Texas City Electric Light & Water Company is planning to build an electric power station and install a 100-kw. turbo-generator with a converter for street railway service and an emergency lighting unit. The company heretofore has purchased energy to operate its system.

Pacific and Mountain States

CHEHALIS, WASH.—The Commissioners of Lewis County have granted the Central Light & Power Company a franchise to erect electric transmission lines on the county roads west of Meskill, Chehalis and Wallville districts. The company expects to secure energy from the North Coast Power Company and supply electrical service in small towns west of Chehalis.

NORTHPORT, WASH.—The Electric Point Mining Company is planning to install an aerial tramway, to cost about \$50,000

It will have a capacity of about 20 tons per hour.

SEATTLE, WASH.—Preparations are being made by the Puget Sound Traction Light & Power Company to begin work immediately on an addition to its George town power plant. The cost is estimated at \$30,000.

GARDINER, ORE.—The Umpqua Light & Power Company, which recently took over the plant of the Gardiner Light & Power Company, is planning to install a new 125-hp. steam engine in place of the 40-hp. gasoline engine now in use. The company also proposes to extend its electric transmission line across the Umpqua River to Reedsport.

LONG BEACH, CAL.—Work has begun on the erection of a new substation at Eas Wilmington Junction for the Long Beach San Pedro and Los Angeles-San Pedro line of the Pacific Electric Company.

LOS ANGELES, CAL.—The board of education is contemplating the construction of an addition to the machine shop at the Manual Arts High School.

LOS ANGELES, CAL.—The finance and public safety committees of the City Council have been jointly instructed to arrange for the installation of an auxiliary lighting system in the receiving hospital and city jail.

LOS ANGELES, CAL.—According to a statement made by T. T. Woodman, Mayor of Los Angeles, an additional hydroelectric unit capable of developing 20,000 hp., utilizing water now going to waste, will be built in the near future by the municipal government of Los Angeles. Under the present charter of the city it cannot sell power at wholesale. The city is desirous of taking over the distributing systems of the Los Angeles Gas & Electric Company as well as other private electric distributing concerns.

ORANGE, CAL.—Steps have been taken by the City Council for the installation of electric street lamps on Chapman and Glassell Streets. The plans provide for ornamental standards mounted with a single lamp.

RIVERSIDE, CAL.—The Southern Sierras Power Company is contemplating the reconstruction of one of its main electric transmission lines extending from its hydroelectric plant located on Rush Creek in the Sierra Nevada range, a distance of 60 miles. The new line will increase the potential capacity of the Rush Creek plant by 5000 kw. The cost of the work is estimated at \$279,000.

SAN FRANCISCO, CAL.—Application has been filed with the Railroad Commission by the Sierra & San Francisco Power Company for authority to issue \$1,000,000 in bonds, the proceeds to be used for the construction of an additional hydroelectric plant on the middle fork of the Stanislaus River, the construction of storage reservoirs on the middle or the south fork of that river, building additional flumes, ditches, etc.

VERNAL, UTAH.—Application has been filed with the State Engineer by Charles B. Bartlett of Vernal for the use of 40 sec. ft. of water on Whiterocks Creek in Uintah County. The plans provide for a development of 950 hp. to be distributed in and near Lapoint. The power will be developed through three 6-ft. wheels under a 286-ft. head.

RONAN, MONT.—Negotiations are under way between the Council and the Mission Range Power Company of Polson for an extension of its electric transmission lines to Ronan, a distance of about 14 miles, to furnish electrical service here.

Canada

LONDON, ONT.—The Helena Costume Company, 190 King Street, is contemplating the purchase of a 60-kw., 110-volt, direct current generator, compound wound.

EAST BRIGHTON, QUE.—The Quebec Asbestos Company is contemplating a power development, to cost about \$30,000.

Miscellaneous

PANAMA.—Bids will be received by the general purchasing officer, the Panama Canal, Washington, D. C., until April 22, for furnishing manganese link pins, electric steel furnace, electric drill, copper magnet wire, split T connectors, storage batteries, rubber tires, etc. Blanks and information relating to this circular (1211) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY ENGINEERS. Secretary-treasurer, W. J. Arp, Little Rock, Ark. Annual convention, Hot Springs, Ark., May 21-23.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Stein, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holbert, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Keesport, Pa. Annual convention September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Ireucetti, Chicago & North Western Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, son, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, September, 1918.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redh, 505 Rialto Building, San Francisco.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, C. Gilman, Toronto Electric Light Company.

COLORADO ELECTRIC LIGHT, POWER AND HEATING ASSOCIATION. Secretary-treasurer, F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light Power Co., St. Louis, Mo.

CONNECTICUT ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 North Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavelly, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Ellis, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Smith, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, R. Benton, Gainesville, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting, May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Exchange, Atlanta, Ga. Annual meeting, June, 1918, Tybee Island, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuy, Central Electric Co., Peoria, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ILLUMINATING ENGINEERS' SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railway & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER, Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinotti, Louisville, Ky. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MASSACHUSETTS ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. E. Wilson, 263 Summer St., Boston, Mass.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

MISSOURI ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

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NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekun Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

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SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual meeting, June 19-20, Atlanta.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex. Annual convention, April 15-16, Galveston.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Bargebaugh, 703 First National Bank Building, El Paso, Tex. Annual meeting, April, 1918.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

WISCONSIN ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

(Issued March 5, 1918.)

Record of Electrical Patents

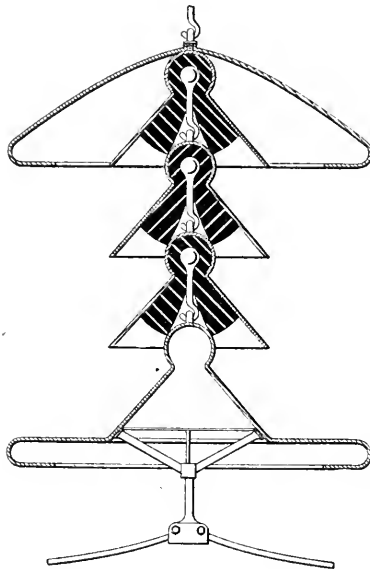
Notes on United States Patents

- 1,258,374. TELEPHONE-EXCHANGE SYSTEM; Franklin A. Stearn, Paterson, N. J. App. filed Oct. 28, 1916. Operator may listen from one cord to another at high rate of speed.
- 1,258,401. RAILWAY SIGNAL; Robert M. Gilson and Frank H. Nicholson, Pittsburgh, Pa. App. filed May 12, 1913. Improvements.
- 1,258,419. REMOTE CONTROL OF DYNAMO-ELECTRIC MACHINES; Alexander D. Kline, Schenectady, N. Y. App. filed June 12, 1914. Machines in the substations and as rotary converters.
- 1,258,423. VARIABLE ELECTRICAL APPARATUS; Fritz Lowenstein, Brooklyn, N. Y. App. filed June 28, 1910. Condensers.
- 1,258,473. PRIMARY BATTERY; Charles B. Shoemmel, Waterbury, Conn. App. filed Dec. 24, 1914. Effective contact between the positive elements and the current conducting and supporting means.
- 1,258,497. INDICATOR SYSTEM; William F. Straub, Chicago, Ill. Secondary device that responds to rapid changes of energization.
- 1,258,519. ARC LAMP FOR MOVING-PICTURE STUDIOS; William Bach and William A. Cunningham, New York, N. Y. App. filed May 16, 1916. Uniform distribution of light over a wide area.
- 1,258,529. PROCESS AND APPARATUS FOR PRODUCING ALKALI METALS; Johannes Brode, Ludwigshafen-on-the-Rhine, Germany. App. filed July 3, 1915. Improvements.
- 1,258,538. ELECTRIC SWITCH; William W. Dean, Chicago, Ill. App. filed July 18, 1913. Pressure-operated type.
- 1,258,540. SYNCHRONIZING SYSTEM; Amos P. Dixon, Newark, N. J. App. filed April 11, 1914. Maintaining motor-driven rotating mechanism in synchronism.
- 1,258,548. RADIOTELEPHONE; Carl R. Englund, East Orange, N. J. App. filed March 11, 1916. Improvements.
- 1,258,559. LAMP-SOCKET MEMBER; Monroe Fuett, Hartford, Conn. App. filed Sept. 26, 1916. Improvements.
- 1,258,577. PHASE-ADVANCER FOR DYNAMO-ELECTRIC MACHINES; Gisbert Kapp, Birmingham, England. App. filed Dec. 31, 1915. Energy to be obtained from a fly-wheel.
- 1,258,616. SIGNALING SYSTEM; Olin B. Frink, Elizabeth, N. J. App. filed March 25, 1915. Automatic and reliable system using a minimum number of wires between adjacent signals.
- 1,258,622. BLOCK-SIGNALING SYSTEM; Allen B. Kendall, Maywood, Ill. App. filed Aug. 7, 1913. System for controlling automatic signals on a single-track road.

(Issued March 12, 1918.)

- 1,258,641. ELECTRIC HEATER; John Berg and Lloyd W. Golder, Chicago, Ill. App. filed Dec. 4, 1916. Durable.
- 1,258,642. COMBINED ELECTRIC HEATER AND BOILER; Napoleon Bergeron, Montreal, Canada. App. filed June 8, 1917. Provides a heater whereby steam may be generated which will be supplied to a motor for actuating the generating apparatus.
- 1,258,646. ATTACHMENT PLUG; August Bouchery, Brooklyn, N. Y. App. filed Jan. 22, 1915. Improvements.
- 1,258,657. ELECTRIC TERMINAL; John Vuthbert, Chicago, Ill. App. filed Dec. 2, 1915. Wire clamping adapted for connecting circuit wires.
- 1,258,679. SWITCH - CONTROLLING MECHANISM; Edward W. Hedberg, Chicago, Ill. App. filed June 29, 1916. Improved limit switch.
- 1,258,686. CALLING DEVICE; William Kaisling, Chicago, Ill. App. filed Jan. 22, 1913. Automatic telephone systems.
- 1,258,721. ELECTRIC SWITCH; Lewis L. Tatum, Milwaukee, Wis. App. filed Nov. 6, 1911. Adapted for use in connection with solenoid.
- 1,258,722. SUSPENSION MEANS FOR HIGH-POTENTIAL WIRES; Chester H. Thordarson, Chicago, Ill. App. filed April 19, 1912. Minimizes the convection losses of energy.
- 1,258,758. MOTOR VEHICLE; Justus B. Entz, Cleveland, Ohio. App. filed Feb. 24, 1908. Improvements.
- 1,258,767. IMMERSION HEATER; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed Jan. 28, 1918. Heater unit readily removable.
- 1,258,774. IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES; Ole Holen, Wyndmere, N. D. App. filed Dec. 26, 1916. Novel and improved circuit closer.

- 1,258,782. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed April 29, 1917. Improvements.
- 1,258,783. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed June 30, 1917. Improvements.
- 1,258,785. ENGINE-STARTING SYSTEM; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed Sept. 13, 1913. An electrical system which may be brought into operation, independently.
- 1,258,802. INSULATOR SUPPORT; Andrew J. Morgan, Framingham, Mass. App. filed May 22, 1917. Serviceable and convenient support for glass and porcelain insulators.
- 1,258,803. AUTOMOBILE-SERVICE RECORDER; John F. Ohmer and Frederick L. Ohmer, Dayton, Ohio. App. filed Oct. 6, 1916. Improvements.



1,259,385—Suspension Insulator

- 1,258,809. TRANSMITTING APPARATUS FOR ELECTRIC TELEGRAPHS AND THE LIKE; Louis M. Potts, Baltimore, Md. App. filed Oct. 18, 1912. When keyboard is operated at an irregular rate it permits a uniform rate of line transmission.
- 1,258,813. BELL; Louis E. Richmond, Cleveland, Ohio. App. filed Aug. 28, 1915. Electrical bell-sounding mechanism.
- 1,258,814. WIRELESS-BATTERY HOLDER; Earl H. Rollinson, Lyons Farms, N. J. App. filed May 29, 1917. Impossible for the cell connections to become disarranged.
- 1,258,816. INSULATOR PIN; Mortimer C. Rosenfeld, Cleveland, Ohio. App. filed Oct. 27, 1916. Permits the insulator to be turned in any direction.
- 1,258,838. METHOD AND MEANS TO CONTROL INDUCTION COILS; Paul R. Werner, Philadelphia, Pa. App. filed March 24, 1916. Adapted to be employed for the ignition of internal-combustion engines.
- 1,258,904. ELECTRICAL HEATING DEVICE; George A. Hughes, Chicago, Ill. App. filed Dec. 16, 1915. For warming the engine and radiator of automobile.
- 1,258,933. COMBINED BURGLAR AND FIRE ALARM; Edward C. Newson and Charles E. Beach, Jacksonville, Fla. App. filed March 18, 1916. Graphophone is automatically set into operation for announcing the audible signal to a telephone.
- 1,258,956. AUTOMATIC TELEPHONE SYSTEM; Arthur B. Smith, Evanston, Ill. App.

- filed March 25, 1914. Increases the capacity of an exchange without increasing the number of switches.
- 1,258,984. ELECTRODE FOR LUMINOUS-ARC ELECTRIC LAMPS AND PROCESS OF MAKING THE SAME; Frank Buchanan, Syracuse, N. Y. App. filed June 19, 1911. Combination of elements.
- 1,259,000. LIGHTNING PROTECTOR; West Dodd, Des Moines, Iowa. App. filed Oct. 23, 1917. For petroleum tanks.
- 1,259,040. MACHINE FOR MAKING MUSIC ROLLS; Edgar W. Myers, San José, Cal. App. filed Dec. 3, 1914. Improvements.
- 1,259,097. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; William T. Hensley, Connersville, Ind. App. filed June 8, 1912. Sheet metal employed in place of castings.
- 1,259,160. APPARATUS FOR RECTIFYING HIGH-POTENTIAL ALTERNATING AND OSCILLATING CURRENTS AND ELECTROMOTIVE FORCES; William Walker, Pittsburgh, and Arthur F. Nesbit, Wilkesburg, Pa. App. filed June 3, 1913. Improvements.
- 1,259,170. ELECTRIC HAIR DRYER; Walter G. Trautman, Cleveland, Ohio. App. filed Dec. 20, 1911. Varies the heating by regulating the speed of the electric motor.
- 1,259,172. ELECTRIC REGULATOR; William A. Turbayne, Niagara Falls, N. Y. App. filed Feb. 11, 1915. Operates over a wide range of current or voltage values.
- 1,259,184. APPARATUS FOR COVERING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY AND THE CONTROL THEREOF; Thomas G. Willson, Swissvale, Pa. App. filed July 20, 1916. Improvements.
- 1,259,193. STORAGE BATTERY; John M. Ahlgren, Indianapolis, Ind. App. filed Oct. 6, 1917. Equal distribution of current to and from the plates.
- 1,259,202. ALTERNATING-CURRENT SOLENOID; Sydney N. Baruch, San Francisco, Cal. App. filed Aug. 31, 1916. Polyphase solenoid in which the tractive efforts of all of the phases are exerted in the line or axis.
- 1,259,206. CARBON-PILE SUPPORT; William L. Bliss, Niagara Falls, N. Y. App. filed June 5, 1916. Provides sufficient rigidity.
- 1,259,259. AUTOMATIC RAILROAD SWITCH; John Martin, Colton, Cal. App. filed Aug. 30, 1916. Electrically operated by a moving train.
- 1,259,268. ELECTRIC FUSE PLUG; Thomas E. Murray, New York, N. Y. App. filed Dec. 29, 1916. Improvement.
- 1,259,270. METHOD OF MAKING WELDED METAL RINGS; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Oct. 4, 1917. Improvements.
- 1,259,271. ELECTRIC WELDING; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Oct. 4, 1917. Objects are united in circumscribed area.
- 1,259,272. METHOD OF AND APPARATUS FOR ELECTRICAL WELDING; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Nov. 9, 1918. Improvements.
- 1,259,273. METHOD OF ELECTRICAL BUTT-WELDING; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Nov. 9, 1917. Improvements.
- 1,259,274. ELECTRIC WELDING MACHINE; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Dec. 10, 1917. During its formation the weld will be caused to travel in a straight line.
- 1,259,275. PROCESS OF ELECTRICAL MOLDING; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Dec. 10, 1917. Improvement.
- 1,259,295. STARTING SYNCHRONOUS MACHINES; Emanuel Rosenberg, Altrincham, England. App. filed Jan. 30, 1914. Starting and synchronizing device.
- 1,259,296. ELECTRIC SIGNAL APPARATUS FOR MARINE ORDER-TRANSMITTING MECHANISM; Walter S. Rush, New York, N. Y. App. filed March 15, 1912. Improvements.
- 1,259,310. AXLE COLLAR; Charles W. Starkner, Pittsburgh, Pa. App. filed Oct. 9, 1914. For positioning electric motors on the wheel axles of electric railway vehicles.
- 1,259,344. SUBMARINE CABLE; Edwin W. Beardsley, San Francisco, Cal. App. filed March 11, 1916. For the transmission of electric currents.
- 1,259,350. CROSSING SIGNAL; William A. Braden, Chicago, Ill. App. filed July 25, 1910. Signaling system for controlling traffic at street intersections.
- 1,259,368. DYNAMO-ELECTRIC MACHINE; James F. Curtis, Pitsaun, Pa. App. filed Sept. 10, 1914. Effective ventilation.
- 1,259,385. SUSPENSION INSULATOR; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed May 25, 1914. For supporting high-potential lines.

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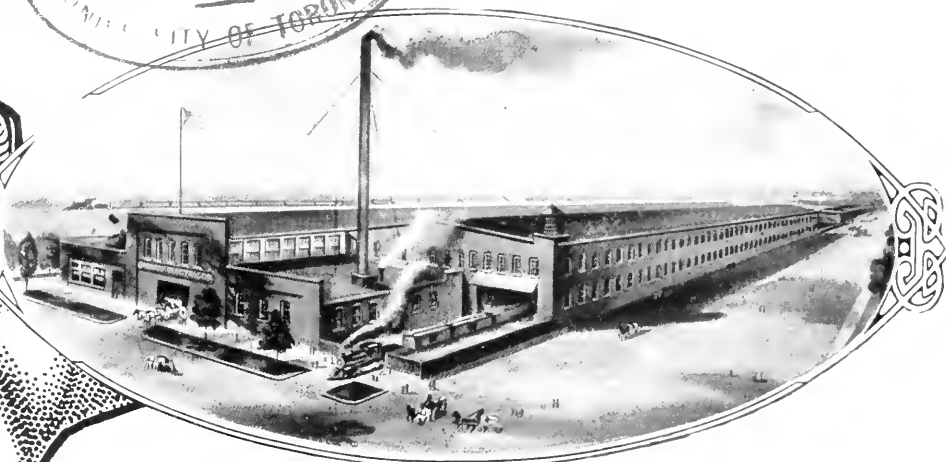
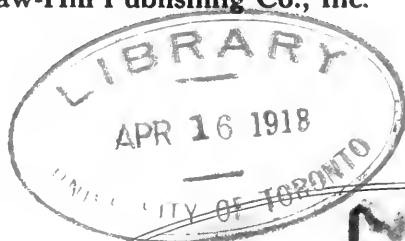
Electrical World

x, April 13, 1918

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Volume 71

New York, Saturday, April 13, 1918

Number 15

The N. E. L. A. 1918 War Convention

IN DECIDING to hold a war convention on June 13 and 14 the National Electric Light Association officials meet a real need for conference on the urgent problems of the times. The problems of normal years fall into the background, and the trials that now loom large call for the exercise of much patience, foresight, courage and ability. Central stations are not meeting merely to parade troubles. They are working constructively to overcome difficulties, but they ask co-operation and sympathy while they are doing it. An exchange of experiences will help the companies of enormous generating capacity, and it will be of still more value to the properties of medium and small size. Small properties feel most keenly the burden of present conditions, because in many cases they lack a margin of financial resource to withstand serious curtailment in net revenue due to abnormal swelling of operating expense. Therefore the lesson of the forthcoming Atlantic City convention may very wisely be directed to carry comfort to the operator of the property of moderate business volume. The convention will be effective in the degree in which it answers the two paramount questions of the day affecting central stations of average standing: First, how they can best help to win the war; second, how they can at the same time meet the pressing needs created by unparalleled demands for power, scarcity and high cost of capital, materials and labor, and inadequate rates.

Business Men Have Their Inning

REALIZING that without their efforts and resources the war cannot be won, American business men have given the country one of the most striking examples of what can be done in arousing industry to patriotic service and achievement. So prompt and so generous has been the response of business in this national crisis that the whole country has awakened to a profound faith in the big soul of business and has caught something of its spirit and felt something of its inspiration and determination. This week some three thousand of the nation's busiest manufacturers and merchants met in Chicago to deliberate over a constructive program for the war and the industrial struggle that is to follow it. It was not the gathering of any one industry but a great gathering of all kinds of business. While labor and agriculture have been organized for a long time in this country, it has remained for business in recent years to organize a democratic

form of expression. War-time organization of industry was the dominating subject, as well it might be, for has not the government within the past week showed its appreciation of some of the problems of business? The Webb-Pomerene bill, passed by Congress last week, assures the American business man a fighting chance in foreign markets, and the War Finance Corporation bill will provide him with funds to turn out the sinews of war for ourselves and our allies. Thus business men have a new hope for the future. With the government at their elbow to encourage and to help, and with the added incentive to greater accomplishment for the purpose of winning the war, nothing is impossible for business men. Moreover, the constant drive for greater and more efficient production will serve as an excellent training for world competition in foreign markets.

Economy in Power Plants

A VERY practical and effective paper on this subject was recently read by C. H. Parker of the Edison Electric Illuminating Company, Boston, and it is abstracted to the advantage of our readers in the current issue. It is probably altogether true that there are very few plants where no saving can be effected. Any carefully conducted boiler test can be assumed to yield better results than will be obtained in regular running, quite aside from all questions of steadiness of load. After all, economy in coal consumption comes back to care in stoking, whether in attention to the automatic machinery or in supervising the details of hand firing. Mr. Parker points out that it is a perfectly easy matter to cause a loss of 10 per cent in the heating value of the fuel by neglecting attention at this point, and he might have added that greater losses are too common.

In these days particularly, when unwonted grades of coal are being used, study of the details of combustion is all-important to economy. There are, too, minor losses, such as those due to water and excessive smoke. These are small on the whole, but the smoke matter is important on account of the indications it gives of improper firing, although a smokeless chimney does not necessarily mean an efficient furnace. Standby losses are in large measure dependent on the character of the load and the skill of the load dispatcher. Thorough watching of the performance of the boilers and furnaces gives the clew to moves for economy. In some plants overloading is a necessary evil, and here the judicious use of forced draft will often result in saving, especially through enabling the operator to work boiler and furnace at their most efficient output a larger proportion of the time.

Gas-Filled Lamps for the "Movies"

ONE of the very useful recent developments in incandescent lamps is the production of a special type for optical projection, especially in that wide field which is furnished by the "movies." Until within a very short time the arc lamp was the only reliance for projection on a practical scale. It combined two advantages of supreme importance for the purpose, great light-giving power and the extremely high intrinsic brilliancy which makes it possible to reduce the source of light to very small dimensions. The former quality is of great importance in projecting pictures at high magnification; the latter makes it relatively easy to get good definition with an optical system of moderate dimensions. The ordinary incandescent lamp was long ago developed into a projection lamp with a flat spiral filament which gave fair results on a small scale but was by no means good enough for motion-picture work. With the coming of the metallic-filament lamp still further improvements were made, but the low intrinsic brilliancy always stood in the way of successful competition with the arc. The gas-filled lamp has very materially changed the situation, so that now it is practicable to use it for regular projection work, gaining thereby the immeasurable boon of steadiness, a quality in which the arc is unhappily lacking.

The intrinsic brilliancy of even the gas-filled lamp is only about one-fourth that of a direct-current arc, so that particular pains have to be taken in the design of the projection apparatus to make up for this loss by higher efficiency of utilization. The brilliancy of the filament is limited by its possibilities of life, and it is also dependent on the actual diameter of the filament. The larger this diameter, the higher the brilliancy that can be secured without loss of effective life. In the most recent form of lamp for projection purposes, as is well shown in our paper by R. P. Burrows and J. T. Caldwell, an arrangement of filament is adopted which brings all the coils into very nearly the same plane compressed into as small an area as practicable. This arrangement gives a distribution of light strongly outward from the front and rear of the plane and consequently in the directions most useful for the projection. The filament must be placed in a bulb of relatively small diameter in order to afford available space for placing the projecting system, and hence the filament is actually mounted in a long cylindrical bulb to obtain this advantage with the requisite bulb space. The optical system itself which furnishes the working beam consists of a spherical mirror of rather short-radius behind the filament and a Fresnel lens of short focus in front. The light which proceeds from the rear of the filament plane is reflected back upon it, and by careful focusing the system of images can be made to fall between the loops of the actual filament, so as to produce a virtually nearly uniform plane of light in the focus of the lens.

With this sort of source it is possible to use a projection lens of wider aperture than usual, since there is no longer danger of magnifying the flicker of the arc lamp. With an equipment of this kind it is easy to throw a picture 12 ft. by 14 ft. (3.7 m. by 4.3 m.) in dimensions on a first-class screen up to at least 90 ft. (27.4 m.) distance. In other words, one can do the

regular standard work of the motion-picture theater with highly satisfactory results and with a minimum of care and trouble. The standard type of lamp used is for 20 amp. and about 30 volts. It is superlatively easy to work this off an alternating-current circuit, and a special transformer has been developed for this purpose with provision for taking care of the variations in line voltage and for cutting out the rush of current into the cold lamp at the starting. On direct current a motor-generator or its equivalent has to be used unless one cares to waste an inordinate amount of energy in a rheostat. Oddly enough, this just reverses arc-lamp practice, where direct current is relatively easy to use and alternating current involves some trouble. The advantage of the incandescent lamp for projection lies in the fact that when once adjusted it stays on the job without further trouble, eliminating flicker, always staying in focus and saving energy. The problem of beating the arc at its own game has been no easy one, but it seems to have been finally solved in a very successful and practical manner.

Preparing for Industrial Load

IN THESE days of daylight saving the uninformed public imagines that central stations are likely to lose most of their revenue and save most of their coal. The said uninformed public may, however, acquire a new idea or two by noting our article in the current issue on what is being done in one New England city in the way of preparing for industrial load of rapidly growing dimensions. The scene of operations is New Bedford, where textile work is on the jump, and the present article supplements that in our Feb. 23 issue by giving additional details of the big station in that city. It gives some adequate impressions of the requirements of the present situation in dealing with increasing service. The piping arrangements of the new plant in particular are deserving of comment. The water supply has been the subject of particular study. The feed-water system is installed in duplicate, with duplicate connections for supplying the make-up water from the city mains, the general supply, of course, being taken from the condensate well. To save using city water a portion of the condensate is utilized for circulation around the bearings of the turbo-generators and then fed back again to the well. The supply to the boilers is measured by flow recorders, one for each of the 5000-hp. feed-water heaters, with an auxiliary meter to check their performance.

The steam piping has been similarly devised for flexibility of connections and short runs to the generators. The boilers deliver steam into a horizontal steam main next the well between the boiler and turbine rooms, and from this is fed a steam bus across the turbine room so that each generating set can be reached by a short connection. This sectionalizes the piping effectively and obviates the need for a multiplicity of steam leads into the turbine room. In connection with the turbo-generators it is worth noting that an air-spraying equipment with a capacity of 50,000 cu. ft. (1415.8 cu. m.) a minute is provided to condition the ventilating air for the generators. Another striking evidence of the magnitude of the work is found in the switchboard and feeder equipment. To this strictly electrical work

devoted a four-story bay of which the electrical arrangement was shown in our previous article. The interesting point about it is that it actually provides for more feeders and switches than the great hydroelectric plant at Keokuk, one of the biggest in the country. So much for the necessities of a great and intricate industrial load. To secure immunity from the danger of switchboard troubles the whole system has been isolated with particular care, every oil switch being housed in a compartment of its own, and the commercial lighting and street-lighting equipments are also thoroughly separated. Similarly the 2300-volt and 13,200-volt bus systems are completely separated from each other, and each is provided with duplicate buses parted from each other by fire walls. From the 2300-volt busbars are served the six 750-kw. transformers which feed the 22,000-volt system for the more distant part of the distribution. It is rare to see a more complete scheme for safety and continuity of service in a plant requiring from the nature of its load an unusually comprehensive order equipment.

The Increasing Use of Fuel Oil

THE great shortage of coal during the past winter impelled many plants to operate on fuel oil, until, our article in the issue of last week indicates, in New England alone oil-burning plants reach an aggregate of nearly 100,000 hp. Fuel oil has come into use also in heating plants for ordinary commercial buildings, for public buildings, and even for private residences. Of course, in other parts of the country the use of fuel oil has been familiar; that it has not been more widely used is due to a complication of reasons, chief among which is the fact that its price has varied in an entirely erratic fashion owing to various familiar natural and artificial causes. If its use in a particular case turned out to be economical, it was always a question as to how long it would stay so. The present state of affairs, however, puts an entirely new phase on the matter. Not only is coal at a very much higher price than usual, but transportation from the coal mines has been extremely difficult. Fuel oil, however, comes into New England ports in tankers, which in the main have not yet been commandeered, and is distributed in tank cars which cannot well be used for other purposes. The usual oil is chiefly so-called "topped" oil from the Southern or Mexican fields, oil from which the lighter distillates have been separated. It runs a little heavier than 18,000 B.t.u. per pound, about 150 gallons (37.8 l.) being equivalent to a ton of good steam coal. As regards the mere matter of price, when three years ago such oil could be obtained for about 2½ cents a gallon it was practically on an even footing with steam

coal at the same period, at about \$3.75 per ton. It now ordinarily costs about twice the figure just given and has run even higher, so that as regards fuel value it is safe to say that it is kept practically on a par with coal. There are, however, some very marked advantages in the use of oil as such, particularly in the matter of labor and general maintenance. If properly handled, it gives substantially smokeless combustion, although very sensitive to improper treatment in this respect. It also keeps the heating surfaces cleaner than coal and is very much easier to store and handle than solid fuel. The whole question of ash is also eliminated and the upkeep of the boiler room somewhat lightened. A very characteristic advantage is the ease and quickness with which boilers can be forced to the limit in their output and kept there for long periods if necessary, since there is no reduction due to necessary cleaning of the fires. The added output can be assumed very quickly, and if boilers have to be kept in reserve they can be kept hot by oil fuel at a minimum cost. This advantage is particularly striking in cases where the plant is completely shut down for the night and has to start up at full capacity in the morning, as in textile working.

With proper equipment there seems to be usually a gain in boiler efficiency from the cleaner and steadier fires furnished by the oil, as well as greater steadiness in the steam pressure owing to the uniformity of conditions. Last week we gave details of the results in typical plants, all of which show material improvement in the performance of the boiler plant and great advantages of convenience as well. In the long run the question is that of the relative cost and availability of the two fuels. With a thoroughly modern boiler plant burning coal the boiler efficiency can be kept at a point where the advantage of oil fuel is not conspicuous. We are rather inclined to the opinion that the most marked gains have resulted in substituting a thoroughly first-class oil-firing system for a rather indifferent coal-firing system. There are many instances, however, of this very kind, and they are furnishing perhaps the most advantageous opportunities for changing to the use of oil. Its employment in relatively small plants, as in heating apparatus, offers advantages of convenience not lightly to be put aside. They are perhaps more striking here than in big plants, and the use of oil even in domestic furnaces has very conspicuous advantages in cleanliness and ease of fuel supply. At present prices of anthracite oil look attractive, and if the oil supply from the Southern and Mexican wells can be well kept up it would seem probable that a large increase in oil firing is likely to take place. The chief difficulty is that the use of fuel oil on ships has grown enormously. The needs of the navy are enlarging very rapidly, and the price of oil is likely to soar.

LONG-SPAN construction, characteristics of commonly employed dielectrics, selection and arrangement of motors for woodworking and features of a steam plant built to supplement a large Canadian water-power development will be the basis of several articles to be presented in the ELECTRICAL WORLD shortly. The article on long-span construction will dwell on the problems that differ

The Coming Issues

from those usually encountered in line construction and will contain the opinions of many prominent Pacific Coast engineers. The article on characteristics of dielectrics should interest designer and operator alike, as only through knowledge of their properties can dielectrics be properly applied to electrical apparatus. Central-station conditions will be reviewed in another article.

Central Stations Meeting War Demands

Great Volume of Business Pressed Upon the Companies—Labor Short and Materials High and Scarce—Many Men in the National Service—
Power Famine at Niagara

ANNUAL reports made by the electric utilities to their stockholders carry this year strong reminders of the war, of the extraordinary economic conditions of the times affecting costs of operation and of the tremendous power business urgently pressed upon the companies. The great bulk of the properties are operating with forces depleted by men in the national service, and they are in effect turning their physical plants to such ends as the government authorities desire.

NIAGARA FALLS POWER COMPANY

Significant of the shortage of power in a district where war industries are operating at high pressure is the statement of Stacy C. Richmond, president Niagara Falls Power Company: "It is confidently believed that double the present output of all the existing plants would soon be absorbed for at least the duration of the war."

"Throughout the year the demands on both companies for power were far in excess of the plants," says Mr. Richmond. "Practically a power famine now exists at Niagara."

The Niagara Falls Power Company, like all other properties, felt the influence of large sales and of heavy costs.

"Increases in production and sales by your companies," says the president, "resulted in substantial increases in gross revenues. The increases were more than offset by greater operating costs and by large increases in taxes."

As a further precautionary step it also was considered proper by this company to appropriate from surplus a substantial reserve against certain contingent liabilities, consisting in the main of possible further requirements under constructions which may be placed on recent war and excess profits tax laws.

The Niagara company calls attention to the expense of protecting both American and Canadian plants against lawlessness as one of the recent increases in operating cost. Military and private guards are stationed at the Canadian plant and private armed guards at the American plant. A protective inclosure has been built around the American plant.

UNION GAS & ELECTRIC COMPANY

The Columbia Gas & Electric Company, Charleston, W. Va., controls, among other properties, the Union Gas & Electric Company, Cincinnati.

Among the property developments of the year, A. B. Leach, the president, mentions the fact that in order to guarantee an adequate coal supply the company acquired a one-half interest in the Wood Coal Company, Logan, W. Va. "The mine owned by this company," he says, "has a seam of the highest quality steam coal and is sufficient to meet the coal requirements of your company's subsidiary properties for many years."

As indicating the favorable prospects for the electric business of the Union Gas & Electric Company, it stated that a third 30,000-kw. turbo-generator has been ordered for delivery in 1919 for the new power plant making a total capacity of 90,000 kw. Notwithstanding numerous delays due to congestion in manufacturing and railroad deliveries, the new plant is nearing completion.

DETROIT EDISON COMPANY

Alex Dow, president Detroit Edison Company, serves in the report of that company that during latter months of 1917 there was a persistent change in the products of the principal industries served from those of peace to those of war.

"The earlier manufacture of munitions for export was comparatively small in this territory," says Mr. Dow. "It is now an important part of local industry and is apparently to become more important. The change has been made thus far, and continues to be made, with no apparent effect on our sales of energy. Up to the end of the year 1917 there had been no notable addition because of munitions manufacture to the demands upon us, the work in progress being done by diversion of existing power supply to the new uses. Our increase during 1917 has been due to normal growth."

In speaking of the increase in operating ratio from 54.5 per cent in 1916 to 63.8 per cent in 1917, Mr. Dow says that this is due to increased coal cost. "We are paying higher wage rates, and everything going into operating expense has increased seriously in cost. But by careful management and with the loyal help of our employees we have been able to keep all expenses excepting fuel, down to a reasonable proportion of total earnings. Coal, however, has cost out of all reason and has been scarce and of poor quality, notwithstanding its high price."

Mr. Dow pays a fine tribute to the men who have responded to the call to arms. Many of the young employees have gone. The total number who have joined the colors to Dec. 31, 1917, was 311.

Now senior skilled men, whom it is difficult or impossible to replace, are being taken by the government for special service.

"Thus far," Mr. Dow adds, "we have not asked for exemption of any employee, and we wish to avoid doing so. Neither have we filled all the vacancies. We have asked our operating employees to close their ranks so far as practicable, behind the men who went off and they have loyally done so."

An example of what it has been possible to do is cited by Mr. Dow: "We have been able, without losing the good will of our customers, or without impairing service, to do away with some of our routine bills, for instance, since midsummer we have been rendering bills to our Detroit residence customers for two-month periods, instead of for one-month periods, as formerly."

out the necessary work is being done with a less number of employees, both relatively and actual."

One effect is that the company is paying higher average wages in every operating department, partly in recognition of increased cost of living and partly in recognition of increased efficiency.

Mr. Dow notes, in speaking of construction expenditures, that the net increase of plant investment during the year was \$8,069,496. This, though the largest amount expended by the company in any one year, is less than it was planned to spend. Much new work has been deferred indefinitely. Construction was accomplished under difficulties, labor costs were high, materials costly and scarce, machinery under contract for delivery has been delayed to give right of way through shops for United States requirements, and even weather conditions have been adverse to quick and cheap construction.

Among the larger items of construction deferred indefinitely, Mr. Dow mentions, is a proposed new power plant on the St. Clair River south of Port Huron. Steam turbines and boilers purchased for this plant will be put in storage for the present.

The policy as to line extensions is: "We have latterly refused to make any considerable extension of lines, excepting for supply of power to factories undertaking government contracts. Our intention is to carry out our engagements made before the war and to connect business on existing lines up to the capacity of these lines and of our power plants; but, excepting for extensions for national service, as stated above, and excepting the few cases where a refusal will work very great hardship, to decline to make line extensions."

Reverting to the change in character of industry from peaceful uses to war orders and stating that additions to existing factories and numerous new factories being erected are, with few exceptions, to be devoted to war-material production, Mr. Dow adds: "It is our expectation, therefore, that our sales of industrial power, which are the most important part of our business, will be fairly maintained."

Gross revenue of the company increased 21.9 per cent in 1917 over 1916, and output 22.9 per cent.

MONTANA POWER COMPANY

John D. Ryan, president Montana Power Company, notes that in spite of disturbed labor conditions, interfering with mining and smelting operations, and affecting practically all large industries, there were substantial increases in lighting and power consumption in small towns and in other branches of the business. Gross earnings increased nearly 11 per cent over 1916.

About \$3,600,000 was expended during the year for new construction. Some construction work suspended temporarily last October, owing largely to labor conditions, will be resumed and carried to completion in 1918.

Forecasting the new year, Mr. Ryan says: "The outlook for business in general in Montana during the year 1918 is very good. All of the principal products of the State will doubtless bring higher prices, and as a result we may expect the usual increases in the lighting and small power business of our branches and towns, as well as increased income from electrical operations of railroads and the larger power business,

which we estimate will more than offset the probable increases in higher cost of labor and materials and any increase in taxes."

EFFECT OF WAR ON NEW YORK COMPANIES

The annual report of the Consolidated Gas Company, New York, for 1917 refers generally to conditions affecting its electric subsidiaries, which include the New York Edison Company and United Electric Light & Power Company, in part as follows:

The effect of the war upon the cost of producing and distributing gas and electrical energy has already been very disastrous and will be much greater during the present year than it was in 1917.

The price of practically all the materials and supplies required in the production and distribution of gas and electricity increased very substantially in 1917. The same was true of labor. The price of boiler coal used in generating electricity increased 59.2 per cent, and that of anthracite and bituminous coal used in gas manufacture 11.3 per cent, the average increase in the price of all varieties of coal used amounting to 34.3 per cent.

Coupled with the increase in the cost of coal has been the difficulty of obtaining it as well as a marked inferiority in its quality, causing an excessive consumption as well as impairing the capacity of the various plants.

As an insurance against any possible contingency which might interrupt the normal supply of coal, the lighting companies for years past have made it a practice to carry a large stock of coal on hand. This stock has generally been accumulated during the summer months, when shipping conditions were favorable. Mining and railroad conditions during the summer of 1917 were such, however, that the stocks of coal could not be brought up to the full quantities required and always theretofore maintained.

The increase in the cost of labor has also been very considerable, the principal causes for this being an extraordinary demand for men on the part of contractors engaged in the manufacture of war munitions and supplies, the building of cantonments and unusual activities in local shipbuilding yards, including the navy yards. The available supply was greatly diminished by the effect of the enlistment of a great many men in the army and navy and the conscription of many others.

Notwithstanding some improvement in the revenue from the sale of residual products, credited to the cost of gas manufacture, the increase in the combined operating expenses of the gas and electric companies amounted to \$9,336,003, including the increase in taxes (\$1,486,626) and the increase in operating expenses due to the greater quantity of gas and electricity sold (\$2,413,332).

More than 1050 employees of the Consolidated Gas Company and its affiliated gas and electric companies are now serving in the army and navy, representing every grade of employment from departmental superintendents to day laborers.

The technical and engineering departments were particularly affected in this respect, the demand for the services of men thus qualified and the inducements offered them to join the various branches of the service having resulted in a great many enlistments. In the various clerical departments the difficulty of obtaining men to fill the vacancies thus caused resulted in the employment of many women, who are performing their duties in an entirely satisfactory manner.

When the first Liberty loan 3½ per cent bonds were issued employees of the Consolidated Gas Company and affiliated gas and electric companies were offered the privilege of paying therefor in installments. This privilege was availed of by 12,357 employees, who subscribed for an aggregate of \$847,700. Similar action was taken in respect of the second Liberty loan 4 per cent bonds and 7478 employees subscribed for an aggregate of \$511,750.

Sales of electric energy during the year, including sales to the Third Avenue Railroad, the Brooklyn Rapid Transit Company and the New York, New Haven & Hartford Railroad, amounted to 749,827,761 kw.-hr., an increase over the previous year of 11.37 per cent.

METHOD OF IMPROVING POWER PLANT ECONOMY

Reiteration of Principles Involved in Efficient Combustion of Coal, with Suggestions as to How This End Can Be Attained

ECONOMY in the use of fuel in power plants was discussed recently before the sanitary section of the Boston Society of Civil Engineers by C. H. Parker, superintendent of the generating department, Boston Edison company. He emphasized the importance of even a 1 per cent saving in the 32,000,000 tons of bituminous coal which the Fuel Administration estimates New England uses yearly, pointing out that this would release one 10,000-ton collier for a year and that the railroads could release 6400 50-ton coal cars one trip a year for other work as a result.

The first part of Mr. Parker's remarks referred to principles of efficient combustion. This was followed by a number of practical suggestions bearing on plant economy. He pointed out that there are many plants where substantial savings can be made and very few plants where no saving at all can be effected. The loss due to combustibles in the ash, the speaker pointed out, depends on the type of grate or stoker and the care taken by the firemen in firing and cleaning the fires. This loss may amount to 10 per cent of the heating value of the fuel. The openings in the grate or stoker should be proportioned to the kind of coal to be used, a non-coking coal requiring smaller openings than a coking coal. It is often possible to save a lot of the siftings, especially with stokers, by installing proper hoppers or pans to catch them and keep them free from the ashes. A periodical examination of the ashes carted away was suggested.

The loss due to water in the coal is twofold. First, if coal containing moisture is purchased it is very expensive, as each per cent of water means that a certain percentage of coal paid for cannot be utilized thermally. Second, the moisture has to be evaporated and superheated to flue temperature. Together these considerations mean about 1.1 per cent loss for each 1 per cent water in the coal. Sometimes it is helpful to wet the coal just before firing on ordinary hand-fired grates to prevent the rapid release of the volatile hydrocarbons and give them a chance to be consumed also. On some overfeed stokers wetting may prevent excessive sifting. In each of these cases the loss due to evaporation and superheating to flue temperature is present, but the other gains more than offset it. The water acts only in a mechanical way and adds no heat.

The loss due to visible smoke is usually very small, rarely reaching 1 per cent of the coal fired, but dense smoke quite often means bad conditions elsewhere. If the coal is fed in excessive quantities, considerable hydrocarbon may be liberated without being burned. Smoke may also indicate too small a combustion chamber. A smoky chimney, however, may be more economical than a clear chimney if the latter is obtained by excessive air dilution.

Standby losses may be considerable in plants having a fluctuating load. They consist of (1) coal required to start up cold boilers, (2) coal used to bank fires during shut-down periods, (3) heat lost in shutting down boilers, and (4) heat lost in water blown off to get rid of mud and scale from mud drum. The magnitude

of these losses is dependent on the character of the load that is carried. Where boilers are not needed for more than twenty-four hours it is usually cheaper to let them go out and build new fires rather than bank them.

Flat grates are fired by hand satisfactorily up to 150 hp. rating on return-tubular boilers and up to 300 hp. on water-tube boilers. Above these sizes smokeless combustion is difficult without special arrangements, such as Dutch ovens, the Chicago settings or steam jets.

Steam jets pointed downward to force extra air over the fire at the front wall, through the side walls, or even through the bridge wall, and mix it with the volatile matter from the coal often produce good results by improving the efficiency and reducing the amount of smoke. Unfortunately, when the operation of the jets is left to the fireman results as good as those from tests are not always obtained. The jets should be used only while the volatile matter is being liberated and should be shut off afterward until the next charge of coal is fired. Steam air injectors can be made automatic and therefore independent of the fireman, but they need adjustment to obtain the best economy.

THE DIFFERENCE IN COALS

Semi-bituminous coals, such as New River, Pocahontas, Clearfield, etc., work well with a fire 12 in. to 14 in. (30.5 cm. to 35.5 cm.) thick, and should be fired every ten or fifteen minutes. The more volatile coals used in New England are harder to burn efficiently and the fires should be thinner. With our most volatile coals the fire should not be more than 7 in. or 8 in. (17.75 cm. to 20.3 cm.) thick. The thinner the fire the more often should coal be put on.

Interest on the investment, depreciation, repairs and power for operation cost more with mechanical stokers than with hand firing, but mechanical stokers make possible the use of poorer fuels with efficiency as high or higher than is obtainable in hand firing with better grades of fuel. All underfeed stokers can burn the cheaper grades of coal economically, and one man can fire 3000 hp. or 4000 hp. of the inclined type, but not so many of the horizontal type, where hand cleaning is necessary. At the present time, however, unless an addition to plant is required by reason of increased load, the question of fuel saving resolves itself into the best use of the existing plant rather than replacing it with new, as the costs are very high and deliveries cannot be made for a year or more in many cases.

A control panel centrally located, with all of the meters and controls for the operation of one or several boilers mounted on it, is worth its cost, as the stoker operator can tell at a glance what fires need attention and what ones are operating satisfactorily. Without this a man must move continually from one fire to another for inspection of the conditions that exist.

A log sheet showing the starting and stopping of machines and boilers, pressures, temperatures, vacuums and loads carried is wasted effort and material unless it is studied and the facts discovered are acted upon for increasing the efficiency.

Where coal is very expensive or there is not exhaust steam enough to heat the feed water economizers are of advantage. When high boiler pressures are used, resulting in high flue-gas temperatures, they result in considerable saving. In existing plants where boilers are poorly designed and have to work at heavy over-

loads, it might be cheaper to increase the capacity by installing economizers than by adding more boilers.

Some plants are called upon to carry considerable overloads for a short time, either periodically or occasionally. Forced draft will often save fuel and money in such cases. If these periods are frequent it may be advisable to install the more expensive fan equipment, as that will only use 2 per cent to 4 per cent of the steam; but if these occasions are few, it is cheaper to install a steam air injector that may use from 5 per cent to 10 per cent of the steam or more. The standby losses of boilers, such as banking, are considerable, and if boilers have to be kept banked for

long periods to cover a few emergencies, auxiliary forced draft will be found advantageous.

The steam loop is a simple means of returning the condensation in piping to the boiler and is adequate for small stations. In plants of several units, however, it does not work so well and the drip return system may be used. By these means all high-pressure drips are saved and the bleeder steam from the nozzle in the upper tank can be put into the feed-water heater and the heat saved. The exact saving depends on the men operating the plant and what wastage of steam would be allowed from drips if the automatic arrangement were not used.

Assuring Satisfactory Fuse Operation

Proper Installation and Renewal of Transformer Fuses Are Essential to Good Service and the Protection of Apparatus—Necessity of Standardization of Fuse Types

THE transformer fuse is usually looked upon as a necessary evil; it is purposely made the weak link in a system in order to protect by its weakness other more important apparatus. But this weakness must be dependable and predetermined. A fuse failure means either premature failure or incomplete failure; the first results in poor service and the latter in destruction of apparatus.

No transformer fuses would be used if other more dependable apparatus could be installed at a permissible price. However, so long as conditions and available apparatus remain as at present, distribution transformers of moderate size must be fused; hence means have to be devised for obtaining the best possible results from an admittedly recalcitrant device.

Among things essential to the satisfactory action of transformer fuses are proper installation, in the first place, and proper renewal of fuse elements at all times. Transformer fuses are often blamed for shutdowns and apparatus burn-outs which are really the results of incorrect renewals rather than of inherent fuse troubles. Many of these troubles will be eliminated if employees are carefully supervised in handling fuse renewals and furnished at all times with proper materials.

The equipment of every troubleman engaged in this class of work should include a suitable container for fuses. If this is standardized and extra sets, completely filled, are kept in stock at headquarters, emergency demands will be more easily met. A fuse kit used by one company in the far West is shown in an accompanying illustration. This company operates 2300-volt and 11,000-volt distribution circuits. The 2300-volt link fuses for the ordinary transformer insulator-type cut-outs, together with larger sizes for expulsion-type installations, are placed in the lower partitioned section of the case, while the 11-kv. fuses are contained in waterproof cylinders carried in an upper tray. A pair of rubber gloves, extra expulsion fuse holders and a treated wood puller complete the outfit. A fuse puller of the pincer type is to be preferred to those with spring metal jaws, first because of the ab-

sence of metal and secondly because the wood type may be used for pulling fuse holders of a variety of sizes and affords a positive grip on any.

To avoid mistakes in selecting fuses, a stamped aluminum plate is soldered to one end of each fuse compartment, showing the size fuse contained therein. A number tag is fastened to each 11-kv. cylinder for a similar purpose. To the inside of the fuse-kit cover is attached a printed schedule of the fuse sizes required with the various types of transformer stations used on the sys-

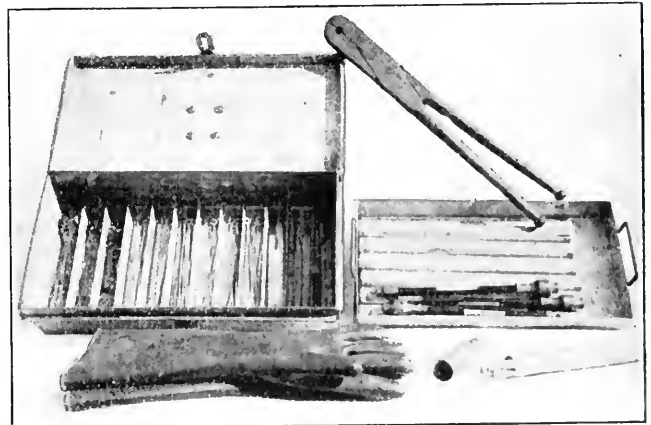


FIG. 1—CABINET THAT AVOIDS WRONG SELECTION OF FUSES

The box is constructed of No. 24 gage galvanized sheet iron. The upper tray and the partitions in the bottom are of No. 26 gage, while the tubes are No. 30 gage. The upper edge of the case is reinforced with $\frac{1}{4}$ -in. (6.4-mm.) round iron, and the edge of the cover is similarly reinforced with $\frac{3}{16}$ -in. (4.8-mm.) stock. The box measures 18 in. by 9 in. by $5\frac{1}{2}$ in. (15.7 cm. by 22.9 cm. by 13.9 cm.). The bottom partitions are $1\frac{3}{4}$ in. (4.4 cm.) deep. The tray is $17\frac{1}{2}$ in. by $8\frac{1}{2}$ in. by $2\frac{1}{4}$ in. (44.4 cm. by 21.6 cm. by 5.7 cm.) and rests directly on the lower partitions. The cylindrical containers for 11-kv. fuses are 14 in. (35.6 cm.) long and $1\frac{1}{4}$ in. (3.2 cm.) in diameter.

tem. This information is considered especially important since troublemen stopping to figure the proper size may make serious errors.

The company employing this box ordinarily fuses 2300-volt transformers for double load and 11-kv. transformers for from 50 to 60 per cent overload. The intention is to protect 2300-volt transformers primarily

against short circuits, while 11-kv. transformers are given what is as nearly an overload protection as is possible with the use of fuses and consistent with good service. Obviously the higher the overload for which transformers are fused the better the guarantee against interruption to service, but on the other hand the transformer protection is reduced. Consequently the lower-

SIZES OF FUSES FOR 1-TO-100-KW. TRANSFORMERS RECOMMENDED IN FUSE-KIT LIST—FUSE RATING IN AMPERES

Size of Each Transformer (Kw.)	2300-VOLT			11,000-VOLT			
	Single-Phase	Open-Delta*	Closed-Delta	Single-Phase	Open-Delta*	Closed-Delta	Three-Phase Transformer
1	1	4	1	2	2	2	2
3	3	3	3	2	2	2	2
5	5	5	5	2	2	2	2
7½	10	10	10	2	2	2	2
10	10	10	15	2	2	2	2
15	15	15	20	2	3	3	2
20	15	20	25	3	3	5	2
25	20	25	30	3	5	5	2
30	25	30	40	5	5	8	2
50	40	60	75	8	10	12	5
75	60	75	100	12	12	15	5
100	75	100	100	15	15	20	8

*Middle lead. Outside lead is same as single-phase.

priced lines of transformers are fused for larger percentages of overloads than the higher-priced.

It is evident from the accompanying table that 11-kv. transformers of less than 15 kw. are protected against short circuit only and not against overload, the reason being that 11-kv. fuses smaller than 2 amp. are very unreliable and not recommended for practical service. The practice of using larger fuses in the middle wire of open-delta banks than in the outside leads may seem peculiar at first glance, and a refinement not justified by the wide variation in fuse performance and the fact that current in the middle lead should ordinarily be only slightly greater than in the outside leads. Nevertheless, practice has shown that a decided percentage of middle-lead fuses have blown, and this change has seemingly improved service without jeopardizing the equipment to any greater extent.

The insulator-type primary cut-out ordinarily rated by the manufacturers at 30 amp., while having certain disadvantages, is nevertheless so attractive as to price that it is standard with nearly all companies for small 2300-volt installations. In higher-grade installations expulsion fuses are used for 2300-volt service over 30 amp., and even in some cases for 20-kw. or 25-kw. transformers. Oil switches should be used whenever possible for installations over 75 amp.

The positive advantages of oil switches, such as reliability of action, ease of resetting and protection against single-phase operation, should lead to a careful consideration of this protective device for all transformer stations of any considerable size and importance. The last feature is particularly important where stations serve large groups of small three-phase motors not equipped with low-voltage and overload releases. A case is on record where one 11-kv. station consisting of three 30-kw. transformers and furnishing energy to twenty-one agricultural installations of 5 hp. each operated single-phase after blowing a fuse, causing the burning out of seven of the motors.

Companies operating close to the coast or under other

severe conditions experience much difficulty due to the corrosion of the fuse links in the ordinary transformer plug cut-outs. This has been somewhat obviated by the use of fuses with copper terminals protected by asbestos sleeves. Under especially severe conditions this type of fuse holder must be mounted on an insulator to prevent breakdown to the cross-arm.

Standardization of fuse types is a necessity, since every trouble car must carry renewals for every type used on the system. At present when central stations are purchasing whatever brand of transformer the market affords without regard to contracts, it is particularly necessary to insist on a standard. Some plugs so nearly fit holders of foreign type that repairmen will be tempted to use them, yet they will often loosen, owing to vibration, or give trouble due to poor contact.

When companies use expulsion-type cut-outs troublemen should invariably be cautioned not to make fuses of larger size by twisting smaller sizes together. Many repairmen take it for granted that two 10-amp. fuses twisted together will make a 20-amp. fuse.

Fuses of the inclosed-cartridge type for voltages of 6600 and up, consisting of glass, porcelain, fiber or treated paper tubes, are best made up complete in the shop and issued to the troublemen properly tagged as to size. While space in the trouble kit can be saved by carrying a stock of fuse wire and filling powder, uniform care is not assured in making up the cartridge. For this type of fuse glass is to be preferred to fiber or treated paper. Although the most recent product of the latter type shows very little tendency to warp in the weather, nevertheless there is more opportunity for failure by leakage than with glass, and the fuse tube may catch fire after blowing, owing to a heavy "short." In one instance a grain field was set afire and the flames were extinguished only with difficulty; in another case a brush fire was started. While it is true that the

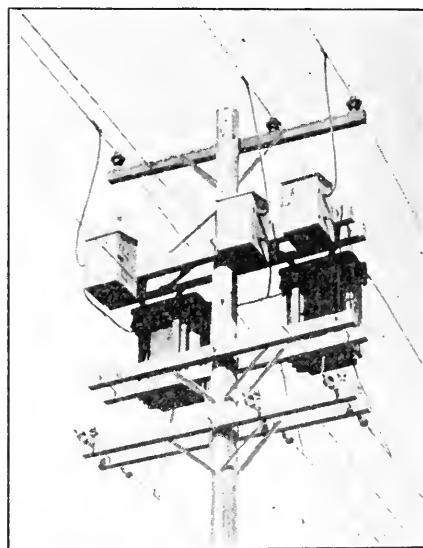


FIG. 2—FUSE INSTALLATION ON THREE-PHASE CIRCUIT

fragility of glass is a serious objection, nevertheless its qualities are such as to warrant its use until such time as a fireproof, non-warping, non-hygroscopic treated tube is produced.

A cheap grade of gage glass is ordinarily used for fuses of this type. Breakage is of course to be expected, both in transportation and under short-circuit

conditions, but in any case the renewal cost is moderate. A good 11-kv. to 22-kv. fuse of this type can be made, as shown in Fig. 2.

Combination fuses and switches are now on the market at very reasonable prices and are favorable for voltages of 11 kv. and up. They may be easily arranged for operation from the ground. There is an operating saving in such construction, since it obviates the neces-

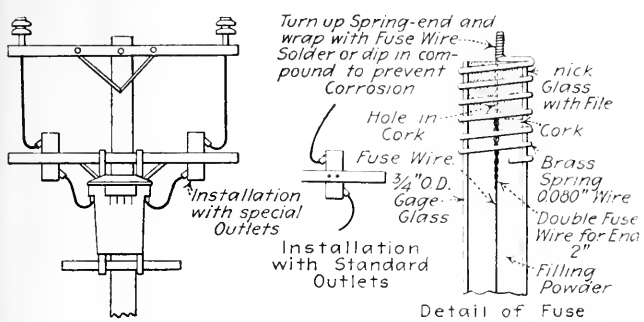


FIG. 3—SINGLE-PHASE FUSE INSTALLATION AND DETAILS OF FUSE

The fuse consists of a gage glass $\frac{3}{4}$ in. (19 mm.) outside diameter by 17 in. (43.2 cm.) long with a $\frac{1}{4}$ -in. (3.2-cm.) wall. The ends are ordinarily corked; an aluminum fuse wire is brought out through a hole in the center of the cork and is soldered to a turned brass ferrule cemented to the end of the tube. A brass spring ferrule consisting of 0.08-in. (2-mm.) spring-brass wire turned up into a spiral of slightly smaller diameter than the glass may be used with a considerable saving over the solid ferrule. There is less metal and less labor in manufacture, placing on the tube and removal from broken tubes. In addition, attachment of the fuse wire is simplified. The end of the glass tube may be nicked with a file to obviate any possibility of the spring slipping off. The fuse wire should be doubled for the first few inches at each end of the tube so that it will be sure to blow well within the tube and also to assure good conductivity where the wire is most subject to injury. The end of the spring where the fuse wire is twisted around should be dipped in solder or, if a good aluminum solder is unobtainable, in compound to prevent corrosion.

sity of sending two men to renew a fuse, which would be advisable if the pole had to be climbed with the transformer "hot." With this equipment the renewal may be made with perfect safety by a single man, as the installation can be de-energized before the renewal is attempted. Furthermore, since the circuit is closed from the ground, there is no danger to the operator when a renewal is made under unsuspected short-circuit conditions. An added advantage of such an installation is that it permits an arrangement with the customer for cutting out transformers when service is not required, thus eliminating transformer losses.

Companies employing expulsion-type fuses mounted in wooden boxes will do well to give careful attention to box construction. Boxes which will not withstand the weather should not be used, because they will cause disastrous pole fires and line failures unless frequently inspected and repaired. A good box may be constructed of 1-in. (2.54-cm.) poplar painted inside with P. & B. and outside with three coats of a good pole paint. Boxes of this type are ordinarily constructed with one lead at the upper left side and the other at the lower right. This scheme may be improved upon by drilling an upper and a lower hole in each side of the box. The bushings and leads being readily removable, either upper hole may be used in conjunction with either lower. Thus four combinations are possible, and that which will give the neatest installation may be used in any case.

A typical single-phase installation is shown in Fig. 3, in which conditions are improved by using upper right-handle and lower left-handle holes on one side and

vice versa on the other. In some three-phase installations (Fig. 5) the best arrangement is secured by placing both bushings on the same side of the box. The practice of sometimes attaching the line wire to the upper and sometimes to the lower terminal should be discouraged, as this may lead to an accident. Where four holes are drilled in the boxes two pieces of sheet fiber should be sent out with each box to be used in closing the unused holes. This is necessary not only as a protection against the weather but also to prevent the entrance of birds. In this connection it may also be noted that if the bottom of the box contains a hole through which the expelled gas is blown, a wire screen covering should be used with a mesh small enough to exclude bees.

In installing boxes of this type they should be placed on the transformer arm and not above, and should be mounted on the back of the arm, so that they will be accessible to the troubleman without the necessity of passing by live apparatus. It is often advisable to use leads insulated for the full line voltage from the point where the main line is tapped to the transformer terminal. No. 6 seven-strand annealed copper wire with a 16/64-in. (6.4-mm.) 30 per cent Para rubber covering and single-braid and tape covering over all makes a good 11-kv. lead. Some troubleshooters do not understand that as long as one fuse remains in place pressure is maintained through the transformer windings, and consequently all transformer terminals are energized. This matter should be called to their attention.

A record of transformer fuse renewals is of considerable value in reducing transformer burn-outs and improving service. For this purpose a 3-in. by 5-in. (7.6 by 12.7-cm.) card of the form shown in Fig. 4 has been used with success by one company for a number of years. There are many cases in which the cause of the fuse blowing is never known. It may be taken for granted, however, that repeated blowing indicates an incorrect condition which should be investigated. This company having all transformer stations appropriately numbered files the record cards in numerical

Report of Primary Transformer or Line Fuse Blown			
Station or Switch No.	365	Location	Columbia St
11,000 2,300	Volt Fuse Blown at	830	A. M. P. M.
Installed	10	Amp. Fuse in	Outside Lead
CAUSE OF TROUBLE WAS AS FOLLOWS:			
Fuse Block Burned Up		Motor Trouble	
Overload		Miscellaneous	
Short in House			
Primary Down			
Secondary Down	X		
Lightning			
Date	9-4-17	Trouble Man	A. Smith

FIG. 4—RECORD OF TRANSFORMER FUSE FAILURE

order, and whenever three blown-fuse cards appear against one station within two years an investigation is made, particularly with reference to overload or defective customers' installations. The card also serves as a check on the installation of fuses of proper size.

Everybody Doing It—Buying Bonds

Light Projection with Gas-Filled Lamps

How the Lamps and the Optic System Used Therewith Have Been Sympathetically Developed So that It Has Now Become Possible to Make Satisfactory Use of Them for Motion-Picture Projection

BY R. P. BURROWS AND J. T. CALDWELL

Engineering Department, National Lamp Works of the General Electric Company

THE application of incandescent lamps to purposes hitherto served by carbon arc lamps has been considerably extended by the development of gas-filled lamps. The carbon arc for street and industrial lighting, and for nearly every application with the exception of projection, has been replaced by the incandescent lamp. For a time it was believed that the incandescent lamp would never replace the arc in projection lighting, especially as applied to motion-picture projection, because of its inherent limitations. The principal limitation was the relatively low intrinsic brilliancy of the source. If only the common types of incandescent lamps and the usual optical systems are considered, the limitation still holds. However, new incandescent lamp constructions and a sympathetic design of the optical system have made it possible to overcome obstacles that formerly existed. It is reasonable to expect that in a few years incandescent lamps will be as widely used in this field as in others previously dominated by the carbon arc.

Viewed from practical and commercial standpoints, optic projection has many complicated features. In the past the arc, the source most widely used for light projection, has been commonly, though incorrectly, considered a point source. Light projection with arc lamps has been accomplished with varying degrees of success, due chiefly to the high brilliancy of the arc and less to the efficiency with which the light is utilized. With gas-filled lamps the brilliancy is limited to about one-fourth that of a good direct-current arc, so the success with which the light is projected depends upon the utilization of the light. This is of the utmost importance in the use of gas-filled lamps for projection purposes.

An optical projection system may be divided into three parts and each considered individually, and then all considered collectively. They are the source of light (including mirror), the condensing lens, and the projection lens (or objective). They are related as follows: The condensing lens gathers the rays of light from the light source and redirects them through the image—film or slide—to be projected to the projection lens, which in effect enlarges the transparency on the screen. In general, the shorter the rear focus of the condensing lens (distance between lens and illuminant) the more light the lens will gather and redirect.

LIMITATIONS TO THE EFFECTIVE USE OF GAS-FILLED LAMPS

Limitations upon the efficiency of this operation follow:

I. Too short a rear focus will give too great a thickness of lens, which (a) increases absorption, due to its thickness and internal reflection; (b) gives poor definition, due to spherical aberration; (c) gives color, due to chromatic aberration.

II. Too short a rear focus will require light rays to strike the lens surface at too great an angle, increasing the surface reflection and causing a loss of light.

The light source may be considered from four viewpoints—brilliancy, size, construction and wattage.

I. Brilliancy.—Brilliancy is limited by (a) life of filament—the higher the temperature, the shorter the life and the greater the candle-power emitted per unit area of filament; (b) diameter of filament—in general, the greater the diameter of filament the higher the operating temperature for the same life.

II. Size of Source.—With condensing lens and projection lens given, there is an area of source which if increased will decrease the efficiency of utilization. It should be understood that a larger size of light source can be used, but that that portion of the source which

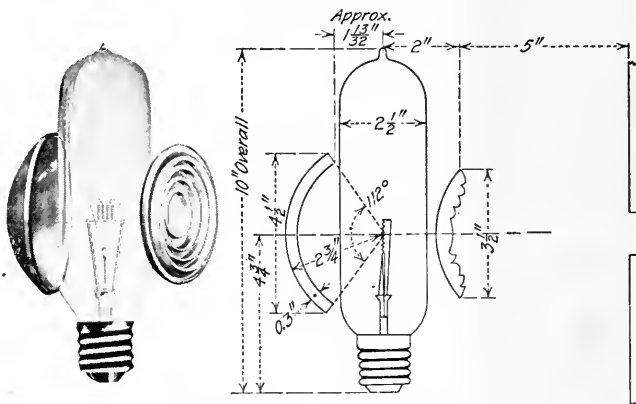


FIG. 1—RELATIVE POSITIONS OF GAS-FILLED LAMP, MIRROR AND CONDENSER FOR PROJECTION PURPOSES

The filament is wound in the form of four parallel helical coils lying in the same plane. The distance between the coils is slightly more than one-half the diameter of the coils. The lamp is designed for operation on circuits regulated for current rather than for voltage. It is made for operation with the tip end of the bulb uppermost, has a maximum over-all length of 10 in. (25.4 cm.), and a light-center length—the distance from the extremity of the base to the center of the light source—of 4 3/4 in. (12.2 cm.). The bulb is tubular and of such length that the fine particles given off by the filament are carried upward by the hot gas and deposited on a portion of the bulb well out of the zone of useful light. The rated average life is 100 hours. The mirror is backed with a heat-resisting material to withstand 125 deg. to 150 deg. C.

falls outside the dimensions determined by the character of the optical system is used much less efficiently than that falling inside the dimensions.

III. Construction of Source.—The construction or form of the source governs the distribution of light, which in turn limits the amount of light which can be used by the condensing lens.

IV. Wattage.—The wattage is limited by (a) size of light source; (b) construction of light source; (c) the diameter of filament.

The purpose of the projection lens (that nearest the screen) is to gather the rays which have passed through the film, redirect them to the screen and thus produce the size of picture desired. The larger the size of this lens, the greater will be the amount of light

projected, but the loss of definition and the high cost of large lenses of this kind limit the size to be used.

No doubt, the most radical change in lamp design, although not an entirely new development, is the use of the so-called "monoplane" type of lamp filament (Fig. 2), which is so arranged that all of the coils are in one plane, so to speak. This construction allows most of the filament to come within the focus area of the lens system to a much greater extent than obtains in the regular stereopticon lamps. In the latter the area occupied by the filament is greater and the coils, since they are not all in one plane, cannot all be close to the proper focus.

The light from the rear portion of the filament is gathered and redirected as useful light by a spherical mirror. The mirror is so placed that the filament is at the center of the outside radius of curvature of the mirror. With the monoplane construction images from the filament can be made to fall at points between the filament coils, thus giving a solid plane of light if the lamp and mirror are properly focused (Fig. 3). It is evident that to secure this effect with the stereopticon lamp filament would be impracticable, if not impossible.

Another characteristic feature of the new filament construction which is of great importance is the light distribution in a horizontal plane (Fig. 4). The light falls largely within angles at which the light can be utilized by the lens and mirror system. The advantages of such distribution should be evident.

It must not be inferred that the use of the monoplane filament construction is best adapted for all types of lamps for projection service. There are cases where some other type of construction may be used in order to obtain the size of source necessary.

It may be readily seen that if a large bulb were to be used to inclose the filament, advantage could not be taken of the short-focus condensing lens; consequently, it is necessary to use a bulb of as small a diameter as is practically possible. The size of bulb—that is, the area—is determined mainly by the wattage of the lamp. If the bulb can be made long and small in diameter—that is, tubular—the necessary area can be obtained with the advantage of the small diameter.

In obtaining concentration of filament it is necessary to get as high a wattage and filament brilliancy as possible for the size of light source previously determined. This can be most easily accomplished by the use of a large diameter wire, or, in other words, through the use of a high-current, low-voltage lamp. The high brilliancy of source desired is obtained by operating the filament at a higher temperature than is advisable for lower current lamps. At the same time, by the use of high current at low voltage, it is practicable to concentrate a higher wattage in the same size of source than if the lamp were designed to operate directly on 110-volt circuits. This low-voltage, high-current lamp is objectionable from one viewpoint, namely, that it cannot be used directly on regular lighting circuits. However, equipment can very readily be obtained for the operation of this lamp on lighting, power or isolated-plant circuits.

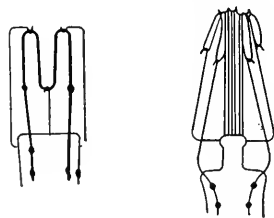


FIG. 2—MONOPLANE AND CONCENTRATED FILAMENT CONSTRUCTION

It has been found economical to burn the lamp at a high efficiency. It has also been found that where these lamps are used for long periods, say daily, as, for instance, where they are to replace the carbon arcs for motion-picture projection, the renewal cost on the basis of 100 hours' lamp life is comparable to the average cost of carbons, and though the cost of carbons may in certain cases be slightly lower, the reduction in wattage by the use of incandescent lamps with properly designed lens systems is such as to considerably more than offset this difference.

In order to utilize the maximum amount of light generated by the incandescent lamp, it is necessary to use a condensing lens with a short rear focus. The difficulties with this lens, as outlined before, were eliminated by the use of a prismatic lens of the Fresnel type (Fig. 1). This condenser utilizes a 76-deg. solid angle of light as compared to a 45-deg. solid angle with the arc-lamp condenser. The prisms are so designed and arranged as to make the condensing system as thin as possible and to distribute the light on the film so as to give an excellent "flat picture." The prismatic condenser is the most efficient condenser which can be used with gas-filled lamps at the present time, and it should be a part of every installation.

The correct operating positions of the lamp, mirror and condenser with respect to each other, with the various dimensions, are shown in Fig. 1. The spherical mirror performs two functions: (1) It utilizes the light from that portion of the filament farthest from the condensing lens, projecting the light back to the source and increasing the light on the screen from 50 to 75 per cent, depending upon the mirror used and the spacing between filament sections. (2) It fills in the space between the filament sections, thereby approximating a solid band of light.

METHODS OF INCREASING SCREEN ILLUMINATION

There is some uncertainty at present in the minds of theater managers as to how bright a motion picture should be shown. The tendency in the past has been toward brighter and brighter pictures, but to-day the trend appears to be toward pictures of moderate brightness. However, increased screen illumination can be obtained with gas-filled lamp equipment by the use of projection lenses with wider apertures. The wider the

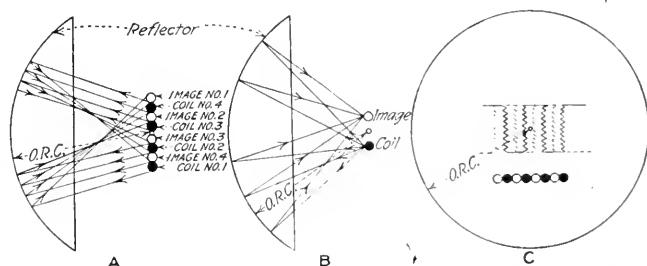


FIG. 3—IMAGE OF FILAMENT FALLS BETWEEN COILS GIVING SOLID PLANE OF LIGHT

aperture of the projection lens—that is, the larger the diameter of the opening of the lens—up to a certain limit, the more light there will be projected on the screen. It has not been entirely possible to gain this advantage with the arc projection owing to the fact that as the diameter of the opening of the projection lens is increased the magnification of the arc lamp flicker is increased. The change from a projection lens

of F-2.5 to one of F-2* opening, of the same equivalent focus, increases the illumination on the screen by approximately 100 per cent.

In certain instances a two-wing shutter will give an increase in illumination and yet not increase the flicker. Two of the reasons for the use of two-wing shutters

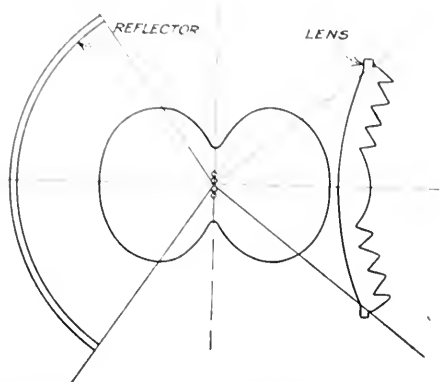


FIG. 4—DISTRIBUTION OF LIGHT FROM MONOPLANE FILAMENT

are as follows: (1) With light sources which do not pulsate in intensity—for example, with gas-filled lamp and the direct-current arc—either shutter may be used. Flicker may occur, depending on the speed of film travel on screen surface with the two-wing, but the efficiency of light transmission is rather better than with the three-wing. (2) With pulsating light sources, such as the alternating-current arc, there is a possibility of a bad stroboscopic flicker of very low frequency if certain relations exist between the shutter characteristic and the alternating-current frequency. The customary 60-cycle service and the three-wing shutter constitute the most common example of an objectionable combination. Hence two-wing shutters are usually employed with alternating-current arcs, since the 32-cycle flicker of the shutter is less objectionable than the flicker caused by the stroboscopic effect.

The type of screen to be used in the theater depends to a large extent upon the length of throw and width of the theater or any extreme angles at which the picture must be viewed. Metallic and selective screens offer a picture brightness of from one time to seven times that of white paint and muslin screens for a projected beam of equivalent power. However, metallic screens are limited in their application to the narrow theaters in most cases. It is possible to project a satisfactory 12-ft. (3.7-m.) picture on a white paint or muslin screen. The width of the picture projected can be increased to approximately 13½ ft. to 14 ft. (4.1 m. to 4.3 m.) when a good type of metallic screen or ground mirror screen is used.

CONTROL APPARATUS FOR GAS-FILLED LAMPS

Twenty-ampere, 28-30-volt gas-filled lamps, like incandescent lamps for regular lighting service, operate equally well on either direct or alternating current, with no difference in the light output. The operation on alternating current may be at any commercial frequency.

On direct current a motor-generator set or rotary converter with proper control equipment and ammeters

is required to supply the lower voltage required by the gas-filled lamp. Of course, it is possible to use a resistance with a sensitive adjustment and an ammeter instead, but this method is not usually advisable because of the energy lost in the rheostat.

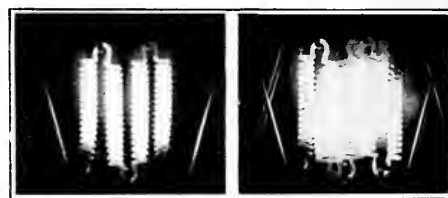
A transformer has been developed which can be used on 110 120 volt and 220-volt alternating-current circuits. This transformer includes a variable resistance, or a reactance, in the primary circuit to take care of the variations in line voltage, thus enabling the operator to maintain the normal current on the lamp. An ammeter is placed in the secondary circuit of the transformer, and a four-point starting switch is included in some equipments. This switch eliminates the possibility of a rush of current through the cold lamp when the current is first applied, for the connections are such that the current is gradually increased as the switch is turned from the "off" to the full-current position.

For use with the present arc-lamp transformers a panel attachment has been developed, which includes a rheostat for regulation, an ammeter, a reactance coil and the four-point starting switch.

At the present time there are on the market a number of transformers which are being used with the 20-amp. gas-filled projection lamp, but which are not recommended, although they are cheaper than the transformer mentioned above. They do not contain a variable resistance in the primary circuit to take care of fluctuation in the line voltage, nor do they include an ammeter. Thus the operator is not in a position to know whether his lamp is burning at, above or below normal current, which is very important with gas-filled lamps. In order to take advantage of all the light possible, the filament is operated at a temperature close to the melting point. Any marked increase in current delivered to the filament materially shortens the life of the lamp, and any decrease in current delivered to the lamp is followed by a loss in light on the screen.

ADJUSTMENT OF LAMP, MIRROR AND CONDENSER

A number of things must be done in order to place the lamp and mirror in the correct operating position. First, it is essential that the plane of the four parallel coils of the filament be perpendicular to the optical axis, which is an imaginary line drawn through the center of the screen, the projection lens, the aperture plate, the condenser, the lamp filament and the mirror. To obtain this condition the lamp should be put in the



FIGS. 5A AND 5B—FILAMENT ALONE AND FILAMENT WITH IMAGE BETWEEN COILS

relative position determined by the dimensions, then moved horizontally and vertically until the image of the filament coils can be seen very distinctly on a piece of white cardboard or paper held against the shutter wing in front of the projection lens (Fig. 5A). Then the mirror should be inserted, making the proper ad-

*This term is obtained by dividing the equivalent focus of the projection lens by the diameter of its free opening.

justments so that the mirrored image of the coils appears on the card as distinctly as possible in the spaces between the direct image of the coils, which is also on the card (Fig. 5B). Extreme care should be taken to avoid focusing the mirrored image over the direct image.

From the above discussion it will be noted that gas-filled lamps can be used for motion picture projection to the fullest advantage only when installed in connection with the proper mirrors, special condensing lens and good regulating equipment. The authors claim that, in general, wherever alternating-current arcs are at present in use the 20-amp. gas-filled lamp will, when properly installed, project pictures equal to or better than the arc lamp, with a considerable saving in operating cost. Furthermore, it can replace direct-current arcs rated up to 35 amp. and may be used for either motion picture or stereopticon projection work. A satisfactory picture can be projected with gas-filled lamps with a throw up to at least 90 ft. (27.4 m.). The permissible width of the picture to be projected will, of course, be affected by the character of the screen used. As previously mentioned, the type of screen and rating of the projection lamps used play an important part in obtaining the most satisfactory and largest picture which can be projected with this lamp.

In the past it has been the usual practice to endeavor to obtain the maximum screen illumination in projecting motion pictures, but the tendency at the present time is to decrease the screen illumination to a point where eye fatigue is entirely eliminated. The fatigue is caused by the sharp contrast between the white portion of the pictures and the darkness of the theater.

The intensity of the projected beam determines only the relative brightness of the picture. This may be understood when the different classes of screens are considered. The three common types of screens in use to-day are the matte screen, the metallic surface screen and the mirror screen with a ground surface. The percentage of illumination reflected by the above screen depends upon the type or surface of the screen.

The transmission efficiency of the various tinted and toned films in use to-day reduces to a certain degree the glare which would otherwise result from the high intensities if black and white films were used entirely. The tinted and toned films give a soft picture but absorb considerable light, about 20 per cent for light tinting and up to 80 per cent for some of the deep reds.

The screen illumination produced by gas-filled lamps is very uniform. There is neither travel of the light source nor source flicker, as in the case of the arc. The color values of the light from the incandescent lamp are desirable. Gas-filled lamps are entirely inclosed in metallic housings so that the heat is confined and the booths kept comparatively cool. Trouble with carbon dust deposits on the condensing lens is also eliminated. The reduction in operating expenses has been previously mentioned; the average renewal cost is slightly lower and the wattage required is much less. There is a further saving in the elimination of the warming-up process with its requirement of overload capacity. In fact, the simplicity of the gas-filled lamp is a feature which appeals to the operator. Once the lamp is placed in the projection machine, it requires no further attention from the operator until it burns out.

POTENTIAL GRADING ON SERIES LIGHTING CIRCUITS

Tests on Circuits in Chicago Park—Lighting System Shows Advantages of Operating Series Circuits Ungrounded

TESTS to determine the potential gradient and the location of the electrical center on a series street-lighting circuit with its last lamp 6 miles (9.6 km.) from the switchboard have been made by engineers of the electrical department of the Lincoln Park Commission under the direction of C. H. Shepherd, electrical engineer in charge. The circuit investigated consists of the following: One 37.5-kva., single-phase, 60-cycle, 12,000 2000 5000-volt Moloney transformer regulated by a 50-lamp Western Electric induction regulator rated at 7.5 amp. with the necessary "disconnects," oil-switch, instrument transformers, etc.; 104 gas-filled tungsten lamps rated at 400 cp., 15 amp.; two Kuhlman series-multiple 7.5 15-amp. transformers; 102 Westinghouse 7.5/15-amp. compensators; 63,360 ft. (about 19,500 m.) of No. 6 solid single-conductor paper-insulated lead-covered cable and 8440 ft. (about 2400 m.) of No. 6 solid single-conductor rubber-insulated triple-braided cable. The total length of the circuit was 71,800 ft. (about 21,900 m.). The inherent power factor of the compensator was 97.5 per cent, and the inherent efficiency of this unit was 93 per cent. The power factor and efficiency of the transformer were respectively 99.5 per cent and 94 per cent. The lamps are staggered on the cable, and both legs of the circuit are run in the same type of non-magnetic conduit.

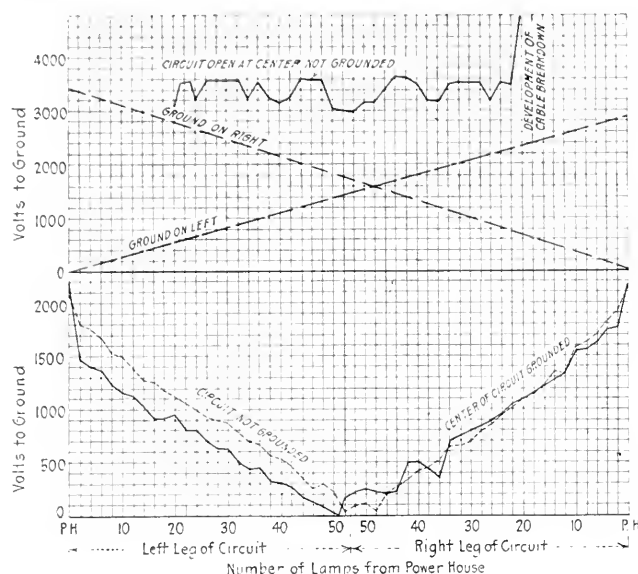
Tests were first made in the station by placing grounds at different points with the following results: With a ground at the station on the left leg of the circuit the pressure across the circuit was 2840 volts. With the ground at the station on the right leg of the circuit the pressure across the circuit was 3440 volts. The potential across the circuit with no ground on the circuit was 3540 volts; the potential to ground on the left leg of the circuit with no ground on the circuit was 1760 volts, and the potential to ground on the right leg of the circuit with no ground on the circuit was 1740 volts. These data showed that with one end of the circuit grounded at the power house the potential to ground was approximately 100 per cent greater at the other end than when the circuit is operated ungrounded.

Readings of potential from the line to ground were then taken at each lamp and showed that the potential gradually increased from 50 volts at the center of the circuit to 2160 volts to ground on the left and 2140 volts on the right leg of the circuit. These readings were taken without the line being grounded. The readings seemed to indicate that the end of the physical center of the circuit was also its electrical center. The circuit was then grounded at its physical center with a 15-amp. ammeter in the ground connection. The ammeter showed 2 amp. flowing to ground.

Readings taken from the line to ground with the line grounded showed that the electrical center of the circuit shifted and that the potential to ground increased at practically all points along the line. The potential across the circuit at the switchboard was 3500 volts, and the highest potential to ground proved to be at the switchboard, where the value was 2160

volts. At the lamp nearest the power house, which was practically 3 miles (6.4 km.) distant, the potential to ground was 1900 volts.

Curves plotted from the readings taken in these tests are shown in the accompanying curves. By reference thereto it will be seen that the potential gradient is almost uniform. This is due to the fact that there was during this test no ground on the circuit, allowing the neutral point to shift its position to compensate for changes in reactance on the circuit due to lamp burn-outs, regulator movements and electrostatic conditions throughout the entire length of the circuit. The curves also show that with the apparent electrical center of the circuit grounded the potential gradient is unbalanced and not uniform owing to the fact that the neutral point is fixed by being grounded. Flexibility



VOLTAGE FROM SERIES CIRCUIT TO GROUND AT DIFFERENT POINTS UNDER DIFFERENT CONDITIONS

and freedom of adjustment of the ungrounded circuit in response to changes of electrostatic and electromagnetic conditions are thereby seriously hampered. The unbalance due to action of the regulator and to changes in electrostatic capacity due to variations in the specific inductive capacity of the various dielectrics used along the circuit are plainly apparent.

It was expected that the introduction of a ground at the apparent neutral point where a potential of only 50 volts to ground existed would reduce the potential at that point to zero and accordingly reduce the potential to ground all along the circuit. The ground was not placed at the electrical center, however, because the reading at the supposed middle lamp rose from 50 volts to 199 volts, while the potential to ground at a lamp three posts from the supposed center fell to zero. The maximum potential to ground on the circuit with the ground connection in place rose by amounts varying from 20 to 60 volts at different points. This apparently showed that grounding at a definite point does not reduce the maximum potential to ground, owing possibly to electrostatic conditions.

Grounding does, however, make it easy to locate trouble. With a ground at the electrical center of the circuit, it is apparent that should another ground occur on the circuit the lamps between the two grounds will

not burn. It would be very easy, therefore, to locate the second or accidental ground which is the cause of the trouble.

In another test conducted in order to get an idea of the relative value of the induction and capacity of the circuit the cable was opened at its physical center. A potential reading at this point showed a value of 4500 volts across the ends of the circuit. Readings to ground were then taken at each lamp with the circuit open at its center. While this test was in progress trouble developed on the circuit at a little over 3000 volts, showing that at this low potential to ground a breakdown is possible under open-circuit conditions. The exact voltage conditions causing the trouble were not determined at the time because of lack of instruments. To all appearances, however, a great rise of pressure occurred, possibly due to a condition approximating resonance.

While further investigation of these conditions on the park circuits is still in progress, certain conclusions appear evident at present: First, better voltage conditions, less dielectric strain to ground and greater flexibility of adjustment appear when operating the circuit ungrounded. Second, grounding the apparent electrical center causes no apparent release of electrical strain nor decrease of pressure to ground, but on the contrary impairs the uniformity of the potential gradient and causes an unbalanced condition. Third, the advantage of quickly locating a ground made possible by a grounded electrical center is outweighed by the disadvantages caused by grounding, because a ground can always be placed on a circuit at the station quickly. Fourth, the practice of grounding one end of the circuit evidently makes a large increase in the dielectric strain to ground at the other end of the circuit. On the whole, it is thought the ungrounded circuit offers greater advantages than any system of straight grounding as far as operating conditions are concerned.

STATUS OF NON-WAR PROJECTS

War Industries Board, in the Public Interest, Will Discourage All Such Enterprises

Calling attention to the organization of new industrial corporations in different sections of the United States for non-war manufacturing and to the plans being considered by certain states, counties, cities and towns for construction and other improvements not contributing toward winning the war, the War Industries Board has passed a resolution indicating a firm attitude toward such projects. The resolution concludes:

That in the public interest all new undertakings not essential to and not contributing either directly or indirectly toward winning the war which involve the utilization of labor, material, and capital required in the production, supply or distribution of direct or indirect war needs will be discouraged, notwithstanding that they may be of local importance and of a character which should in normal times meet with every encouragement.

That in fairness to those interested therein notice is hereby given that this board will withhold from such projects priority assistance, without which new construction of the character mentioned will frequently be found impracticable, and that this notice shall be given wide publicity, that all parties interested in such undertakings may be fully apprised of the difficulties and delays to which they will be subjected and embark upon them at their peril.

New Bedford Company's 52,000-Kw. Station

Engineering Features of Steam Turbine Plant Which Supplies Textile District with Power and Is Interconnected with Other Utilities in Buzzards Bay and Cape Cod District

OWING to the difficulty of securing coal and the shortage of capital for industrial development, many textile plants in New England have been attracted to the use of central-station energy. In the Feb. 23 issue it was pointed out how these conditions have put an unusually heavy demand on the New Bedford Gas & Edison Light Company, which has endeavored to meet it by building a new 52,000-kw. steam station. Some of the factors which influenced the location and design of this plant were outlined, and engineering features of the coal-handling and boiler-room equipment were discussed. This article will dwell on the remaining mechanical and electrical features.

PIPING ARRANGEMENTS, COOLING OF BEARINGS AND BOILER-ROOM INSTRUMENTS

Two 5000-hp. feed-water heaters are in service, each having a capacity of 150,000 lb. (66,035 kg.) of water per hour, with a range of temperature of 40 deg. to 210 deg. Both heaters are mounted on a gallery between the boiler-room and turbine-room walls, one heater being of Hoppes and the other heater being of Cochran make. The feed-water piping is of semi-steel and is installed in duplicate to insure maximum flexibility of service. The feed-water supply is taken from a discharge well into which the condensate is delivered, make-up water coming from the city mains, which enter the premises by two lines, on opposite sides of the property, with cross-connections between. Copes feed-water regulators are installed.

A portion of the water from the hot well is circulated through the bearings of the turbo-generators instead of relying entirely upon city water for this service, thus securing a decided economy in the consumption of the latter. After leaving the bearings the water is returned to the hot well, from which it is drawn into the feed system of the boilers. The feed pumps consist of four Terry turbo-driven Janesville units, rated at 250, 350, 500 and 1000 gals. (946.3, 1324.8, 1892.6 and 3785.3 l.) per minute respectively. A service pump of the same make, driven by a 15-hp. Terry turbine and capable of handling salt water at the rate of 200 gal. (257 l.) per minute, is also provided for wetting down ashes and for lavatory supply. This, with a Westinghouse locomotive-type air compressor for general service, is installed in the basement of the boiler house near one of the forced-draft fans.

Each boiler is equipped with a General Electric steam-flow meter of indicating and recording type, two Ellison draft gages showing conditions above and below the fire, an indicating steam-pressure gage, Foxboro steam-pressure and temperature recorder, a Hohmann & Maurer indicating flue-gas thermometer, and two Bailey feed-water flow and temperature recorders, one for each heater. A Lee V-notch meter is provided for checking the feed-water measurements.

Each pair of boilers delivers steam into an overhead cross line which joins a horizontal main running par-

allel to the fire-wall separating the boiler and turbine rooms, the main being supported on saddles about 36 in. (91.4 cm.) above the boiler-room floor. Ample provision has been made for expansion loops. Long-radius curves are provided in the piping between boiler batteries and in the risers which take the steam from the main to the various generating units. Instead of running a separate steam line to each of the 4000-kw. units a single branch or steam bus is run from the main across the turbine room at right angles to the axes of these generating sets, a short connection being made with each.

This arrangement sectionalizes the turbine piping, giving the station one main live steam connection for each unit of 10,000 kw. rating or more, and avoiding

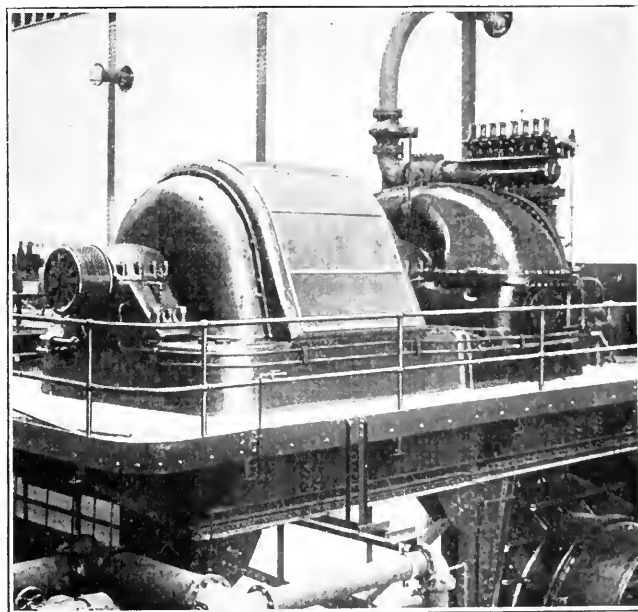


FIG. 1—CONDENSER AUXILIARIES ARE SITUATED IN PIT AT RIGHT

the use of a greater number of small-capacity steam leads into the turbine room. From the steam-supply standpoint, therefore, the three smaller turbines may be treated as a single unit, although each machine is provided with an individual stop valve between the branch main and the turbine inlet. Blind flanges are left in the cross steam connections leading to the main for the attachment of feeders from boilers on the opposite side of the firing aisle as the new boilers are added.

The condensing water tunnels run under the turbine-room basement, the intake, discharge and air duct leading to the generator being combined in a single reinforced-concrete structure. Cleaning of the screens is accomplished by raising sections out of the grooves in which they are seated, the lifting being accomplished by a 1-ton Sprague traveling electric hoist, which runs above the screen bulkhead. A small shelter is provided at one end of the crane runway to house the hoist when

it is not in service. The circulating water is drawn from suction wells built into the station foundations.

All of the condensers are of the surface type, the 10,000-kw. and 15,000-kw. units being Worthington equipment supported on springs with copper expansion joints. At the time when the 10,000-kw. turbo-generator was purchased it was felt that the Worthington

2800 r.p.m. on the auxiliary turbine to 460 r.p.m. at the pump shaft.

The condenser for the 10,000-kw. unit has a capacity for liquefying 130,000 lb. (59 kg.) of steam per hour, the capacity of the circulating pump being 19,000 gal. (71,921 l.) per minute against a head of 24 ft. (7.3 m.). Provision is made for 15 per cent speed regulation in

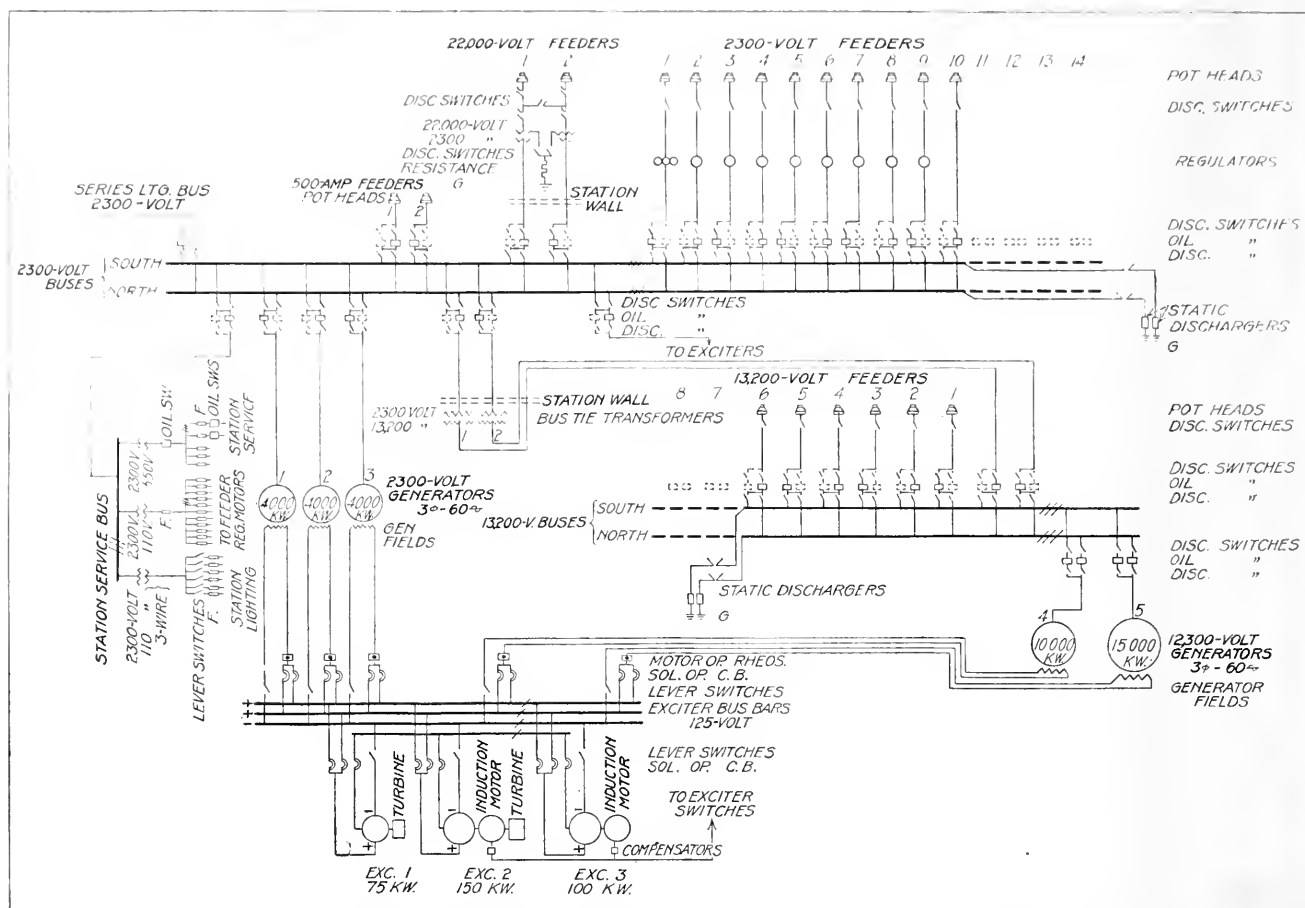


FIG. 2—LARGE GENERATORS ENERGIZE 13,200-VOLT BUS AND SMALLER GENERATORS FEED 2300-VOLT BUS, THE TWO BEING CONNECTED BY BUS-TIE TRANSFORMERS

hydraulic air pump was in the development stage, so a Laidlaw-Dunn-Gordon reciprocating dry-air pump was provided for this unit and the first 15,000-kw. set. The second 15,000-kw. unit will be equipped with a Worthington hydraulic air pump of the centrifugal type, however, as will also one 4000-kw. unit. These pumps are much more compact than the reciprocating type and permit the use of steam-turbine drive, which eliminates oil in the exhaust steam. Maintenance is reduced as compared with a reciprocating pump, and the number of working parts is less. While nearly twice as much steam is required as with a reciprocating pump, the utilization of the exhaust with an efficiency of about 80 per cent makes the actual consumption of steam of minor importance.

Two of the 4000-kw. turbines are equipped with Alberger surface condensing sets transferred from the old station. All of the circulating pumps are driven by Terry turbines. Worthington hot-well pumps are provided with the later units. By the use of Falk reduction gears for driving the centrifugal circulating pumps higher turbine speeds are obtainable, resulting in approximately 50 per cent increased auxiliary steam economy. A representative speed reduction is from

this pump. The 15,000-kw. units are equipped with circulating pumps having a rating of 25,000 gal. (94,663 l.) per minute each. Each condenser has a capacity of 190,000 gal. (719,213 l.) per hour. Each of the smaller turbines requires about 8400 gal. (3179.7 l.) of circulating water per minute.

Each main generating set is equipped with the following instruments: Hohmann & Maurer mercury column vacuum gage, Ashcroft steam-pressure indicator and vacuum indicator, first-stage steam-pressure indicator and a General Electric speed indicator reading in terms of frequency. A 110-volt lamp-signal system is in use at the various units and is connected with the switchboard.

GENERATING UNITS

All the generating units are General Electric three-phase alternators driven by Curtis horizontal turbines. The three 4000-kw. units are wound for 2300 volts, the larger generators for 13,200 volts. There are two General Electric-Terry exciters of the combination motor and turbine-driven type, rated at 150 kw. and 200 kw.; one 100-kw. motor-driven exciter and one 75-kw. turbo-exciter, all wound for 125 volts. It is planned to stand-

ardize the use of combination exciters. A spray air-washer installation with a capacity of 50,000 cu. ft. (1400 cu. m.) of air per minute is installed to treat the ventilating air. Another set will be provided shortly.

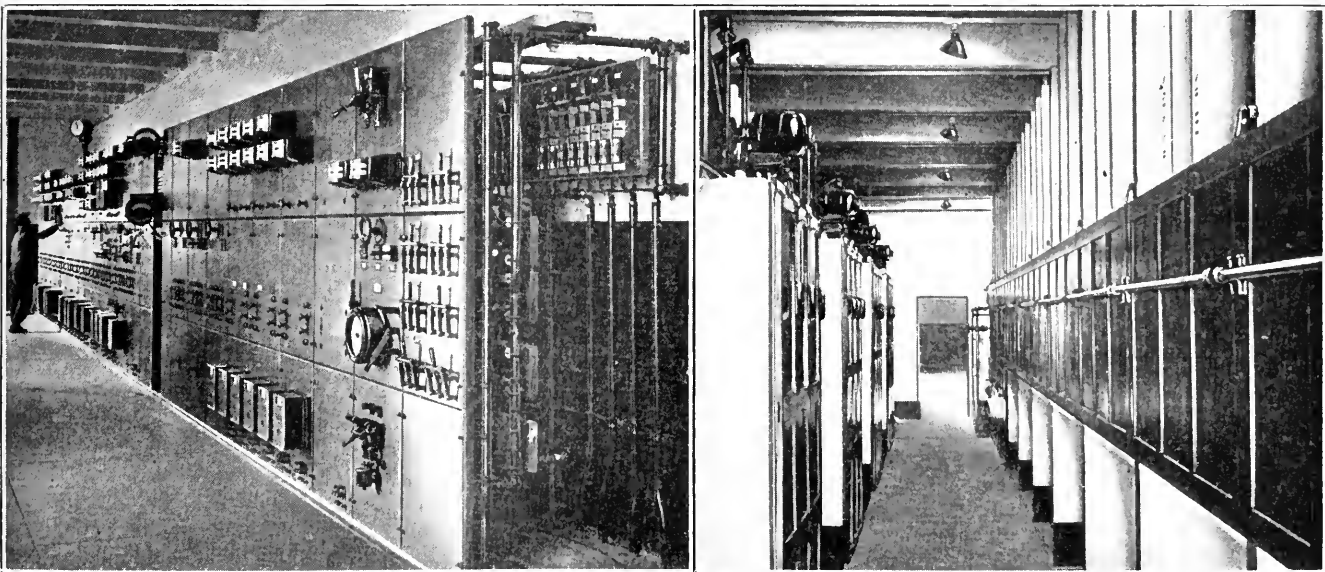
The turbine room is served by a 50-ton Northern four-motor electric crane which has a 5-ton auxiliary hoist. The bridge speed is 175 ft. (53.3 m.) per minute, the trolley travel 100 ft. (30.4 m.) per minute, the main hoisting speed 6 ft. (1.8 m.) per minute, and the auxiliary hoisting speed 30 ft. (9.1 m.) per minute. The crane serves all the larger auxiliaries in the turbine room. A standard-gage railroad track enters the room on the ground level to facilitate handling heavy machinery while another track entering the room on the south side permits moving transformers into the building when they have to be repaired or inspected.

The electrical bay of the station is four stories high, the operating switchboard being on the third floor and completely shut off from the turbine room by a fire wall. The general arrangement of electrical layout was shown in Fig. 1 of the first installment of this article. The electrical bay provides for more feeders, switches and other electrical apparatus than the hydro-electric plant of the Mississippi River Power Company at Keokuk, Iowa, where the installed capacity in generators is nearly three times that of the New Bedford installation now under contract. This is due to the difference in service requirements.

Special effort has been made in this plant to isolate each switch and bus section from others. Every oil switch is housed in a reinforced-concrete compartment of sufficient strength to localize the effects of an explosion in the switch to that particular cell. The street-lighting equipment is also isolated; voltage regulators on the commercial lighting feeders are separately located and confined, and the 2300-volt and 13,200-volt

room enabled short runs of cable to be used between the exciters and the exciter buses, and from the latter to the generator fields. On the second floor are the switches and buses of the 13,200-volt system. The third floor contains the main operating switchboard, street-lighting switchboard and rectifier sets and local testing apparatus, and the fourth floor is devoted to 2300-volt buses and oil switches. Feeder regulators are installed on the third floor, in fireproof compartments separated from the main switchboard. These are conveniently situated where they can be connected with the 2300-volt system, the cables being carried down the north wall of the electrical bay from the bus and oil switch compartments to the underground conduit system.

Investment in duplicate selector-type oil switches has been avoided for the time being by the use of cross-connecting leads between each oil switch installed for feeder service and the appropriate terminals of the disconnecting switches placed between the oil switch and the buses. The cells are installed in the switch structure so that ultimately each feeder switch can be connected by remote control with either bus. For the present, however, only one oil switch is provided per feeder, selection of buses being made by knife switches. No feeder can be connected to a bus when the oil switch is open, and each feeder can be isolated from both buses by opening the oil break switch. The same arrangement prevails in connection with the oil switches used between the bus-tie transformers and the 2300-volt and 13,200-volt buses. The bus-tie transformers, of which there are six, are 1500-kva. General Electric oil-cooled transformers supported on rollers outside the station, as illustrated. The bus structure is supported on steel framework, the cables being carried thereto from the corresponding buses in the electrical bay through ducts and vertical concrete structures shown in



FIGS. 3 AND 4—MAIN SWITCHBOARD AND VIEW OF OIL-SWITCH AND BUSBAR COMPARTMENTS

bus systems are entirely separated. Furthermore, each of these systems has duplicate buses which are separated from each other by vertical fire walls.

The exciter switchboard and field rheostats are installed on the south side of the station just above the street floor and under the offices of the chief engineer. Installation of this apparatus outside the switchboard

the illustration. The latter are to prevent persons coming in contact with the high-tension cables where they rise to the outdoor bus structure.

The 22,000-volt line radiating from the station is fed through six 750-kw. General Electric oil-cooled transformers installed in the same row as the bus-tie sets. They are connected with the 2300-volt busbars

on the low-tension side. This line is operated, Y-connected, with the neutral grounded through a resistance installed in a fireproof house at the end of the transformer banks.

The main switchboard, containing twenty-seven panels, is provided with remote-control connections to all oil switches, control energy being supplied by a sixty-cell battery furnished by the Electric Storage Battery Company. General Electric type H-3 motor-operated oil switches are installed in connection with both 2300-volt and 13,200-volt buses. The disconnecting switches are arranged for locking in position. All generating units, bus-tie lines, feeders, exciters and trans-

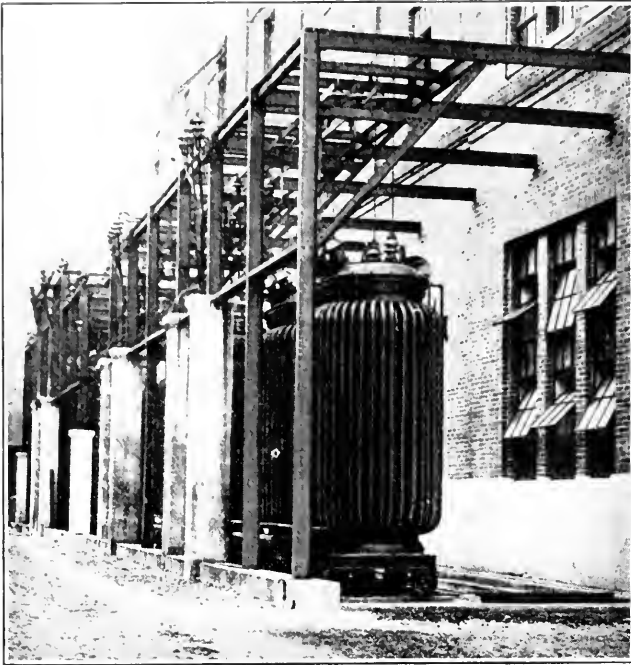


FIG. 5—BUS-TIE TRANSFORMERS WHICH ARE CONNECTED WITH BUSBARS INSIDE STATION BY CABLES LEADING DOWN CONCRETE DUCTS

formers for outside service are controlled from the main board. Dummy buses are not installed, they being considered unnecessary with this arrangement of panels and controls. The central location of the main board resulted in a saving of considerable control wire, with switch structures above and below. The control battery is charged by a 5-kw. General Electric motor-generator set in the switchboard room. From this room 22,000-volt open-air switches on the line side of the transformers, serving Lakeville and the territory at the east of New Bedford, may be opened by mechanical handling of rods and levers carried down the side of the building to the transformer bus structure.

W. H. Snow is manager, D. W. Beaman general superintendent, and R. H. Barber chief engineer of the New Bedford company.

Win-the-War Spirit in Business Letters

"See that a win-the-war spirit gets into your business letters" is the slogan of a movement launched by the Department of Commerce to remind business men that the every-day business letter is a most effective instrument for creating confidence in the government's war policies and inspiring others.

COLLECTING STATISTICS FROM CUSTOMERS' ACCOUNTS

Use of Tabulating Machines for Quickly Determining Vital Data Regarding Growth, Income, Rates, Etc.

BY G. R. KENNY

San Joaquin Light & Power Corporation, Fresno, Cal.

SINCE April, 1917, the San Joaquin Light & Power Corporation has used the Hollerith tabulating machine to compile statistics on accounts of light and power consumers. This company and the Midland Counties Public Service Corporation, with headquarters at Fresno, supply electric energy to consumers in five counties in central California. The population of the territory served is approximately 200,000. In November, 1917, the two companies were serving 26,657 lighting consumers and 3724 power consumers. The total connected load in power was 58,717 hp. Several large consumers who purchase power at wholesale rates for large industries, or for redistribution, are considered as power consumers, and the capacity of their transformers is included in the connected load above. The main transmission is at 60,000 volts and 30,000 volts, with distribution from thirty-one substations. During the year ended with November, 1917, 119,576,947 kw.-hr. were distributed from the substations.

Power consumers are served at uniform non-discriminatory rates, the principal types in use being the "block," "demand and energy" and the "Wright" forms of schedules. Flat rates per horsepower of demand are in use for irrigation pumping business. A straight kilowatt-hour rate is used for some of the oil-well pumping. Demand indicators are used to determine the demands in most cases. "Block" and "demand and energy" forms of rates are in use for lighting service.

Light and power consumers' accounts are kept in separate ledgers in each of the thirteen districts served. For the city and town service the consumers' ledger sheets are arranged in street-number order, the name being changed in case one consumer moves out and another moves in. In case a consumer moves out and it is probable that another will move in within a reasonable time, the meter is sealed and left on the premises. The ledger sheet is removed from the ledger where buildings are changed or the street-number order is otherwise upset. Each ledger sheet is arranged to carry a consumer's account for a period of two years and also for recording meter data and other necessary information.

One Hollerith sorting machine and one five-bank tabulator are installed in the Fresno office, and a key punch is supplied to the consumers' department in each district. The cards are punched by the consumers' department after the first of each month with the data for the previous month. One person can punch from 800 to 1200 cards per day. This work is done by regular employees in the consumers' departments.

When the system was installed each ledger sheet in each district was "coded" with the code numbers applying to it. Any changes in code are made on the ledger sheets when the information which makes the change necessary is recorded on the sheets.

A code which gives the size and voltage of single-

phase and polyphase meters, and the constant in use, if any, is entered on the ledger sheet, and the number appearing on each sheet is punched in the meter data column of the card for that consumer. Nine hundred and ninety-nine combinations are possible in this code, but only about 300 are in use. The even numbers are used for regular installations, and the next odd number if a demand indicator is installed. As an example No. 2 indicates a 5-amp., 110-volt watt-hour meter, but if a demand indicator were installed No. 3 would be entered on the ledger sheet. To each account or ledger sheet a number is given, and the "service" is divided under light and power.

The principal codes provided outside of the meter data are the "occupied as," under which the business is divided into fifty-one classifications, as "residences," "drug stores," "saloons," "restaurants," "agricultural consumers," "oil production consumers," etc., and the "rate schedule code," under which each rate schedule is given a specific number. These code numbers are entered on the consumers' ledger sheet, and do not vary unless there is some change in the installation or the business.

A "new or old" code is provided to show present consumers, business disconnected during the month, and new business connected. The "minimum" code covers the several classes of minimums in use by the company, and is used only when a consumer is billed on a minimum. The maximum demand, consumption and amount of bill are entered each month on the ledger sheet, but the connected load is changed only when a change is made. The information regarding connected load in power is accurate, but it is very difficult to keep accurate record of the connected load of lighting consumers, owing to so many changes being made without the company being notified.

METHODS OF COLLECTING AND TABULATING INFORMATION

When the system was put in operation all ledger sheets were "coded." The code number is changed if changes are necessary, and all new ledger sheets are "coded" when placed in the ledger. The key-punch operator punches the month, year and service automatically, and finds the account number, district number, "occupied as," rate schedule and meter data codes, and connected load on the upper part of the ledger sheet. The maximum demand, consumption, amount of bill, and the new or old minimum codings, are taken from the monthly entry in the ledger. One card is punched for each sheet, a special "new or old" code number being provided for dead sheets. The codes are then checked and sent to the general office. The total earnings are taken directly from the ledgers, proved, and reported in totals in advance of the cards being punched. As soon as the cards arrive at the general office they are run through the tabulating machine and the total earnings taken. This must agree with the earnings already reported. If not, the adding machine tapes are sent in and the cards checked against them. If the earnings in dollars and cents agree it is assumed that all other data contained on the cards are correct. The cards are then run through the sorter to eliminate dead accounts, company business, cut-outs and adjustments. The remaining cards represent active consumers for the month. The eliminated cards are tabulated for all information contained on them. The

active cards are run through the sorter and segregated according to rate schedules, then put through the tabulator, which counts the cards and sums up the connected load, maximum demand, consumption and amount of bill. This information is recorded by rate schedule and by districts by the operator and sent to the statistical department, where the information is entered in special books provided for that purpose, and statements showing the monthly system totals are made up. This information is entered so that annual totals can be taken by adding across the sheets. In the same manner the "occupied as," meter data, and new or old reports, are then made.

Statements of number of consumers, consumption, connected load, maximum demands, earnings and average earnings per consumer, per kilowatt hour and per horsepower, for power, are prepared by rate schedules and by classification of business under the "occupied as" code each month. A statement of earnings by districts, and the number of light and power consumers added or lost by districts, is prepared and a "meter report" made up.

USE OF INFORMATION

The information is used to show the income from various classes of business, in studying the past growth of the business and estimating future growth and requirements, in determining which classes of business are most profitable, in studying the effect of rates, and in making new rates and changing existing schedules. As an example of the use in "rate making," the income from a given block rate may be accurately predetermined if the consumption in each block is known. This information can be quickly assembled by sorting the cards according to consumption and tabulating by kilowatt-hours used, either by all the amounts used, from zero to the maximum, or by the blocks which are to be applied. Before this system was installed it became necessary to assemble this information, but it required three months for two men to tabulate the information for 3000 consumers over a period of twelve months. A sample run indicates that this information can now be assembled for a twelve-month period on 26,000 lighting consumers in about six days.

About forty days' total time is necessary to punch and check all cards. One person operates the machines and one tabulates the information and makes the regular statements for 30,000 consumers. Ordinarily, but two or three days' time is required to punch and check the cards in each district, nine days being necessary for the largest district with over 10,000 cards. At the present time it takes about twenty-five days' time for the Hollerith machine operator to run the cards, and twenty days' time for a clerk to assemble the information and make the statements each month. The monthly reports are all prepared and out by the end of the following month. The work has been slow on account of many changes and lack of help in the districts. Under normal conditions the districts would be able to punch their cards, and the information could be tabulated and each month's statements made and out by the 20th of the following month. It is the intention to extend this scheme to give similar information for about 7000 gas consumers and 9000 water consumers. All of this work can be handled by the present machine and the present force.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

WOOD SHAVINGS USED FOR FUEL IN A POWER PLANT

Plant Shutdown Averted by Their Use During Coal Shortage—Description of Conveyor Utilized for Handling Shavings

The Missouri Public Utilities Company of Poplar Bluff, Mo., is using wood shavings from a nearby wagon-spoke factory for fuel. As the factory is about 2000 ft. (609 m.) from the power house, it was at first considered advisable to convey the shavings to the plant by means of a pipe line equipped with blowers. It was found impossible to do this on account of the character of the shavings, which were of the long hard wood type. The shavings therefore have to be hauled to the plant by wagons and are dumped into a storage shed. A flight conveyor carries the shavings to the boiler room and drops them into conveyor pipes which lead to the furnaces. Shavings swept past the pipe openings are caught by a chute and dropped into a cage mounted on a wheelbarrow. They are then wheeled back to the storage shed at frequent intervals.

In order to fire the shavings in combination with coal the furnaces, which formerly burned coal alone, had to be redesigned. It was decided to extend the furnace fronts to give a Dutch oven effect. When the furnace fronts were extended it was possible for the conveyor tubes to drop the shavings directly over the middle of the fires. It has been observed that the efficiency with shavings is greater than that with coal alone because coal cannot be thrown far enough back into the furnace to give the best results. Under the present method of operation, coal is shoveled into the furnace in conjunction with the shavings, as the supply of shavings varies with the output of the wagon-spoke factory. During the recent severe winter it was impossible to obtain coal, and had it not been for the availability of the shavings the plant would have been compelled to shut down for lack of fuel.

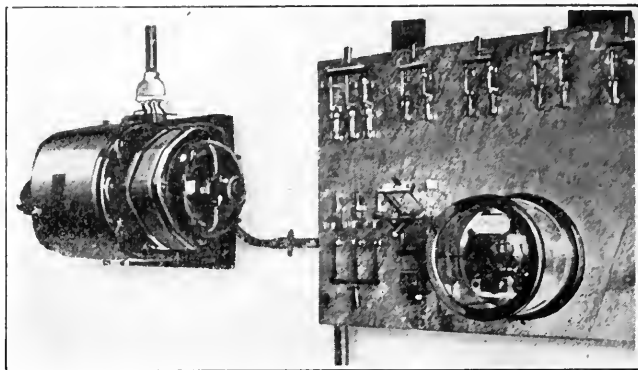
Liberty Calls—Lend to Protect It

MOUNTING MOTOR-GENERATOR SET ON THE STATION WALL

Simple Arrangement Afforded and Less Space Occupied by This Unusual Installation of Battery-Charging Outfit

In a New England hydroelectric plant space limitations made it desirable to mount a small motor generator set, used for storage battery charging, off the floor and at low initial cost. Accordingly the machine was attached to the station wall, as illustrated, on a vertical base bolted through to the outside of the building. With all wiring carried in conduit and the controlling switch, relay and watt hour meter for this service

mounted on a marble panel about 3 ft. (0.9 m.) from the motor-generator, an unusually simple arrangement, free from danger of injury to circuits, carried well above the flood line of the stream and affording a clear floor for station cleaning, is obtained. The front



PUTTING MOTOR-GENERATOR SET OUT OF MOPPING ZONE

of the unit does not extend beyond the clearance plane of the switchboard equipment on the front of the panel, and thus the set forms no material obstruction to movement in the operating room.

Your Money Helps to Save Liberty

FIVE-WIRE SUPPLY FOR BIG ELECTRIC FURNACES

Distribution of Heat in Large Furnaces Can Be Effected by Making Use of Four Electrodes and a Neutral

In a paper entitled "Electric Steel-Refining Furnaces" presented before the Faraday Society recently J. Bibby said that while two electrodes may be sufficient for small furnaces up to 5 tons capacity, it is not advisable to concentrate the heating zone in larger furnaces in two places. Another reason why more than two electrodes are required in large furnaces is because the electrodes at present available cannot carry more than 10,000 amp. each.

Whatever system is adopted it must be such that when equal currents are flowing through each of the arcs, then equal currents must be taken from each of three high-tension mains, and each of these three primary currents must be practically in phase with its voltage in order to secure a high power factor. Further, for metallurgical reasons it is considered desirable that a certain amount of current should flow vertically through the hearth to a fifth fixed electrode beneath it. Therefore some system is required which will impress an equal voltage between each upper electrode and the hearth electrode and give four equal heating zones.

The condition is met if four equal phases can be obtained on the furnace side of the transformers—one for each electrode and a common return to a neutral electrode beneath the hearth. In short, a four-phase, five-wire system is required. This can be obtained by having two sets of two phases working in parallel, but this system has serious electrical objections. The problem has been satisfactorily solved by using a four-phase arrangement, which involves three single-phase transformers. Two of the transformers have their terminals connected separately to the four upper electrodes. A tap is taken from the middle of the third or teaser transformer to the hearth electrode, and the terminals of the teaser transformer are connected to an intermediate tap on the main transformers. A closed system is thus obtained when arcs are struck between the four upper electrodes and the bath of metal.

This system gives equal voltages in the arcs and therefore equal heating zones. When the electrodes are regulated for equal currents equal currents are taken from the three primary mains. The average power factor of the system on a non-inductive load is unity. Further advantages of the system are that when the furnace is under poor regulation the primary current remains tolerably balanced with a high power factor.

First, Second, Third Call—Liberty

MILL REFUSE AND POWDERED COAL FOR POWER GENERATION

Comparative Values of Coal, Oil and Mill Refuse, with Estimates of the Cost of Using Mill Refuse and Powdered Coal

"If the war continues it will probably be only a matter of time before fuel oil will not be available for power purposes where other fuel may be substituted," wrote J. D. Ross, superintendent of lighting of the Seattle Municipal Company recently. "The federal Fuel Administration is already inquiring into the possibilities of a change in fuel for our steam plant. A supply of coal suitable for use on stokers does not appear to be available at a price that can be considered for power purposes. The fuel problem, therefore, narrows down to the use of powdered coal, which makes it possible to use lower-grade coals. Mill refuse is at present largely an economic waste, and its use would therefore be considered as especially serving the national cause at this time."

Several alternatives present themselves: (1) To buy powdered coal; (2) to buy screenings and have the city pulverize them; (3) to buy mill refuse. Since the engineering problems in any case can be solved, the best procedure is determined largely by the cost of fuel delivered to the furnaces. This makes each fuel directly comparable with oil as now used.

Based on efficiencies obtainable in commercial practice (70 per cent) under fair average load condition, the following comparison of heating values can be made for the different fuel mentioned:

Fuel	Heat Convertible into Steam (B.t.u.)
1 unit of mill refuse.....	8,730,000
1 bbl. oil.....	4,351,200
1 ton coal (10,500 B.t.u.).....	14,700,000
1 ton coal (12,000 B.t.u.).....	18,800,000

Therefore the equivalent prices delivered to the fur-

naces will be in the following ratios: 1 bbl. oil : 1 unit mill refuse : 1 ton coal (10,500) : 1 ton coal (12,000) as 1 : 2 : 3.36 : 3.86.

Based on the above commercial efficiencies and allowing 20 lb. (9 kg.) of steam per kilowatt-hour, the following comparison can be made:

Fuel	Electrical Equivalent (Kw.hr.)
1 bbl. oil	225
1 unit mill refuse.....	450
1 ton powdered coal (10,500).....	756
1 ton powdered coal (12,000).....	870

The overhead charges on the equipment necessary for the use of various fuel have a marked influence on the economy of any fuel, especially when used for an auxiliary or standby plant. Their effect is less marked when the fuel is used for a strictly generating plant. The low overhead for oil equipment makes this fuel very desirable for an auxiliary plant, but the high prices now prevailing make it prohibitive for generating purposes. The high overhead for powdered coal equipment makes this fuel unsuited for small plants or for large plants having a small station factor. The comparatively lower investment for mill refuse than for powdered coal operates in favor of mill refuse for the lower loads, provided always that there is an ample, dependable supply of fuel.

COST OF USING MILL REFUSE

Estimate of extra equipment necessary when using mill refuse*:

Barges (eight), at \$6,000	\$48,000
Receiving dock	20,000
Conveying machinery	5,000
Storage bins, chutes, etc., in building.....	10,000
Remodeling eight furnaces	25,000
Incidentals	12,000

Total\$120,000

Estimated total cost per unit of fuel\$1.89
Fuel cost per kilowatt-hour (\$1.89 ÷ 450)..... 0.0042

COST OF USING POWDERED COAL

Estimated cost of powdered-coal equipment for 20,000-kw. plant\$200,000

Estimated cost per ton of passing coal through pulverizing plant, based on interest at 6 per cent, writing off investment in ten years and different continuous load:

Kw.		Kw.	
20,000	\$0.40	7,500	\$0.87
17,500	0.445	6,000	1.06
15,000	0.50	5,000	1.25
12,500	0.63	4,000	1.50
10,000	0.69	3,000	2.00

In the Seattle steam plant the output for 1917 was 12,000,000 kw.-hr., while in 1918 it was 24,000,000 kw.-hr. This output represents less than 3000 kw. continuous load; hence the cost for pulverizing would run high. For such a load 110,000 bbl. oil, 32,800 tons of coal (10,000 B.t.u.) or 55,000 units of mill refuse (8,730,000 effective B.t.u.) would be required.

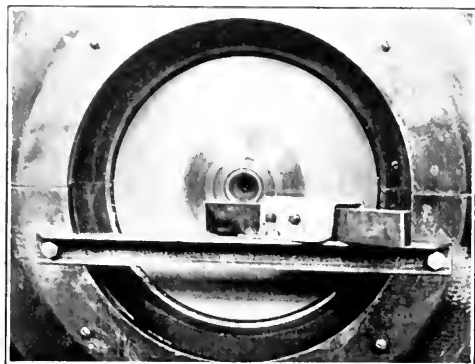
In view of the present fuel situation and as a result of the analysis he has made of the economy of different fuels, Mr. Ross has recommended that bids be called to determine the price of the following in amounts of 45,000 and 75,000 units per year: Mill refuse f.o.b. mill and steam plant; screenings f.o.b. steam plant and mine.

*Includes f.o.b. mill, towing round trip, interest at 6 per cent, depreciation (writing off investment three and a half years), extra labor above oil (\$6,000).

LEAKAGE CURRENT CAUSED PITTING OF BEARINGS

Trouble Is Remedied by Attaching Brush to Bearing
at End of Shaft to Provide Short Path
to Ground

Owing to the presence of grounds and also because of weak insulation of some of the armature coils electrical leakage occurred on some of the motor-generators used in a generating plant serving a railway system. The leakage current transversed a path along the shaft



BRUSH FOR COLLECTING LEAKAGE CURRENT FROM
GENERATING SHAFT

and through the bearings, causing pitting or disintegration of the journal surfaces. As a remedy there was assembled and affixed to the end bearing a $\frac{3}{4}$ -in. by $1\frac{1}{4}$ -in. (19-mm. by 31.7-mm.) copper brush which afforded a low-resistance connection between the shaft and ground. It was made adjustable so as to provide for wear. After three years of use no pitting has developed.

Principal Safe, Interest Sure

INSTALLING APPARATUS TO PROTECT DAM FROM HEAVY ICE

Utilization of a 5-Hp. Air Compressor Prevents Ice
Formation During Winter Months, Releasing
Five or Six Men for Other Work

Some hydroelectric companies operating in a cold climate have found it advisable to cut ice away from spillways and Tainter gates during the winter because the expansion and contraction of the ice causes dangerous pressures on the dams. Others believe that the condition brought about by the rise and fall of the water level causes more danger.

One company with several dams in the Northwest looks upon the cost of keeping its spillways clear of ice as an investment to insure against breakdown. Ordinarily it requires the work of six or seven men to keep a 2-ft. (0.6-m.) space clear along one of this company's 750-ft. (228-m.) spillways. It is difficult to obtain men to do this work in severe weather, however, owing to the exposure they must undergo. To obviate this difficulty the company last winter rigged up an "agitating" apparatus to prevent the water freezing so quickly. The apparatus consisted of a 5-hp. motor driving an air compressor delivering air to a pipe laid about 2 ft. (9.6 m.) under the water, parallel to and just back of the spillway. At intervals of 18 in. (45

cm.) this pipe was punctured with needle holes through which the compressed air escaped into the water. The pipe was supported by brackets placed on the spillway and on the ice that was left intact. After the ice had once been cut clear of the spillway so as to permit this pipe to be installed it was easier to maintain the 2 ft. (0.6 m.) of open water. One man and the 5-hp. motor were all that was necessary under ordinary weather conditions. When the thermometer registered exceptionally low additional men were added to the force. The scheme resulted in minimizing the expense and remedied the labor problem.

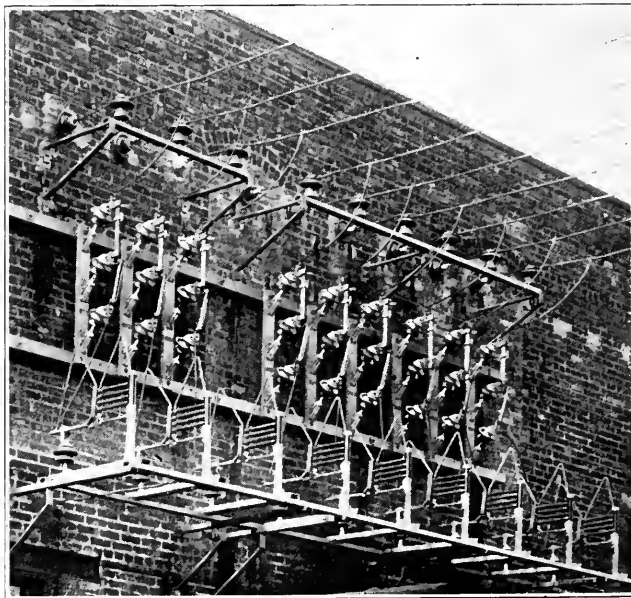
Make the Total Large—Lend Now

MOUNTING THAT MAKES ARRESTERS CONVENIENT

Support of Protective Apparatus on Steel Structure
Attached to Building Wall Proves
Excellent Method

Because of lack of space inside one of its 12,000/2300-volt substations the Sanitary District of Chicago employed the arrangement illustrated herewith to support its protective apparatus and the incoming lines. This construction was considered preferable to some other alternatives because more steel would have been required if a roof structure had been employed, while at least two poles would have been necessary if a separate outdoor structure had been erected. This location of the apparatus is also attractive because it is accessible from a roof just below and still does not present a hazard to life.

The apparatus consists of Schweitzer-Conrad high-



PROTECTIVE APPARATUS READILY ACCESSIBLE FROM ROOF
BELOW

speed sphere-gap graded-resistance lightning arresters protecting three 12,000-volt, three-phase circuits. Each phase is equipped with a disconnecting switch and limit fuse, and the disconnecting switches are so connected that the arresters can be readily isolated for inspection and adjustment.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

USING CAMOUFLAGE IN HOUSE-WIRING CAMPAIGN

Company Advertises House-Wiring with Expectation of Accomplishing Many Things in Addition to Securing New Residential Contracts

A large central-station company in the Middle West is busily engaged in conducting a strong house-wiring advertising campaign. "How do you figure you can afford to make a bid for residential business now?" the sales manager was asked. He replied: "We have a great many prospective customers that we could reach by simply running a service. That would cost us only about \$6 per customer on the average, and we can afford to take on that class of business. The business of that sort which we will get will be the direct result of our campaign of advertising and intensive solicitation. In addition we will receive some indirect benefits. In the first place, there are about 4000 houses in this city that are wired but not connected. Some of them can be 'hooked up' in a campaign of this kind. Besides this, the curtailment of lighting in signs, street lighting, in windows and in houses has cut down the company's annual revenue at a rate that would amount to \$150,000 a year. If the company comes out as it now is and asks for new customers, the public and the municipality will soon begin to appreciate that the patriotic necessity for curtailment is apparently not so great as they imagined. So the house-wiring campaign may bring back to normal consumption some of the company's good sign and window lighting customers. Since the business of this class is largely the company's net, it is important that it be enticed back to normal as soon as possible."

Liberty Is in Peril—Will You Lend?

FINANCING NEW TIE LINES DESPITE WAR-TIME DEMANDS

Method That Is Meeting with Approval of Both Small and Large Companies in the Northwest When Coal Costs Are High

Under present conditions, with coal at a high level of prices and with winter-time deliveries of fuel very uncertain, many a company operating a small steam plant naturally feels that it would like to tie in with a neighboring large transmission company if possible. By so doing it not only shifts the generating responsibility to another company which may have some water power, but it also may reduce somewhat its production cost and put off into the far future any possibility of expenditures for plant replacements. From the small plant's viewpoint interconnection at the present time has many advantages.

When the tentative proposal to the transmission company is made, however, the difficulty of financing the

tie line between the present transmission system and the small steam plant looms large. The large company is having trouble taking care of the financing of necessary war business and its own community. The transmission company would be glad to furnish the service at 2.5 cents to 3 cents per kilowatt-hour, however, if the financial difficulty were not in the way.

In the Northwest a number of companies are getting around their troubles in a common-sense sort of way. The small company with the steam plant is financing the line and in turn is selling it to the transmission company, taking in payment the stock of the transmission company. This plan works well for several reasons. First, the small company can easily raise the money for the line in its own little community because its present security holders and the other investors in its town are in businesses that are not greatly affected by war. They are accustomed to putting their income in banks or putting it back into their local business and are willing to divert it to a local utility enterprise at a fair price. So the small company can raise the money. Second, it appears a good stroke of business to take the large company's stock in payment for the line because they get it at a price to yield around 8 per cent and are likely to come out handsomely or any advance in market value. This method is satisfactory to the large company particularly because it relieves it from the financial strain. It is usual practice for the small company to draw the specifications for the line it expects to build and then submit them to the engineers of the larger company for such revision as may be thought necessary to make them conform fairly well with the transmission company's standards of construction. The small company then does the actual building of the line. This has been found wise under present circumstances, for the small company can usually build the line at a great deal lower cost than the transmission company. At first it may seem paradoxical that the small company with less experience can build cheaper than a large concern with transmission specialists. It is true nevertheless. The difference in cost comes largely in the labor-camp and transportation expense. The small company can pick up labor in its own easy market and usually makes no special provision for housing and feeding the men. They know the community and shift for themselves. Farmers with teams do the hauling during lulls in farm work, and this keeps down transportation expense.

This plan of providing service has, therefore, many advantages to both companies. It is being used to the mutual advantage of concerns in the Middle West and Northwest and is at the same time making for increased capacity in the small towns and for conservation of the nation's fuel.

Safest on Earth—Liberty Bonds

A NEW "THRIFT CARD"

Specially Designed for Use by New Jersey Company
at Cooking Demonstration

The card here illustrated was prepared for the Public Service Electric Company, Newark, N. J., by S. H. Alexander, who is in charge of displays at the com-

Public Service Gas Company
Public Service Electric Company

thrift

If you know a way
to save time -

If you know a way
to save labor -

If you know a way
to save fuel -

then you know how to
help your government.

Knowing how is not enough -
you must do it

S. H. Alexander

pany's various offices, and was used in connection with a cooking demonstration which was given at one of the offices.

Our Boys Go—Shall Money Fail?

A DEPARTMENT TO LOOK AFTER THE TAX EXPENSE

Well-Organized Bureau Devoted to This Work Saves
Central-Station Company Considerable Money
by Its Endeavors

A Middle Western central-station company which has a department to look after all questions of taxation has found that this method of operation assists in preventing local taxing bodies from discriminating against it unjustly. This company's real estate and personal property taxes in recent years have increased from \$220,000 to \$240,000, but the ratio of its taxes to gross earnings decreased in the same period from 4.2 per cent to 3.9 per cent, relatively 7.1 per cent. The tax department of the company feels that this is a good record in view of the ratio of taxes to gross earnings shown by other companies in similar operating circumstances in the United States.

In making recommendations for continued activities of his department the taxation authority of this company recently said it did not appear reasonable to expect a decrease in valuation on the company's property in view of the rapid growth it was enjoying. He expressed the thought that the best policy would be to

maintain cordial relations with all local taxing authorities and to try to keep valuations at their present level. He suggested that one way to effect a reduction in the amount of taxes paid would be to reduce the number of subsidiary companies and thus to eliminate the duplicate payment of tax under the federal law on income passing from one company to another.

DATA ON THE OPERATION OF ELECTRIC FURNACES

Electrical and Tonnage Ratings of Various Sizes of
the Resistance Type—Some Types Pay for
Themselves Quickly

Thaddeus Bailey, president of the Electric Furnace Company, in a paper presented before the Chicago Section, American Institute of Electrical Engineers, gave data on electric furnaces of the resistance type which should be of value to commercial men of central stations in discussing this class of business with industrial plant "prospects." The field of the resistance-type furnace is mainly in operations requiring temperature between 400 deg. and 1650 deg. Fahr. (200 deg. and 900 deg. C.) and includes such work as annealing and heat treatment of steel and other metals and melting of non-ferrous metals, especially those with a strong affinity for oxygen.

One furnace with a 20-in. by 12-ft. (50.8 cm. by 3.7 m.) hearth used for annealing brass and silverware blanks handles 1 ton (0.9 t.) of blanks per hour with an energy input of about 200 kw. A motor-driven pusher mechanism pushes a pair carrying the blanks into the furnaces and discharges another pair on the other side into a quenching bath at the end of each annealing period. Another furnace of the same general type, but with its pusher mechanism automatically controlled by clock-actuated relays, is handling steel motor-car parts. Its hearth is 26 in. (66 cm.) wide by 12.5 ft. (3.8 m.) long. It is heating 800 lb. (282 kg.) of steel to 1650 deg. Fahr. per hour with an electrical input of 130 kw. A third size of this general type has a hearth 4 ft. (1.2 m.) wide by 20 ft. (6.1 m.) long. It is heating 1.5 tons (1.4 t.) of steel to 1650 deg. Fahr. per hour with an electrical rating of 360 kw. The largest size of this type in operation has a hearth 7 ft. (2.1 m.) wide and 20 ft. (6.1 m.) long and handles 3 tons (2.7 t.) of steel to 1650 deg. Fahr. per hour. It is rated at 660 kw. Equipments of this character, when automatically controlled by a contact-making pyrometer, reduce the human element to a minimum and lessen the chance for error in treatment. One man loads the pans. Drawbar knuckles and motor-car parts are among the products now being treated in these furnaces.

Another and somewhat similar type of furnace is known as the car type. With this type parts loaded on cars are pushed into the furnaces, treated and pushed out. Cast-steel parts for motor-car construction, locomotives and car axles, aluminum, copper, brass and gun castings and forgings are treated in these car-type furnaces. Among the sizes of this type now in operation are those with hearths 4 ft. (1.2 m.) wide and 10 ft. (3 m.) long, with a capacity of 0.5 tons (0.45 t.) per hour and a rating of 150 kw., and those larger sizes with 6-ft. (1.8-m.) by 18-ft. (5.5-m.) hearths

with a capacity of 1 ton (0.9 t.) of steel per hour and a rating of 300 kw.

A new type of furnace that is just being put into operation for annealing steel and copper is the recuperative car type. It is arranged to accommodate two lines of cars passing through the furnace in opposite directions, so that the hot outgoing cars give up some of their heat to the cold cars on the way in. This furnace, which is 22 ft. (6.7 m.) wide and 19 ft. (5.8 m.) long, is rated at 600 kw. It will heat 150 tons (143 t.) of steel to 1500 deg. Fahr. or 350 tons (317 t.) of copper or brass to 1200 deg. Fahr. (649 deg. C.) in twenty-four hours. No covers are required to keep the metal from scaling.

Another new type of special furnace is one built for reduction of tungsten ores. It is also of the car type. The cars with their contents are, however, moved continuously through the heated furnace, which is gas-tight. After being fully heated the cars are pushed into a long discharge hood to cool slowly. The furnace is built in one size only. It is 10 ft. (3 m.) wide, 50 ft. (15.2 m.) long, and has a capacity equivalent to annealing 0.5 ton (0.45 t.) of steel to 1650 deg. Fahr. (900 deg. C.) in one hour. It is rated at 150 kw.

Melting furnaces of the resistance type were also discussed by Mr. Bailey as apparatus for melting brass, copper, zinc and aluminum. Tilting furnaces for this work with a hearth capacity of 1500 lb. (680 kg.) and a melting rate of 600 lb. (272 kg.) per hour are rated at 105 kw. The metal losses on furnaces of this type when handling yellow brass and pouring at 2200 deg. Fahr. are always less than 1.5 per cent. They are used in making extrusion press billets, castings for plumbers' supplies and slabs for cartridge case rolling. Operating records of these furnaces in actual use show that in melting brass the energy consumption averages one weekly runs from 540 kw.-hr. per ton to 515 kw.-hr. per ton. Non-tilting furnaces of the same general type

These furnaces, Mr. Bailey stated, impart no particular quality to the metal treated because of their electric operation, but they are tools that for particular heating operations more closely approach the ideal equipment than any others in commercial use. In some cases these furnaces effect considerable saving over other methods. This is especially true where automatic heat treatment permits reduced labor cost and reduces the quantity of rejected products. In melting brass large savings are shown over crucible or open-flame furnaces, as electric furnaces permitting control of the furnace atmosphere reduce the zinc losses from 3 per cent to 4 per cent over the open-flame type and 2 per cent over the crucible type. Moreover, eliminating the crucible cost strikes out such a great item of expense that an electric furnace will often pay for itself in three or four months, where it replaces a crucible furnace even with energy at 2 cents a kilowatt-hour.

Will You Lend for Human Freedom?

USING BILL FORM WITH TWO DETACHABLE SLIPS

One for Cashier's Memorandum and the Other for the Collector—Latter Slip Is Used When Customer Mislays Bill

The Lehigh Valley Light & Power Company, Allentown, Pa., uses a bill form with two slips as illustrated, one a cashier's memorandum and the other a collector's memorandum. The latter is filled out at the same time the bills are made out in the billing department, all of which is done at one point. These collectors' slips are then detached from the bills before delivery and sent to the local offices where they are due. In this way a customer wishing to pay his bill but failing to bring the statement with him can very quickly be informed of the

Allentown, Pa., Dec. 31, 1917			
To Lehigh Valley Light and Power Company, Dr.			
OFFICE: 512 HAMILTON STREET.			
LIGHTING SERVICE		From November	To December
Present Reading			
Previous Reading			
Total Consumed			
		Rate per K. W.	12-17
		Cts.	
If paid on or before January fifteenth Discount 10%			
Net			
"READY TO SERVE" Charge			
Flat Rate Net			
Balance Overdue			
SUNDRY ACCOUNT (See terms on the invoice)			
Received Payment this 1918			
LEHIGH VALLEY LIGHT AND POWER COMPANY			
Per			
OFFICE OPEN TO 9 P. M.—AVOID THE RUSH OF THE 15TH			
Receipted Bill will not be returned unless requested			

ALLENTOWN—I
CASHIER'S MEMORANDUM

Please keep bill but detach and send this stub with mailed remittance. RECEIPTED BILL WILL NOT BE RETURNED UNLESS REQUESTED.

12-17

Lighting Bill	
Discount	
Net	
CASH	
Sundry Sale	
CASH	

ALLENTOWN—I
COLLECTOR'S MEMORANDUM

To LEHIGH VALLEY LIGHT AND POWER COMPANY, Dr.

12-17

Lighting Bill, Net (No Discount allowable)	
Flat Rate	
Overdue Balance	
Sundry Account	
CASH	
Remarks	

BILL FORM USED BY PENNSYLVANIA COMPANY WHICH AIDS IN COLLECTIONS AND BOOKKEEPING

with a hearth capacity of 7000 lb. (3175 kg.) of aluminum and a melting rate of 2000 lb. (907 kg.) of aluminum per hour are rated at 500 kw. The hearth measures 4 ft. (1.2 m.) wide and 10 ft. (3 m.) long. This same furnace used on brass or copper has a hearth capacity of 12,000 lb. (5443 kg.) and a melting rate of 000 lb. (1814 kg.) of brass per hour.

amount due. His payment can be accepted without telephoning or reference to other departments.

Immediately after the discount period these slips are returned to the bookkeeping department, where by removing those paid from the list there is left a complete record of delinquent customers, which is immediately turned over to the collector.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Magnetic Pull on Armatures of Electrical Machines.—E. ROSENBERG.—The maximum value of the one-sided pull is given by $F = C\pi DL(B/5000)^2(x/a_1)$, where πDL is the cylindrical surface of the armature and C has a value nearly equal to $2/3$ except for two-pole machines with salient poles, in which cases C is about 0.4 . B is the flux density at the point on the saturation curve for which the inclination of the curve is about five-sixths of that of the straight part of the curve.—*Science Abstracts, Section B*, Jan. 31, 1918 (abstracted from *Elektrotechnik und Maschinenbau*, Nov. 4 and 11, 1917).

Automatic Starting of Motors of Medium Rating.—PIERRE LEGRAND.—For direct-current motors, automatic starting is a relatively simple problem, solved by the use of either contactors or auxiliary starting motors. The principles underlying both these types of methods are described and their requirements outlined. With alternating-current motors it is necessary to have the contactor coils in circuit with the primary current of the stator and also to delay the action of the mechanism by a dash-pot, a method which, however, becomes ineffective with motors of 100 hp. and more. Compromises have been made by the use of an auxiliary dynamo. Some engineers prefer the auxiliary starting motor. These methods are also described by the author, who in conclusion dwells upon the large economy that can be realized by the employment of automatic starters.—*L'Industrie Electrique*, Jan. 25, 1918.

Generation, Transmission and Distribution

Transformer Losses in Large Rural Distribution Systems.—H. ROTH.—Two systems are compared. In the first the energy is transmitted and distributed at 20,000 volts or 30,000 volts. In the second the energy is transmitted to transformer stations at 30,000 volts to 50,000 volts and distributed at a lower pressure, say 6000 volts. Allowing for the extra copper losses in the intermediate transformers totaling 6000 kva., it is shown that when the distribution voltage is 20,000 the intermediate transformers increase the losses by about 20 per cent, but when the distribution pressure is only 6000 volts the losses are decreased by 4 per cent.—*Science Abstracts, Section B*, Jan. 31, 1918 (abstracted from *Elektrotechnische Zeitschrift*, Oct. 18, 1917).

Transmission-Line Practice; Sag and Span Problems.—LIEUT. E. T. DRIVER and E. V. PANNELL.—The authors give the fundamental formulas for determining sag and span and then point out how temperature, wind, sleet, etc., affect different kinds of conductors, including copper, aluminum, aluminum-steel and copper-clad steel. Tables and curves are given for calculating the sag on copper conductors when the ice and wind loading is relieved, increase in sag from 0 deg. to 120 deg. Fahr. with 600-ft. (182.8-m.) copper cables, and

sag in feet and stress in pounds per square inch for different classes of cable on a 600-ft. span.—*Toronto Electrical News*, Feb. 1, 1918.

Electric Power Supply in Great Britain.—LEON GASTER.—In this article the author comments on the report recently issued by the coal conservation sub-committee of the reconstruction committee. In part he says that small generating stations are admittedly uneconomical. It is estimated that the adoption of the scheme recommended by the committee will result in an annual saving of about 57,000,000 tons of coal. This scheme is also commendable as it will increase the industrial output for a given coal consumption. The great advantage to the lamp industry of a standard voltage should also be borne in mind. In selecting the sites for the generating stations and in the choice of plant the possibility of working hand in hand with the gas supply companies should be carefully considered, as in this way the by-products of the coal can be utilized before it is used in the generation of electricity.—*London Illuminating Engineer*, December, 1917.

Ground Connections for Distribution Systems.—W. C. HESTON.—The great cost of ordinary grounding methods for overhead distributing systems has led a Portland company to experiment with various types of ground to see whether a more inexpensive method might not be found which would meet requirements. The results of these comprehensive tests and the conclusions drawn from them are presented in this article.—*Journal of Electricity*, March 1, 1918.

Control of Large Amounts of Power.—W. B. WETMORE.—The author considers in detail where reactance should be inserted so as to limit and confine disturbances on large networks. The subjects of limitation of disturbances, generator reactance, feeder reactance, voltage disturbance, busbar reactance, transfer of power, parallel operation and the limiting effect of fault resistance were also discussed.—*London Electrician*, March 8, 1918.

Installations, Systems and Appliances

Electric Purification of Gas.—J. SAGET.—A historic summary of the various processes used to eliminate solid or liquid particles contained in gas. Electrical apparatus which causes the ionization of these particles and expels them from the electric field created is described.—*Revue Générale de l'Electricité*, Feb. 9, 1918.

Constant-Torque Magnetic Clutch.—The action of a new magnetic clutch used in driving a dynamo for electric welding is explained. The clutch consists essentially of a differential electromagnetic coupling, which will release on overloads. The article is illustrated with diagrams of connections, construction details, efficiency curves, etc.—*London Electrician*, Jan. 25, 1918.

Labor-Aiding Appliances in Steel Works.—S. WELL-MAN.—The subject of handling pig iron and scrap by the open-hearth charging machines and lifting magnets is discussed, it being stated that the saving in labor charges in American steel works by the use of these appliances amounts to nearly \$100,000,000 per annum. Every open-hearth plant of any size in the world to-day is equipped with these auxiliaries, says the author, and they are considered as much a necessary part of the equipment as the furnace itself.—*London Electrician*, March 8, 1918.

High-Temperature Processes and Products.—Electric furnaces are now being used by the thousands for the purpose of hardening dies and gages. In some instances these furnaces are also used for gear hardening. Another important product of the electric furnace is carborundum. There are more than seventy electrical furnaces in Sheffield, England, for refining steel, having an output of over 150,000 tons per annum.—*London Electrician*, March 1, 1918.

Electroculture at Chester, England.—An interesting report on electroculture experiments carried out during the summer has just been presented by S. E. Britton. The electrical equipment consisted of a 10-in. (25.4-cm.) induction coil with mercury-break current interrupter, Lodge valves and an earth plate. An elevated net of No. 30 galvanized-steel wires placed 15 ft. (4.57 m.) apart and hooked to 7/16-in. (1.6-cm.) span wires by insulators, was used for the one electrode, the whole being supported by six poles. To each of the poles was fixed a wrought-iron bar which enabled the discharge wires to be placed at any distance above the ground between 2 ft. 6 in. (76.2 cm.) and 6 ft. 6 in. (198.1 cm.). The apparatus was supplied with 5 amp. at 210 volts direct current to maintain a spark $\frac{3}{4}$ in. (1.9 cm.) long when an earth wire was placed that distance from any part of the discharge network. At the beginning the discharge wire was placed as near as possible to the ground, and, as the crop grew, raised to about 6 in. (15.2 cm.) above the foliage. This experiment indicated that it is not detrimental to place the discharge wire near to the plants, and it was concluded that electroculture increased potato crops as much as 153 per cent in some cases. Some kinds of potatoes thrived better than others under this treatment.—*Toronto Electrical News*, March 15, 1918.

Electrophysics and Magnetism

Magnetization of Iron in the Absence of Hysteresis.—WINTHROP R. WRIGHT.—In general two methods have been proposed for suppressing hysteresis, namely, mechanical shocks or vibrations and an alternating magnetic field, either transverse or longitudinal. While Ewing employed mechanical vibration, others used alternating-current fields superposed upon the magnetic field and yet others investigated the change of magnetization with the temperature. A table giving the composition of steels in per cent is included in the article.—*Physical Review*, March, 1918.

Electrochemistry and Batteries

Stellite as a Substitute for Platinum.—E. HAYNES.—Refers to the present scarcity of platinum and to possible substitutes. An alloy of gold and palladium is probably the best alternative material. While the cost is high, bulk for bulk, it is only half that of plat-

inum. The alloys of nickel with chromium, silicon with iron and pure quartz have also given satisfactory results where resistance to acid attack is the requirement.—*Proceedings of the American Chemical Society*.

Units, Measurements and Instruments

Three Devices for Use in Electrometry.—E. H. KENNARD.—A method is suggested for increasing the deflections of an electrometer under circumstances where the scale cannot be conveniently placed a long distance from the mirror. The suggestion is that a concave lens be interposed between the mirror and scale to magnify the deflection. Sometimes a simple means of connecting two wires together is desired which will permit of easier disconnection than a soldered joint and yet will not introduce the additional capacity and possible leakage of a key. For this purpose a little silver cup may be soldered to one wire and the other wire attached to a piece of heavy wire tipped with a silver point and bent so that the point rests upon the floor of the cup. To obtain time signals at rather long intervals, a torsion pendulum is more useful than a gravity pendulum because of the ease with which the period may be varied over a wide range.—*Science*, March 15, 1918.

An Electrical Instrument for Recording Sea-Water Salinity.—ERNEST E. WEIBEL and ALBERT L. THURAS.—An apparatus to give a continued record of sea-water salinity by the measurement of its electrical conductivity is described. A pair of electrolytic cells has been designed which when used with a suitable alternating-current galvanometer will give satisfactory operation in connection with a recorder. The temperature compensation is obtained by immersing both cells connected in the two arms of a Wheatstone bridge in a bath of uniform temperature.—*Journal of the Washington Academy of Sciences*, March 19, 1918.

Power Plant Instruments as an Investment.—M. A. SALLER.—This article deals with the installation of automatic feed-water regulators, the author saying that they should be an excellent investment in practically every plant, except possibly in small plants running at a very steady load, where the feed pumps can be run at a steady rate just sufficient to supply the feed water as fast as it is being evaporated. Among the benefits which can be derived from their use are the following: (1) Elimination of the uncertainty attendant on hand regulation; (2) firemen or boiler-room force relieved of this care and attention; (3) provision of a continuous feed in accordance with load demands, making possible the maintenance of the highest attainable feed temperature; (4) maintenance of a steady water level which results in the production of drier steam; (5) improved firing and furnace conditions, and (6) reduction in wear and tear by eliminating expansion and contraction strains in the boiler. Wherever a variable or fluctuating load is encountered the automatic regulator can be arranged to adjust the feeding of the water to the particular load conditions.—*Power Plant Engineering*, Chicago, March 15, 1918.

Temperature Effects in Direct-Current Meters.—G. W. STUBBINGS.—The author points out that a temperature variation of 3 deg. C. will cause a variation in the accuracy of an unshunted mercury meter of about 1 per cent. When two such meters are being used, one at

20 deg. C. and the other at 8 deg. C., there will be 4 per cent difference in the accuracy of the two meters. Then follows a discussion of the magnitude of the temperature coefficient of various types of meters. In meters like the shunted watt-hour type the elimination of temperature effect should be more feasible than in the simpler types, owing to the greater number of available adjustments. The high temperature coefficient is a serious defect in the small mercury meter. There seems no simple way in which it can be decreased, and until the problem is solved the commutator meter will retain an advantage over the small mercury meter in that the temperature coefficient of the former meter can be made as small as may be desired.—*London Electrical Review*, March 1, 1918.

Telegraphy, Telephony and Signals

Stray Interference in Radio-Telephony.—ALFRED N. GOLDSMITH.—With the more sensitive receivers—*e. g.*, the regenerative vacuum tube receivers—heavy "strays" have a more detrimental effect than merely to cause noises. They break up the incoming sustained wave trains of the receiving system and thus prevent the utilization of resonance phenomena in circuits having small damping ability. Some types of detectors—*e. g.*, the sensitive crystals or gas-containing bulbs—may be paralyzed by heavy strays and require some time to regain their sensitiveness. Even very high-vacuum tubes may show this effect, since a powerful stray impulse may charge the grid negatively to such an extent that the plate current will be practically cut off until the grid charge escapes by the normal leakage. In some tests over considerable distances it was found that good reception requires that the signal audibility shall be three times that of the strays and that the strays shall not occur continuously even then, but intermittently and not more frequently than say once or twice per second. Reception becomes difficult if the strays are five times as strong as the signal, and almost impossible if the ratio is greater, particularly if the strays are continuous. The effective range of a radiophone transmitter depends on the loudness of strays at the receiving station, and consequently any method of reducing strays should increase the effective power of the transmitter in just that proportion.—*Wireless Age*, March, 1918.

Wartime Wireless Instruction.—E. E. BUCHER.—Ninth article of a practical course for radio operators. Among the subjects covered are coupled transmitter circuits in radiotelegraphy, wave length and frequency.—*Wireless Age*, January, 1918.

Signal Officers' Training Course.—MAJOR-J. ANDREW WHITE.—Eight articles in a series intended for instructing soldiers preparing for United States Army service. This article deals with the radio apparatus of the Signal Corps and describes the construction and operation of the equipment used. Among the subjects covered are the following: Sectional mast, antenna and counterpoise, generator, speed indicator, gearing, connections, operating chest, quenched-spark gap and tuning of sending set and receiving set. Some useful data are given in the accompanying tables.—*Wireless Age*, January, 1918.

Receiver for Undamped Oscillations.—By means of a combination of capacity and shunt resistance, it is possible to adjust the voltage of a plate battery to a

value higher than would be possible without its use. A critical adjustment of the value is thus obtained, so that the effect of very minute disturbances impressed thereon causes a much greater flow of current through head telephones when receiving damped and undamped oscillations.—*Wireless Age*, March, 1918.

Figuring for the Power Plant.—P. A. PRICE.—The article gives data required for the determination of power plants for common-battery telephone exchanges and shows how these data are applied to practical cases to provide for future exchange growth.—*Telephony*, March 16, 1918.

Miscellaneous

Hydroelectric Power and University Instruction.—With the development of hydroelectric power in the Alpine and other regions of France, certain industries—*e. g.*, electrochemical, electrometallurgical, general mechanical engineering, paper-making, etc.—are also being developed. The Polytechnic Institute attached to the university intends to keep pace with the requirements that will grow for technically trained men for the electrical and allied industries. In an article in *La Nature* for Feb. 9 the director of the Polytechnic outlines the courses of instruction held at the institute. The establishment comprises (1) a high school of electrotechnics for training electrical engineers, electrochemists, electrometallurgists, etc.; (2) an elementary electrotechnical school; (3) an electrical standardizing and testing laboratory; (4) a school for the paper-making industry; (5) a paper-testing laboratory; (6) an electrochemical and electrometallurgical test station with a 1000-hp. experimental plant. A chair of electrochemistry and electrometallurgy has also been established at the university.—*London Electrical Review*, March 1, 1918.

The Fertilizer Industry and Its Power Requirements.—J. E. MELLETT.—The power requirements of different types of plants are given, the different operations discussed, and the kilowatt-hour consumption and power cost per unit of product are presented for several plants engaged in this work.—*General Electric Review*, February, 1918.

Constant Heat for Metal Electrode Welding.—ROBERT E. KINKEAD.—Believing that constant-arc temperature requires constant current, many persons believe that the latter condition is essential for welding. On the other hand, constant heat in an arc requires that the product of the current and voltage be constant. The author expresses the opinion that designers of electric welding apparatus have neglected the technical details that should have influenced them.—*Railway Electrical Engineer*, March, 1918.

Revision of Boiler Code.—The revisions of the boiler code made recently by the American Society of Mechanical Engineers are outlined.—*Journal of the American Society of Mechanical Engineers*, March, 1918.

Purchasing Coal by Specification and Methods of Sampling.—J. A. MOYER and J. P. CALDERWOOD.—This article, embodying information of considerable value, deals with the purchasing, specifying, sampling and analysis of coal, the calorific value requirements, and methods of its determination. The specifications issued by several companies, corporations and engineering societies are quoted.—*Pennsylvania State College Engineering Experimental Station Report*, 1916.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

MEMBERS OF A. I. E. E. IN UNIFORMED WAR-SERVICE

Total Number Up to April 1 Was 760, or More than
8 per Cent of the Aggregate Membership,
Which Is 9200

F. L. Hutchinson, secretary American Institute of Electrical Engineers, states that the total number of members in the uniformed service, including those instances of which notice was received after the Year Book went to press and up to April 1, is 760. This is more than 8 per cent of the total membership, now in excess of 9200.

In the 1918 Institute Year Book the names of members who are in the army or navy of the United States or of an allied nation have been designated by a special entry in every case where notification to this effect had reached the secretary.

ILLUMINATING ENGINEERS TO HOLD A CONVENTION

Society Council Approves Tentative Report of Committee on Time and Place—One-Day Technical Session on War Lighting

A tentative report has been made to the council of the Illuminating Engineering Society by the committee on time and place for the annual convention.

The members of this committee, on which are representatives of each section, decided that the usual annual convention, including the entertainment features and excursions, was undesirable at this time. The consensus of opinion favored a short technical session.

The council approved the report and decided that a one-day technical session consisting of papers on lighting subjects pertaining to the war should be held. Details as to time and place were left in the hands of the committee, which will make such further recommendations to the council as seem advisable in the light of future conditions.

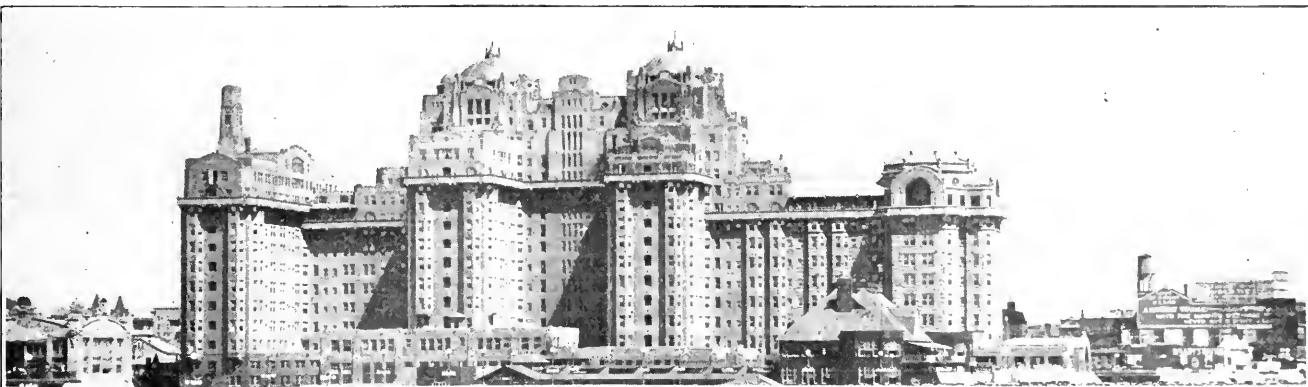
N. E. L. A. CONVENTION TO BE AT ATLANTIC CITY

June 13 and 14 Have Been Fixed as the Time for Annual Meeting at the Famous New Jersey Seashore Resort

The convention committee of the National Electric Light Association decided unanimously on April 3 to recommend to the officers of the association to hold the annual meeting, devoted entirely to war problems, at Atlantic City on June 13 and 14, with the Hotel Traymore as headquarters. President Lieb has decided accordingly.

While it is felt that it is necessary under the constitution to hold the annual meeting, the essential requirement is the limitation of work in the meeting to the consideration of pressing and vital war problems as related to the industry. In view of the fact, however, that practically all member companies are short-handed and that their officers have their time taken up not only with general problems of the industry but with local problems and difficulties that come upon them as patriotic citizens, it is believed that the attendance at the meeting will inevitably be much smaller and more restricted than would occur in normal times and under the usual conditions, all other subjects, however important, being swallowed up for the time being in the fundamentally vital and essential one of winning the war.

The convention committee is composed of Walter Neumuller, New York, chairman; T. C. Martin, New York, secretary; H. C. Abell, New York; J. L. Bailey, Baltimore; R. H. Ballard, Los Angeles; M. R. Bump, New York; J. E. Davidson, Omaha; Leavitt Edgar,



HOTEL TRAYMORE, ATLANTIC CITY, WHERE N. E. L. A. WAR CONVENTION WILL BE HELD

Boston; E. A. Edkins, Chicago; Dudley Farrand, New York; Martin Insull, Chicago; W. H. Johnson, Philadelphia; A. W. Leonard, Seattle; Robert Lindsay, Cleveland; S. J. Lisberger, San Francisco; R. J. McClelland, New York; E. S. Mansfield, Boston; C. S. Ruffner, St. Louis; Frank W. Smith, New York; S. B. Way, Milwaukee, and W. F. Wells, Brooklyn, N. Y.

Helping to Sell the Third Liberty Loan

Typical Example of the Part of Electrical Men Seen in Boston, Where a Great Parade Opened the Campaign—Central Station Employees and Others Swell the Totals

THROUGHOUT the country the different branches of the electrical industry are giving their earnest attention to the best ways and means of advertising and selling the third Liberty loan. Typical of their activities is the part taken in the great parade in Boston on Saturday, April 6.

Although it was 6.45 p. m. when the section of the Edison Electric Illuminating Company of Boston reached the reviewing stand it presented an imposing appearance. President C. L. Edgar marched at the head of his employees. Behind, in the first row, were General Superintendent W. H. Atkins and bureau chiefs; the Edison company service flag with 300 stars; the Edison girls' section; the Edison Red Cross float, with boat symbolizing carrying aid across the water to the front, and the men's contingent.

Edwin S. Webster led the Stone & Webster contingent in the same parade, and directly following him were Russell Robb and Henry G. Bradlee of the firm.

NEW ENGLAND CENTRAL STATIONS AND THE LIBERTY LOANS

Every central station in New England with which the ELECTRICAL WORLD has been in touch as the campaign for the third Liberty loan opens is in hearty sympathy with the raising of funds for the war work of the government. In general the companies do not purchase and carry the bonds for the employees, leaving that for the banks. The latter are usually so well organized to do this work that the central stations have not found it necessary or desirable to underwrite the loans on behalf of their own people, speaking generally.

The companies, however, are co-operating with the banks in every way and in many cases are deducting from salaries and wages, with the consent of employees, the installment payments required where the bonds are not purchased outright. In some cases companies purchase bonds on their own corporate accounts, but this is not a general practice in view of the present high cost of money.

Not many of the central stations in New England have issued publicity material of their own composition bearing upon the Liberty loans, but special plans for the sale of bonds have been carried out successfully, in addition to the routine banking methods. The central stations operated by C. D. Parker & Company of Boston, instead of making a Christmas gift of money to their employees last year, anticipated this in the cases of those purchasing fifty-dollar bonds on installments by crediting each purchaser at the beginning of the second loan drive in October with the first ten weekly payments, amounting to \$10 per bond. This plan encouraged subscriptions and was much appreciated throughout the organization.

Employees of the Edison Electric Illuminating Company of Boston took \$80,000 bonds on the first loan and \$78,000 on the second, subscriptions being made through a local savings bank. *Edison Life*, the com-

pany's monthly publication for employees, supported the loans most vigorously in both editorial and reading pages. The company has about 2000 employees, and the general plan of installment payments from wages and salaries was followed, usually one man from each department looking after the deposits at the bank. On its own account the company purchased bonds of the second loan to the amount of \$530,000. The treasurer of the company gave a number of talks to employees in groups on the earlier loans. The third loan is being handled through a committee headed by J. W. Cowles, superintendent of installations, and it is expected that the same general arrangement as in the first two will be followed.

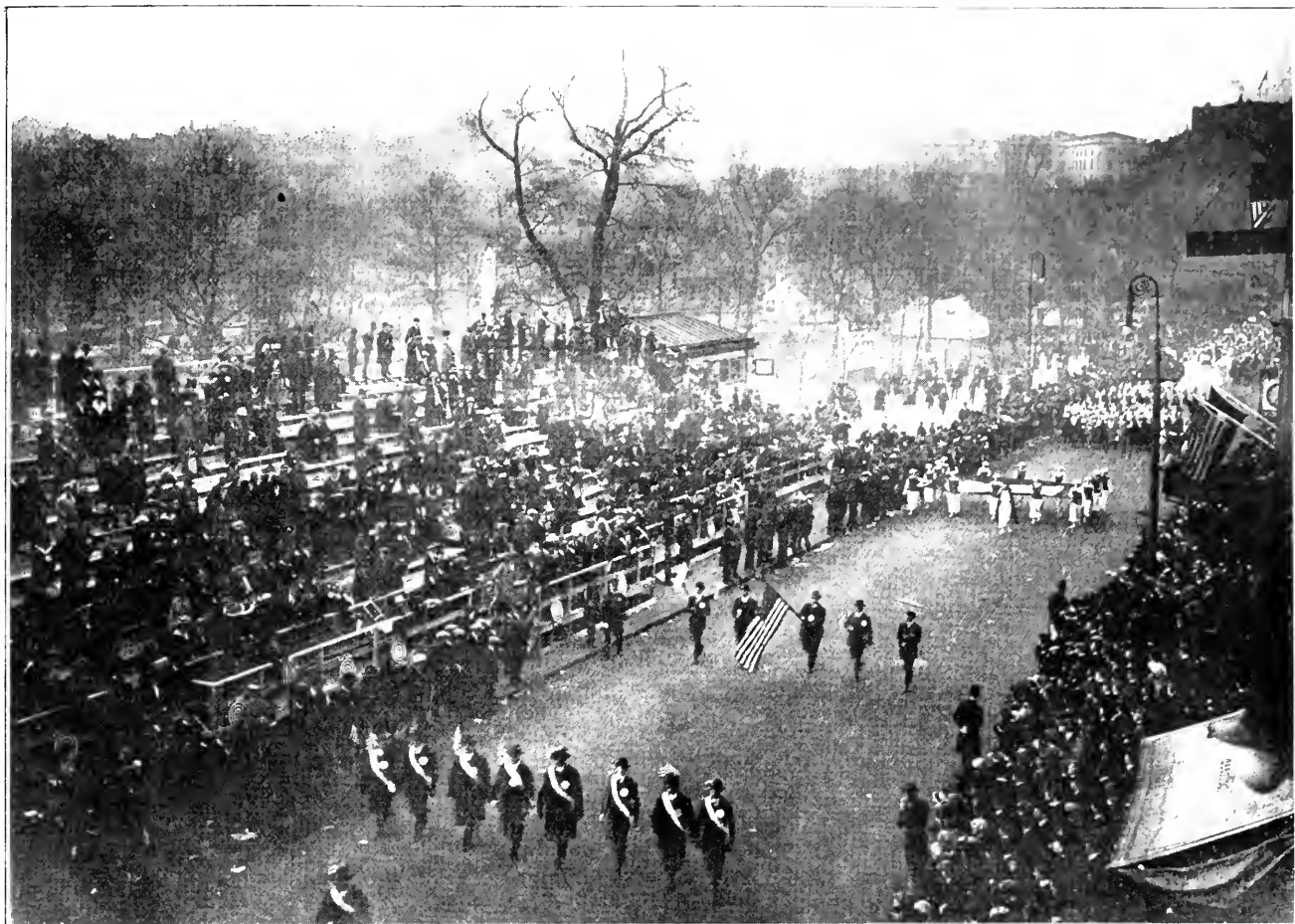
The Narragansett Electric Lighting Company, Providence, R. I., purchased bonds and carried them for its employees in the first two loans and will do the same



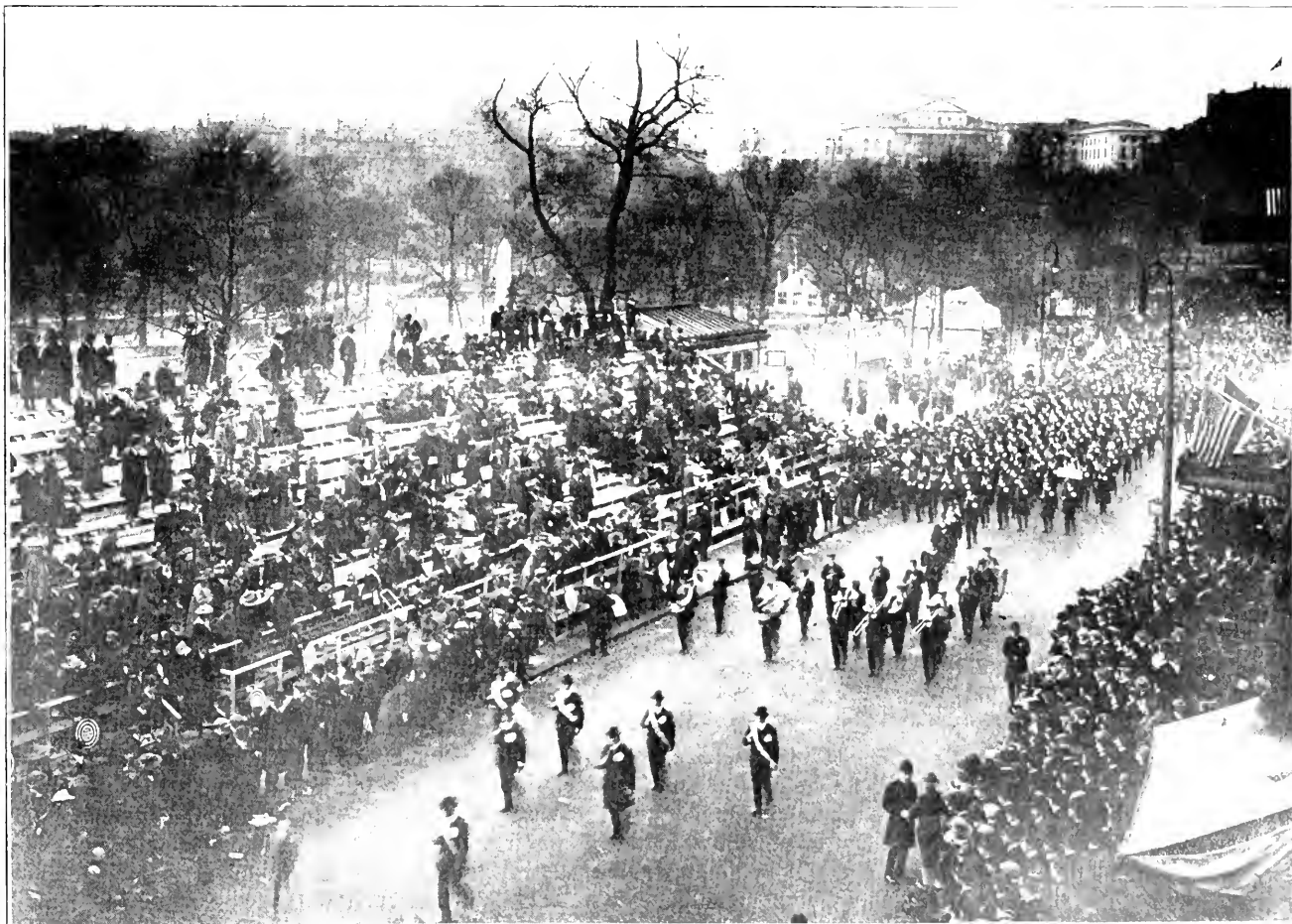
FLOAT OF EDISON ELECTRIC ILLUMINATING COMPANY

this time. The usual \$1 per week payment basis per \$50 bond was required. The company gave its employees all coupons. About 200 employees purchased bonds in the first two loans, aggregating \$34,000. The employees of the Worcester (Mass.) Electric Light Company subscribed to bonds to the amount of \$14,300 on the first two loans, \$1 per week payments being made on the fifty-dollar basis. The company purchased bonds to the amount of \$154,800 in its own name, but did not carry its employees' bonds. About 90 per cent of the employees subscribed.

At Hartford, Conn., the industrial and public utility subscriptions to the Liberty loans were handled in large measure through the Aetna Life Insurance Company, which worked out a most successful plan under the personal supervision of its president, former Governor and United States Senator Morgan G. Bulkeley. The Hartford Electric Light Company participated in this plan, under which twenty months is allowed for payment on the bond, an unusually liberal period. On the first loan the Aetna company allowed 3.5 per cent interest on the money paid in by the subscriber; on the second loan 4 per cent, and the third loan will be handled along the same lines but with 4.25 per cent interest allowance.



EDISON ELECTRIC ILLUMINATING COMPANY DIVISION IN BOSTON LIBERTY LOAN PARADE



STONE & WEBSTER DIVISION IN BOSTON LIBERTY LOAN PARADE

Business Men in Great Chicago Meeting

Government Organization in Relation to Business in War, the Railroads, Financing of War and Ships the Supreme Questions Before United States Chamber of Commerce

FOUR questions of supreme importance to the nation as a whole and to the American business world formed the nucleus around which the sixth annual convention of the Chamber of Commerce of the United States, held this week in Chicago, centered. These were government organization in relation to business in war, the railroads, the financing of war and ships. The definite, practical and concrete things that business can do not only to assure the future of this country, a speedy victory and a solution of the labor problems but also to keep intact the germ of existing but less essential industries so that they may blossom forth with renewed vigor after the war were discussed from all angles. Business men of the highest rank, Cabinet officers, bankers and economists contributed greatly to the importance of the convention and its deliberations. As an evidence of the universality and recognition of general business in the war may be cited the addresses of Secretaries Daniels and Lane and that of Earl Reading, the British Ambassador. Business could ask no greater recognition than the presence of these men at its sessions.

R. Goodwyn Rhett, president of the chamber, painted the vision of America in glowing color, reminding his hearers of their greater obligations to civilization and to country than to themselves. That the great development of this country and of its resources has been due in large part to the energy, enterprise and genius of the American business man was the idea developed. His was the leadership, the vision and the courage to follow that vision to realization. Linking this idea up with his conception of the mission of the United States Chamber of Commerce, Mr. Rhett said: "To me the highest mission of this chamber is to put a soul into business, to transform the cold clay into the sentient being, to transfuse into the marble statue the warm blood of the human being that will make its face to shine, its eyes to glow, its hands to clasp, its heart to beat and its soul to vision. In that sentient being only can democracy find its safeguard and protection. When business men have found out that what is not good for the country is not good for business and have transmitted that creed to their fellow citizens and made them understand that it should also be the creed of liberty, of agriculture, of the citizenship of America, they will have placed democracy on a broader foundation and have mounted infinitely higher in the scale of civilization."

Reports of the various committees were presented at the Tuesday afternoon session and on Wednesday morning. On Wednesday afternoon the following reports were made: Finance, Charles S. Hamlin, Federal Reserve Board; railroads, Harry A. Wheeler, chairman National Chamber's committee on railroads. The chamber's activities in relation to government organization, shipping and finance were presented in brief addresses by Waddill Catchings, chairman war committee; Edward A. Filene, chairman war shipping com-

mittee, and Wallace D. Simmons, chairman committee on finance.

On Wednesday evening the Auditorium theater was filled to capacity—for the convention was the largest ever held by the chamber—to listen to addresses by Josephus Daniels, Secretary of the Navy, and Franklin K. Lane, Secretary of the Interior.

Secretary Daniels devoted the major portion of his speech to a recital of the achievements of the American navy in convoying troops to France and in patrolling the seas in conjunction with the fleets of the Allies. He accentuated the fact that ships are vitally necessary in winning the war and urged the business men of the country to give up skilled mechanics so that the ship-building program can be carried through without delay.

Secretary Lane, in the midst of a very patriotic speech, outlined a scheme for caring for the returning armies of the United States when the war is over. Secretary Lane said: "We must think of the making of a new America, and we must begin with the boys who come back from the front. I say that every one of these men should have an opportunity to acquire a piece of the soil of the United States. We have along the lines of the Colorado River a million acres which can be irrigated if we will dam that river and develop power and hoist that water on to the mesa. It will take vast numbers of men from the returning army to build these dams and put up that power plant. I would pay those boys in farms on the mesa itself: Let each man have his forty acres of irrigated land with a house, with stock, and let him pay Uncle Sam in labor for it by constructing the works which make it possible."

There were indications in Chicago during the convention that this proposal of Secretary Lane might come forward in the form of bills in Congress before long.

THURSDAY'S FOUR SESSIONS

Four sessions were held simultaneously on Thursday, one devoted to government organization in relation to business in war, the second devoted to finance, the third to railroads and highway transportation, and the fourth to shipping.

Waddill Catchings, chairman of the war service executive committee of the Chamber of Commerce, presided and addressed the meeting on the war-time organization of industry. The discussion that followed embraced these topics: (a) What principles should be adopted by the government as the basis of price control? (b) To what extent should the government fix prices? (c) What regulations should govern the determining of priorities? (d) What is a non-essential industry under war conditions? "How shall employer and employee co-operate to maintain war-time production?" was discussed by Prof. Leon C. Marshall of the University of Chicago, until recently secretary of the advisory committee of labor administration, Department of Labor. William H. Vandervort, a member of the official conference board of employers and employees,

also spoke. "Reconstruction in Foreign Trade" was the subject of an address by Dr. Frank W. Taussig, chairman United States Tariff Board. James G. White of New York City was another speaker.

Charles A. Hinsch, president American Bankers' Association, presided at the session on finance. "Trade Acceptances" were discussed by Lewis E. Pierson, chairman of the board of directors of the Irving National Bank, New York; George Woodruff, president First National Bank, Joliet, Ill.; W. B. Fish, treasurer Printz Biederman Company, Cleveland, Ohio; Wallace D. Simmons, president Simmons Hardware Company, and George H. Paine of Philadelphia. "The Effect of Government Financing on Industries" was dealt with by David R. Forgan, president National City Bank, Chicago; Thomas N. McCarter, president of the Public Service Corporation of New Jersey, Newark, N. J., an abstract of whose address is given below; August H. Vogel, secretary and treasurer Pfister & Vogel Leather Company, Milwaukee, Wis.; John V. Farwell, president John V. Farwell Company, Chicago, and O. M. W. Sprague, professor of economics at Harvard University. "How May Helping the Shipbuilders Best Be Made the Business of Local Organizations?" was the subject of addresses by Charles E. Falconer, chairman of the war shipping committee, Baltimore; Edgar S. McKaig, secretary of the war shipping committee, Philadelphia, and Crawford H. Ellis, chairman of the shipbuilding committee of the Louisiana State Council of Defense.

Harry A. Wheeler, chairman of the chamber's committee on railroads, presided at the transportation session. "Motive Power" was the subject of Alba B. Johnson, president Baldwin Locomotive Works; "Terminals," that of John F. Wallace, chairman Chicago Railway Terminal Commission; "Car Supply," Samuel O. Dunn, editor *Railway Age*; "Extensions," Francis H. Sisson, vice-president Guaranty Trust Company, New York. Roy D. Chapin, chairman highway transportation committee of the Council of National Defense; F. A. Seiberling, president Goodyear Tire & Rubber Company; A. C. Bedford, president Standard Oil Company of New Jersey and chairman of the petroleum war service committee, and M. H. G. Shirley, chief engineer State Roads Commission of Maryland, were other speakers.

Edward A. Filene, chairman of the war shipping committee of the Chamber of Commerce, presided at the session to consider shipping problems. "How Can We Get More Ships in the Next Six Months?" was discussed by Charles Piez, vice-president and general manager Emergency Fleet Corporation; "Patriotic Labor," by Dr. Charles A. Eaton, national service department, Emergency Fleet Corporation; "Big-Scale Shipbuilding," by Joseph W. Powell, vice-president Bethlehem Shipbuilding Corporation; "The Rochester Plan," by James T. Hutchings, general manager and vice-president Rochester Railway & Light Company; "Reducing Ship Labor Turnover," by Meyer Bloomfield, head of the industrial service department Emergency Fleet Corporation; "The World's Ship Labor," by Crawford Vaughan, ex-Premier of South Australia; "The Fabricated Ship and Its Part in the War," by George J. Baldwin, president American International Shipbuilding Corporation.

Following these specialized discussions there was a general conference on Thursday afternoon under the

chairmanship of B. D. Caldwell, war shipping committee, New York, dealing with the following topics: "Should Business Men Help the Transference of Their Skilled Employees to Shipyards?" B. F. McLeod, Charleston, S. C., and N. Sumner Myrick, vice-chairman National War Shipping Committee; "What Can the Local Business Organizations Do in Helping to Provide Adequate Transportation Facilities for Ship Workers?" Philip H. Gadsden, president Charleston Light & Power Company, Charleston, S. C.; "What Can the Local Organizations Do to Provide Adequate Housing Facilities for the Ship Worker for the Next Six Months and Thereafter?" J. R. Flannery, manager division of general service, Emergency Fleet Corporation, and Bert L. Fenner, head of production department, Department of Labor; "What Can Business Organizations Do to Express Their Appreciation of Ship Workers and Their Work as an Encouragement to Utmost Effort?" V. Everit Macy, chairman adjustment board, Department of Labor; "What Can the Local Business Organization Do to Make Two or Three Shifts in the Shipyards Possible?" Holden A. Evans, president Baltimore Dry Dock & Shipbuilding Company, and J. B. Weaver, manager Harlan plant, Bethlehem Shipbuilding Corporation.

The feature of Thursday's session was the address of the British Ambassador in the evening. Friday was given over to a war convention of secretaries. Throughout the entire convention there was manifest a spirit of determination to subordinate all business to the great business of winning the war and that quickly. Patriotic enthusiasm bubbled from every speaker and optimism was everywhere apparent.

ADDRESS OF MR. MCCARTER

Mr. McCarter showed in his address the vital importance of utilities to the country, saying in part:

If this country is ultimately to take its place in the forefront of the Allies and be the final decisive factor in the termination of the world war, as we all believe, the integrity of the utility industry of this country must not only be preserved but its activities must be speeded up to a point never hitherto attained; its capacity for service must be greatly increased, and the capital necessary to accomplish this result must be provided. The power companies must keep pace with the extraordinary demands being made upon them to furnish power in large quantities to the shipyards, to the aeroplane factories and to the innumerable industries engaged either exclusively in the manufacture of war products or of materials which ultimately become a part of them.

The utilities of the country constitute, if I may make use of the term, no "piker" industry. Viewed from every angle—from that of service rendered, from that of annual income, and from that of capitalization—they constitute a highly important factor in the economic life of the nation. They daily furnish the public with necessities of modern civilization. Their securities are owned by millions of people, as well as by financial institutions. It would be difficult to find a banking institution in the country that would not be embarrassed by a permanent collapse of the credit of these utilities. Like those of every other industry in the country, their costs over pre-war conditions have enormously increased. It is susceptible of proof that their labor and material costs have increased by an average of 70 per cent. Unlike the ordinary private industry, however, they have not been able to "pass the buck" of increased costs to the consumer.

There is now a country-wide movement under way by the utilities for increased revenue. In many cases, I am happy to say, the state commissions are facing the issue courageously and granting the necessary increases; but if widespread disaster is to be averted, a public spirit of fairness and justice to these companies must be developed that will quickly manifest itself in commission decisions.

Invest Safely—Buy Liberty Bonds

LABOR AND CAPITAL UNITED FOR THE WAR

BY LOYAL A. OSBORNE,

Vice President Westinghouse Electric & Manufacturing Company

[At the request of the ELECTRICAL WORLD Loyall A. Osborne, vice-president Westinghouse Electric & Manufacturing Company, and chairman of the executive committee of the National Industrial Conference Board, made a statement on the work of the Commission of Employers and Workers, of which he was a member representing the employers. The report of this commission was published in part in last week's issue, page 736. Mr. Osborne's statement follows.]

The significance of the agreement reached by the commission of employers and employees lies in the fact that in the face of a great national emergency two groups whose views have been popularly believed to be irreconcilable have met and by discussion and concession agreed upon a program that fully protects not alone the legal rights of both groups but the cherished principles for which they have most tenaciously contended.

The cardinal principle upon which the commission proceeded in its deliberations was that there must be no interruption to the production of war essentials by acts to prevent which lay within the control of either employer or employee.

This meant that for the period of the war there should be no lockouts or strikes.

If labor is to relinquish the principal weapon by which it has heretofore secured compliance with its demands, it becomes necessary that there be created a tribunal through which both the worker and the employer shall be guaranteed that every just grievance shall have a hearing and be settled fairly and in accordance with a body of agreed-upon principles.

This, I believe, the program insures.

If the leaders of labor throughout the country are, as I believe them to be, of the same high-minded and patriotic type as their representatives with whom I had the honor and good fortune to sit in conference, I am sure there will be no difficulty that the machinery provided cannot compose with impartial justice to all parties.

Speaking for employers, I am confident that they will whole-heartedly support the program agreed upon by their representatives. I have construed my presence on the commission and my agreement to the program as a pledge of the great national associations of manufacturers represented on the National Industrial Conference Board, which sent me there, that employers will observe the letter and spirit of the understanding.

I cannot express too highly my appreciation of the invaluable services rendered to the commission by the representatives of the public, ex-President Taft and Frank P. Walsh. Their counsel was of the utmost value to the other members in all of the difficult and complex questions that formed the subject of discussion.

Second only to the army of our brave fighting men is our great productive industry, and if we can maintain a condition of industrial peace at home through the medium of the agreement now reached, as I firmly believe we will, no American need doubt the successful outcome of our national effort.

Some Day The Fuel Question May Be Settled



—Knoxville (Tenn.) Tribune

SIGNALING APPARATUS WORK IN ASSOCIATED MANUFACTURERS

New Section Effects Further Organization by Appointment of Committees to Take up Activities in Many Lines

The Signaling Apparatus Section, which was formed recently in the Associated Manufacturers of Electrical Supplies, held its second meeting at the association rooms, New York, on April 5.

George L. Patterson of Stanley & Patterson, Inc., New York, is chairman of the section, with R. Edwards, Jr., of Edwards & Company, Inc., New York, secretary and E. Whitmore of the Manhattan Electrical Supply Company, New York, treasurer. The following standing committees were appointed in the section:

Committee on Annunciators.—E. Ward Wilkins, chairman, Partrick & Wilkins Company, Philadelphia; T. W. Ness, Holtzer-Cabot Electric Company, Boston; R. Edwards, Jr., Edwards & Company, Inc., New York.

Committee on Small Bells and Buzzers.—W. J. Tonkin, chairman, Ansonia Electric Company, Ansonia, Conn.; C. P. La Shelle, W. R. Ostrander & Company, New York; E. Whitmore, Manhattan Electrical Supply Company, New York.

Committee on Contact Devices.—E. Whitmore, chairman, Manhattan Electrical Supply Company, New York; W. J. Tonkin, Ansonia Electrical Company, Ansonia, Conn.; Albert S. De Veau, Stanley & Patterson, Inc., New York.

Committee on Fire Alarm Apparatus.—Vernon Durbin, chairman, Holtzer-Cabot Electric Company, New York; G. L. Patterson, Stanley & Patterson, Inc., New York; R. Edwards, Jr., Edwards & Company, Inc., New York.

Committee on Signal Gongs.—G. L. Patterson, chairman, Stanley & Patterson, Inc., New York; T. W. Ness, Holtzer-Cabot Electric Company, Boston; R. Edwards, Jr., Edwards & Company, New York.

Committee on Telephone Apparatus.—B. C. Rogers, chairman, Connecticut Telephone & Electric Company, Meriden, Conn.; A. S. De Veau, Stanley & Patterson, Inc., New York (one member still to be appointed).

Committee on Telegraph Instruments.—E. Whitmore, chairman, Manhattan Electrical Supply Company, New York (two members still to be appointed).

Uncle Sam Pays—Buy His Bonds

Membership Committee.—C. P. La Shelle, chairman, W. J. Ostrander & Company, New York; E. Ward Wilkins, Partridge & Wilkins, Philadelphia; M. J. McElroy, Holtzer-Nabot Electric Company, New York; B. C. Rogers, Connecticut Telephone & Electric Company, Meriden, Conn.; F. J. Tonkin, Ansonia Electric Company, Ansonia, Conn.

Another meeting will be held at an early date, when the various committees will have plans formulated for active work along the different lines already suggested. It is felt that this section will be a very important one in the industry covered.

ILLUMINATING ENGINEERING ACTIVE WAR SERVICE WORK In Many Ways the Society Has Aided the Government Since War with Germany Was Declared

A bulletin has been issued by the Illuminating Engineering Society telling in general terms of the war service work done by members.

As soon as war was declared the society offered its services to the government. Since then it has lost no opportunity to be of service. Its committee on war service, acting upon requests received directly or through the National Committee on Gas and Electric Service, has designed lighting installations for various departments of the government. The committee has also prepared a treatise on protective lighting at the request of government officials.

Members nominated by the society, constituting the divisional committee on lighting under the committee in labor, of the Council of National Defense, have prepared a treatise on industrial lighting for application wherever work is done under contract with the government. Lighting experts for each state in the Union have been selected to co-operate.

The National Research Council has availed itself of the services of the society's experts in prosecuting its researches on problems of lighting and vision. The society's membership has been classified so that the government may have ready access to lighting specialists.

Showing that light properly controlled is a very important instrument for winning the war, the society says:

"At the front or on the sea it reveals and locates the enemy, his works, operations, submarines. It also conceals our own operations by camouflage or glare. It conveys intelligence by signals, even in the daytime. At home it protects buildings, piers, bridges and other works; it speeds production and prevents waste. It prevents accidents which jeopardize life and material. It conserves eyesight; gives cheer and comfort to workers."

NATIONAL COMMITTEE ON PUBLIC UTILITY CONDITIONS

Action by Executive Committee of National Electric Light Association to Give Direction to Work Under Way

At a recent meeting of the executive committee of the National Electric Light Association it was decided that a committee of three members should be appointed to co-operate with similar committees of the electric railway and gas industries in the formation of a conference or joint committee to advise in regard to such utility problems of national interest as may be specifically assigned for consideration. This suggestion arises from the desire to give specific direction and authority to the work which is being done now by the National Committee on Public Utility Conditions, representing the N. E. L. A., American Electric Railway Association, American Gas Institute and National Commercial Gas Association.

President J. W. Lieb reported at the meeting that the association, in the referendum of the Chamber of Commerce of the United States on water-power development, has given its affirmative vote for the proposed legislation by Congress. The committee approved the action.

Twenty-seven additional central stations have been admitted as members, also 773 Class B members, 13 Class D members, 76 Class E members and 3 foreign members.

HIGHER RATES ARE NEEDED IN CALIFORNIA

Power Companies Ask Commission to Apply Increases to All Consumers, Instead of to Selected Classes

The application which is now pending before the California Railroad Commission for a 20 per cent increase of rates on electric service for industrial plants, irrigationists and commercial lighting has been amended by the appellants, who ask that the increase apply to all classes. All of the power companies serving central California districts are affected.

Attorney B. D. Marx Greene, representing sixty California cities, asked the commission to order cancellation of all special contracts between the Great Western Power Company and the Pacific Gas & Electric Company and preferred consumers.

Mortimer Fleishhacker stated for the Great Western Power Company that if the schedule rate were to be applied to holders of special contracts the company's income would be increased between \$100,000 and \$200,000 annually.

Public utility men should regard it as both a duty and a privilege to subscribe for Liberty bonds to the fullest extent of their ability. They know from their own experience that ready and ample capital is essential to efficient and quick results in large undertakings. Our government has on its hands the largest undertaking in its history. The abundance or lack of money will determine the assurance or the difficulty of the early fulfillment of its war program, the complete success of which is essential to the safety of our citizenship and the preservation of humanity in the world.

W. W. FREEMAN,
President Union Gas & Electric Company, Cincinnati.

PLAN TO INTERCONNECT PLANTS IN OHIO DISTRICT

War Industries Board Interested in Arrangement to
Effect Improvement in Power Supply for
Group of Cities

A report from Alliance, Ohio, indicates that the War Industries Board is working on a plan of tying in the central stations of Pittsburgh, Youngstown, Niles, Warren, Akron, Alliance, Canton and Massillon in order to insure continuous power for manufacturers of munitions and war materials in the district. Several of these cities are already connected by high-tension lines and the plan would provide for lines between the others mentioned. Army engineers, it is said, have about completed a survey of the cities and will report soon to the board.

The shortage in the district is placed at 125,000 kw., and it is said that several plants will be enlarged to meet this need. One will be the large plant of the American Gas & Electric Company and West Penn Power Company at Windsor, W. Va. In addition, the plant of the Doherty interests at Bolivar, Tuscarawas County, Ohio, is to be completed. The two will supply about 80,000 additional kilowatts.

Should the government demand additions to plants, it is supposed that some plan will be provided to furnish funds.

Invest and Do Your Fair Part

SERVICE CHARGE RATE IN STATE OF NEW YORK

Empire State Gas & Electric Association Anxious to
Prevent Public Misunderstanding Where This
Charge Is Introduced

The Empire State Gas & Electric Association has printed a booklet on the "Service Charge Rate," which it has sent to electric and gas companies in New York State.

A letter accompanying the booklet, signed by the executive committee of the association, says that on account of rising costs many companies are finding it necessary to increase their rates, and in this connection some have adopted a method of charge consisting of a service charge plus a commodity charge, while others now have the matter under consideration.

As this is a very important subject, affecting not only individual companies but the entire industry in the State, it was deemed advisable to prepare the general discussion of the service charge rate, to which very careful attention is requested.

The executive committee is deeply interested in this matter and in seeing to it that whenever a service charge rate is established the method of procedure shall be such as will not prejudice the public against the form of rate or prevent the company from being able to justify it before the commission.

On April 19, 1917, the committee after careful consideration passed the following resolution:

"Resolved, that the executive committee approve the plan of a demand, service or customer charge plus a commodity charge for gas and electric rates."

On Nov. 22, 1917, this resolution was expanded thus:

"Further resolved, that the inclusion of the service charge in any change of rates should carefully be specified to be based on costs properly entering into such charge, which costs have heretofore been inequitably and disadvantageously obtained through the commodity charge, and should not be included merely as a means to increase revenue."

The above amendment was occasioned by an apparent misunderstanding of the matter on the part of some companies, but in a number of recent instances the method of procedure employed by the companies in establishing this form of rate has indicated that, in spite of the above resolution, the subject is not yet clearly understood and that some further explanation is necessary in order that mistakes may be avoided.

The committee expresses the hope that the discussion will clarify the question, will encourage the adoption of this method of charge where the circumstances and conditions warrant, but will prevent its adoption without full ascertainment of the facts and a convincing explanation to consumers.

"Liberty or Death"—Liberty Bonds

GREAT PROGRESS BEING MADE IN ELECTROCHEMISTRY HERE

C. F. Burgess, Addressing Chicago A. I. E. E. and
Western Society of Engineers in Joint Session,
Tells of Accomplishments in the Art

C. F. Burgess of Madison, Wis., who is now spending much of his time as an electrochemist for the government at Washington, spoke before a joint meeting of the American Institute of Electrical Engineers, Chicago Section, and the Western Society of Engineers, on March 25.

The features of the address were the speaker's emphatic statements that wonderful progress is being and has been made by United States electrochemists since war began in spite of all enemy statements and inferences to the contrary, and his equally emphatic avowal of the necessity for more electrochemical work to win the war.

Choose the Best—Liberty Bonds

N. E. L. A., Pacific Coast Section

The joint convention of the Pacific Coast Section, N. E. L. A., California Association Electrical Contractors and Dealers, and the National Electrical Supply Jobbers' Association of the Pacific Coast will be held at Del Monte, Cal., May 9-11, 1918. As noted in the ELECTRICAL WORLD for March 23, this convention, which had been planned for April 24-27, was postponed to avoid interference with the Liberty Loan campaign.

Annual Meeting of Society for Electrical Development

The annual meeting of the Society for Electrical Development, Inc., will be held on Tuesday, May 14, at 11 a. m., at the offices, in the Engineering Societies Building, 29 West Thirty-ninth Street, New York.

San Francisco Electrical Development League.—At the luncheon of the league on April 3 Gen. C. A. Woodruff gave a talk on "How We Can Help."

Buffalo Engineering Society.—On April 17 the Buffalo Engineering Society will devote a meeting to discussions regarding electrical and chemical engineering subjects.

A. S. M. E., St. Louis Section.—On March 29 the St. Louis Section of the American Society of Mechanical Engineers elected Louis Gustafson chairman and J. P. Morrison secretary.

A. I. E. E., Portland Section.—At a recent meeting of the Portland (Ore.) Section of the American Institute of Electrical Engineers J. B. Fiskien talked on "Changes in Distribution System on Account of Range Load."

I. E. S., Philadelphia Section.—At a meeting of the Illuminating Engineering Society at Philadelphia M. Luckiesh of the Nela Research Laboratory, Cleveland, Ohio, gave an interesting talk on the "Esthetics of Street Lighting."

Jovian Electric League, Los Angeles, Cal.—At the March 27 meeting of the league E. S. Parker, manager of the Knox School of Business Efficiency and Salesmanship of Cleveland, Ohio, spoke on "Salesmanship That Concerns Everybody on the Payrolls."

Electrical Supply Jobbers' Association.—The date of the tenth annual meeting of the Electrical Supply Jobbers' Association at the Homestead Hotel, Hot Springs, Va., has been changed from May 28, 29 and 30, 1918, to May 21, 22 and 23, 1918.

Engineers' Society of Milwaukee.—At the April 10 meeting of the Engineers' Society of Milwaukee Charles L. Fortier, chief engineer of the Johnson Service Company, gave an illustrated talk on "Automatic Control Apparatus for Temperature Regulation."

A. I. E. E., Indianapolis-Lafayette Section.—E. P. Shepard of the Bureau of Standards delivered an address on "The Work of the Bureau of Standards," with special reference to electrolysis and its mitigation, before the Indianapolis-Lafayette Section of the American Institute of Electrical Engineers.

National Association of Electrical Contractors and Dealers.—The officers and executive committee of the National Association of Electrical Contractors and Dealers held a three-day session in Detroit on April 1, 2 and 3. It was attended by a large number of contractors from Detroit and the rest of Michigan, and also by a considerable number of important men in the electrical industry.

A. I. E. E. in Joint Meeting.—A very interesting meeting of all the engineering societies of San Francisco, consisting of civil engineers, mechanical engineers, chemical engineers, mining engineers and electrical engineers, was held recently. P. M. Downing, chief engineer of the Pacific Gas & Electric Company, delivered an address on "Interconnections of Power Plants," and D. M. Foulson talked on "Fuel Oil Saving."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Minnesota Electrical Contractors' Association.—Dean John R. Allen of the College of Engineering and Architecture, University of Minnesota, spoke on "Electrical Conditions in Europe Before the War" at the convention of the Electrical Contractors' Association of Minnesota. At the business meeting of the association it was decided that the old officers should remain in office until the regular meeting in June. W. L. Goodwin spoke on the Pacific Coast merchandising plan and answered questions concerning it.

Southwestern Electrical and Gas Association.—The annual convention of the Southwestern Electrical and Gas Association, to be held in Galveston April 15 and 16, as previously announced in the ELECTRICAL WORLD, will consider some vital problems which have been forced upon public utility plants by war conditions. The increased and still increasing cost of fuel, material and labor, the possibility in the near future that prices may be still further increased, and the inability on the part of the public utilities to obtain these commodities will be the more important subjects. Labor and the demands of the government in the matter of taxation on gross earnings and profits will also be discussed.

Oklahoma Gas, Electric and Street Railway Association.—The annual convention of the Oklahoma Gas, Electric and Street Railway Association will be held at Oklahoma City on April 22 to 24 at the Lee-Huckins Hotel. Among the interesting papers to be presented will be "Electricity in Oil and Gas Fields," by L. E. Mohrhardt, Southwest Gas & Electric Company, Oklahoma City; "High-Tension Transmission and Distribution," by Lee Boyer, Choctaw Power & Light Company; "Gas-Fired Boilers," by L. A. White, Muskogee Gas & Electric Company; "Present Trend in Rate Making and Valuation," by H. N. Strait, H. M. Byllesby Company; "Relations of Utilities to the Public," by A. L. Mitchell, engineer for State Corporation Commission; "Needed Utility Legislation," by Charles Hoopes, Oklahoma Railway Company; "Utility Taxation," by Prof. F. F. Blachly, University of Oklahoma; "Relations to Customers," by R. K. Johnston, Washita Electric Company, and W. J. Dibbens, Guthrie Gas, Light, Fuel & Improvement Company; "Oklahoma Utilities and War Problems," by Prof. L. W. W. Morrow, University of Oklahoma, and Guy B. Treat, Oklahoma Railway Company. In addition association policies for 1918 will be discussed and the question box will be opened. Officers will be elected.

A. I. E. E., Schenectady Section.—Lieut.-Col. Nugent H. Slaughter, Signal Corps, U. S. A., delivered an address on "Army Radio Communication" before the Schenectady Section of the American Institute of Electrical Engineers on April 5.

A. I. E. E., Toledo Section.—The regular monthly meeting of the Toledo Section of the American Institute of Electrical Engineers will be held at the Scott High School auditorium on Wednesday, April 17. E. E. F. Creighton will speak on "The Theory and Practice of Lightning Protection."

A. I. E. E., Utah Section.—John H. Lewis, state engineer of Oregon, delivered an address on "Western Development and Its Relation to National Transportation Policies," on March 20, before a joint meeting of the Utah Section of the American Institute of Electrical Engineers and the Utah Society of Engineers. He said that "only through development of hydroelectric resources on a vast scale, with the aid of the federal capital, will the United States be saved from industrial disorganization after the war." By means of electrification of the railroads at this time the transportation facilities of the country can be immediately organized on a war-time basis. The development of electrical energy in large centralized water-power or steam plants by the federal government and its sale at approximate cost in wholesale blocks at important industrial centers to run the railroads and industries of this country is a national economy. This must be worked out if the United States is to survive the bitter industrial war to follow the close of the present war.

National Electrical Contractors and Dealers' Association, Connecticut Section.—At a meeting of the Connecticut Section of the National Electrical Contractors and Dealers' Association on March 27 James R. Strong, chairman of the advisory committee of the national association, read several letters from some of the large manufacturing companies, pledging themselves to an established differential between the industrial plants and the contractor and jobber. Isolated plants and industrial plants are to pay the consumers' prices for electrical machinery and materials, and shipbuilding companies and construction companies of like nature will have to pay the contractor's price. It is thought by the association that this differential will have a favorable effect upon the industry as it means fair competition to the jobber and the contractor. At a dinner given by the association W. L. Goodwin gave a talk on the so-called Goodwin plan and answered questions about it. The meeting was presided over by the state secretary, George M. Chapman, instead of E. A. Francis, who was unable to attend on account of illness. The meeting was attended by all branches of the electrical industry, consisting of seventy-five contractors, fifty-two manufacturers' representatives, twenty-seven jobbers and nineteen central-station men.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Municipal Capital Issues.—The capital issues committee of the Federal Reserve Board announces that, upon the recommendation of its advisory committee, in view of the large aggregate of municipal issues offered in relatively small amounts, it has decided to reduce from \$250,000 to \$100,000 the minimum limit on municipal issues upon which it will give advice with respect to the question of whether or not such issues at this time are compatible with the public interest.

New Hydroelectric Service Saving Coal.—By the shutdown on March 19 of the Margaret Street generating plant of the Springfield (Mass.) Street Railway and the operation on this site of a substation of the Turners Falls Power & Electric Company supplying the city lines through step-down transformers and motor-generator sets, a great improvement in service has been effected. The estimated saving in coal is 100 tons per day. Mayor Stacy, members of the City Council and of the Springfield Chamber of Commerce inspected the substation recently as guests of President C. V. Wood of the railway company.

Mountain States Power Company.—The Mountain States Power Company has acquired all the property of the Northern Idaho & Montana Power Company in Oregon, Washington, Idaho and Montana. The property operating as the Oregon Power Company, with headquarters at Eugene and Marshfield, Ore., will continue to operate under that title. The properties with headquarters at Kalispell, Mont., and Sandpoint, Idaho, will operate under the name Mountain States Power Company. The company will be under the operating direction of Elmer Dover, vice-president of H. M. Byllesby & Company, with headquarters at Tacoma.

Flatbush Electric Rates.—Figures tending to show that its operating costs have greatly increased within the past few months and that inferentially it is not in a position to offer reductions in its rates for electricity have been placed in evidence by the Flatbush Gas Company before the New York Public Service Commission for the First District. The occasion of their presentation was the rehearing granted by the commission upon its recent order directing the company to reduce its electric rates from a maximum of 12 cents to 10 cents on March 1, 1918, and to make other reductions to a maximum of 8 cents by March 1, 1919. The company has refused to accept the commission's order, and announced that it would demand a rehearing and would

take such steps as were possible to prevent the order from going into effect.

Radio Course in University of Pennsylvania.—The University of Pennsylvania is planning to add to the curriculum of the Electrical Engineering School a new course in radio communication especially adapted to fit students for enlistment in the Signal Corps of the United States Army. Announcement of the new course has just been made by Dr. Harold Pender of the faculty, and a large enrollment is anticipated. Upon completion of the course, students enlisting in this branch of service will be sent to special government schools for further training, where opportunities for qualifying as non-commissioned officers, with possible advancement to commissioned grades, will be afforded.

Men Needed in Ordnance Office.—Men are needed for the requirements section of the Control Bureau, Ordnance Office, War Department, of which section Lieut.-Col. M. C. Rorty is in charge. This section is charged with the responsibility of estimating quantities and delivery dates for all purchases of ordnance material, amounting to many hundreds of millions of dollars per annum. The men should be capable of analyzing a variety of facts in relation to the needs for such material and presenting sound conclusions as to the purchases that should be made. They should in general be college graduates and ordinarily should be men who ranked in college from a scholastic standpoint in the upper 25 per cent of their classes. The men should have had experience in preparing estimates or reports on which their reputation has rested and on the basis of which substantial money expenditures have been made.

Cincinnati Needs Amendment of Rate Agreement.—The Union Gas & Electric Company, Cincinnati, has sent to the Ohio Public Utilities Commission a motion to reopen its appeal from a city rate ordinance which was settled by agreement in February, 1917. President W. W. Freeman and Attorney Miller Outcalt first notified Mayor Galvin of their intention to do this unless some arrangement could be made to allow an increase over the present maximum rate, 8½ cents per kilowatt-hour. An ordinance fixing this figure was enacted by the council in 1915, and the company appealed to the Public Utilities Commission. Then a settlement was reached on the rate fixed by the ordinance. Mayor Galvin informed President Freeman that the city would oppose any change or increase. He said that the appeal, which was settled by agreement, cannot be legally reopened. The agreement provided that the above rate should continue for five years and that at the end of that time either side should have the right to an appeal from its provisions for the next five years, the contract covering ten years. President Freeman stated that the company lost several thousand dollars last year and cannot go on losing.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Apparatus Must Prevent Injury to Customers During Lightning Storms.—A city furnishing light was bound to employ such approved apparatus in general use as would be reasonably necessary to prevent injury to a customer using its light arising from lightning conducted into residence, the Court of Appeals of Georgia held (94 S.E. 637). An amended petition in action for personal injury, based on incapacity of defendant's transformer to reduce primary current of high voltage so as to permit a safe current of low voltage to pass into light wires entering plaintiff's home, was held to state a cause of action.

Cost of Acquiring Customers in Valuation Proceedings.—Upon a valuation by the Public Utilities Commission, pursuant to the General Code, with a view to a city's use in the framing of a new ordinance fixing maximum rates following the expiration of an agreement between it and certain electric companies furnishing electricity in the city, the inclusion in the final valuation of an item scheduled as "costs of attaching business, \$375,000," conceded to represent the cost of acquiring customers, was erroneous, as, in view of varying circumstances which in advance would be purely hypothetical, the valuation was necessarily uncertain, theoretical and somewhat arbitrary, the Supreme Court of Ohio held in City of Cincinnati versus Public Utilities Commission of Ohio (118 N.E. 97).

Distance Between Tower and Telephone Lines.—That an electric company operating a power line and a telephone line constructed them as far apart as required by statute does not necessarily render it free from negligence in maintaining them at such distance, the Supreme Court of California held in Sickles versus Mount Whitney Power & Electric Company (170 P. 599). Where an electric company operating a telephone line and a power line knew of and consented to another company moving its telephone line to a position near its power line, it is liable for damage done by reason of their subsequently coming in contact with each other and burning a house. Where two electric companies are equally liable for damages done by wires coming in contact, one cannot complain that verdict was returned against it alone, because each was independently liable and the jury can find for one defendant and against the other. Where, by reason of negligence of an electric company, plaintiff's house was burned, the measure of damages by law was the value of the property destroyed.

R. W. Spofford, general manager of the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga., who is a retired officer of the United States Navy, has been called to active service. W. C. Callaghan succeeds him as general manager. Mr. Callaghan has been with the J. G. White Management Organization, New York City, the operator of the Augusta company since 1913.

W. P. Southard, manager of the Albuquerque (N. M.) Gas & Electric Company, has been transferred by the parent company, the Federal Light & Traction Company, to Trinidad, Col., to manage the Trinidad Electric Transmission, Railway & Gas Company, succeeding E. C. Deal. Mr. Southard has been manager of the Albuquerque property for the last three years. Prior to that he was manager of the Las Vegas Light & Power Company, another company under Federal Light & Traction control.

Samuel W. Greenland, general manager of the Northern Indiana Traction Company and an electrical engineer of considerable prominence, has obtained a leave of absence in order to supervise the construction of a government power plant at Baltimore, Md., to be used in connection with a munition factory. The plant, it is understood, will have a rating of 20,000 kw. Mr. Greenland since the beginning of the war has taken a prominent part in his home city, Fort Wayne, Ind., in patriotic work such as Liberty loan drives, Red Cross campaigns, Y. M. C. A. work and boys' working reserves.

Weare Parsons, who has resigned as treasurer and manager of the Springfield (Ohio) Light, Heat & Power Company, has been engaged in public utility work since the very early days of telephoning. He began his career at Burlington, Iowa, in the early 80's. After spending approximately twelve years in the construction of telephone, electric light and street railway properties, during a part of which time he was with the Westinghouse Electric & Manufacturing Company's Chicago office, he joined the staff of the Western Electric Company. He remained approximately nine years with that concern, and for two and one-half years of that time operated an electric light property controlled by the Western Electric Company at Rutland, Vt., which was known as the Marble City Electric Company. Following that period he went to Joplin, Mo., in charge of the property of the Southwest Missouri Light Company, and for five and one-half years divided his time between that concern and the Keokuk Railway & Light Company of Keokuk, Iowa. Later he became connected with a Chicago bond house known as A. J. Whipple & Company. Leaving that concern, he was employed by the Springfield Light, Heat & Power Company, and during his seven and one-half years of service saw steady progress in the growth of that concern. He is at present enjoying a long-delayed vacation prior to taking up work again in the industry.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

John R. Ruggles, former assistant electrical engineer of the Acme Power Company, Toledo, Ohio, is now general superintendent of the Durham (N. C.) Traction Company.

S. M. Moore, for the last six years on the staff of the New Haven (Conn.) office of the General Electric Company, has been appointed service manager of the power equipment department of the New England Engineering Company, Waterbury, Conn.

Samuel Insull, president of the Commonwealth Edison Company, received word April 8 of the death on April 5 of his mother, Mrs. Emma Insull, in London. Mrs. Insull was in her eighty-fourth year. She is survived by five children, Samuel and Martin J. of Chicago; Joseph, whose home is in Pittsfield, Mass.; Mrs. James McAdam and Miss Emma H. Insull of London. Prior to the war Mr. Insull was in the habit of visiting his mother from two to four times a year.

W. A. Brackenridge, vice-president and general manager of the Southern California Edison Company, Los Angeles, Cal., has been elected president of the company. Mr. Brackenridge, who is a well known hydraulic engineer, went to Los Angeles in the summer of 1909 to take the management of the predecessor company, the Edison Electric Company of Los Angeles. Prior to that he was a member of the advisory board of consulting engineers of the new barge canal in New York State.

Le Roy Clark, president of the Safety Insulated Wire & Cable Company and chairman of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies, has been appointed a member of the War Industries Board, of which he will be chief of the wire and cable section of the finished products division. This has necessitated the resignation of Mr. Clark as chairman of the war service committee of wire and cable manufacturers, although he will continue with official recognition the work he has been doing as chairman of this committee. All orders by the government and the Allies, and eventually, should conditions warrant, all commercial orders, for wire and cable henceforth will be placed before Mr. Clark for allocation among the manufacturers. Mr. Clark, who was born in 1872, upon graduation from Columbia University in 1894 in electrical engineering became permanently connected with the wire industry. He has always been in the employ of the Safety Insulated Wire & Cable Company, starting as electrical engineer in 1894 and becoming president of the company in 1906.

Obituary

George J. Jackson, president of the National Conduit & Cable Company, died on Monday morning of heart trouble at his home in New York City in his fifty-seventh year. Mr. Jackson has been prominently identified with the cable industry for many years, having been prior to that engaged in the wholesale dry goods business as an importer. His first connection with the wire field was with the Norwich Wire Company, a small concern which he had purchased. About twenty years ago this company was bought out by the National Conduit & Cable Company and Mr. Jackson was retained as secretary. He had continued in this capacity until last month, when he was elected president on the retirement of E. S. Perot.

R. W. Blackwell, president of R. W. Blackwell & Company and Johnson & Phillips, cable and electric supply manufacturers, London, England, died in that city on March 29. Mr. Blackwell was born in New York City on Jan. 27, 1858. He was educated at Andover Academy, Princeton, class of 1879, and Columbia Law School, class of 1881. He was associated with R. R. Hazard in the Gramme Electric Company, a combination of all the early electric companies. He was also associated with Mr. Hazard and with W. B. Parsons in the first proposed underground railroad in New York. He was one of the organizers in 1883 of the Bentley-Knight Electric Company, of which he was president. Mr. Blackwell went to England in 1888, where he formed the importing and contracting firm of R. W. Blackwell & Company, which built the first electric railways in England and equipped them with American apparatus.

Capt. Henry N. Brooks, a member of the United States Engineers Reserve Corps, whose death in France of pneumonia has just been announced in a cablegram, was prior to enlisting an electrical engineer with James N. Hatch, consulting engineer, Chicago. He went to France last December and was stationed in a small village as engineer depot officer, in charge of a large engineer supply depot for the United States Army. He was a graduate of the engineering college of Cornell University in the class of 1888 and was one of the pioneers in the electrical railway engineering field. One of his first jobs was as an electrical engineer on the electrification of the car lines in Philadelphia in 1892 and 1893. During his career he also operated an electric railway property in Florida and was at one time employed in electric railway work by the Westinghouse Electric & Manufacturing Company. He afterward had charge of the construction of the interurban line from Grand Haven to Grand Rapids, Mich. He was for eight years electrical engineer for the firm of Sargent & Lundy of Chicago. He had been with James N. Hatch for two years prior to his enlistment in the army last June. Mr. Brooks's father was the late Admiral William B. Brooks, U. S. N.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

TRADE PROTECTION IS GROWING IN THE EAST

Preferential Discounts and Quantity Discounts
Together Are Expected Materially to
Strengthen Trade Distribution

Quantity purchase discounts have for a long time been used in the electrical jobbing field, but not too closely adhered to. There has been the old-time conflict between preferential or protective discount on the one hand and quantity discounts on the other. At the present time, however, the tendency seems to be firmly toward a strict adherence to the quantity purchase plan together with a trade preferential.

It has long been felt that retailers in the trade had been receiving a discount on purchases so small that they amounted to nothing more than retail transactions. There is a growing conviction that the contractor-dealer is not entitled to a discount unless he purchases in discount quantities; that he is not really a merchant unless he accumulates a satisfactory stock; that unless he can purchase in standard package quantities he is not big enough to be classed with contractors. Consequently the often expressed wish that contractors should pay retail prices for retail quantities seems about to bear fruit.

In wholesale purchases, however, a number of jobbers and a few manufacturers in the East have already notified the trade that quantity purchase discounts will prevail with a trade differential in the neighborhood of 10 per cent between contractor and all others.

This is but a beginning, and if it has the desired effect of strengthening the merchandising side of the contractor there is every reason to believe that a better preferential might result. The contractor to-day has practically nothing to do in the construction line and consequently is in an excellent position to give attention to the retail side of electrical merchandising.

Money Points the Way to Victory

TO PREVENT CONFUSION
IN GOVERNMENT ORDERING
Requirements Division Created to Collect All Purchasing Information, with Special Sections for Separate Commodities

A new plan of organization of the War Industries Board has been undertaken, the general purpose of which is to prevent confusion and conflict in the ordering and delivering of supplies and to secure unification of the government's policy in dealing with industrial problems. The essential change involved is the creation of a requirements division to which will be furnished information on all contracts, purchases and deliveries, and to which the supply divisions of the purchasing departments and the Allied Purchasing Commission will as far in advance as possible submit statements of their respective needs for raw materials and finished products.

To take charge of particular problems of supply there have been created special commodity sections, and whenever necessary to handle raw materials or finished products of which there is an actual or threatened shortage or the price and production of which should be controlled new sections will be created by the chairman of the War Industries Board. It is the purpose of the chairman of the War In-

dustries Board to make each of the section heads the sole government agency for dealing with the industry for which his section is responsible.

The chief of the commodity section will study the problem referred to his section and will procure from all available sources, including the supply departments, information and data which will be helpful in the allocation of these requirements. At meetings of the commodity section the allocation of materials or facilities to meet the requirements will be determined, and in this distribution the representatives of the various supply departments of the government who are members of the section will have full share.

In addition to dealing with problems referred to them by the requirements division, the commodity sections will have certain definite functions. The first will be the collection of information regarding industrial conditions already mentioned. Further, they will consider from time to time the extent of the existing sources of production, the creation of new facilities, the disclosure—if necessary, the opening up—of additional sources of supply, and the conversion of existing facilities to new uses.

Each commodity section will consider market conditions pertaining to the materials or commodities over which it has jurisdiction and will, where deemed advisable, recommend purchase plans to the several purchasing departments. In cases where it becomes necessary to control an industry in whole or in part by means of allotments, the appropriate section will determine the allotments of materials, commodities and facilities to the several departments of this government and to its allies, and also the extent to which manufacturers and others, whether serving the civilian population or engaged in the manufacture of war supplies, shall be supplied.

Back Up the Boys—Buy Bonds

TRADE ACCEPTANCE PLAN
OF CREDIT INDISPENSABLE
Its General Adoption Declared Necessary in Order
to Keep Commercial Credit in State of Fluidity
and Usability

In an address before the United States Chamber of Commerce convention on Thursday of this week Lewis E. Pierson, chairman of the board of the Irving National Bank, New York City, spoke on trade acceptances, giving opinions arrived at by the American Trade Acceptance Council. The following is quoted from Mr. Pierson's address:

"We believe, and feel prepared to prove, that in the intelligent and consistent use of this method is to be found the possibility of relief from most of the business absurdities and weaknesses which appear inherent in open account procedure.

"We find upon the testimony of hundreds of business men of highest standing, experienced in the use of the trade acceptance method, that obligations expressed in this form almost without exception are paid promptly at maturity.

"Were there no other consistent trade acceptance merits beyond this, and we have discovered many, still we would feel fully justified in appearing before this body and recommending the maximum of activity in the interest of substituting live, liquid, written, respected trade acceptances for the indefinite, imperfectly expressed and casually treated open accounts so common at present in American business.

"To the seller of merchandise we would say that the trade

acceptance is calculated to protect his proper interests to the fullest extent—that it carries with it a definite promise to pay, an acknowledgment of the correctness of deliveries, a shorter term of credit, greater flexibility of assets, better facilities for collection, a logical and improved relationship with customers and practical relief from expensive and burdensome practices which have grown up under the open-account method.

“To the buyer of merchandise we would say that the trade acceptance operates to his distinct benefit—that it gives to him classification as a preferred customer, one who serves notice upon the business world of his disposition and ability to meet his obligations promptly at maturity; that it gives to him greater independence of action; that it provides an effective check against overbuying and overborrowing; that it tends to establish his standing with banks and in the discount market and provides for him a substantially increased field of operations.

“To the nation and to all those properly interested in protecting its interests in the present grave emergency in history we would say that the development of the trade acceptance method in American business is not only important and urgent but indispensable. If we are to win this war and protect the national interest in the world commercial contest which will follow, we must put the business of the nation upon a sounder basis. Not only must our soldiers and sailors fight and suffer and citizens of all classes serve and sacrifice, but the American business man, in his particular field of service, must so direct his energies that this great resource, intrusted to his keeping—the commercial credit of the nation—will be kept in such a condition of fluidity and usability that to the fullest possible extent it will serve as an unshakable foundation upon which can be based the greatest effort of the greatest nation the world has known.”

Save Lives by Lending—Lend Now

METAL MARKET SITUATION

Higher Prices for Wire Products Freely Predicted—Persistent Efforts to Increase Official Rate

An intimation is going the rounds of jobbing circles that bare copper wire, rubber-covered, cable and weatherproof, may be advanced in price. The copper market is said to be tightening, and therefore a higher government rate will be urged to meet the so-called extra cost of refining and other overhead expense. Instead of the official selling figure for ingot copper being 23.50 cents, advocates of a higher price say it ought to be 25 cents flat. Should this argument prevail, naturally all wire products would follow suit, and while May 30 is the date when the existing price expires, an effort is evidently being made to discount the future. Insiders declare that this is the real reason of the talk about an advance. An authority disputes the necessity of increasing the current cost of the metal by saying, “A good many things may happen to the copper situation between now and June 1, but they will have to be very different from the present comfortable position of supply, demand and profits, we think, to justify higher prices.”

NEW YORK METAL MARKET PRICES

	April 1			April 8		
	£	s	d	£	s	d
Copper:						
London, standard spot....	110	0	0	110	0	0
Prime Lake	Govt. price	23.50		Govt. price	23.50	
Electrolytic	Govt. price	23.50		Govt. price	23.50	
Casting	Govt. price	23.50		Govt. price	23.50	
Wire base	26.25	to	26.75	26.25	to	26.75
Lead, trust price.....	7.25			7.25		
Nickel, ingot	50.00			50.00		
Sheet zinc, f.o.b. smelter....	Govt. price	15.00		Govt. price	15.00	
Spelter, spot	7.17½			7.17½		
Tin, Straits	*85.00			*85.00		
Aluminum, 98 to 99 per cent.Govt. price	32.10			Govt. price	32.10	

OLD METALS

Heavy copper and wire....	21.50	to	22.00	21.50	to	22.00
Brass, heavy	14.00	to	15.25	14.00	to	15.25
Brass, light	10.50	to	11.00	10.50	to	11.00
Lead, heavy	6.00	to	6.25	6.00	to	6.25
Zinc, old scrap	5.00	to	5.62½	5.00	to	5.62½

*Nominal.

THE WEEK
IN TRADE

EXCELLENT business in electrical equipment and staple merchandise is the tenor of advices from various parts of the country. To be sure, purchases and specifications for government work continue to lead the market, but the entire trade is participating in these requirements. Stocks have been depleted and the backward freight deliveries are not easing the situation. Conduit is short everywhere, and there is a strong demand for pole-line material, copper wire, sewing and washing machines and general household electrical appliances. Price changes are announced by individual firms on a number of items. Scarcity of skilled labor is a cause of anxiety in manufacturing centers.

Business is being carried along on a smaller margin of profit than in former years, but it appears to be satisfactory nevertheless. Collections are excellent, in some sections surprisingly good, while fair on an average everywhere. Credits receive close attention.

NEW YORK

Commercial business with the jobbers is not so brisk; in fact, some houses frankly state it is rather flat at present. The government requisitions for all kinds of electrical goods—large and small orders for quick delivery—however, reflect a stage of activity more than compensatory for loss of sales in the regular trade channels. While no special pinch is felt for goods, the orders on manufacturers are no longer small. In certain lines either a full case must be taken or no goods are shipped. The “twelfth part of a dozen” practice, to use the expression of several jobbers, has been abrogated.

Deliveries on commercial orders are not getting better, but going from bad to worse. Jobbers are trying various expedients to place goods in the hands of the dealers in the quickest possible time.

Financially the trade is in a stronger position than for some time, collections growing better with the opening of spring business. The careful scrutiny of credits is maintained rigorously.

LAMPS.—Until further announcement import licenses will be denied on electric lamps. The import trade is very light at present, anyway, less than \$4,000 worth coming in in January. The owners of the tungsten lamp patent, on winning their infringement suit, refused to license imported infringing lamps other than those in stock at the time.

HOUSEHOLD SPECIALTIES.—Dealers are said to be stocking up liberally on sewing and washing machines in anticipation of a rapid movement during the late spring and early summer. The price increase of from 10 to 12 per cent which was put into effect April 1 by one concern affected ironing and washing machines, flatirons, glue pots and soldering irons. Deliveries on all this merchandise are from twelve to fourteen weeks behind, and distributors specially interested declare shipping conditions are growing worse.

RADIATORS.—The sharp demand has been caught up with, and surplus stocks are not infrequent.

CONDUIT.—Difficult as it is to get conduit from the mills at Pittsburgh and Youngstown, Ohio, a carload reaches its destination occasionally. It is of little relief to the market, however, and stocks continue low.

SOCKETS.—Though stocks on standard sizes have greatly improved, shipments from the Western manufacturing centers are behind six and eight weeks; New England points, ten days to two weeks. Express facilities are rapidly equaling freight delinquencies, which is partly due to the government commandeering many of the companies' special cars. Some jobbers are meeting the emergency by splitting packages and using parcel post. One large manufacturer states

that, whereas his company was four weeks in arrears on shipments, now an order can be filled and forwarded within a week.

PORCELAIN.—The new price list foreshadowed recently is expected to go into effect about April 15. Stock is difficult to obtain on account of the embargoes, word being received that an ample supply is ready for shipment from the factories. No curtailment of manufacturing has occurred. Jobbers claim to be paying a higher price for porcelain than the government, one leading manufacturer stating that his primary bid was promptly rejected on specifications submitted, with the intimation that unless the prices were reduced the War Industries Board would take over the plant and run it on a "cost-plus" basis. The producer succumbed to the inevitable.

DRY BATTERIES.—The factories are behind on orders, owing to the unusual demand, which is occasioned by jobbers and dealers doubling their requirements on the "safety first" plan. A dealer customarily carrying a dozen batteries on re-ordering increases it 100 per cent, with the jobber following suit to meet his trade's specifications. This occasions the congestion at the factories, which are further handicapped by an acute labor shortage.

REFLECTORS.—An ample supply is reported with no change in prices.

COLLECTIONS AND CREDITS.—Judging from statements of credit managers, collections are holding up, and bills are met with reasonable promptness. This is further proved by the gradual tightening of credit accommodations.

BOSTON

The tide of electrical activity shows little sign of receding, although business is reported to be somewhat quieter in sporadic instances. Jobbers with numerous connections and established in the larger centers are in general very much rushed with orders. Stocks are on the whole in good shape to meet the spring demand, and firm prices insure stable profits under good management. Collections are very fair indeed, despite the dominating influence of the third Liberty loan upon capital outpouring. Jobbers are feeling the shortage of skilled labor not a little, and it would seem that the wider utilization of women in this branch of the industry cannot long be deferred. The expected improvement in freight deliveries on the railroads materializes very slowly. The trade acceptance idea is also slow in gaining ground, especially in the interior. Experience is favorable toward the more extended use of this method of handling credits. It is reported that the National Army cantonment at Camp Devens, Mass., will be enlarged to about double its present troop capacity this year. This, with the army base for which plans are being pushed at Boston, is occupying the attention of the trade.

STORAGE BATTERIES.—Business is excellent, especially in units for automobile service. An enormous trade in second-hand and rebuilt automobiles is getting under way in Massachusetts this year, and more cars are registered than at this time a year ago. Express shipments from Eastern factories are now on a very satisfactory basis, deliveries of three or four days from New York City being not uncommon. No recent price changes are in evidence.

SEWING MACHINES.—Central stations are making a vigorous drive in sewing-machine motors, and the public is responding well. The deferred-payment plan seems to do away with the price question.

FANS.—The large jobbing houses are accumulating fans very rapidly now, and dealers are stocking up fast for over-the-counter deliveries. One of the larger houses has now received 4500 fans out of a total of 5000 ordered, and the next warm spell will find the dealers well prepared to meet the public demand. It is expected that there will be an unusually big sale this summer of the lower-priced fans.

ELECTRIC STOVES.—Interest is growing rapidly in electric cooking, and the smaller, portable stoves are moving unusually well. One central station now has 2000 electric ranges in its territory and has sold 300 of the smaller outfits within a year. Emphasis upon the coal-saving and

food-saving advantages of electric cooking makes a patriotic appeal to which many prospective customers listen intently at this time. In suburban towns where no gas supply exists the smaller electric ranges and stoves are arousing unusual interest.

WASHERS.—It is rumored that a price advance may be expected soon on washers. Trade is good in this line.

MOTORS.—Stocks of the smaller sizes tend to increase and prices remain steady. A few of the larger units are now to be found here and there.

CONDUIT.—Some improvement in deliveries from Ohio mills is reported, and "pick-up" shipments from Boston stocks are reported to be fairly prompt to the interior.

APPLIANCES.—Irons are moving well. Portable lamps are very quiet, although good stocks are on hand. Prices are in many cases attractive, and some extra business for summer homes is always in sight at this time.

LAMPS.—Stocks are increasing steadily.

MOTOR-DRIVEN CASH REGISTERS.—These labor-saving equipments are moving well, one Boston department store having purchased over \$100,000 worth in the past year with an increase in clerical efficiency of about 20 per cent compared with former cash-carrier methods.

CHICAGO

A checking up of jobbers' business for the first three months of 1918, as compared with the same period last year, shows that the gross on the average was practically the same. It is said, however, that the 1918 business is not a good business. There is less profit in it than there was in the same period of last year, and it is not of the same steady character. One jobber described it as an "accidental" business, meaning that its spotty character as seen in the retrospect made it seem only an accident, caused by a large order or a good week here and there, that the total is as high as it is. The business this last week has been generally quiet. Among the contractor-dealers considerable interest was manifested in the news carried by word of mouth from New York that one large company had rearranged its schedule of discounts in favor of the contractor-dealers in the New York territory.

CONDUIT.—The industrial-plant demand for the larger sizes continues exceptionally strong. There was some relief in the delivery situation this week, but not enough to permit stocks to be replenished.

COPPER WIRE.—Jobbers report it impossible to keep a stock of any type of wire used by industrials. The demand is strong and very steady. Prices remain unchanged, with a slight weakening in discounts by some manufacturers.

TAPE.—An increase in prices has been announced which amounts to about 20 per cent. The higher price of cotton and rubber are given as causes.

PORCELAIN INSULATORS.—High-tension equipment continues to move with rapidity. There are no orders for new lines, but the business for replacements on present lines does not look like small business when it persistently comes in in lots of 50,000 items. Recent factory shipments to France have also helped to hold up the total volume.

ELECTRIC RANGES.—Certain sections of the West are ordering in large quantities. The small-town demand continues strong, with continual evidence that small companies which never before sold ranges are going into the field.

INCLOSED FUSES.—Some manufacturers have recently rearranged their schedule of discounts to protect the contractor-dealer. Certain concerns in the field had been using a schedule of this sort for some time. Such a plan, of course, made it necessary to give the jobber a better price. This recent change has given the jobber a better price by from 5 per cent to 10 per cent. There is no change, however, in the price of fuses to the consumer.

DOMESTIC APPLIANCES.—The market in 32-volt electrical appliances is very active. Manufacturers of 32-volt equipment are finding farm lighting plant manufacturers and distributors very ready to line up with them in the distribution of this merchandise.

ATLANTA

Although the federal government's Capital Issues Committee has passed upon about a quarter of a billion of securities so far, the issues in question covered refunding purposes and no visible effect is felt in this section at present. Residence construction is moving along fairly well in Atlanta, but there is more or less uncertainty in the Southeast regarding the Fuel Administrator's order covering the clay industries. The consensus of opinion is that these products will advance 25 per cent, in view of the curtailment, which will be reflected in building operations. Word has been received to the effect that the Terry Shipbuilding Company, Port Wentworth, Ga., will construct two floating dry docks at a cost of \$2,000,000.

The demand for all staple lines is holding up well and considerable improvement is noted in deliveries generally.

POLES AND LINE MATERIALS.—There is a steady demand for poles, and deliveries are much better. Prices remain the same. Sales in hardware continue good. Deliveries have been reduced to four weeks. The demand for carload lots of cross-arms has decreased, but the less than carload lot requirements have increased about 400 per cent. Considerable difficulty is experienced in getting the railroads to accept shipments of this class, and deliveries are being made in approximately three months. Prices advanced 10 per cent April 1. The sale of insulators continues steady in the face of a 10 per cent increase and poor shipments.

CABLE.—The transportation situation is affecting shipments, but on the whole deliveries are slightly better.

TRANSFORMERS.—Although the demand from central stations for capacities up to 25 kva. has fallen off, the volume of business is holding up well when government purchases are taken into consideration. Stocks are getting in better shape. The delivery on the power type is improving.

PANELBOARDS.—This line continues strong, the volume of business being satisfactory. Deliveries are coming in from two to three weeks.

SEATTLE

The feature of the past week's business was the placing of a large order for power apparatus in the Portland territory and the continued movement of floodlamps and sewing machines. During the past month several large orders for power apparatus in the Portland and Gray's Harbor fields have been placed by shipyards, but the last order was considerably heavier than the preceding ones. The buying of electrical apparatus and equipment in the Puget Sound district continues with steady volume. Last week showed a noticeable increase in government buying for navy yard and cantonment work.

A recent order was placed for floodlamps for both the navy yard and the American Lake cantonment, also for a considerable amount of house-wiring material and matter listed as pick-ups. An inquiry was received in Seattle for 400 washing machines for the Montana territory. Washing-machine and other domestic appliance sales are keeping up well. Irons and ranges are expected to begin a sharper movement with the approaching summer. The conduit situation is again causing much concern. Recent shipments, consisting of several carloads, relieved the situation temporarily, but the available supply is practically exhausted. Eastern manufacturers cannot obtain closed cars to make shipments. The shortage of rubber-covered wire in the larger sizes, of porcelain, of the larger motors and of certain sizes of lamps has not been relieved to any extent. Prices remain practically the same. Several large credits are in the process of being placed in the Seattle territory for shipbuilding enterprises. Collections are excellent. A Seattle shipyard recently signed a contract for constructing six submarines for the United States government. By-products factories of various kinds are in prospect for immediate establishment in Seattle and contiguous territory. Electrical jobbers are in receipt of inquiries for electrical equipment for several wood by-products plants, including corks, lignum, cellulose, wood alcohol, wood flour, fir oil, etc.

Dealers report that sales of house-wiring devices are well sustained, and fixture sales show a noticeable increase over the past two weeks. Jobbing and factory propositions are receiving favorable consideration in the Spokane field, and it is believed that Spokane is on the eve of an important industrial expansion. The total of elevators already up, contracted for or under construction in the Northwest—Washington, Oregon and Idaho—is placed at 200 to date.

Douglas fir lumber is specified by the government for the frame superstructures of 100,000 new freight cars. Car builders of the Northwest are trying to land a portion of the car-building contract. Shops in Portland, Seattle and Tacoma assert they are equipped to handle 10,000 cars within a specified time. The car supply at the West Coast mills is slightly improved, although a permanent improvement will not result until it substantially exceeds the volume of production at the mills. Railroad and steamship companies are slowly reducing the amount of accumulated export freight in Seattle's yards and docks. Freight conditions are deplorable, with no immediate signs of improvement.

SAN FRANCISCO

The past week has been a quiet one for the electrical industry, and this condition will doubtless continue during the course of the Liberty loan drive. In deference to this campaign, the National Electric Light Association convention at Del Monte, which was to be held in April, has been postponed to the second week in May so as not to interfere with the patriotic efforts of the delegates.

There is little new building reported, the outstanding features being the awarding of contracts by the Pacific Gas & Electric Company for the extension of its transmission lines to Guinda, Rumsey and Brooks and by the Pacific Telephone & Telegraph Company for a six-story class A building in Oakland and several street railway extensions in San Francisco. The scanty snowfall of last winter is reflected by the construction of a third reservoir on the Stanislaus River by the Sierra & San Francisco Power Company and a planned interchange of power between the San Joaquin Light & Power Corporation and the Mount Whitney system, which have tied their power transmission lines together at Strathmore. San Francisco building permits for March, 1918, totaled 380, costing \$758,000, as against the respective figures of 597 and \$2,040,000 for March, 1917.

No general statement can be made that will adequately cover credit conditions, for they vary with different classes of customers. They can be approximated by the assertion that collections from dealers and contractors are surprisingly good, but that payments on work and material for industrial plants are quite slow. In the opinion of shrewd credit men the reasons for this state of affairs are plain—first, that electrical dealers are no longer inclined to recklessly take work without regard to the credit risk; second, that on account of widespread industrial work retail money is plentiful and payments are prompt to dealers; third, that a great deal of this industrial work is for the government, whose routine for payment takes time and slows up successive payments; fourth, that there seems to have been a wave of slower conditions that was first noted in New York two months ago and has gradually spread West.

Staple material is found to be ready for factory shipment in a far shorter time than during the first two months of the year, although it is almost impossible to get special material. The strenuous efforts of the various car conservation committees have resulted favorably, but the time in transit is still unimproved, forty-five days for carloads and from fifty to sixty days for less-than-carload shipments being the average.

LAMPS.—Deliveries are better and business still holds strong. The customary summer let-up will be welcome this year, as it will enable dealers to catch up on their back orders, and the 10 per cent increase in the price of lamps will more than care for any lessened consumption due to the new daylight law.

MOTORS.—Stocks are good and deliveries fair, with a steady demand for 2-hp. to 5-hp. sizes and an increased call for 20-hp. to 50-hp. sizes, some of which is due to the opening of new mines.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	
Less than coil.....	List to \$61.00
Coil to 1000 ft.....	10% to 57.25
No. 12 Solid	
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	10% to 66.75

Twin-Conductor

No. 14 Solid	
Less than coil.....	List to \$104.00
Coil to 1000 ft.....	\$97.75 to 10%
No. 12 Solid	
Less than coil.....	List to \$135
Coil to 1000 ft.....	10% to \$126.80

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	5% to 20%
No. 12 Solid	
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	5% to 20%

Twin-Conductor

No. 14 Solid	
Less than coil.....	15% to 10%
Coil to 1000 ft.....	20%
No. 12 Solid	
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to \$24.00
1/5 to std. pkg.....	20% to 19.80
Std. pkg.....	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	20% to List
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

No. 6 Regular	
Each Net	No. 6 Ignitor
Less than 12.....	\$0.40
12 to 50.....	.35
50 to barrel.....	.32
Barrel lots.....	.28 to .285 .29 to .295

CHICAGO

No. 6 Regular	
Each Net	No. 6 Ignitor
Less than 12.....	\$0.40
12 to 50.....	.35
50 to barrel.....	.3175-.3195 .3275-.3295
Barrel lots.....	.2875-.2895 .2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 100 FT.—NEW YORK

Less Than Coil	
3/4-in. s. stp. Net to \$75.00	—15% to \$69.75
3/4-in. d. stp.+10% to 75.00	List to 72.00
1/2-in. s. stp. List to 100.00	—15% to 93.00
1/2-in. d. stp.+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	
3/4-in. single strip.....	\$75.00 \$63.75
3/4-in. double strip.....	78.25-78.75 71.25-71.75
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
3/4.....	.15	2.....	.55
1.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	
7/32-in.——	\$15 to \$60 \$60 to \$150
1/4-in.——	List List
\$25.00-\$55.00	\$20.50-\$24.50 \$20.00-\$21.50
\$28.00-\$60.00	\$22.50-\$27.00 \$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	
7/32-in.——	\$15 to \$60 \$60 to \$150
1/4-in.——	List List
\$36.00-\$55.00	\$25.00 \$22.50
\$40.00-\$66.00	\$27.00 \$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38	
Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37 1/2
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

Size, In.	List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	
Less than 2500 lb.....	4% to 12% 7% to 15%
2500 to 5000 lb.....	.6% to 14% 9% to 17%
(For galvanized deduct six points from above discounts.)	

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	
Less than 2500 lb.....	5.3% to 8.9% 8.3% to 10.9%
2500-5000 lb.....	7.3% to 10.9% 10.3% to 13.9%
(For galvanized deduct six points from above discounts.)	

FLATIRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	20% to 30%
1/5 to std. pkg.....	38% to 40%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28% to 30%
1/5 to std. pkg.....	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Less than 1/5 std. pkg.	Per 100 Net
1/5 to std. pkg.	\$5.00
Standard packages, 500. List, each,	\$0.07.

CHICAGO

Less than 1/5 std. pkg.	Per 100 Net
1/5 to std. pkg.	\$5.25
Standard packages, 500. List, each,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B.....	100	\$0.30
60-watt—B.....	100	.35
100-watt—B.....	24	.70
75-watt—C.....	50	.70
100-watt—C.....	24	1.10
200-watt—C.....	24	2.20
300-watt—C.....	24	3.25
Round bulbs, 3 1/2 in., frosted:		
15-watt—G 25.....	50	.53
25-watt—G 25.....	50	.55
40-watt—G 25.....	50	.55
Round bulbs, 3 3/4 in., frosted:		
60-watt—G 30.....	24	.77
Round bulbs, 4 3/8 in., frosted:		
100-watt—G 35.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

Less than coil (250 ft.)	Per 1000 Ft. Net
Coil to 1000 ft.	\$31.00 to \$34.90
	26.20 to 27.90

CHICAGO

Less than coil (250 ft.)	Per 1000 Ft. Net
Coil to 1000 ft.	\$29.00 to \$30.00
	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	\$24.00
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CHICAGO

Net per 100	\$21.75
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OUTLET BOXES

	List, per 100
01—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
02—B.A., 6200, S.E., 300, AX, 1 1/2 4 S.....	30.00
03—C.A., 9, 4R, B 1 1/2.....	25.00
06—F.A., 7, C.S., 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.....	25%	20%
10.00 to \$50.00 list.....	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.....	40%	35%
10.00 to \$50.00 list.....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200. List per 1000.	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200. List per 1000.	\$20.

PORCELAIN KNOBS

NEW YORK

	Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.	

Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

	Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.	

Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10 to \$11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg. List
1/4-in. cap key and push sockets. 500	\$0.33
1/4-in. cap keyless socket.....	500 .30
1/4-in. cap pull socket.....	250 .60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	24% to 25%
1/5 std. pkg.	30% to 33%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

Low Grade:

30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

	High Grade	Low Grade
Less than \$10 list.....	List to + 5%	5% to 10%
\$10 to \$25 list.....	11%	16%
\$25 to \$50 net.....	14% to 15%	24% to 25%

DISCOUNT—CHICAGO

	High Grade	Low Grade
Less than \$10 list.....	+5%	+5%
\$10 to \$25 list.....	10% to 11%	16%
\$25 to \$50 list.....	14%	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List Each
Union and Similar—	
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....		
\$2.00 to \$10.00 list.....	List 40%	Net to 30%
\$10.00 to \$50.00 list.....	10% to 50%	5% to 40%
	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25%	20%
\$2.00 to \$10.00 list.....	25%	20%
\$10.00 to \$50.00 list.....	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price.....	\$6.00
Discount.....	30%

CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.....	\$0.41 1/4 - \$0.44 1/4
No. 18, full spools.....	0.36 1/4 - 0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.....	\$0.57 1/2 to \$0.65
No. 18, full spools.....	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net
Less than 500 to 1000 to	
No. 500 Ft. 1000 Ft. 5000 Ft.	
11. \$15.00-\$18.00	\$12.50-\$13.00 \$9.85-\$11.50
12. 23.25-25.40	21.30-21.80 15.95-19.35
10. 32.40-35.20	29.70-30.20 22.10-27.00
8. 45.70-49.15	41.90-42.10 30.88-38.00
6. 72.40-77.85	66.35-66.75 48.95-60.30

CHICAGO

	Price per 1000 Ft. Net
Less than 500 to 2500 to	
No. 500 Ft. 2500 Ft. 5000 Ft.	
14. \$18.00	\$13.00 \$11.50
12. 25.33-\$26.28	22.02-\$25.33 18.35-\$20.93
10. 30.49-36.54	27.94-31.26 22.86-29.23
8. 42.54-51.57	38.99-44.13 31.90-41.36
6. 66.46-88.38	56.15-75.61 50.53-70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$33.25 to \$35.25
25 to 50 lb.....	31.25
50 to 100 lb.....	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.....	\$35.42 to \$40.00
25 to 50 lb.....	34.42 to 39.00
50 to 100 lb.....	33.42 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Weldless Guy-Rod Head

The Diamond Expansion Bolt Company, 90 West Street, New York City, has developed a new guy-rod head shown in the accompanying illustration. It consists of a weldless loop constructed so that a square-headed rod can be slipped through it and held in position against turning. The weldless



GUY-ROD HEAD ALLOWS NATURAL BEND
FOR WIRE

eye is shaped so that the wire looped through it will not be bent in too small radius. Another advantage lies in the fact that there are no screw threads above the ground level to deteriorate from atmospheric conditions.

Portable Commutator Slotting Machine

A new and simple slotting machine for undercutting mica in commutators is being manufactured by F. E. Aurand of 123 South Cuyler Avenue, Oak Park, Ill. The machine consists essentially of a head which contains a small circular saw attached to a transverse shaft carrying a worm gear, and a hollow handle which contains the worm shaft and a small motor. The service wires for the motor enter through the outer end of the handle.

The device can be used for all sizes of commutators and can be adjusted to cut at various depths. A thin guide shoe slides in the slot immediately behind the cutting saw and greatly aids in holding the saw in its proper plane.



MACHINE SLOTS COMMUTATORS WITHOUT
REMOVING BRUSH RIGGING

One of the principal advantages lies in the fact that most commutators can be undercut with this device without removing the brush-holder rigging. On small machines it may be necessary to

remove one set of brushes, but on most large machines no dismantling is necessary. By using care in the selection of properly gaged saws the manufacturer claims that mica can be cut as clean as by a milling machine.

The small motor contained in the handle is of the universal type. Machines which will be operated by means of a flexible shaft instead of the motor will be built if customers desire. The hollow handle is made of cast aluminum and the complete outfit weighs about 11 lb. (5 kg.). Its simplicity and the ease with which inexperienced mechanics readily learn to operate it are among the features claimed for the device.

Portable Electric Sewing Machine

A light, compact sewing machine has been placed upon the market by the Triumph Specialty Company, 235 Canal



ENTIRE OUTFIT CAN BE EASILY CARRIED

Street, New York City. The device consists of a sewing-machine head, a motor, a speed regulator and a cover. The whole outfit can be packed inside the cover, and is so light that it can be easily carried and placed out of the way when not in use. Power is supplied by a Westinghouse "sew-motor" designed for 115-volt direct-current and 110-volt alternating-current circuits. The machine and motor are directly connected by a belt, which, it is claimed, insures quiet operation. The motor is controlled by a foot-operated speed regulator which provides any speed from one to several hundred stitches per minute. It is made of heavy steel and well insulated, being connected to the motor by a reinforced flexible cable.

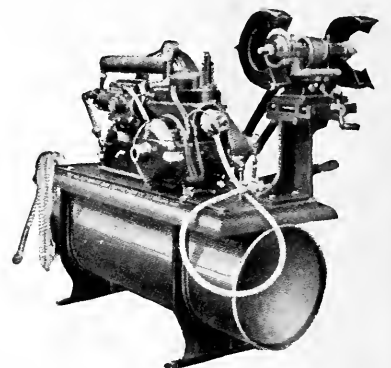
Small-Size Warming Pad

The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has placed on the market a 9-in. by 12-in. (22.8-cm. by 30.5-cm.) warm-

ing pad. The pad is similar to the standard 12-in. by 15-in. (30.5-cm. by 38.1-cm.) pad manufactured by the same company. It is equipped with two thermostats which are inclosed in the pad. These thermostats are connected in series and prevent overheating by opening the circuit when the temperature rises to a point near the maximum safe value. When the temperature falls the thermostat will reclose the circuit and thus maintain the heat at a uniform temperature. The pad is manufactured in one style only for a voltage range of 95 volts to 125 volts, and the power demand is 48 watts at 110 volts.

Combined Air Compressor, Buffing and Grinding Head

The United States Air Compressor Company, Cleveland, Ohio, has placed upon the market a combination air compressor and grinder outfit which is especially suitable for service in garages and similar places where compressed air is required. The outfit, driven by a 1-hp. Robbins & Myers motor, consists of a self-oiling air compressor with filtering trough, safety valve, buffing head and pressure tank with accessories. The air compressor is air-cooled and is designed for pressures up to 300 lb. per sq. in. (21 kg. per sq. cm.). An extra tank is provided to allow the motor to start against no pressure and obtain momentum before any load is applied. When the air in the main tank is raised to the proper pressure the automatic switch stops the motor and operates an automatic pressure release which



AUXILIARY TANK ALLOWS MOTOR TO GAIN
SPEED BEFORE ASSUMING LOAD

opens the tank to the air. The rating of the motor is sufficient to allow the use of the buffing and grinding outfit at the same time the air compressor is working.

Concealed-Terminal, Fuseless Cleat Rosette

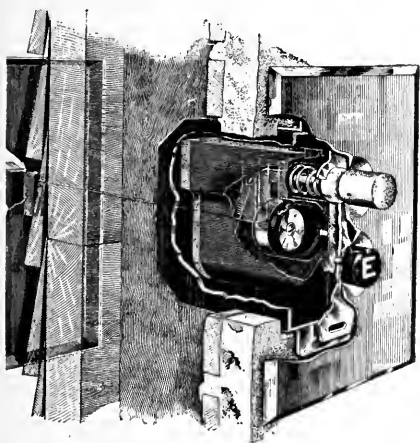
Pass & Seymour, Inc., Solvay, N. Y., have placed upon the market a concealed-terminal, fuseless-cleat rosette with a pivot cap. The rosette is of special rugged construction and is designed to carry the wires a full half inch (1.27 cm.) from the surface wired over. The binding screws which secure the cap to the base are so arranged that the cap may be pivoted on one end while the other end of the cap, when the binding screws are released, swings in or out of position. This feature makes it easy to wire the rosette at a bench or on a step-ladder.

Electric Iron with Switch Plug

Landers, Frary & Clark of New Britain, Conn., are marketing two 8-lb. (2.7-kg.) electric iron models equipped with permanently attached push-button switches. These switches are conveniently arranged on the iron so that they can be controlled without moving the hands from the iron handle. A quick double-break switch of simple construction is inclosed in a heavy split casing held together by a steel clamp which also serves to attach the plug to the handle bracket. It is claimed that the use of this switch lengthens the life of the cord, saves energy, and is advantageous because of the fact that it eliminates the arc which would ordinarily occur when the commonly used plug is removed from the iron.

Push-Button Switch with Automatic Time Regulation

The accompanying illustration shows a switch that can be closed by direct or remote control and will stay closed for



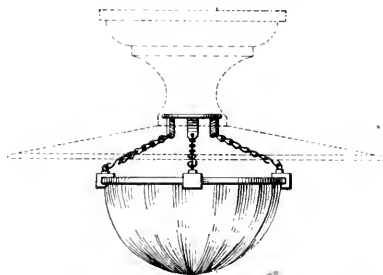
ADJUSTABLE DASH-POT CONTROLS THE TIME

a predetermined time. The connecting operation is accomplished by pressing the button at the top of the switch or by working a device on the opposite side of the room that is connected to this

button by means of a steel wire. An adjustable dash-pot limits the time during which the circuit remains closed. This time limit can be varied from a few seconds to a ten-minute interval. If it is desired to close the switch for an indefinite period the black button marked *E* is pressed upward. To open the circuit the same button is pressed down. The device is useful for installations of porch and basement lamps, and in many halls and garages. It is claimed that the device is economical because its action is positive and there is no chance of the lamp burning unintentionally after the predetermined period. It is being marketed by Samuel M. Esler, 59 East Adams Street, Chicago.

Adapter for Changing from Direct to Indirect Lighting

The accompanying diagram shows a method of adapting diffusing bowls to old lighting fixtures having standard fittings. The adapter makes it possible to use the flat-type doric moonstone or other direct-lighting reflector styles of shades with gas-filled lamps for indirect lighting. This adapter consists merely of three chains with spring clips at the lower end and a shade fitting at the



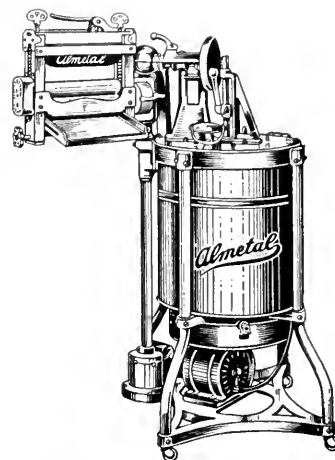
SPRING CLIPS THAT ARE EASILY REMOVED FROM BOWL FOR CLEANING

upper end. The upper end is attached to the shade holder of the original unit and the lower spring clips are attached to the diffusing bowl. The spring clips can be easily attached to the bowl but cannot slip off accidentally. By using these adapters an even pull is exerted on the diffusing-bowl rim and the bowl does not have to be lored and thus weakened. This device is manufactured by the Lighting Studios Company, 220 West Forty-second Street, New York City.

Household Steam Laundry with Facilities for Inspection

The accompanying illustration shows a motor-operated "Almetal" household steam laundry marketed by the Manufacturers' Distributing Company, Fullerton Building, St. Louis, Mo. The machine, which is gas-heated, boils, washes and sterilizes fabrics in one operation by the vacuum-suction system. It forces boiling soapsuds through the clothes, heats the water in the machine, and keeps it boiling until the washing oper-

ations are finished. Inspection of the clothes in this machine is facilitated by a device that automatically lifts the clothes out of the hot water. If they are found to be clean they can then be



CLOTHES AUTOMATICALLY LIFTED OUT OF WATER

run directly through the wringer. The washing machine is of metal construction throughout and is operated by a 0.25-hp. Robbins & Myers waterproof motor.

Gothic Lantern

The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has placed on the market a new Gothic lantern that is adapted for use in a building decorated in Gothic style. The fixture is made of "compone" in a variety of finishes with either opal or colored glass panels. The lantern can be used for luminous indirect, indirect or direct lighting, and is especially desirable for use in churches, clubs or public buildings.

Expansion Joint for Pipe Line

A device that, it is claimed, eliminates pipe-line expansion difficulties is being placed upon the market by the R. D. Nuttall Company of Pittsburgh, Pa. The expansion joint is made of one piece of material, machined inside and out from a solid forged-steel blank which is oil-tempered. The corrugations allow expansion or contraction by an action similar to that of bellows. The one-piece joints are made in all sizes with standard flanges for either high-pressure or low-pressure pipe lines. The high-pressure joints are designed to allow an expansion and contraction of 1 in. (2.5 cm.) from normal, or a total movement of 2 in. (5 cm.). The low-pressure joints allow 0.31 in. (0.8 cm.) movement over or under normal, or a total movement of 0.63 in. (1.6 cm.). Limiting bolts are provided as shown to prevent expansion beyond the safe limit, and a sliding sleeve is also inserted in the high-pressure joints to minimize friction and help support the internal pressure strain.

Trade Notes

THE H. W. JOHNS-MANVILLE COMPANY'S Youngstown (Ohio) office is now at 520 Market Street.

THE VARNALL-WARING COMPANY of Philadelphia has decided to group its several products under the name of "Yarway."

THE HOMESTEAD VALVE MANUFACTURING COMPANY of Homestead, Pa., has opened a branch office at 1 Franklin Street, New York City.

THE CLEMENS ELECTRICAL CORPORATION, 725 Main Street, Buffalo, N. Y., has appointed the Doherty-Hafner Company, 618-626 West Jackson Boulevard, Chicago, its agent.

ROBERT S. BLAKE, formerly employed by the Conduit Electric Manufacturing Company of Boston, Mass., in charge of the Philadelphia office, has been made district manager in the Chicago territory for the Duquesne Electric & Manufacturing Company. Mr. Blake has headquarters at 230 South La Salle Street, Chicago.

THE HOTPOINT DIVISION OF THE EDISON ELECTRIC APPLIANCE COMPANY, INC., of Chicago, New York and Ontario, Cal., has formulated extensive publicity plans to increase the use of electrical appliances. The Hotpoint distributors have been sent a complete outline of promotion plans for the first half of 1918.

A. D. ALEXANDER has purchased the Pittsburgh office of the Richard D. Kimball Company, consulting engineer, and will continue the business under his own name. Mr. Alexander has been resident engineer in charge of the Pittsburgh office of the above concern for the past three years and was formerly engineer with the Pittsburgh Board of Public Education.

THE NAVY DEPARTMENT, Bureau of Supplies and Accounts, division of inland traffic, has issued, under date of March 21, a set of instructions to navy contractors concerning car supply and expeditious trade movement—carload and less than carload. A copy of these instructions can be had from H. P. Anewald, manager inland traffic, Navy Department, Washington, D. C.

MACGOVERN & COMPANY of New York City, well-known dealers in second-hand equipment, announce the opening of branch offices at Pittsburgh, Pa., and St. Louis, Mo. The office in Pittsburgh is at 498 Union Arcade and is under the direction of L. H. Tippins and W. L. Sprengle. The St. Louis office is at 315 North Twelfth Street and is under the direction of R. S. Fisher, district manager.

WILLIAM C. MAGELSEN, United States Consul, advises the Bureau of Foreign and Domestic Commerce that Melbourne, Australia, has a movement now on foot to secure the standardization of all electrical goods. When standards have been adopted the schedules will be made available by the Commonwealth Bureau of Science and Industry, and copies will be very serviceable to American manufacturers intending to compete in this trade.

THE SPRAGUE ELECTRIC WORKS OF THE GENERAL ELECTRIC COMPANY are now in the new building in Bloomfield, N. J., which provides increased capacity for the manufacture of generators, motors and controllers, dynamometers, hoists, ozonators and electric fans. It is of reinforced concrete, 75 ft. by 550 ft., with an L 75 ft. by 175 ft., six stories in height, walls and columns being designed for the addition of another story should it be necessary at some future time.

W. H. HOLCOMB has joined the sales forces of the Moloney Electric Company and will be connected with the home office in St. Louis. Formerly Mr. Holcomb was sales engineer for the Frank Adam Electric Company of St. Louis, and later he was with the Allis-Chalmers Company of Milwaukee. More recently he had returned again to the employ of the Frank Adam Electric Company and had been opening branch offices for that concern at Detroit, Cincinnati, Minneapolis and Washington, D. C.

THE IRVINGTON (N. J.) VARNISH & INSULATOR COMPANY has made plans for giving free to each employee who has been drafted or who has enlisted a life insurance policy for \$2,500, the premiums to be paid by the company during the period of the war. There are at present about 460 employees who will benefit by this action. If other employees are drafted or enlist, they will automatically come within the provisions of this gift. This was done by the company in its desire to

make sure that any dependents of its soldier employees should not be left destitute in any circumstances.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has just announced that, as of April 1, 1918, the Copeman Electric Stove Company will be merged in a new company to be known as the Westinghouse Electric Products Company, with headquarters and factory at Mansfield, Ohio. This factory will be devoted to the manufacture of heating appliances previously made at the Newark works of the Electric Company and the Flint (Mich.) works of the Copeman Electric Stove Company. The general operations of the Westinghouse Electric Products Company will be directed by W. K. Dunlap as general manager. Mr. Dunlap is also assistant to vice-president of the Westinghouse Electric & Manufacturing Company.

THE WAR TRADE BOARD, Washington, D. C., under date of March 28, addresses the following notice to exporters and importers: "It has come to the attention of the War Trade Board that various individuals, firms and corporations have been advertising their services to be rendered in the matter of securing export and import licenses. The War Trade Board suggests that it is not necessary for exporters and importers to consult such agencies. The various bureaus of the War Trade Board will supply all the information desired on receipt of requests therefor. The board desires to place as little inconvenience and expense upon importers and exporters as possible, and therefore this suggestion is made in order that they may not be put to the expense of employing such agencies to obtain licenses unless they so desire."

Trade Publications

PUMPS.—The Manistee Iron Works Company, Manistee, Mich., has issued a catalog entitled "The Pump That 'Manistee' Builds." An exploded view brings out the features of the pump construction. Data on operating characteristics are given.

DISCONNECTING HANGERS.—"Do Your Reflectors Reflect?" is the title of a circular being circulated by the Thompson Electric Company, 5606 Euclid Avenue, Cleveland, which illustrates the principle of the Thompson "safety" disconnecting hangers. These hangers allow the reflectors to be cleaned easily.

LAVA INSULATORS.—The Tennessee Burner Manufacturing Company of Chattanooga, Tenn., has issued a circular entitled "After Your Patronage," describing its lava insulators for high-frequency circuits. These insulators are designed to withstand a temperature of more than 2000 deg. C. and are made in any shape or form.

HYDROELECTRIC TURBINES.—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has issued a circular illustrating the most powerful high-head turbine in the world. The turbine, which is used by the Puget Sound Traction, Light & Power Company, is rated at 25,000 hp. and rotates at 360 r.p.m. against a 440-ft. (134-m.) head.

INDUSTRIAL POWER-PLANT CONSTRUCTION.—The Guarantee Construction Company, 140 Cedar Street, New York, is distributing bulletin No. 122, entitled "Economic Handling and Storage of Coal, Ashes and Other Material." The bulletin is well illustrated and shows actual installations that the company has designed and constructed. A description of the Darley suction conveyor is given and its advantages are pointed out.

STEAM TABLES FOR CONDENSER WORK.—The Wheeler Condenser & Engineering Company, Carteret, N. J., has issued the fourth edition of a bulletin entitled "Steam Tables for Condenser Work," which is a handbook of steam tables with pressures below atmosphere expressed in inches of mercury referred to a 30-in. (762-mm.) barometer. It also includes discussions on the use of the mercury column and the accuracy of such measurements.

INDUSTRIAL TRUCKS CHARGING OUTFIT.—A folder has just been issued by the Cutler-Hammer Manufacturing Company of Milwaukee, illustrating and describing the "C-H" sectional battery-charging equipment for industrial electric trucks. A type of battery-charging outfit is referred to which is especially suitable for public and private garages. This charging equipment is provided in sections, each of which is a complete charging unit so that new sections can be added with the purchase of additional trucks.

SILK TAPE.—The Mitchell-Iland Manufacturing Company, 99 John Street, New York, is distributing a card price list of its plain silk insulating tapes. A sample of silk tape is attached to the card and prompt delivery is assured.

BOILER METERS.—"How to Save Coal" is the title of a circular being distributed by the Bailey Meter Company of 141 Milk Street, Boston. The bulletin shows the things that must be considered in the boiler room to obtain efficient operation.

ELECTRICAL EQUIPMENT IN THE WOODWORKING INDUSTRY.—This is the title of circular 7133, being distributed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The bulletin describes the applications of electric drive in woodworking industry and shows actual installations. Motors and their controllers are very clearly described in the bulletin. In the back of the booklet is a table giving the power requirements of woodworking machinery. Practically every machine used in the woodworking industry is listed in the table.

New Incorporations

THE MEASURED SERVICE METER COMPANY of Uniontown, Pa., has been incorporated by R. A. Neville and others. The company is capitalized at \$50,000 and will make telephone and other meters.

THE CEILITE COMPANY of Utica, N. Y., has been incorporated with a capital stock of \$100,000 by W. L. Foley, W. I. Taber and S. Garfunkel of Utica. The company proposes to manufacture gas and electric fixtures.

THE ELECTRIC ZINC RUST PROOF COMPANY of Detroit, Mich., has been chartered with a capital stock of \$10,000 to deal in solution and electroplating equipment. The incorporators are: Alfred T. Warner, Charles G. Bennett, Thompson W. Kirby.

THE HOME LIGHTING & STORAGE BATTERY COMPANY of Newcastle, Ind., has been incorporated by Samuel N. Denton, Luther O. Draper and Isaac E. Hays. The company is capitalized at \$25,000 and proposes to manufacture storage batteries.

THE LIBERTY LIGHTING SUPPLY COMPANY of New York, N. Y., has been incorporated by M. P. Hartman, A. Weiss and H. Hoffman, 2270 Seventh Avenue, New York. The company is capitalized at \$5,000 and proposes to manufacture lighting fixtures.

THE AMERICAN ELECTRIC PRODUCTS COMPANY of Montreal, Que., has been incorporated by L. Macfarlane, W. B. Scott, J. McNaughton and others. The company is capitalized at \$1,500,000 and proposes to manufacture electrical equipment, machinery, etc.

THE CELL BEAM CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$5,000 to manufacture and deal in lighting fixtures. The incorporators are: J. Record, R. W. Wadman and N. G. Rost, 251 West Ninety-eighth Street, New York, N. Y.

THE JONAS LALLEY LIGHT COMPANY of Milwaukee, Wis., has been incorporated by August A. Jonas, John P. Peterson and Gustave Jonas. The company is capitalized at \$25,000 and proposes to manufacture and install electric-lighting systems in isolated localities.

THE AUBURN ELECTRICAL COMPANY of Androscoggin, Auburn, N. Y., has been incorporated with a capital stock of \$10,000 to do a general electrical and automobile business. The officers are: Fred H. Lancaster, president, and Elmer W. Nickerson, treasurer and clerk.

THE AMERICAN FUEL SAVING ENGINEERING CORPORATION of Fort Wayne, Ind., has been chartered with a capital stock of \$1,000,000 by Austin W. Stultz, Charles H. Hall and Bruce M. Wylie. The company proposes to manufacture fuel-saving and smoke-consuming devices.

THE GEORGE POEHLMANN & SON COMPANY, 430 Third Street, Milwaukee, Wis., has been chartered with a capital stock of \$50,000 to take over the business of George Pöehlmann & Son, manufacturers of industrial electrical generating and distributing equipment. Orville G. Pöehlmann is secretary and treasurer.

THE SUN POWER EQUIPMENT COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$10,000. The company proposes to do an electrical engineering business, etc. The incorporators are: C. L. Rimlinger, M. M. Clancy and F. A. Armstrong, Wilmington, Del.

New England States

BANGOR, ME.—The Eastern Maine Railroad Company, it is reported, contemplates the construction of either a steam or electric railway from Bangor, crossing the Penobscot River to Brewer, thence in an easterly direction through the timberlands of eastern Maine through Holton, a distance of 112 miles. Right-of-way has been purchased for about 32 miles.

CONCORD, N. H.—Extensive improvements are under consideration by the Boston & Maine Railroad Company at its local plant, which provide for the erection of a new roundhouse and other changes. As yet nothing definite has been decided upon.

BRANDON, VT.—The Public Service Commission has granted the petition of the Fortonia Power Company asking permission to make a contract with Wetherbee & Sherman, owners of the Iron mines and other industries, in Port Henry, N. Y., whereby the company might borrow \$75,000 for development work. The project upon which the loan is to be expended is situated short distance south of Middlebury.

BOSTON, MASS.—Plans have been filed by the New York, New Haven & Hartford Railroad Company for the construction of a one-story electric battery building, about 100 ft. by 140 ft., at Dover, near Boston. Contract has been awarded to C. W. Murock, 185 Church Street, New Haven, Conn.

CLINTON, MASS.—A 66,000-volt transmission line, 16 miles long, connecting the power station at the Wachusett dam in Clinton with the power station at the Sudbury basin in Southboro will be completed about May 1. An existing electric transmission line, 1415 ft. long, connects the Wachusett station with the New England Power Company's line and a 13,200-volt transmission line connects the Sudbury power station with the line of the Edison Electric Illuminating Company. William E. Ross, 1 Ashburton Place, Boston, is chief engineer of the Metropolitan Water and Sewerage Board.

SHIRLEY, MASS.—The Shirley Electric Company has purchased the G. M. Ballou mill property, including a valuable water power, located in the center of the village. The company, it is understood, contemplates the construction of a new electric generating plant, together with substations.

SPRINGFIELD, MASS.—Contract has been awarded by the United Electric Illuminating Company for improvements to its State Street plant to the Stone & Webster Engineering Corporation of Boston. The cost of the work is estimated at about \$300,000 and the plans provide for the installation of entire new switching equipment throughout the plant to replace the apparatus now in use, and a 25,000-hp. steam turbine to take the place of 16 of the old 400-hp. boilers.

SPRINGFIELD, MASS.—Work has been started by the Turners Falls Power & Electric Company on the construction of towers across Hampton Plains to the Springfield Street Railway Company's station on the Westfield River dike preparatory to erecting wires from the Southampton town line. The power belt will continue down the dike to East Main Street crossing the highway in the vicinity of Little River Street and hence to the Agawam town line.

WEST STOCKBRIDGE, MASS.—The local electric-light plant, owned by J. F. Bossidy, has been purchased by the C. D. Parker Company of Boston.

WHITMAN, MASS.—The town has voted to enter into a new five-year contract with the Edison Electric Illuminating Company of Brockton for lighting the streets of the town, under the terms of which ornamental lamps will be erected in the business district of the town.

NARRAGANSETT PIER, R. I.—The Town Council has agreed to accept the proposal of the Narragansett Pier Electric Light & Power Company for changing the lighting system on Caswell Street and placing the wires underground, provided the town will pay one-third of the cost.

BRIDGEPORT, CONN.—Plans of the United Illuminating Company of Bridgeport for the erection of a three-conductor 6600-volt transmission line on jointly used poles have been approved by the Public Utilities Commission, because "of the emergency due to war conditions."

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ALBANY, N. Y.—The Public Service Commission has authorized the Hudson Power Corporation to issue \$15,000 in capital stock. The company was incorporated to build a power plant on the Wallkill River near Rifton.

AUBURN, N. Y.—Application has been filed by the Empire Gas & Electric Company and the Empire Coke Company for authority to issue \$170,000 in joint bonds, the proceeds to be used for extensions and new equipment in both the gas and electric departments, including new transmission lines. The principal work is to be a new substation on Clark Street to supply electricity to the manufacturing plants in the city.

BROOKLYN, N. Y.—Plans have been prepared by G. L. Knight, 13 Willoughby Street, for alterations and improvements to the power house of the Edison Electric Company on Gold Street.

BROOKLYN, N. Y.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded contract to Westinghouse, Church, Kerr & Company for the construction of a one-story power house, 45 ft. by 80 ft., at the Brooklyn navy yard.

BROOKLYN, N. Y.—The War Department has decided to take over the waterfront property between Fifty-seventh and Sixtieth Streets at Bay Ridge, Brooklyn, on which it will erect a permanent quartermaster's warehouse, at a cost of about \$25,000,000.

NEW YORK, N. Y.—Plans are under consideration by the Edison Storage Battery Company for the erection of a new three-story building, about 60 ft. by 100 ft., at 247-51 West Thirty-fifth Street.

NEW YORK, N. Y.—Bids will be received by the board of trustees or the curator of the College of the City of New York, 114 Main Building, 139th Street and Convent Avenue, New York, until April 16, for alterations and repairs, including the installation of electric-lighting system and alterations to fire-alarm system in the basement of the first story west of the main stair hall in the Twenty-third Street building of the College of the City of New York, Lexington Avenue and Twenty-third Street. Copies of specifications, etc., may be obtained at the office of Crow, Lewis and Wickenhoefer, architects, 200 Fifth Avenue.

NYACK, N. Y.—The capital stock of the Rockland Light & Power Company has been increased from \$1,000,000 to \$1,300,000.

OXFORD, N. Y.—Bids will be received by Mrs. Georgianna Griffith, president of the board of managers of the New York State Women's Relief Corps Home, Oxford, until April 24 for a refrigeration plant. Drawings and specifications may be obtained from the New York State Women's Relief Corps Home, Oxford, at the New York City office of the Department of Architecture, Room 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany.

ST. GEORGE, S. I., N. Y.—Bids will be received by the president of the borough of Richmond, Borough Hall, St. George, New Brighton, until April 18, as follows: (1) For lighting fixtures of an additional county court house in the county of Richmond located at Jay and De Kalb Streets and Stuyvesant Place, St. George, contract No. 10: (a) For the entire work, complete, using brass plated steel chain for hanging fixtures; (b) for the entire work, using solid brass chain for hanging fixtures. (2) For electric clocks for the above court house. Blank forms, plans and specifications may be obtained at the office of the engineer, Bureau of Engineering, Borough Hall, St. George.

UTICA, N. Y.—The capital stock of the J. & M. Electric Company has been increased from \$25,000 to \$50,000.

WATERVILLE, N. Y.—Application has been filed with the Public Service Commission by the Waterville Gas & Electric Company for permission to construct and operate an electric distribution system to supply electricity for lamps and motors in the town of Marshall under a franchise granted by the Town Board in February.

BORDENTOWN, N. J.—Plans are being considered by the Board of Commissioners for the installation of new electric-lighting fixtures throughout the city hall building in connection with other improvements.

KEARNEY, N. J.—Plans are being prepared by the Niles-Bement-Pond Company,

111 Broadway, New York, N. Y., for the construction of new plant on the Lincoln Highway and the Hackensack River, Kearney. The cost of the initial work is estimated at about \$2,000,000, and the plant will specialize in the manufacture of industrial locomotives and heavy machinery. Harris & Richards, Drexel Building, Philadelphia, Pa., are the architects.

NEWARK, N. J.—Plans have been filed by the New York Telephone Company, 15 Dey Street, New York, for improvements and alterations to its local telephone exchange building. Contract has been awarded to W. A. L'Hommiedieu, 1 Madison Avenue, New York City.

TRENTON, N. J.—Plans are being prepared by the Crescent Insulated Wire & Cable Company, Olden and Taylor Streets, for the erection of a three-story addition, about 85 ft. by 100 ft., to its factory. The company manufactures cables, electric wire, etc.

BRIDGESBURG, PA.—The Henry A. Hitter's Sons Company, Gaul and Hazzard Streets, Philadelphia, manufacturer of hardware and iron and steel specialties, contemplates the construction of a new plant at Buckius and Lefevre Streets, Briddlesburg. Three buildings will be erected, one 110 ft. by 500 ft., two stories, and two shops, each 80 ft. by 150 ft., one story high.

CLIFTON HEIGHTS, PA.—Contract has been awarded by the Kent Manufacturing Company for the construction of its proposed power house to D. J. McNamee of Philadelphia, Pa.

EAST BRADFORD, PA.—Contract has been awarded by the Kendall Refining Company for the construction of an addition to its boiler plant, about 40 ft. by 75 ft.

KITTANNING, PA.—The Triple Airless Tire Company of Pittsburgh is planning to build a new plant in Kittanning, to cost about \$85,000. The plans provide for the erection of a power plant, about 40 ft. by 80 ft. Herbert & Henderson of Kittanning are architects.

NEWCASTLE, PA.—The contract for the installation of a curb lighting system in the Seventh Ward has been awarded to the Ochiltree Electric Company of Pittsburgh, at \$14,149.

PARKESBURG, PA.—Plans have been filed by the Parkesburg Iron Company for the erection of an addition to the boiler plant at its works. Contract has been awarded to the Rust Engineering Company, Penn Building, Philadelphia.

PHILADELPHIA, PA.—Permit has been taken out by the Bell Telephone Company for the construction of a new building at 5154 Lancaster Avenue.

PHILADELPHIA, PA.—The Philadelphia Storage Battery Company, Ontario and C Streets, is contemplating the construction of an addition, 40 ft. by 100 ft., one story, to its plant.

PHILADELPHIA, PA.—Work will soon begin by the Philadelphia Rapid Transit Company on the extension of its railway on Island Avenue at Eastwick to the ship-building works of the American International Company at Hog Island.

PHILADELPHIA, PA.—The Atlantic Refining Company, 3144 Passyunk Avenue, has awarded contract to Metzger & Fisher, Otis Building, for improvements and alterations to its power house at Thirteenth and Race Streets, to cost about \$11,300.

PHILADELPHIA, PA.—Contract has been awarded by the Electric Service Supplies Company, Seventeenth and Cambria Streets, to the John N. Gill Company, Otis Building, for improvements to its plant. The company manufactures electrical supplies, etc.

PHILADELPHIA, PA.—Plans have been filed and contract awarded by the Philadelphia Storage Battery Company, Ontario and C Streets, for the construction of an addition to its plant, about 40 ft. by 100 ft. Contract has been awarded to Stewart Brothers, 2526 Orkney Street, Philadelphia, Pa.

REYNOLDS, PA.—The Atlas Powder Company has awarded a contract for the construction of power house and large outside buildings at Reynolds to Andrew Breslin of Summit Hill.

SHAMOKIN, PA.—The Pennsylvania Lighting Company, which supplies electricity in both Shamokin and Mount Carmel, together with a number of other towns in this vicinity, contemplates the erection of an electric transmission line to Natalie this summer.

FORT DUPONT, DEL.—Plans have been prepared for the erection of a one-story radio station at Fort Dupont for the United States government.

Middle Atlantic States

ALBANY, N. Y.—Notice has been filed with the Secretary of State by the Havens Electric Company of an increase in capital stock from \$25,000 to \$100,000. Morton Havens, Jr., is interested in the company.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company has awarded contract for construction of a substation to the Cogswell-Koether Company. The proposed building will be 26 ft. by 40 ft. one story high.

BALTIMORE, MD.—S. W. Greenland, general manager of the Port Wayne & Northern Indiana Traction Company, has been engaged by the United States government to supervise the construction of a government power plant at Baltimore.

BALTIMORE, MD.—Plans are being considered by the City Council for extending the electric lighting, fire prevention, sewerage, etc., to the four new wards recently annexed to the city. Immediate attention will be given to lighting the roadways. Special attention will probably be given to such suburbs as Roland Park and Mount Washington in regard to lighting the streets, and the system throughout Highlandtown and Canton and other industrial suburbs will be greatly improved.

MOUNT AIRY, MD.—The Mount Airy Ice & Electric Company is contemplating the installation of an additional generating unit and establishing a day service. C. C. Riddemoser is manager.

MYERSVILLE, MD.—The City Council is considering the question of establishing a municipal electric-light plant and water-works system.

CHARLESTON, W. VA.—The Charleston-Dunbar Traction Company, it is reported, contemplates placing contracts in the near future for the construction of a new power house and for two new boilers.

CHARLESTON, W. VA.—Plans are being prepared by the Charleston Interurban Railway Company for improvements to its system, involving an expenditure of about \$500,000 among which is included the construction of a 2-mile extension.

OLCOTT, W. VA.—The Kanawha Central Power Company, recently incorporated, is planning to construct and operate an electric power plant. The company is capitalized at \$100,000. I. C. Jordan and S. B. Avis are interested in the company.

NORFOLK, VA.—The Norfolk & Western Railroad Company is contemplating extensions to its shops and yards at North Bristol, involving an expenditure of about \$300,000.

WASHINGTON, D. C.—The Washington-Virginia Railway Company is considering an extension of its system from Mount Vernon to Camp Humphrey, a distance of 4 miles.

North Central States

CHARLEVOIX, MICH.—The city of Charlevoix has recently placed a contract for a 300-hp. Leffel water wheel and generator to be installed at Bellaire, to be in operation by July 1. In the issue of Feb. 9 an item was published stating that the city of Charlevoix has leased the plant of the Hydraulic Power & Light Company of Bellaire. Through mistake the present equipment of the plant was given as new equipment contemplated for the plant. The transmission line (28 miles) was erected in 1906. A. J. Hamilton is superintendent.

FRANKFORT, MICH.—Bonds to the amount of \$5,000 have been voted for improvements to the water-works system. It is proposed to replace the engines in the pumping station with electric motors.

CANTON, OHIO.—Improvement and alterations in the local system of the Ohio State Telephone Company, involving an expenditure of about \$200,000, have been authorized by the State Public Utilities Commission.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company is planning to erect a two-story addition, 35 ft. by 165 ft., to its switch house. New equipment, including electric switches, generators, etc., will be purchased. F. Hansel, 408 Illuminating Building, is architect.

HICKSVILLE, OHIO.—Steps have been taken to secure the installation of a new lighting system in Hicksville.

MARIETTA, OHIO.—Application will be made to the City Council by the Kanawha Traction & Electric Company for a new franchise. The company contemplates a number of improvements in its system and service. The present franchise of the company expires in about three years.

MASSILLON, OHIO.—The plant of the Massillon Electric & Gas Company was recently damaged by fire, causing a loss of about \$30,000.

SANDUSKY, OHIO.—The contract for electrical apparatus and fixtures for the new Good Samaritan Hospital Building has been awarded to Bonn Electric Company, at about \$10,000.

YOUNGSTOWN, OHIO.—Work will begin at once by the Mahoning & Shenango Railway & Light Company on the erection of an electric transmission line from Lowellville to McDonald. This line will supply energy to operate the Youngstown & Niles Railway, now under construction.

HARLAN, KY.—Work has begun by the United States Coal & Coke Company on the development of 30 acres of coal land in Harlan County. The company, which is a subsidiary of the United States Steel Corporation, contemplates an expenditure of \$4,000,000 with the expectation of ultimately producing from 10,000 to 12,000 tons per day. A modern town is being erected to accommodate 6000 workmen and their families.

LOUISVILLE, KY.—The Home Electric Company of Louisville has secured the contract for wiring the 29 new buildings at the quartermaster's depot at Jeffersonville; also the 15 new buildings to be erected by the Aetna Powder Company, near the Kentucky State Fair Grounds.

GOSHEN, IND.—The Hawks Electric Company is contemplating extending its electric transmission line from the Cope land farm, north of Ligonier, through that city to Cromwell, where it has a lighting contract. Electrical service will also be furnished to the farmers along the line.

CHICAGO, ILL.—The property at Prairie Avenue and Twenty-fourth Street has been purchased by the Packard Motor Company, which, it is understood, will erect a six-story service station for passenger cars and trucks. The cost of building and site is estimated at about \$800,000.

EAST ST. LOUIS ILL.—The capital stock of the East St. Louis Light & Power Company has been increased from \$1,100,000 to \$1,200,000.

OAKLAWN, ILL.—Preparations are being made by the Chicago & Eastern Illinois Railroad Company for the construction of an addition to its power house at Oaklawn to provide space for a large Ide generator to be installed. Contract has been placed for generator.

PERRY, ILL.—The Perry Light & Power Company has filed a petition with the Illinois Public Utilities Commission asking permission to discontinue business on the ground that the plant is not making expenses.

SPRINGFIELD, ILL.—The Springfield Plow Company is planning to build a new warehouse four stories, complete with lighting apparatus and sprinkler system, to cost about \$35,000.

ASHLAND, WIS.—The Ashland Light, Power & Street Railway Company is planning to build a new hydroelectric plant at Superior Falls, to cost about \$100,000. The L. E. Meyers Company, 58 West Jackson Boulevard, Chicago, Ill., engineer and contractor, has charge of the work.

MILWAUKEE, WIS.—Plans are being considered by the Pelton Steel Company, Elliott Place and Chicago Road, for further extensions to its plant, which is equipped with a large electric furnace unit. The plans provide for the erection of two new buildings, to be equipped with an electrically-operated traveling crane and other machinery. As yet nothing definite has been decided upon. T. H. Harvey is general manager.

PESHTIGO, WIS.—The local electric-light plant is reported to have been purchased by T. A. Pamerin. Improvements are contemplated, it is understood, including the construction of a new dam and the purchase of additional equipment.

PLATTEVILLE, WIS.—Arrangements have been made between the Interstate Light & Power Company of Platteville and the Mineral Point (Wis.) Service Company to connect their transmission lines from Rewey to Platteville to provide emergency service to the mines at Rewey. In case the energy cannot be supplied from the Mineral Springs plant, it can be obtained from Galena.

SUPERIOR, WIS.—The Lake Superior Electrical Company of Superior has been reorganized under the name of the Benson Electric Company and the capital stock increased from \$50,000 to \$250,000. The company manufactures automatic electric signals and steering control systems. M. B. Benson is president.

MANKATO, MINN.—A committee has been appointed to look into the question of establishing a municipal electric-lighting plant in Mankato.

EDDYVILLE, IOWA.—At an election held recently the proposal to issue \$8,000 in bonds for improvements to the municipal electric light plant was carried.

HUMBOLDT, IOWA.—Bids will be received by the board of education of Humboldt until April 26 for the construction of a high school building, including steam

heating, electric wiring, vacuum cleaner, temperature regulator, etc. The cost of the building is estimated at \$110,000. J. E. Barker is secretary of board.

OTTERVILLE, MO.—The installation of an electric-light plant in Otterville is reported to be under consideration. Jesse Starren is interested.

BOWMAN, N. D.—The purchase of the electric plant of the Bowman Electric Light & Power Company is reported to be under consideration by Fred Cole of Broadhead, Wis., and Frank Christopher of Albany, Wis. If the deal goes through, it is understood that a new plant will be installed.

DALTON, NEB.—Bids will be received by the village of Dalton until April 30 for the construction of a power plant building, 36 ft. by 40 ft. Plans and specifications may be obtained at the office of Royal D. Salisbury, consulting engineer, 1415 East Colfax Avenue, Denver, Col., upon deposit of \$10.00.

OGALALLA, NEB.—The installation of a 5-kw. series street-lighting circuit is under consideration by the Council. James H. Class is superintendent of the municipal electric-light plant.

OMAHA, NEB.—Revised plans have been completed by the Metropolitan Water District for the construction of an ice plant on Twentieth Street and Poppleton Avenue, to cost about \$24,000. Bids will be taken on insulation, cooler doors, electric wiring, etc. R. B. Howell is general manager.

SIDNEY, NEB.—The contract for improvements to the municipal electric-light plant and water-works system has been awarded to the O'Fallen Supply Company of Denver, Col., at \$30,592.

DIGHTON, KAN.—Bonds to the amount of \$15,000 have been voted for improvements to the municipal electric-light plant and waterworks system.

LIBERAL, KAN.—The installation of a new street-lighting system in Liberal is reported under consideration. It is proposed to use ornamental standards carrying cluster lamps.

MORLAND, KAN.—The City Council is considering the installation of an oil engine and generator soon. F. S. Kay is superintendent of the municipal electric-light plant.

NORTH MANHATTAN, KAN.—Bids will be received by George W. Titus, president of the Rebekah Oddfellows' Home, Eureka, care of William J. Russell, Grand Secretary, Topeka, Kan., until April 29 for the construction of the Rebekah Oddfellows' Home at Eureka Lake. Separate bids to be submitted for heating apparatus, kitchen equipment, laundry machinery and refrigerator.

ROSSVILLE, KAN.—Preparations are being made by the Rossville Electric Light & Power Company to enlarge its plant and add steam power. The company is arranging to extend its transmission lines to Delia, Silver Lake and Willard. J. W. Phares is president.

Southern States

CHARLOTTE, N. C.—The Southern Public Utilities Company is contemplating increasing the generating capacity of its plant.

CHARLOTTE, N. C.—The Charlotte Electric Repair Company has awarded contract for a new addition to its plant, to cost about \$5,000.

MORGANTOWN, N. C.—The Southern Power Company, it is reported, is considering the construction of a hydroelectric plant on the Johns River.

PINE LEVEL, N. C.—The Citizens' Power Company is planning the erection of two new substations in connection with its proposed 13-mile transmission system, which will connect several towns.

REIDSVILLE, N. C.—Bonds to the amount of \$10,000 have been voted for extensions and improvements to the municipal electric-light plant.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is now building a 500-kw. rotary substation near the navy yard to supply direct current to the suburban railway. J. D. Felton is chief engineer.

COLUMBIA, S. C.—Work has begun on the enlargement of the Omussee plant of the Columbia Power Company, to cost about \$500,000. The company, it is reported, is contemplating establishing a plant at Kelson, to cost approximately \$500,000. Tucker & Laxton of Charlotte, N. C., have charge of the work at the Omussee plant. Through error this item was published under Columbia, Ala., in the issue of March 30.

SUMTER, S. C.—The installation of a municipal electric-light plant is reported to be under consideration by the City Council.

ATLANTA, GA.—Bids will be received by the Department of Justice, office of superintendent of Prisons, Washington, D. C., until April 16, for furnishing electrical equipment at the United States Penitentiary, Atlanta, including a switchboard, power panel and electric feeders for lamps and motors in east main cell wing. Copies of specifications may be obtained on application to the above office.

COMMERCE, GA.—The City Council is considering calling an election to vote on a proposal to issue \$15,000 electric light bonds.

JEFFERSONVILLE, GA.—Bonds to the amount of \$21,000 have been authorized of which the proceeds of \$6,000 will be used for the installation of a municipal electric-light plant and the remainder for water-works system.

SAVANNAH, GA.—Application will be made for a charter for the Chatham County Traction Company for the purpose of constructing an electric railway from the intersection of Augusta Avenue with Lathrop Avenue, Savannah, to Port Wentworth, a distance of about 6 miles. The company so proposes to own and operate an electric plant and to supply electricity for lamps and motors. The company is capitalized at \$50,000. The incorporators are: H. C. Ross, secretary of the Savannah Electric Company; W. W. Osborne, A. A. Lawrence, David S. Atkinson and Edmund H. Abrahams, all of Savannah.

MOBILE, ALA.—The Murnan Shipbuilding Company has purchased a tract on the east shore of Mobile River, to be utilized for extensions to its shipyards, which will include the erection of a shed and sawmill with a daily capacity of 50,000 ft. of lumber, extensions to electric-lighting plant, dredge and fill.

RUSSELLVILLE, ARK.—The Arkansas Light & Power Company is installing a 1000-hp. steam turbine and a 1500-kw. generator (directly connected) in its Russellville plant. This is supplementary to the present 750-kw. generating unit and the large turbines and generators at the dam.

BLACKWELL, OKLA.—At an election held recently bonds to the amount of \$82,000 were voted, the proceeds to be used for improvements to extensions to the municipal electric-light plant and system; also \$75,000 for waterworks, and \$15,000 for fire-fighting apparatus.

PRAGUE, OKLA.—At an election held recently the proposal to issue \$30,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant and water-works system, was carried.

DALLAS, TEX.—The Dallas Electric Light & Power Company has submitted to F. N. Baker, supervisor of public utilities, for approval requisitions amounting to \$2,800,000. Nine of these requisitions, which it is estimated will cost \$797,713, have been approved, among which are included the erection of a high-tension transmission line connecting the power house of the Texas Electric Power & Light Company at Norwood for exchange of power in case of breakdowns, also for changes in the generating plant and improvements to the distribution system; this work is under way. Requisition No. 3 is for the construction of a new substation in Oak Cliff and connecting the substation with main power station and the downtown substation; No. 11 is for the erection of an electric transmission line to Love Field, to cost \$16,329.

Pacific and Mountain States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 15, under specification 2908 for an electric traveling crane for the gun shop building No. 140, naval station, Puget Sound, Wash. Further information may be obtained from the chief of the above bureau.

HOQUIAM, WASH.—A new machine shop and foundry, each 80 ft. by 140 ft., are being erected by the Lamb Machine Works. An electric steel furnace will also be installed.

SEATTLE, WASH.—The Acme Electric Company of Seattle has been awarded contract for installing electric fixtures, etc., in the offices of the United States Steel Products Company.

SEATTLE, WASH.—The Pacific States Electric Company, 570 First Avenue, South, Seattle, Wash., has been awarded contract

by the Sloan shipyards of Olympia for electrical supplies in the twenty 3500-ton wooden ships now being built by the company.

SEATTLE, WASH.—Beginning with April all cluster lamps in the downtown district, with the exception of four at each corner of street intersections, have been eliminated. If the experiment proves feasible the plan will be continued. The action was taken for the purpose of conserving oil, for which the city is spending \$800 per day. It is estimated that by eliminating the cluster lamps between street intersections \$30,000 a year can be saved. No change will be made in the residence districts.

SEATTLE, WASH.—The lowest bid received by the Board of Public Works for the construction of a hydroelectric plant on the Skagit River was submitted by Grant Smith & Company, at \$2,381,000, on plans prepared by the firm's engineers; on plans and specifications prepared by the city the company's bid was \$4,297,000, both bids calling for cash rather than utility bonds. No bid was submitted for a transmission line, the cost of which is estimated at \$1,000,000, or for a substation within the city limits. The same firm submitted a bid of \$3,556,000 for a completed power plant on Wallace River, one of the tributaries of the Sykomish River, near the town of Gold Bar. Two bids were submitted by the Packwood Lake Construction Company for a completed power plant on Packwood Lake, at \$4,031,000 for high-tension switching outside, and \$4,121,000 for a complete power plant with switching inside. The Puget Sound Bridge & Dredging Company offered to develop the Skagit River project, together with transmission line and city substation, at cost of construction plus 15 per cent, and to accept payment in utility bonds. The same company offered a completed power plant on the Stillaguamish River project, offered to the city some time ago by J. C. Eden, owner, for \$4,200,000 for steel penstock and \$4,100,000 for wood penstock construction. The bids on a completed plant on the Skagit River cover the initial development on a project that may ultimately be increased to from 300,000 kw. to 500,000 kw.

WAPATO, WASH.—The City Council is considering a contract with the Pacific Power & Light Company for a new lighting system for the city, which will include new lamps for the business district and a number of 100-cp. lamps in the residence section suspended on brackets.

BAKER, ORE.—The Cornucopia Mines Company of Baker has recently been granted permission to appropriate the waters of Elk, Jim Fiske and Fall Creeks for power development.

KLAMATH FALLS, ORE.—Arrangements have been made between the California-Oregon Power Company and the Pacific Gas & Electric Company whereby the former will deliver 10,000 hp. of energy to the latter at a point in the Sacramento Valley, which will cause a saving of fuel oil, costing \$450,000 yearly. Electricity will be generated at the Copco plant on the Klamath River in Siskiyou County and will be transmitted nearly 300 miles before it reaches the system of the Pacific Gas & Electric Company.

MAPLETON, ORE.—The North Star Power Company is planning to erect 2 miles of transmission lines within the next 90 days. A. L. Shreve is manager.

PENDLETON, ORE.—The Helix Flouring Company has awarded contract to John Vaughan of Pendleton for the installation of a complete electric system for lamps and motors at its plant.

PORTLAND, ORE.—A permit has been granted to the Electric Steel Foundry, Twenty-fourth and York Streets, to erect a transformer station at its plant.

CORCORAN, CAL.—Preparations are being made by the San Joaquin Light & Power Company for the installation of an electric lighting system on Whitley Avenue. The lamps will be maintained by underground wires.

EL CENTRO, CAL.—Preparations are being made by the directors of the Imperial Irrigation District for the erection of an electric transmission line from Hanlan to a point on the Alamo River, to cost about \$11,000.

EUREKA, CAL.—As a result of the activity in shipbuilding industry at Eureka, the Western States Gas & Electric Company has taken on a large amount of business lately. The Hammond Company has abandoned its private plant, which operated its sawmill during the day, and will purchase energy from the Eureka division. The Rolph Company is doubling its electric power requirements and the new shipyard to be established in the city will require 400 hp.

LOS ANGELES, CAL.—Bids will be received by the Board of Supervisors of the County of Los Angeles until April 15 for moving and erecting boilers in the new power house at the County Hospital in the city of Los Angeles. Plans and specifications may be obtained at the office of the Board of Supervisors.

LOS ANGELES, CAL.—The contract for the installation of the ornamental lighting system on Broadway, between the tunnel and Tenth Street, has been awarded by the Board of Public Works to the Keystone Iron Works. The total cost of the work is estimated at \$65,000. The new standards will be 27 ft. high, each equipped with two inverted arc lamps.

LOYALTON, CAL.—The city of Loyalton is considering replacing the present turbine in the municipal electric plant with an impulse waterwheel in June. C. I. Simmons is general superintendent.

REDDING, CAL.—The Shasta Land & Timber Company of Redding, it is reported, will rebuild its electric power plant and planing mill, recently destroyed by fire. The loss is estimated at \$45,000.

VALLEJO, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 22, under specification 2872 for furnishing two rotary connectors and switchboard for the navy yard at Mare Island, Cal.

DENVER, COL.—The Colorado Power Company of Denver has sold \$250,000 in capital stock, the proceeds to be used to pay for additions and extensions already made and for the construction of a steam power station in Sterling.

STERLING, COL.—The Colorado Power Company is contemplating the construction of a steam driven generating plant in Sterling.

LEWISTON, IDAHO.—F. S. Rice, president of the Union Copper Mining & Smelting Company, it is reported, has presented to the citizens of Lewiston a project to tunnel a mountain and divert the waters of the Salmon River of Idaho across the Horseshoe Bend in that stream in Idaho County, in connection with a hydroelectric power development. The project, it is said, has been financed. It is estimated that 62,000 hp. could be developed. The primary object of the company is the erection of an electrolytic smelter for the reduction of copper ores in the mountains in the vicinity of Horseshoe Bend.

DESERET, UTAH.—The Deseret Irrigation Company is reported to have closed a contract for the installation of a 100-hp. electric generating plant with the erection of 15 miles of transmission lines. In addition the company has placed contracts for the construction of a 250-hp. plant to be put in operation at a later date and operated in connection with the first project. The transmission lines of the company will extend from Deseret to Hinckley, Oasis and Abraham. Milton Moody is president of the company.

HELENA, MONT.—It is reported that the proposed manganese plant of the Anaconda Copper Mining Company at Great Falls will require approximately 21,000 kw., which is about one-half of the output of the Holter plant of the Montana Power Company, which, it is understood, will furnish energy to operate the manganese plant.

COLUMBUS, N. M.—The Columbus Electric Light & Power Company is reported to be considering the construction of a new electric plant to supply electricity in Columbus and Camp Furlong, to cost about \$30,000.

LORDSBURG, N. M.—The local engine house of the Southern Pacific Railroad Company was recently destroyed by fire, causing a loss of about \$500,000.

Mexico

TOLUCA, MEX.—The Molina de la Union of South America is planning to replace the present arc lamp street-lighting system with Mazda series lamps.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 23 for furnishing planished steel, sheet iron, spring steel, steel wire and cable, ignition cable, induction motors, etc. Blanks and information relating to this circular (1213) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York City, and 606 Common Street, New Orleans, La.

(Issued March 12, 1918.)

Record of Electrical Patents

Notes on United States Patents

- 1,259,381. COOLING SYSTEM: David D. Davis, Sw. Ave. Pa. App. filed April 25, 1914. Effective means of controlling the cooling action in transformers and rectifiers.
- 1,259,382. INSULATOR: Charles Le G. Fortesque, Pittsburgh, Pa. App. filed May 11, 1914. Supporting high-voltage lines.
- 1,259,384. INSULATING SUPPORT: Charles Le G. Fortesque, Pittsburgh, Pa. App. filed May 25, 1914. Improvements.
- 1,259,386. ELECTRICAL TERMINAL: Charles Le G. Fortesque, Pittsburgh, Pa. App. filed June 4, 1915. High-potential conductors.
- 1,259,396. VIBRATOR: Albert E. Hartwell, San Francisco, Cal. App. filed Oct. 16, 1916. Motor eliminated.
- 1,259,406. RELAY: Ernest H. Jacobs, Schenectady, N. Y. App. filed June 2, 1914. Protection to alternating-current electrical apparatus.
- 1,259,420. ARC LAMP: George M. Little, Pittsburgh, Pa. App. filed Oct. 3, 1913. Improvements in condensing chambers.
- 1,259,443. METAL-PETITCOAT INSULATOR: Karl C. Randall, Edgewood Park, Pa. App. filed Aug. 6, 1915. High-potential lines.
- 1,259,444. WINDINGS AND INSULATION FOR ELECTRIC APPARATUS: Emerson G. Reed, Wilkensburg, Pa. App. filed June 14, 1912. Small quantity of insulating material.
- 1,259,452. ELECTRIC CONNECTOR: George A. Burnham, Saugus, Mass. App. filed Oct. 1, 1915. Water-tight insulating inclosure.
- 1,259,453. ELECTRICAL DISTRIBUTION SYSTEM: George A. Burnham, Saugus, Mass. App. filed May 27, 1916. Split-conductor system.
- 1,259,454. TIME-LIMIT DEVICE FOR ELECTRIC SWITCHES: George A. Burnham, Saugus, Mass. App. filed Dec. 18, 1916. Improvement.
- (Issued March 19, 1918.)
- 1,446 (reissue). SELECTIVE RELAY: Frank L. Dodgeson, Rochester, N. Y. App. filed April 11, 1916. For controlling a highway crossing signal.
- 1,259,482. LOCKING LAMP SOCKET: Thomas H. A. Brown, Heidelberg, Transvaal, South Africa. App. filed Oct. 27, 1915. Improvements.
- 1,259,485. PROCESS OF MAKING ELECTRIC BATTERIES: Thomas W. Bytne, Boston, Mass. App. filed Jan. 7, 1916. Dry or semi-dry type.
- 1,259,496. TELEPHONE-CALL-DISTRIBUTING SYSTEM: Alfred H. Dyson, New York, N. Y. App. filed Jan. 30, 1913. Applicable to operating exchange.
- 1,259,512. INSULATOR: Charles J. Hellings, Los Angeles, Cal. App. filed Jan. 17, 1916. May be readily changed from a stationary insulator to a swinging insulator.
- 1,259,515. ELECTROMAGNETIC MEASURING INSTRUMENT: John S. Holliday, Wilkensburg, Pa. App. filed May 14, 1915. Adapted to determine the phase difference between electromotive forces.
- 1,259,516. SIGNAL DEVICE: Lewis S. Howard, Chicago, Ill. App. filed March 24, 1917. A simultaneously actuated signal carrier and shutter which co-operate to disclose the desired signal.
- 1,259,529. IGNITION SYSTEM: Lawrence Langner, New York, N. Y. App. filed Sept. 22, 1913. For internal-combustion engines of automobiles.
- 1,259,565. TRANSFORMER: Chester H. Thorndarson, Chicago, Ill. App. filed Jan. 24, 1913. Ventilates the coil by directing the passage of a cooling medium through determinate passages in the coil structure.
- 1,259,577. THERMOSTATIC SWITCH DEVICE: Fred W. Wolf, Chicago, Ill. App. filed Dec. 20, 1916. For controlling an electric circuit.
- 1,259,594. TREATMENT OF ZINC-BEARING MATERIAL CONTAINING IRON: Anson G. Betts, Asheville, N. C. App. filed April 21, 1916. Secures a high percentage of extraction of the zinc present.
- 1,259,597. DEVICE FOR PREVENTING TELEPHONE CORDS AND THE LIKE FROM TWISTING: John A. Breen, New Hartford, N. Y. App. filed Jan. 25, 1917. Improvements.
- 1,259,609. ELECTRIC ATTACHMENT PLUG: Harry W. Denhard, San Francisco, Cal. App. filed Oct. 31, 1911. Small number parts.
- 1,259,612. ELECTRIC LIGHT SOCKET: Leslie W. Friedel, Burlington, Iowa. App. filed April 5, 1917. Electric signs.
- 1,259,672. BRUSH GEAR FOR DYNAMO-ELECTRIC MACHINES: Harry D. Rohman and Frank R. Peters, New York, N. Y. App.

filed Feb. 16, 1917. Substitute for special pole-changing mechanism.

- 1,259,683. PROCESS FOR THE ELECTROLYSIS OF ALKALI CHLORIDES: Rolf van Hasselt, The Hague, Netherlands. Improvements.
- 1,259,696. HIGH-VOLTAGE-MEASURING INSTRUMENT: John B. Whitehead, Baltimore, Md. App. filed April 29, 1916. Voltage determined by the presence of corona.
- 1,259,736. CERTAIN-SHADE CIRCUIT CLOSER: John Hantay, Portland, Ore. App. filed May 18, 1915. Electric alarm.
- 1,259,744. ENGINE-STARTING SYSTEM: John H. Hunt, Dayton, Ohio. App. filed July 3, 1914. Improvements.
- 1,259,752. CONNECTOR: Guy M. Laird, Chicago, Ill. App. filed May 11, 1916. Detachable coupling for electrical conductors.
- 1,259,766. DISTRIBUTION BOX: Earl G. Negley, Canton, Ill. App. filed May 24, 1917. Electric light and power service.
- 1,259,788. MAGNETIC SEPARATOR: John G. Sekinger, Ford City, Pa. App. filed July 21, 1915. Effective in removing the iron and steel from the cullet.
- 1,259,816. VEHICLE LAMP: Charles M. Wilson, Elmira, N. Y. App. filed Oct. 7, 1916. Parts may readily be assembled or removed.
- 1,259,835. CONTROLLING SYSTEM FOR RECEIVING APPARATUS: Allen D. Cardwell, Brooklyn, N. Y. App. filed Nov. 19, 1913. Adapted to operate by impulses sent over a main line.
- 1,259,842. ELECTRODE HOLDER FOR ELECTRIC FURNACE: Paolo Fischer, Chicago, Ill. App. filed June 8, 1917. Improvements.
- 1,259,861. ELECTRICAL MAGNETIC DRIVE AND CLUTCH: David C. Henry, Rosebank, N. Y. App. filed March 22, 1916. Improvements.
- 1,259,862. TELEPHONE SYSTEM: Willi Herrmann, Berlin-Schoenberg, and Otto Stritter, Lichtenrade, Germany. App. filed Oct. 25, 1916. Improvements.
- 1,259,901. RELAY: Frederick R. Parker, Chicago, Ill. App. filed Feb. 19, 1904. Improved.
- 1,259,906. SERVICE-RECORDING INSTRUMENT: George H. Richards, New York, N. Y. App. filed Aug. 4, 1916. Electrically connected with machine.
- 1,259,907. INCANDESCENT LAMP: Thomas B. Rider, Los Angeles, Cal. App. filed May 2, 1917. Inserts automatically a new filament when one of the first-burning filaments burns out.
- 1,259,908. SIGNAL LAMP: Gordon E. Roeding and Edward B. Roeding, Detroit, Mich. App. filed Feb. 29, 1916. Motor vehicles.
- 1,259,915. ANNOUNCER OR INDICATOR: John L. Shahan, West Pullman, Ill. App. filed March 29, 1916. Improvements.
- 1,259,967. TELEPHONE SYSTEM: Alfred H. Dyson, Chicago, Ill. App. filed Sept. 6, 1906. Improvements.
- 1,259,995. SYSTEM OF SELECTIVE ELECTRICAL DISTRIBUTION: Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed Nov. 20, 1912. Improvements.
- 1,260,008. TELEGRAPHIC SENDING MACHINE: Horace G. Martin, Rutherford, N. J. App. filed Aug. 4, 1917. Improvement.
- 1,260,010. DYNAMO-ELECTRIC CLUTCH: William Morrison, Des Moines, Iowa. App. filed Sept. 18, 1913. Self-generating type.
- 1,260,025. PROTECTOR FOR METER CONNECTIONS: Stephen R. Payson, Providence, R. I. App. filed July 29, 1916. Protects case where a cartridge fuse may be readily moved into position to bridge the service and meter terminals.
- 1,260,067. PORTABLE FLASHLIGHT: Julius Samach, New York, N. Y. App. filed Jan. 30, 1917. Non-short-circuiting holder.
- 1,260,070. STRANDED-CONTROL X-RAY SYSTEM: Louis W. H. Schimpf, New York, N. Y. App. filed March 15, 1917. Improvements.
- 1,260,071. STORAGE-BATTERY JAR: Earl T.

Schunmacker, Rapid City, S. D. App. filed Aug. 1, 1917. Improvements.

- 1,260,085. ELECTRICAL CONNECTOR: Parke T. Snyder, Chicago, Ill. App. filed Dec. 14, 1916. To provide a socket with a pair of contacts arranged in position for direct engagement.
- 1,260,094. POWER INDICATING AND LIMITING SYSTEM: John B. Taylor, Schenectady, N. Y. App. filed Oct. 27, 1914. Direct-current railway systems to which power is supplied by a plurality of sources.
- 1,260,152. NIPPLE: Mark V. Croker, Newton Upper Falls, Mass. App. filed Feb. 1, 1917. For water and gas pipes.
- 1,260,160. INSULATOR: Charles Disbennet, Logan, Ohio. App. filed May 8, 1917. Wire-retaining devices.
- 1,260,195. ELECTRICAL SPEED TRANSMISSION: Felix W. Hill, Proctor, Minn. App. filed March 14, 1916. No mechanical connection between the driving and driven members.
- 1,260,215. CONTROLLER FOR ELECTRIC MOTORS: Wilmar F. Lent, Philadelphia, Pa. App. filed March 26, 1917. Adapted to utilize a portion of the starting resistance for subsequent regulation.
- 1,260,218. CHARGING SYSTEM FOR STORAGE BATTERIES: James F. Lincoln, Cleveland, Ohio. App. filed Sept. 19, 1914. Automatic when connected to the battery.
- 1,260,224. RAILWAY ELECTRIC SIGNALING MEANS: Otto M. McLin, Bolivar, Mo. App. filed Jan. 27, 1917. Source of electric energy carried by the passing train.
- 1,260,230. ELECTROMAGNETIC SWITCH: Merle M. Mason, Cleveland, Ohio. App. filed June 11, 1914. Controlled by a light current.
- 1,260,236. COURSE INDICATOR: Willy H. R. Mildebrath, Jacksonville, Fla. App. filed Jan. 29, 1917. For motor vehicles.
- 1,260,252. ELECTRIC HEATER: Philip F. Apfel, Seattle, Wash. App. filed April 3, 1917. Inclosing case whose top wall is made of molded refractory earthy material.
- 1,260,263. ELECTRICALLY HEATED SOLDERING BOLT OR BIT: Francis Husband and Albert E. Woodhouse, London, England. App. filed Oct. 18, 1917. Improvements.
- 1,260,298. PHASE DISTRIBUTION FOR ELECTRIC FURNACES: Thaddeus F. Bailly and Frank T. Cope, Alliance, Ohio. App. filed Jan. 31, 1918. Three-phase supply is distributed to two electric furnaces.
- (Issued March 26, 1918.)
- 1,260,303. WIRELESS TIME SIGNALING: Edouard Belin, Paris, France. App. filed Oct. 24, 1914. Improvements.
- 1,260,317. CLOCK-CONTROLLED ELECTRIC CIRCUIT: James W. Bryce, Bloomfield, N. J. App. filed July 21, 1917. Improvements.
- 1,260,328. ELECTRICAL HEATER: Hoyt W. Chase, Indianapolis, Ind. App. filed July 21, 1917. For use with hand wheels.
- 1,260,354. PHYSICIAN'S ELECTRICAL APPLIANCE CONTROL: Herman G. Fischer and Peter P. Musket, Chicago, Ill. App. filed Jan. 11, 1915. Supply electric charges to vacuum electrodes.
- 1,260,355. VENTILATED SPARK GAP: Herman G. Fischer, Chicago, Ill. App. filed April 1, 1916. Improvements.
- 1,260,360. LAMP SOCKET: Edgar H. Freeman, Trenton, N. J. App. filed Jan. 6, 1915. Large voltage.
- 1,260,363. MERCURY RELAY: Maniquis Garl, Akron, Ohio. App. filed May 26, 1917. Electrical signaling apparatus.
- 1,260,379. ELECTRIC BATTERY: Clarence W. Hazlett, Lakewood, Ohio. App. filed Sept. 23, 1916. Secondary type.
- 1,260,380. SANITARY TELEPHONE-TRANSMITTER COVER: Shiro Higuchi, Los Angeles, Cal. App. filed June 4, 1917. Renders the telephone more sanitary.
- 1,260,381. POLYPHASE WATT-HOUR METER: Jacob H. Hodde and Otis White, Springfield, Ill. App. filed March 12, 1913. Two torque-producing elements are employed to drive a single shaft.
- 1,260,386. ELECTRICAL SYSTEM OF DISTRIBUTION: John W. Jepson, Buffalo, N. Y. App. filed Aug. 24, 1915. Improvements.
- 1,260,400. ELECTRIC FITTING: George C. Knauff, Chicago, Ill. App. filed Feb. 16, 1917. Improvements.
- 1,260,401. LAMP SOCKET: George C. Knauff, Chicago, Ill. App. filed Feb. 26, 1917. Electric fittings employing slidably mounted conducting elements.
- 1,260,412. TELEPHONE-EXCHANGE SYSTEM: Alben E. Lundell, New York, N. Y. App. filed Sept. 22, 1916. Semi-automatic.
- 1,260,413. LISTENING-KEY CIRCUITS: Alben E. Lundell and Franklin A. Stearn, New York, N. Y. Telephone-exchange systems.

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Working to Ease the War Burdens

IT IS highly necessary that adequate steps be taken to place before the public service commissions all of the facts which testify eloquently to the war burdens borne by the public utilities. The work of the National Committee on Public Utility Conditions, representing the associations of utilities in the electric, electric railway and gas industries, is of first importance. Differences as to the general characteristics of these three classes of properties can safely be ignored for the time being; the important consideration just now is that they are all affected by higher costs of labor and materials. Rising costs and rigid rates threaten bankruptcy. If costs do not go down, rates must go up, or the net result will be insolvency for many properties. The problem is as plain as the trouble of the corner grocer who sees his margin grow slender. He promptly puts prices up. To do the same thing the public utility has to have sympathetic co-operation from the public service commission which has jurisdiction over it. Fortunately the truth is understood by a number of the commissions. Their members appreciate that the crisis is due to the war and that it calls for heroic treatment.

Electric Drive for Woodworking Machinery

EVERY industry brings its own problems to the electrical engineer. There is no universal solvent for all the difficulties which he has to meet, for not only every class of work but every individual example requires consideration by itself if the best economic results are to be obtained. General averages are of help in forming judgments, but they do not give the key to the individual problem. Some specific conditions which have to be met in the woodworking industry are pointed out in W. A. Black's discussion in the current issue of the motor drive found desirable in a particular plant. Woodworking machinery requires an exceptional amount of space on account of the bulky nature of both the raw material and the product. If laid out with the compactness sometimes very indispensable, it would be both inconvenient and costly to operate. Hence, if driven by the ordinary steam-power plant with its long lines of shafting and many pulleys, it wastes a great deal of energy on account of the scattered nature of the power distribution. It may turn out in fact that a long line shaft must be continuously operated for a few small machines. Many types of woodworking apparatus must be employed for the specific uses required

by the plant schedule, and these require extra room and more shafting, so that on the whole electric drive in woodworking shops has unusual opportunities for economy.

With individual motors the losses are practically directly proportional to the output of the machines doing useful work, and the uncertain factor now becomes the effect of the operating schedule on overhead cost. It was found, for instance, in the plant described by Mr. Black, that in certain places individual motors would prove to be uneconomical. For example, a battery of nailing machines used for box making gave its best economy through group drive. Each of the five machines constituting the group takes part in a continuous process, but the load of each is from its nature intermittent, and the group as a whole shows a conspicuous diversity factor, so that while each machine would have required when operated by itself a 2-hp. motor, one 5-hp. machine handles the whole group easily at good load and efficiency. To keep down losses the ball-bearing type of motor is used throughout, and it was found advisable to belt machines freely up through the floor from motors suspended from the ceiling below, thus shortening the belts and getting them out of the way. The ball bearings, too, proved to have an advantage in the abolition of the oil and grease which would otherwise cause a sticky coating of the inevitable dust found in woodworking plants. Motors can therefore be kept clean simply by blowing them out by compressed air. In one special case vertical-shaft motors were used to avoid the necessity of quarter-turned belts. Throughout the plant particular care seems to have been taken in adapting the type of motor, as well as its size, to meet the special requirements of the case. The result has been noticeable in the modest cost of operation and maintenance shown by three years of practical use.

A Big Canadian Steam Auxiliary

OUR readers will be struck by the ultimate development intended for the new steam plant of the Dominion Power & Transmission Company at Hamilton, Ontario. The company's main source of energy is a hydroelectric plant on the Welland Canal, about 35 miles (56 km.) from Hamilton, and this power is distributed over a wide area, being connected by three separate 45,000-volt lines to the main switching station just outside of Hamilton. The new plant is on the Lake Ontario waterfront near the load center of the entire system and is designed for an ultimate capacity of 75,000 kva. One-third of this is now installed in two

units. The equipment as designed not only furnishes auxiliary power but can be operated at high efficiency for additional output when it may become necessary. The layout of the plant is well shown in the elevation given. Provision is made for running the coal cars into a separate building, where they are unloaded into a receiving hopper; thence the coal is fed to a crusher and carried into the storage bins above the boilers by a conveyor. Thence again it is dropped to the under-feed stokers which serve the big water-tube boiler units. Both cooling and make-up water are obtained from the lake, the latter being subjected to a treating system before use.

The general layout of the plant is of the ordinary standard type, but each turbo-generator is normally supplied by a short pipe run from its own set of boilers, the piping being arranged so that one set of spare boilers will suffice for the entire plant. Each generator has its own motor-driven exciter, and a steam-driven exciter is held in reserve to be switched on to any machine in case of need. The generators are for 6600 volts, to be stepped up to 42,000 volts through transformers interconnected on the high-voltage side. The transformer arrangement is such that two sets of transformers will be connected to each pair of machines to localize trouble that may occur in either of them. Even power which is transmitted at 6600 volts is not taken directly from the generators but from the high-tension buses. As is commonly the case, the switching and transforming apparatus is in an annex to the main generator room. This the switchboard operator can overlook, he being stationed on the third floor of the switch house. The whole switching equipment is of the remote-control type, and in addition an ingenious set of signals between the boiler room, engine room and control room is organized with a combination of illuminated signs and Klaxon horns, thus appealing violently to two senses instead of trusting to one. The two transmission lines to the main switching line of the whole system pass from the roof of the transformer house and connect to the lightning arresters installed just outside. The station seems a singularly good example of recent practice in efficient design for operation on a large scale.

Ventilating Cable Ducts

THE rapid increase of industrial load in all our large cities puts heavy burdens on the underground distribution. There is a constant tendency to strain the capacity of the cables and increasing danger of breaking them down thereby, since there is a limit to the temperature which the insulation will stand without deterioration. The paper by William Keating and C. H. Mueller, abstracted in another column, gives a most instructive report of the results of overload and the possibility of increasing cable capacity by forced ventilation of the ducts. The particular duct line involved was one in Pittsburgh, less than a mile in length and called upon for heavy peak loads superimposed on a heavy regular load. In this particular line of ten ducts, eight of which were in use, there were no less than thirty-eight failures during the summer of 1916, in spite of the fact that the manhole covers were left off day and night. This showed plainly that the cable

heating was far above the permissible limit, which for the internal temperature on 11,000-volt cables is somewhere about 150 deg. Fahr. (65.6 deg. C.), the internal temperature being normally something over 50 deg. above that measured in the duct. After considerable discussion of ways and means it was determined to ventilate the duct artificially. This was ultimately done by installing eleven pressure blowers in alternate manholes, the intermediate holes being left open to allow the hot air to escape. The effect of these in working through the summer was to bring down the duct temperature just below 100 deg. Fahr., even then very near to the danger limit. In the cool weather of October the blowers were shut down and the manholes closed, and inside of a week the average temperature had gone up more than 20 deg., which caused a rapid resumption of forced ventilation. The temperature in the ducts was found by drawing in indicating coils of which the resistance showed the temperature, and these have proved of considerable service in investigating the conditions in various ducts so as to determine the available extra capacity if any. Some recording instruments were tried, but they proved to be too delicate for the rather hard service. This artificial ventilation of duct lines is, of course, a last resort, but one which may be not infrequently necessary at the present time when loads are high and cables higher. The experiments described by Messrs. Keating and Mueller are certainly of very considerable value in showing for the first time on a really practical scale what can be done if necessary to keep down dangerous temperatures in high-tension cables.

Radiation Losses in Pipes and Fittings

WITH all the effort that is now being made at economizing fuel to keep down operative costs of central stations the subject of radiation losses rises to considerable importance. There is, it is true, little uncovered high-pressure steam pipe now in use in central stations, but the covering on valves, flanges, feed pipes and other fittings is seldom complete or efficient. It is not always convenient to provide them with proper heat insulation, but it can be done without any particular difficulty while still leaving them accessible in case of necessity. The economic importance of the situation lies in the fact that an unprotected bit of pipe or valve gets rid of a large amount of valuable heat which ought to be conserved. At the present time fuel is so considerable a portion of the total expenses in a properly operated central station that savings here are of large importance. Those which can be effected by stopping losses after the steam is generated are of particular importance because they practically are equivalent to improving the boiler efficiency. If this chances to be low, the actual loss from unprotected pipe is particularly conspicuous.

There have been a good many investigations into the properties of insulating materials, but these have not been properly correlated with the possible savings in building up an efficient standard practice in steam-pipe covering. A very wide variety of materials have been used for this purpose. So far as yet discovered entrained air is the best of these. Free air forms a particular poor insulation on account of the heavy

losses by convection, but when it can be confined in the interstices of a material in itself a poor conductor of heat the combination is extremely efficient as an insulation. The intelligent development of heat-insulating material has therefore largely been guided by its capacity to hold air by reason of its porous structure. For practical use in steam plants the selection of material on account of this property is very much limited, for it must be heat-resisting over long periods of time, not changing its structure or losing its fundamental valuable quality by reason of the temperature to which it is exposed. This bars out many organic substances which in themselves possess most remarkable heat-insulating properties.

Losses due to imperfect insulation are startling to those who have not made any study of the subject. A square foot of bare pipe at the ordinary temperature of steam pipes wastes six or seven tons of coal a year, if in continuous operation. At present prices of coal this is a serious matter not likely to be passed over by operators of central stations. The plain moral is to use as short steam piping as is practicable and to insulate it with painstaking thoroughness even at exceptionally high cost of material, for the loss in fuel is a continuing one not unlikely gradually to increase, particularly if poor insulation is used, while to offset it there is only the fixed charge on the cost of proper insulation. It therefore would be well to avoid all unnecessary leaks and complication in a steam-piping system and to insulate it in all its parts with scrupulous care.

The Characteristics of Dielectrics

DIELECTRIC materials are of great practical importance to the electrical engineer because he has to depend upon them in the construction of his machines and of his conducting lines. Considering their importance, it is remarkable how little quantitative and systematic knowledge exists at present concerning the electrical properties of dielectrics. One reason for this deficiency lies in the complexity of the subject. In a dielectric of the simplest kind, assumed to be homogeneous and single, we have to deal with electrostatic stresses which must necessarily be very variable in space, except under ideally simple geometrical conditions. We have the conductivity of the material to deal with, also its inductivity, its dielectric constant and its dielectric strength. All of these properties, which are merely salient selections, are subject to possible variation with impressed voltage, frequency, temperature, time and previous history. When we come to consider compound dielectrics, formed of several substances in layers or juxtaposed masses, the problem of

electric behavior is likely to become very complicated. It is evident, therefore, that we must be content to study one phase of the subject at a time, in order to build up an engineering theory of dielectrics.

In C. A. Butman's article this week reference is made to the properties of two dielectrics well known to makers of electrical machinery; namely, fullerboard and paraffine oil. Some interesting experimental facts are recorded concerning these substances.

In regard to the fullerboard or pressspan slabs, the measurements indicate that, after being subjected to the treatment described, the conductivity of the material, as determined by the ratio of the dissipated watts to the square of the impressed voltage, remained roughly constant up to the gradient of 31.5 kv. per centimeter, which is indicated to be about one-ninth of the instantaneous rupturing gradient. In fact, the conductivity decreased somewhat as the gradient increased from 0 kv. to 31.5 kv. per centimeter. This result is rather remarkable. It is generally assumed that the conductivity of a dielectric is either constant or increases somewhat with the impressed gradient.

The second remarkable fact about these slabs is that their power-factor or phase-angle defect, measured in radians, diminished materially at a given temperature as the impressed potential gradient increased. Thus, at 91 deg. C. the indications of Fig. 2 are that the power factor was 0.095 at 3.15 kv. per centimeter and fell to 0.052 at 31.5 kv. per centimeter, the current strength through the slab increasing directly with this gradient. But since the conductivity of the slab is shown to have remained constant over this range, at least as a first approximation, it would seem that the inductivity, or specific inductive capacity, of the material increased very noticeably with the impressed gradient. If so, this is a noteworthy result, because it is generally supposed that the inductivity of solid or of liquid dielectrics at constant temperature is virtually independent of the impressed potential gradient.

As regards oil, the results indicate that the inductivity was, at least to a first approximation, independent of the impressed gradient up to 16.76 kv. per centimeter, but that it increased markedly with temperature, at first in straight-line fashion and then, beyond 50 deg. C., faster. It is also pointed out that the minimum dielectric strength of this oil occurred near the temperature of -12 deg. C.

These quantitative experimental results are valuable, not merely because they are rare, but also because they are expressed in simple metric units that all electrical engineers can understand. When dielectric properties are measured they are all too commonly concealed when expressed in terms of uncouth and antiquated units that not even English-speaking people can clearly understand.

SCARCITY of power is a serious factor in the present industrial activity.

It affects not only the central-station industry but also the output of supplies for the government by industries which depend on the great generating systems for energy. This situation will be considered in early issues. Among other subjects which will be treated are the standardization of overhead construction with a

The Coming Issues

view to reducing costs; shop repairs to distribution transformers in the interests of economy of time and money, and the performance of polyphase induction motors. In the latter article it will be shown that the choice of motor depends on considerations of load, starting and running current, frequency of starting and efficiency of operation.

The Characteristics of Dielectrics

Results of Investigations to Determine the Dielectric Constants, Strengths, Loss Angles and Energy Loss of Micarta, Fullerboard, Paraffine Oil and Other Substances—Effects of Potential Gradient and Temperature Found Very Important

BY CHESTER ARTHUR BUTMAN

FURTHER development of electrical apparatus is dependent chiefly on the provision of insulation which will withstand higher stresses and temperatures, the reduction of internal heating or the improvement of heat dissipation and the incorporation of electrical or mechanical features which will prevent damage from current surges. Since dielectrics are often the source of considerable heat when subjected to high potential gradients and since their characteristics are considerably affected by numerous factors, including temperature and electrical stress, it is necessary to have a very complete knowledge of the nature of dielectrics if they are to be applied properly. In what follows the writer will outline some of the properties he observed in an analysis of this kind, using a high-potential low frequency series inductance bridge.¹ Among the properties investigated were the dielectric constant, dielectric strength, dielectric loss angle, dielectric energy loss, conduction currents, and how these properties change with the potential gradient and temperature. Fullerboard and paraffine oil, used separately and combined, were the dielectric materials studied.

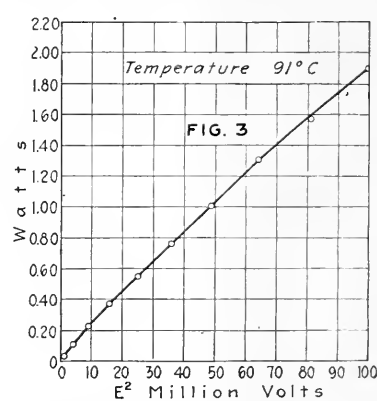
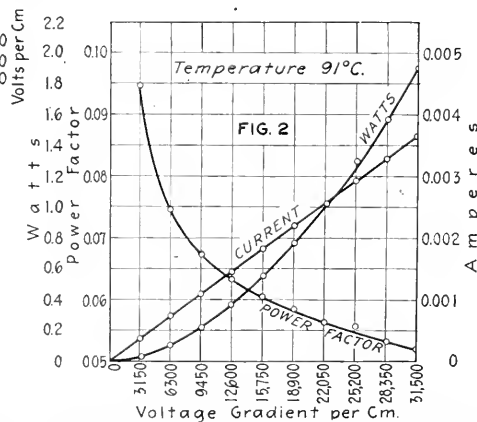
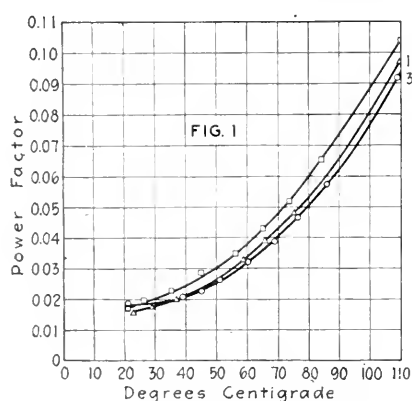
FULLERBOARD IN OIL

The fullerboard (presspan) which was tested was 0.32 cm. thick, uniform in quality and free from moisture. Before testing the samples were dried for three

time of breakdown appeared to depend on the formation of a certain number of bubbles at the electrodes. The writer is inclined to believe, however, that it is the time element rather than the formation of bubbles that determines the time of breakdown. The instantaneous breakdown potential was found to be 90,000 volts, which corresponds to a potential gradient of 283,500 volts per centimeter. The tests also showed that the samples would stand 30,000 volts (94,500 volts per centimeter) without breakdown at any temperature for an indefinite period.

Effect of Temperature on the Dielectric Loss Angle.—The relation between the power factor ($\sin \theta_x$) and the temperature with varying potential gradients (Fig. 1) can only be considered approximate because the temperature of the material under test lagged behind that of the oil in which the thermometers were placed and because an approximate formula was used to calculate the results. Nevertheless, the results are important because they show that the highest potential gives the lowest power factor. The results were verified by testing a sample at a constant high temperature.

Effect of Potential on the Dielectric Loss Angle.—Micarta and fullerboard were tested under identical conditions at a constant temperature of 91 deg. C., but no dielectric hysteresis was observed. The experiment showed further that the power factor² of micarta



FIGS. 1, 2 AND 3—HOW THE POWER FACTOR, DIELECTRIC LOSS AND CURRENT IN FULLERBOARD IN OIL VARY WITH TEMPERATURE, POTENTIAL GRADIENT AND THE SQUARE OF THE APPLIED POTENTIAL

days in a vacuum oven and placed hot in the oil tanks, where they were allowed to soak until saturated.

Dielectric Strength.—The dielectric strength was found to depend upon the time of application of the potential and the temperature. The principal effect of raising the temperature is to retard formation of gas bubbles around the testing terminals. In most cases the point of breakdown was just outside, and in only a few instances was it between the electrodes. This may have been due to the combination of three dielectrics at the terminals increasing the dielectric stress. The

increases with the voltage whereas that of fullerboard decreases (Fig. 2). It is thought by the author that this phenomenon may be due to the fact that the electrostatic field increases the polarization faster than it increases the ionization. Consequently the substance becomes a better dielectric when under electrostatic stress. From the curve it may be seen that the total current is directly proportional to the voltage.

Relation of Energy Loss to Square of Potential.—The

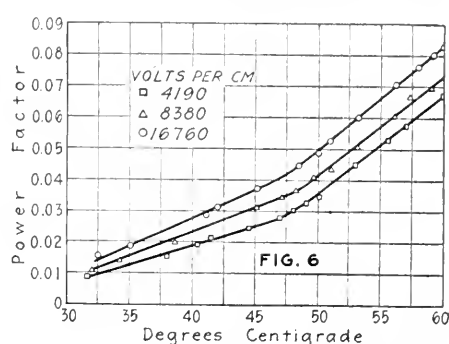
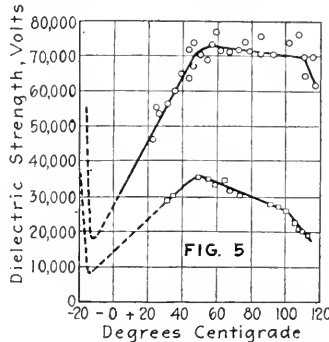
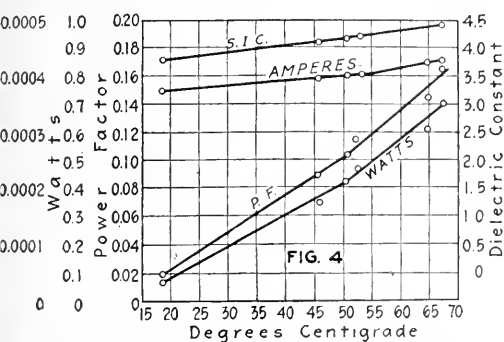
¹Described in ELECTRICAL WORLD for March 9, 1918.

²The fact that power factor of fullerboard decreases with an increase in potential gradient is confirmed by J. P. Minton (*Proceedings A. I. E. E.*, p. 1148, June, 1915).

energy loss is not strictly proportional to the square of the effective potential, as may be observed from Fig. 3. In fact, it increases considerably slower.

HETEROGENEOUS DIELECTRIC

A combination of alternate layers of fullerboard and oil, consisting of four oil-soaked fullerboards separated by three paraffine oil sections, was tested. Results plotted in Fig. 4 show that the dielectric constant of a heterogeneous combination of oil and fullerboard (4.25)



FIGS. 4, 5 AND 6—RELATION BETWEEN CURRENT, DIELECTRIC LOSS, POWER FACTOR, DIELECTRIC CONSTANT AND TEMPERATURE (TESTS ON ALTERNATE LAYERS OF PARAFFINE OIL AND FULLERBOARD ARE GIVEN IN FIG. 4; FIGS. 5 AND 6 REFER TO PARAFFINE OIL ALONE)

is greater than that of either component (3.32 for fullerboard and 3.69 for paraffine) taken separately and less than the sum of the two components. It may also be noted that the current, power factor, watts and dielectric constant increase with the temperature. At about 52 deg. C. there is a sudden increase in the rate of temperature rise due to a change in the physical properties of the oil at that temperature. Moreover, it was observed that the power factor of the heterogeneous combination was greater than that of fullerboard alone. Hence it appears that paraffine oil must have a large power factor at high temperatures. Since this seemed contrary to the usual belief, a dielectric loss test was made by hanging two parallel iron plates in an oil tank. This showed conclusively that the oil has a dielectric loss angle. Further experiments with aluminum plates showed that the dielectric loss angle of the oil is greatly increased by heating.

PARAFFINE OIL

Dielectric Strength.—To study the effect of change in temperature over a wide range some paraffine oil was frozen during an especially cold period and tested as it melted. The melting point (12 deg. C.) marked a transition point in the dielectric strength. Instead of decreasing with the temperature as would be expected, the dielectric strength³ began to increase.

Experiments were made on the dielectric strength of paraffine oil at high temperatures by use of a standard air spark gap placed in a tank of oil. Each point on the curve in Fig. 5 represents the average of ten breakdown values at the same temperature. The broken lines show the probable shape of the curve based on the results at low temperatures. The testing frequency was 25 cycles. It may be observed that the curves obtained with different sparking distances are similar. However, the transition point⁴ is 110 deg. C. with the larger gap, while with the smaller gap it occurs at 100 deg. C.

The most important results obtained from the experiments on the dielectric strength are that paraffine oil has a transition point at about 50 deg. C., and that the dielectric strength remains nearly constant at its maximum value from this temperature up to about 100 deg. C. At the latter temperature a third transition takes place and the dielectric strength falls off rapidly with an increase in temperature.

Heating of Oil Due to Dielectric Energy Loss.—Careful experiments showed that the heating of the oil due

to dielectric energy loss does not affect the principal properties appreciably.

Dielectric Loss Angle.—It may be observed from Fig. 6 that above 48 deg. C. the power factor increases more rapidly with the temperature with the higher potential gradients. The writer believes that this is due to the increased heating effect caused by the higher potential gradient. However, this effect is a small one and does not account for the large difference in the observed angles measured at different voltages.

It may also be noted from the curves in Fig. 4 that the dielectric loss angle increases rapidly with the temperature, that the highest gradient gives the greatest dielectric loss angle, and that there is a transition point in the power-factor curves at about 49 deg. C. This transition point occurs at nearly the same temperature as that in the dielectric strength.

In previous experiments Pungs⁵ discovered that paraffine oil has a large power factor at high temperatures. However, he was not able to detect a change in the dielectric loss angle due to an increase in the potential gradient which is so clearly shown in the experiments here discussed.

Dielectric Constant.—On account of the theoretical significance of the dielectric constant of paraffine oil, extreme care was exercised in measuring it. Contrary to expectations the dielectric constant of paraffine oil (Fig. 7) was found to increase with rise in temperature. Moreover, there is a transition point at about 50 deg. C., after which the dielectric constant increases still faster with the temperature.

It would also be of great theoretical interest if it could be shown that the dielectric constant changes with the potential gradient. The writer believes, however, that there is no such change (Fig. 7).

Currents in Paraffine Oil.—From Fig. 8 it may be observed that a transition point appears to occur in

³This observation had previously been made by Tobey, *Proceedings A. I. E. E.*, Vol. 29, 1910.

⁴T. W. Edmondson found that the dielectric strength of liquids was not directly proportional to the spark length.

⁵See L. Pungs, "Dissertation," Darmstadt, 1913; *Archiv für Elektrotechnik*, pp. 329-344, 1912; *Science Abstracts*, 16 B, No. 592, 1913.

the relation between the current and potential gradient at a higher temperature than for the dielectric loss angle. Upon analyzing the curves to see if the current is proportional to the voltage, an important result is revealed. If the currents are proportional to the voltage, the current at 4000 volts should be twice as great as at 2000 volts, and at 8000 it should be four times as great. The differences between the calculated and observed currents are given in the table printed on the opposite page.

The table proves that the current becomes proportional to the voltage at about 53 deg. C., which is the transition point for the oil. Below the transition this proportionality is departed from, the amount being greater the higher the potential used. From these results the conclusion is drawn that below the transition point there is not a sufficient number of ions to carry the current. The deficiency in ions increases indirectly with the temperature and directly with the potential used. Furthermore, the potential appears to cause the molecules to dissociate and form new ions. Since the currents below 53 deg. C. are strictly proportional to the temperatures, the dissociation appears to be proportional to the temperature. Hence it may be supposed that at the freezing point of the oil the mobility of the ions or the dissociation might be zero.⁶

The preceding ionic interpretations of results are strongly supported by the work of other investigators.⁷ In this connection it is also interesting to note that Bedell and Kingsley⁸ found a transition point in the insulation resistance of vacuum oil (a heavy paraffine

of 49 deg. C. is reached a transition point occurs.

Theory of the Dielectric Properties of Paraffine Oil.—The author believes that all of the dielectric properties of paraffine oil can be explained on the basis of the polarization and ionization. For instance, assume that the temperature increases indirectly as the polarization and directly as the ionization. Then the displacement current which depends on the polarization will decrease with rise in temperature, and the conduction current which depends on the ionization will increase. This relation appears to be in accordance with facts. The dielectric loss angle depends primarily on the polarization and consequently, to a certain extent, indicates its effects.

From a consideration of the analysis of the currents in oil it may be seen that the application of electrostatic stress causes an increased ionization in the oil. Above the transition point (50 deg. C.) ionization easily occurs, so that an adequate number of ions is provided to carry the current. Inasmuch as the dielectric loss angle increases at a more rapid rate above 50 deg. C., it appears that the polarization will decrease more rapidly after this point is passed. The higher rate of decrease in polarization allows the electrostatic stress to reduce the polarization more effectively through dissociation, so that the dielectric loss angle increases more rapidly above the transition point for any given potential.

Considerable light is thrown on the relative dielectric strengths of solids, liquids and gases by the works of other investigators.⁹ Faraday points out, for instance,

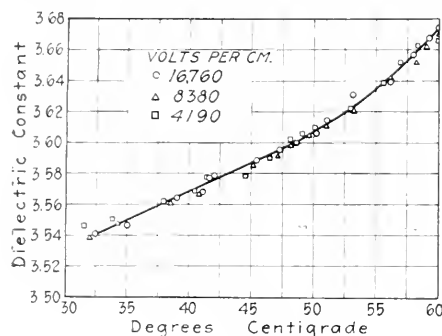


FIG. 7

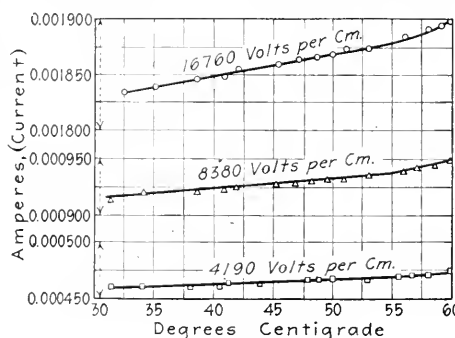


FIG. 8

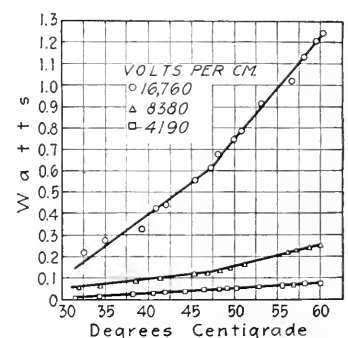


FIG. 9

FIGS. 7, 8 AND 9—VARIATION OF DIELECTRIC CONSTANT, CURRENT, AND LOSS IN PARAFFINE OIL WITH TEMPERATURE

oil) at 50 deg. C. They also found that the resistance of pure oils is a constant at any one temperature and decreases as the temperature increases.

Dielectric Energy Loss.—The dielectric energy loss is dependent on the characteristics of the capacity and the dielectric loss angle which have already been discussed. It may be seen in Fig. 9 that the loss is proportional to the temperature. Inasmuch as the dielectric constant is independent of the voltage, and since the dielectric loss angle increases with the voltage, the energy loss in paraffine oil increases faster than the square of the applied potential. When a temperature

why the intensity of induction required for breakdown must be much higher in a fluid than in a gas and still higher in a solid than in a fluid. Thornton showed that the dielectric strength decreases as the frequency increases. The time element involved in the rupture of dielectric was pointed out by several researchers, Townsend saying that a certain number of ions must be formed by collision before discharge can take place. Chernyshoff and the writer showed that a low-frequency (60-cycle) discharge follows the shortest path, whereas at high frequency there is not sufficient time for ions to be formed by collision, so the discharge may follow a longer path.

The change of dielectric strength of the oil with temperature is satisfactorily explained by the ionization theory. The highest dielectric strength occurs when the ionic conduction begins to take place freely. From

⁶L. Maclès (*Comptes Rendus*, 151, p. 63, 1910) found that vaseline acts as a medium containing free ions whose mobility is zero in the semi-fluid state, but observable in the liquid state. In the same periodical (161, pp. 694-696, 1915) Maclès determined the conductivities of certain insulating liquids from the velocities of recombination, concluding that strong fields reduce the conductivity.

⁷Villemonée, *Journal de Physique*, 5 Ser., Vol. 4, p. 770, 1914; J. Carvallo, *Ann. de Physique* (9), 1, p. 171, 1914; G. Jaffe, *Le Radium*, 10, pp. 126-134, 1913; G. Szewsky and K. Schäfer, *Ann. der Phys.*, 35, p. 511, 1911; H. J. Van der Bijl, *Ann. der Phys.*, 1, pp. 170-212, 1912, and C. H. Greinacher, *Phys. Zeit.*, 10, p. 986, 1909.

⁸*Physical Review*, 2, p. 185, 1895.

⁹Faraday, *Phil. Trans.*, January, 1838; Faraday, "Experimental Researches in Electricity," p. 446, Vol. 1; P. Zeeman, *Konink. Akad. Wetensch. Amsterdam Proc.*, 14, p. 650, 1912; W. M. Thornton, *Phil. Mag.*, Vol. 32, p. 242, 1916; A. Chernyshoff and C. A. Butman, *Electric Journal*, 1915.

this point to about 100 deg. C. the dielectric strength is nearly constant; thus it appears that the liquid is polarized, otherwise it would be difficult to see why the dielectric strength remained nearly constant as the temperature increased. However, if the liquid is polarized it would seem that the same stress would have to be applied until the polarization itself was changed. At the transition point of 50 deg. C. and at higher temperatures there are enough ions to carry the current and the ionic conduction protects the polarization. However, the curves of Fig. 5 indicate that the polarization decreases slightly as the temperature increases until about 100 deg. C. is reached, after which there is a rapid decrease in the dielectric strength. According to the preceding theory, the polarization should decrease rapidly as the temperature increased beyond 100 deg. C. This was proved by C. W. Ackerman,¹⁰ who found that paraffine oil becomes a bad insulator at about 100 deg. C. In this connection it is interesting to observe from the two curves that the breakdown point of polarization occurs at the lowest temperature in the one in which the polarization decreases the fastest.

Below 50 deg. C., the polarization is protected less and less by the ionization until the freezing point is reached, at which point there are probably few if any mobile ions. Hence the freezing point (—12 deg. C.) marks the point of minimum dielectric strength. As the temperature is decreased below —12 deg. C. the oil assumes new physical properties in which the dielectric cohesion and consequently the dielectric strength is greatly increased.

CAUSE OF THE INCREASE OF THE DIELECTRIC CONSTANT WITH THE TEMPERATURE

It would be expected that the dielectric constant would decrease as the temperature increases because there is less matter between the condenser plates at high temperatures. For some substances¹¹ this is so.

However, in the case of paraffine oil it is not sufficient to take into account only the density, because the polarization and ionization are also important factors. The density and polarization both decrease with an increase of the temperatures, so that in the case of paraffine oil the cause of the increase of the dielectric constant must be due to the increase of the ionization with the temperature. When the molecules dissociate an increased stress appears in the ether which is due to the attraction of the free charged atoms. This makes it easier for the lines of the applied electrostatic stress to pass through the liquid, thereby increasing the dielectric constant. This factor appears to predominate over the other two.

The preceding view is confirmed by experiments which showed that the change of the ionization and the dielectric constant with the temperature run parallel. For instance, the point (50 deg. C.) at which increased ionization occurs is the point at which the dielectric constant begins to increase faster with the temperature. However, the dielectric constant is not dependent primarily on the conductivity, for a substance may have a dielectric constant apart from conductivity. For instance, the author tested a sample of micarta made by

a special experimental process near its breakdown value (95.8 deg. C.). It was a conductor because the dielectric loss angle was nearly 90 deg., but it still had a dielectric constant which measured 34.37. At 65 deg. C. and with the same gradient the micarta had a dielectric loss angle of 21 deg. 39 min. 35 sec. and a dielectric constant¹² of 7.979. The difference between a dielectric and a conductor is clearly defined in the author's paper on the series inductance bridge.

NATURE OF A DIELECTRIC

Dielectric phenomena have to do primarily with the distribution and characteristics of polarized molecules; that is, molecules charged on one side positively and on the other side negatively. That the dielectric con-

DIFFERENCE BETWEEN CALCULATED AND OBSERVED CURRENTS IN PARAFFINE OIL

Temperature (Deg. C.)	Observed (at 2000 Volts)	Calculated (at 4000 Volts)	Observed (at 4000 Volts)	Difference	Calculated (8000 Volts)	Observed (8000 Volts)	Difference
32.5	0.000460	0.000920	0.000915	—5	0.001840	0.001833	—7
37.5	0.000402	0.000924	0.000921	—3	0.001848	0.001843	—5
42.5	0.000464	0.000928	0.000925	—3	0.001856	0.001852	—4
47.5	0.000466	0.000932	0.000930	—2	0.001864	0.001861	—3
52.5	0.000468	0.000936	0.000935	—1	0.001872	0.001872	0
57.5	0.000471	0.000942	0.000943	+1	0.001884	0.001886	+2
60.0	0.000950	0.000950	0.000950	0	0.001900	0.001897	—3

stant is a molecular property is shown by its direct relation to other purely molecular properties such as the index of refraction, dispersion, absorption and the capillary constant.

A theory regarding the nature of polarization has been proposed by W. M. Thornton¹³ which does not appear to be at variance with these experiments. He found that polarization, no matter how long continued or slow in action, is quasi-elastic in type. There are three stages. The first involves rapid changes and results in the rearrangement of the atomic charges within the molecule. During the remaining two stages an electrical strain is established throughout the mass under the new conditions of internal stress imposed by the first polarization.

In the case of gases and liquids an explanation of the dielectric phenomena must not be given on a static basis, but on a kinetic one. This is necessary because of the change of the dielectric constant with the temperature, the time necessary to produce electrostatic effects and the known movements of molecules in gases and liquids. Finally the properties of dielectrics may be influenced by their being ionized, as has been shown to be the case for paraffine oil in the foregoing experiments.

The experimental part of this paper was done at the high-tension research laboratory of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., of which C. E. Skinner is director.

¹²F. Sanford (*Science*, pp. 759-760, May 26, 1916), presents the dielectric constant of certain metals. E. A. Harrington ("Dissertation," Clark University, *Physical Review*, Vol. 8, p. 591, 1916) states that water has a dielectric constant "entirely independent of the conductivity."

¹³*Phil. Mag.*, 19, p. 390, 1910.

¹⁰"Dissertation," Göttingen, 1914; *Ann. der Physik* (4), 46, p. 199, 1915.

¹¹M. A. Lorentz (*Ann. der Phys.*, 9, p. 641, 1880) proposed to represent the variation of the dielectric constant K with the density d by the formula $[(K-1)/(K+2)] \times 1/d = \text{constant}$, which has been verified recently by A. Occhialini, *Nuovo Cimento*, 7 Ser., 6, pp. 108-126, 1914.



PRESENT CONSTRUCTION AT WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY'S NEW PLANT

New Works of the Westinghouse Company

Plant at South Philadelphia, Started in 1917 and Now in Partial Operation, Designed for
Eventual Expansion to Size Comparable with
East Pittsburgh Works

FROM a plowed field less than a year ago to an industrial plant embracing at present seven large buildings and employing over 1800 people, engaged in manufacturing ship-propulsion machinery for the government, is the record at the new South Philadelphia works of the Westinghouse Electric & Manufacturing Company.

The East Pittsburgh plant began operations in 1895 with about 2000 employees, and it now employs in the neighborhood of 25,000 people and occupies more than 100 acres (40 hectares) of floor space, a development beyond which it was not deemed to be practicable to expand.

After thorough investigation of available sites during the summer of 1916, the property at Essington, or South Philadelphia, was chosen. The land, embracing 500 acres, is on the Delaware River, in Delaware County, Pennsylvania, 9 miles (14.4 km.) south of Broad Street Station, Philadelphia, adjoining the Hog Island shipyard of the American International Corporation. It is reached by the Philadelphia & Reading and Pennsylvania railroads and by the Chester short line of the Philadelphia Rapid Transit Company. Its location on the river, on which there is a frontage of 4500 ft. (1371 m.) also affords another means of transportation, though as yet no docks have been built.

This location insures adequate fresh water for power-house operation and tests on the turbines and auxiliaries to be built.

Construction was begun early in 1917. In November the plant began operations on a small scale, and these operations have been gradually increasing.

The entire activities at present are devoted to the manufacture of steam turbines, condensers, gears and other accessories used in the equipment of ships, the most vital immediate need of the government. Marine propelling machinery is being built for the Submarine Boat Corporation and the Merchant Ship Building Corporation as agents for the Emergency Fleet Corporation. Turbines and reduction gears are also being built for use by the United States Navy on torpedo-boat destroyers.

It is expected that eventually the plant will be expanded until it is comparable with the East Pittsburgh works. A portion of the tract has been set aside for

a town site that will afford space for approximately 5000 people.

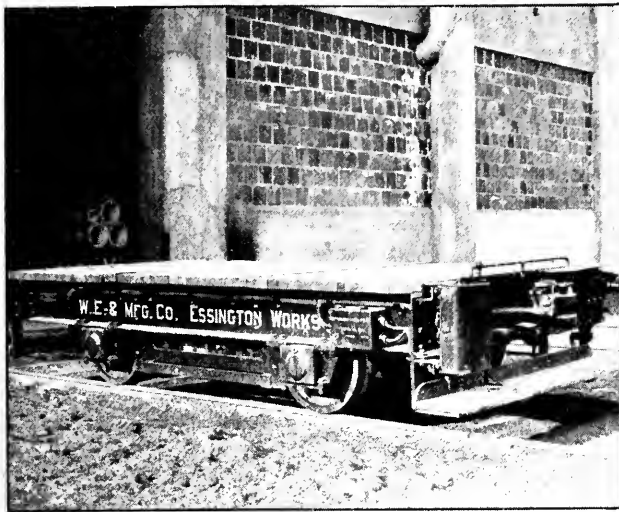
Already seven buildings have been erected. These include the pattern storage shop, foundry, forge shop, power house, erecting shop and two machine shops, representing over 600,000 sq. ft. (55,200 sq. m.) of floor space.

Practicing a policy consistently advocated by the company, the management determined to use central-station power. This energy is supplemented by the company's own power plant.

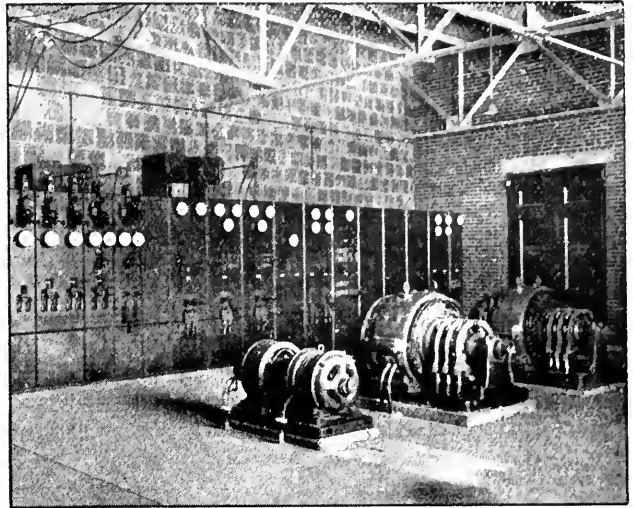
The demand on the Philadelphia Electric Company, which supplies this district, is naturally greater in winter than in summer; it has a surplus capacity in the latter period. On the other hand, the Westinghouse company requires steam heat at from 2 lb. to 4 lb. (140 to 280 grams per square centimeter) pressure for heating buildings during the winter, but requires no steam during the summer except for testing. Steam for heating can be most economically supplied by passing it through a non-condensing turbine and then to heating mains after it has done its work in power generation. An arrangement satisfactory to both companies was entered into by which the Philadelphia Electric Company supplies the works with energy during the summer, and in the winter energy will be generated in the power plant at the works, which, on account of the exhaust steam being utilized, is operated non-condensing. This arrangement affords a reserve source of power, and, when necessary, the local plant may pump back power into the central-station system.

Selection of the site and general direction of the plant activities have been in charge of H. T. Herr, vice-president Westinghouse Electric & Manufacturing Company, who also superintended the securing of all the equipment.

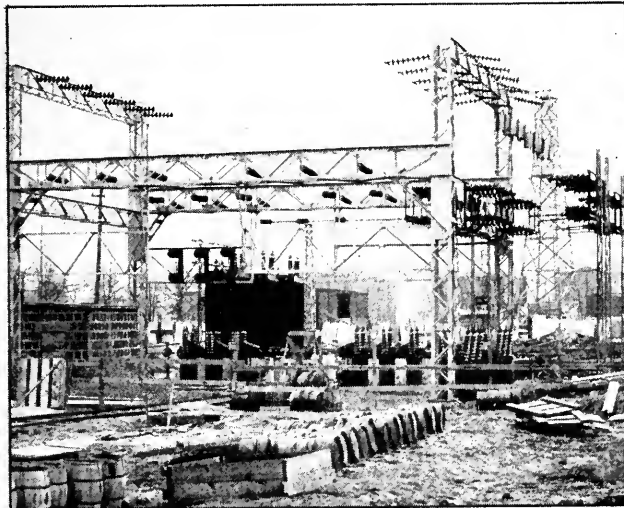
Business relations with Westinghouse, Church, Kerr & Company, who are constructing the plant, were handled by Calvert Townley, assistant to the president, technical arrangements being subject to Mr. Herr's approval. As assistant to Vice-president Herr, R. B. Mildon had general supervision of construction and the providing of equipment, as well as its operation. All arrangements have been subject to the approval of E. M. Herr, the president.



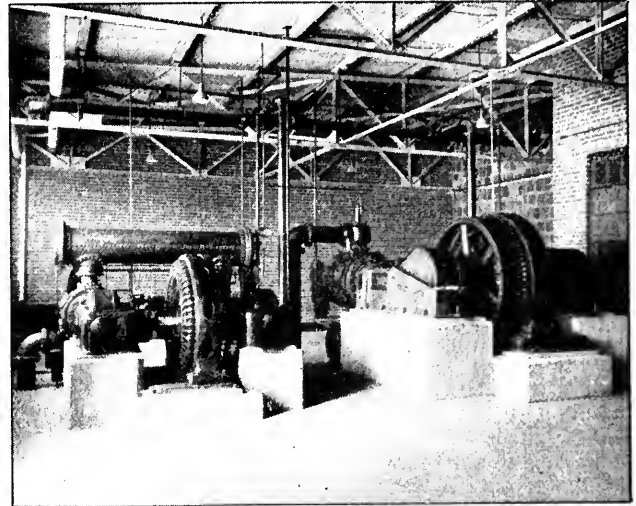
Baldwin-Westinghouse Burden-Bearing Storage Battery Truck with a Capacity of 50 Tons



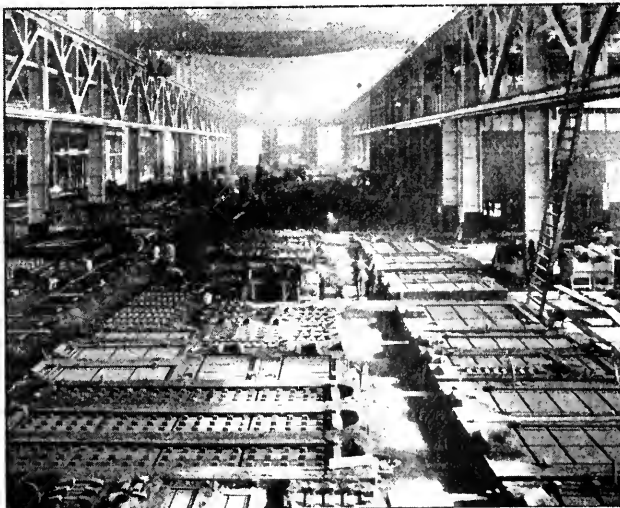
Interior View of Typical Substation, Showing 250-Volt Rotary Converters and Switchboard



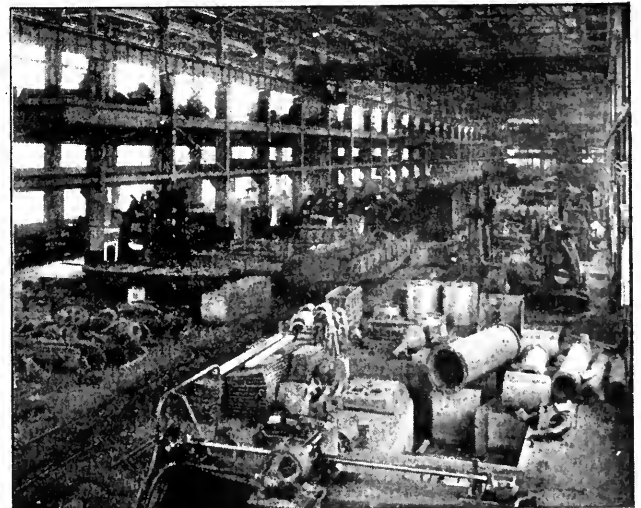
Outdoor Substation where 60,000-Volt Energy from Philadelphia Electric Co. is Transformed to 6,000 Volts



Interior View of Typical Substation, Showing Synchronous Motor-Driven Air Compressors



Interior View of the Foundry



Interior View of No. 2 Machine Shop, Showing Type of Construction, Galleries and Overhanging Balconies

South Philadelphia Works, Westinghouse Electric & Manufacturing Co.

Features of Steam Plant Supplementing Water Power

Station Designed for 75,000-Kva. Ultimate Rating Feeds Hamilton, Ontario, and 42,000-Volt Transmission Lines in Territory Between Lakes Erie and Ontario



A 75,000-KVA. steam generating plant, known as the East End power station, has been built recently by the Dominion Power & Transmission Company, Ltd., at Hamilton, Canada, to supplement its hydroelectric plant at Power Glen. The new station is designed for continuous and even independent operation at high fuel economy and is not intended solely for use as an emergency standby station. It is situated on the Lake Ontario waterfront, where plenty of condensing and boiler-feed water as well as fuel is available.

At present the company's chief source of energy is the hydroelectric station at Power Glen. This plant is situated about 35 miles (56.3 km.) from Hamilton, on the Welland Canal, and develops its power from water taken from Lake Erie under a head of 265 ft. (80.8 m.). Power is supplied to subsidiary companies in the Welland, St. Catharines, Thorold, Port Colborne, Grimsby, Dundas, Brantford, Oakville and Hamilton districts, the largest portion going to the city of Hamilton. So as to minimize interruptions to service three separate lines operating at 45,000 volts are employed to connect the Power Glen plant with the main switching station at Bartonville, a suburb of Hamilton. The accompanying map shows the district served by the Dominion Power & Transmission Company and also the proximity of the newly completed steam plant to the load center of the system.

While the steam station is designed for 75,000-kva. ultimate rating, only 25,000 kva. has been installed so far. The station delivers energy to the 45,000-volt lines of the company, but in addition is designed to fulfill the requirements of a step-down transformer station, as 13,000-volt energy has to be distributed to neighboring factories. Half of the 25,000-kva. step-down equipment is installed.

During the winter months it is necessary to house the coal-hauling equipment, so a separate building is provided for this purpose into which the cars are run and unloaded into a large receiving hopper. From

this hopper the coal is fed to a crusher and then elevated by an inclined conveyor to storage bins above the boilers. From these it may be fed by gravity into a traveling hopper, which weighs it and delivers it to the stokers.

The boilers (1050 hp. each), which are of the Edge Moor type, are equipped with eleven-retort Taylor underfeed stokers and radial brick chimneys 240 ft. (73.2 m.) high, a combination which will allow the boilers to be forced to 300 per cent normal rating if necessary. Automatic soot blowers and boiler-room instruments which will permit the engineers to operate the boilers intelligently are provided. Make-up water for the plant is obtained from Burlington Bay and is treated by the We-Fu-Go system, the apparatus being situated in a separate building.

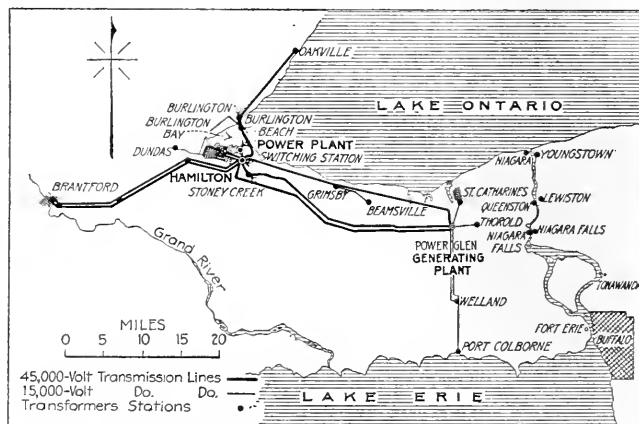


FIG. 1—TERRITORY SERVED BY DOMINION POWER & TRANSMISSION COMPANY

Each of the turbine generators, which are of the Westinghouse Parsons-Curtis type, is supplied with steam from its own set of boilers through piping run through the basement wall. The piping is arranged so that one set of spare boilers is sufficient for the entire plant. Steam is delivered to the turbines at 200 lb.

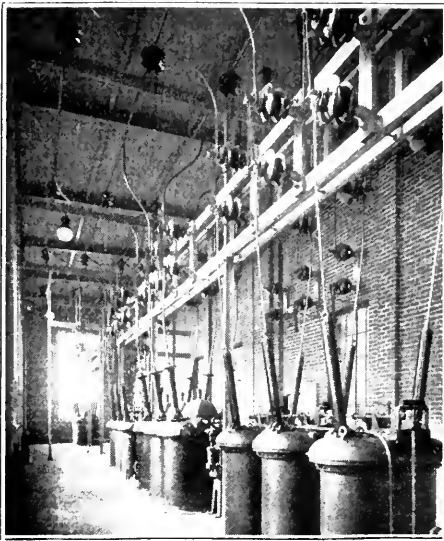


FIG. 2—SOME OF THE 42,000-VOLT OIL SWITCHES AND DISCONNECTING SWITCHES

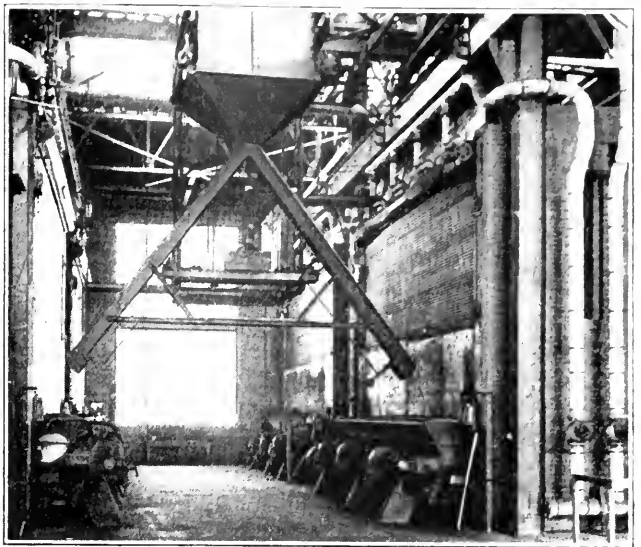


FIG. 3—COAL-WEIGHING LORRY FEEDING BOILERS ON EACH SIDE OF AISLE

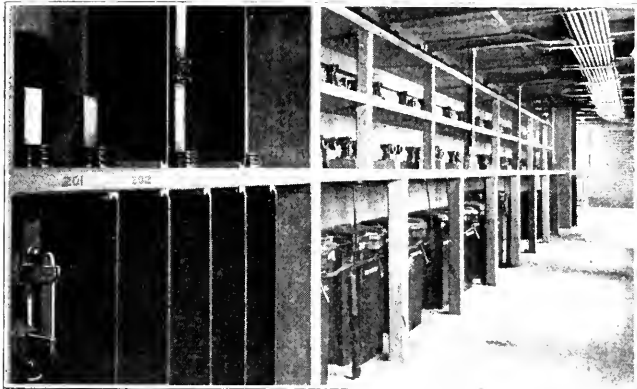


FIG. 4—6600-VOLT BUS STRUCTURE

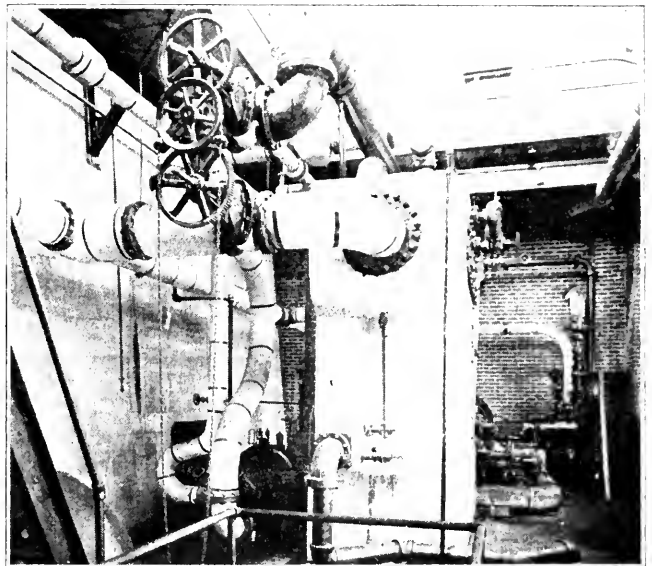


FIG. 5—OPEN-FEED WATER HEATER RECEIVING STEAM FROM AUXILIARIES

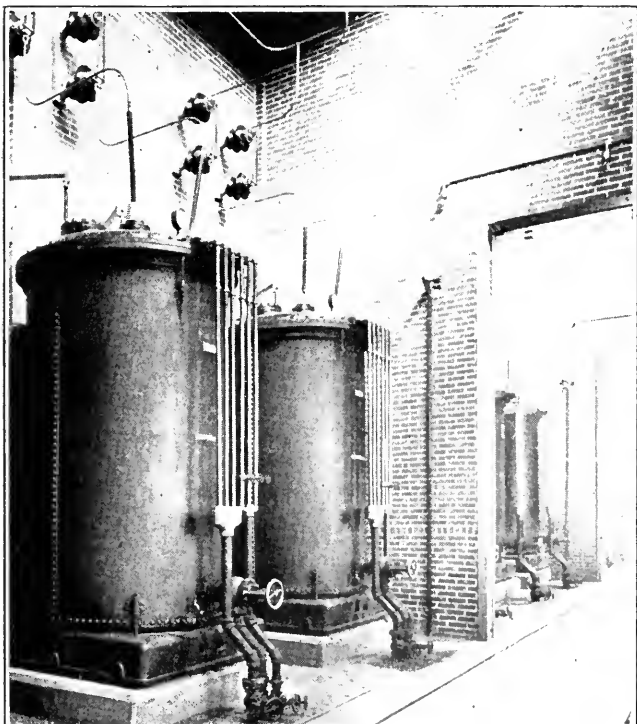


FIG. 6—PART OF 6600/42,000-VOLT TRANSFORMER BANK

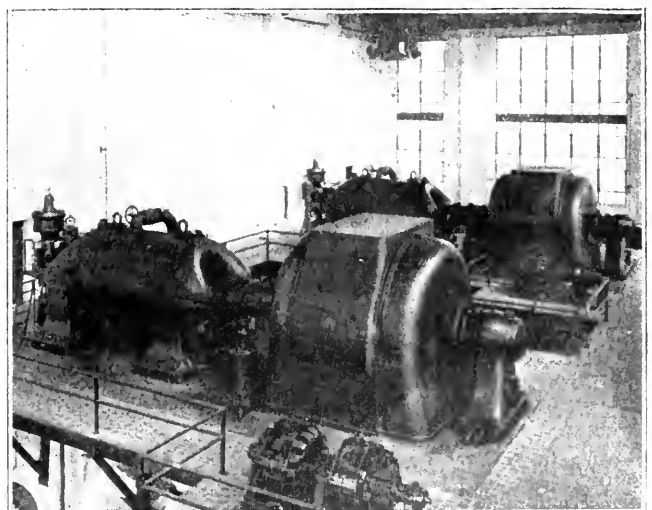


FIG. 7—MAIN GENERATORS AND MOTOR-DRIVEN EXCITERS

(11.1 kg.) pressure and 160 deg. superheat. Surface condensers are installed immediately below each turbine, the condensate and air being withdrawn by pumps coupled to an impulse turbine. Cooling water for the condensers is also taken from Burlington Bay, the pumps being installed below the water level so as to be self-priming. Exhaust steam from the turbines driving the auxiliaries is admitted to Cochrane open-type feed-water heaters. The boiler-feed pumps are also turbine-driven, and each one is large enough to feed four boilers under maximum load.

The turbines drive 12,500-kva., 6600-volt, three-phase, 66⅔-cycle generators, which are cooled by air treated in Carrier humidifiers. Two humidifiers will be provided for each set of three generators. Each generator is separately excited by a motor-driven exciter, although a steam-driven exciter is also available for any machine in case of necessity.

TRANSMISSION OF POWER

Energy from the generators is carried by twelve 500,000-circ. mil lead-covered cables to switches in the control room and then to 6600/42,000-volt transformers which are interconnected on the high-voltage side. With this arrangement two sets of transformers are always between each pair of machines and disturbances are localized in case of trouble in any one of the generators. Power, which must be transmitted at 6600 volts, is not taken directly from the generators but from the 42,000-volt bus through step-down transformers. Energy for station service, however, is taken directly from the generators through step-down transformers. The station-service buses are sectionalized in order that equipment which is used exclusively with each generator may be operated therefrom. Provision is made for supplying general station service from any generator.

All of the electrical apparatus is remotely controlled

As shown by the cross-section of the plant, the switching and transforming equipment is installed in a low building adjoining the power plant. Views of the 42,000-volt oil-switch room, a section of the 6600-volt bus compartments and the transformer bays are shown

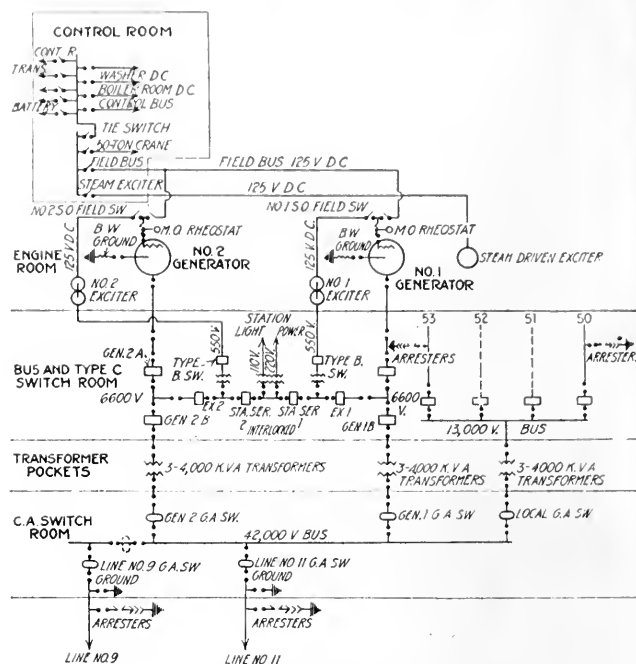


FIG. 8—TRANSFORMERS TIED TOGETHER ONLY ON HIGH-TENSION SIDE

in accompanying illustrations. Two transmission lines pass through the roof and carry energy to the main switching station at Bartonville. The lightning arresters protecting the steam station are installed beneath the terminal structure just outside the switch house.

The plant was designed and built by the company's

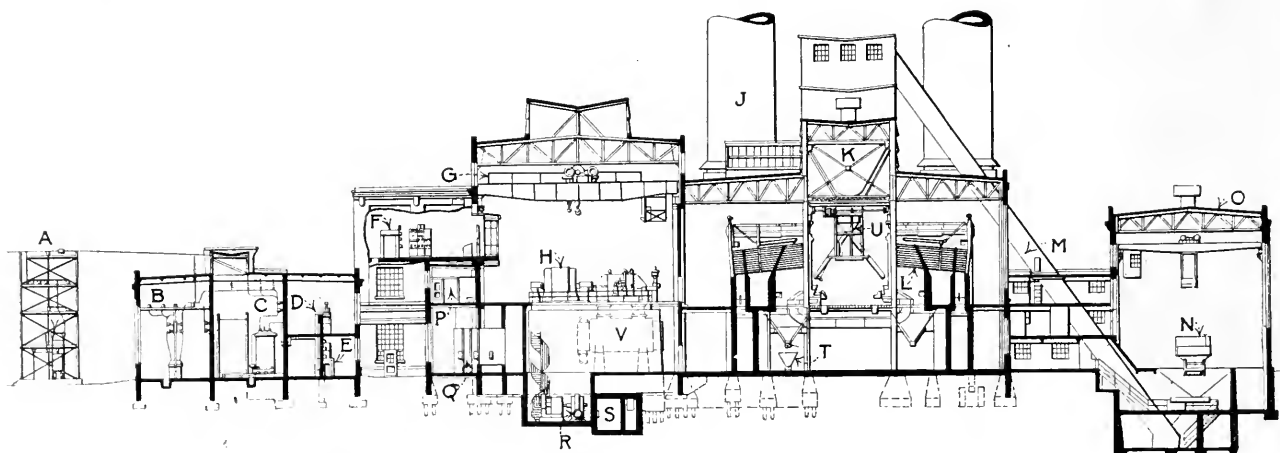


FIG. 9—CROSS-SECTION OF HAMILTON (ONT.) STEAM PLANT

A—42,000-volt arresters; B—42,000-volt reactance circuit breakers; C—three 4000-kva. transformers per generator; D and E—6600-volt circuit breakers and bus structure respectively; F—control room; G—50-ton crane; H—12,500-kva. turbine-generator; J—smokestack; K—420-ton coal bunker; L—1050-hp. boilers;

M—60-ton elevator; N—coal cars; O—coal shed; P—lavatory; Q—humidifiers for generating ventilating air; R—condenser circulating pump; S—cooling water tunnel; T—ash car; U—5-ton lorry; V—condenser.

from the operating room, which overlooks the turbine room. A signaling system, consisting of Klaxon horns and illuminated signs, is provided whereby signals may be exchanged between the boiler room, engine room and control room. Each unit has its individual signal pedestal.

organization of which W. C. Hawkins is chief engineer and managing director, George Service is mechanical engineer and Charles H. Hutton electrical engineer.

Make the World Safe—Buy Bonds

Solving Woodworking Drive Problems

Method by Which One Company Has Practically Eliminated Repairs and Reduced Power Bills by the Proper Selection of Drives and Correct Mounting of Motors

BY W. A. BLACK

Engineer Fairbanks, Morse & Company

WOODWORKING is one industry in which the advantages of motor drive over shaft and belt drive are very marked. Electric drive is especially desirable because the machines can be located for the most convenient handling of the products and because long shafts will be required with group drive if the machines are scattered to permit the piling of stock and finished products. Furthermore, much of the machinery is used intermittently for comparatively

In planning the drive it was found that there were certain places where individual drive would not be economical. For instance, the battery of nailing machines shown in Fig. 1 were arranged for group drive because a careful study showed that the load is intermittent and that seldom more than one machine is required to do actual work at any one instant. If individual drive had been used, a 2-hp. motor would have been required for each machine and the motor would have been loaded only intermittently, giving a very low load factor with its resultant low power factor and efficiency. With the arrangement adopted a 5-hp. motor drives the battery of five nailers, running with approximately steady load at approximately full load and giving a higher power factor and efficiency than the small machines even had they been operating at full load.

Another factor influencing the choice of group drive was that in this work the machines are never operated as individual units, but each machine performs its part of a progressive operation. The machines are used for making boxes, two end machines being used for framing the boxes, the next two machines for nailing sides, and the center machines for nailing the bottom of boxes coming from each side. The boxes finished by center machine are loaded on a truck placed within reach of the operator.

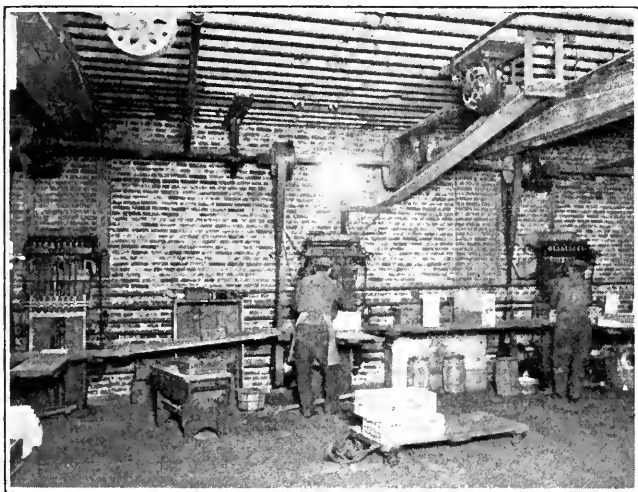


FIG. 1—GROUP-DRIVEN BATTERY OF NAILING MACHINES

short periods, resulting in considerable transmission loss if shaft and belt drive is used.

All these conditions in a line-shaft-driven plant tend to increase the power lost in transmission, because the long lines of shafting must be run continuously in order that power may be available for all machines when it is wanted, though comparatively few are in operation at one time. This loss is increased by the friction of loose pulleys on machines that are not working. With a motor-driven plant having for most purposes individual drive transmission losses are very small because they are almost directly proportional to the number of machines that are doing useful work.

The conservation requirements of the present time have shown that the electric drive alone is not sufficient, but that the type of motor chosen and the method of drive used must be designed for the highest efficiency.

WHERE GROUP DRIVE WAS ADVISABLE

The Riddle-Rehbein Manufacturing Company of St. Louis has laid out its drives with such care that practically all objectionable features of the ordinary woodworking plant have been eliminated and energy bills are less than for similar plants of smaller output. In most cases individual drives are used, as with this method the motors remain idle except at such times as the machines are in use.

VALUE OF SUBSTANTIAL FOUNDATIONS

The 30-in. (76-cm.) double surfacer shown in Fig. 2 is direct connected to a 50-hp., 1200-r.p.m. induction

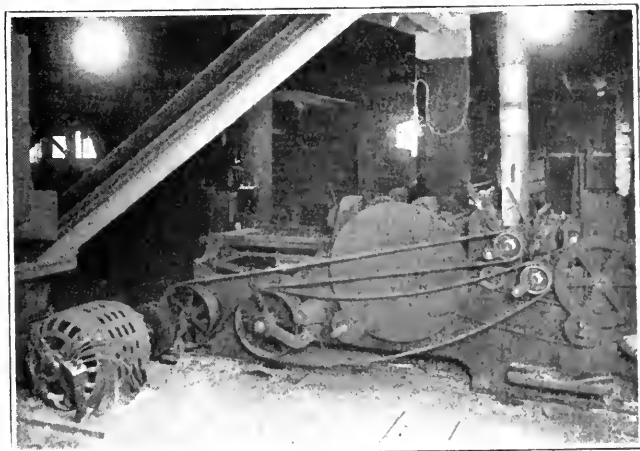


FIG. 2—30-IN. DOUBLE SURFACER DIRECTLY CONNECTED TO 50-HP., 1200-R.P.M. ROLL-BEARING MOTOR

motor. The planer and motor are mounted on I-beams embedded in a concrete foundation which extends through basement into solid ground. Six hundred and fifty cubic feet (18.2 cu. m.) of concrete was used in the foundation, but the expense of making it is well offset

by the freedom from vibration and the perfect alignment maintained thereby. The advantage of a firm foundation cannot be overestimated, especially for direct connected machines. The foundations should be large enough to accommodate both the machine and the driving motor, as failures have occurred where a machine and the driving motor were mounted on sepa-



FIG. 3—TWO-SPINDLE SHAPER BELTED TO TWO VERTICAL MOTORS; BELT-DRIVEN BAND SAW IN FOREGROUND

rate foundations, owing to foundations moving with reference to each other and thus throwing the machines out of line.

The advantages of a solid foundation for maintaining perfect alignment are well illustrated by the performance of a 54-in. (137-cm.) resaw, which was mounted on a substantial foundation and directly connected to a 35-hp., 600-r.p.m. motor. After being in service over four years, the machine, with a tension of 2000 lb. (907 kg.) on a saw, would run for two minutes and thirty seconds after the power was shut off. With a less substantial foundation the heavy machine would have vibrated out of line and the strain on the bearings would have caused excessive repair expenses.

Direct-connected ball-bearing motors reduce the maintenance expense cost to a minimum. There are no belts to slip, break or be taken care of. The ball bearings are contained in dust-proof inclosures requiring only infrequent attention compared with other types. With such motors and bearings the greasy dust so prominent in most woodworking plants can be avoided. Furthermore, the absence of oil and grease on motor frame and windings makes it possible to clean the machines by blowing off the dry dust. For the purpose of cleaning machines the woodworking company has a small motor-driven air compressor which is in use only when the cleaning is necessary.

While machines which are belted to motors mounted on the ceiling have all of the advantages of individual drive, they have the disadvantage that the belts obstruct the light. In addition, since the belts are long, they require more attention and are harder to cover

with protective guards. To overcome these objections many of the motors in this plant were mounted on the ceiling under the driven machine and a belt was run through an opening in the floor. This arrangement had all the advantages of ceiling mounting and at the same time permitted the use of short belts that could be easily protected by guards. No changes were necessary in the bearing construction as ball bearings were used and only occasional attention is required. With this type of drive it was necessary to guard against the use of excessively short belts and against the location of motors directly under driven pulleys, as these conditions would reduce the area of contact of belt on pulleys.

VERTICAL SHAFT MOTORS FOR SHAPERS

A very practical drive shown in Fig. 3 was adopted for the two-spindle shapers used in this plant by belting them to two 3-hp., 1800-r.p.m. vertical motors. The starting switches are mounted on side of machine opposite the motor within reach of the operator. Either or both spindles can be readily started or stopped as required. The use of vertical motors eliminates the need of crossed belts, and the ease with which spindles can be started and stopped reduces the tendency for the operator to leave spindles in operation when not in use.

On a small jig-saw used for cutting out ornamental work the lines of which have to be followed very closely a unique arrangement is used to keep the work free from sawdust. A small ball-bearing motor is belted to a blower, which in turn is connected by flexible tubing to a nozzle placed close to the work. The air from the blower is forced through the nozzle, which blows all sawdust from the work and leaves the lines visible.

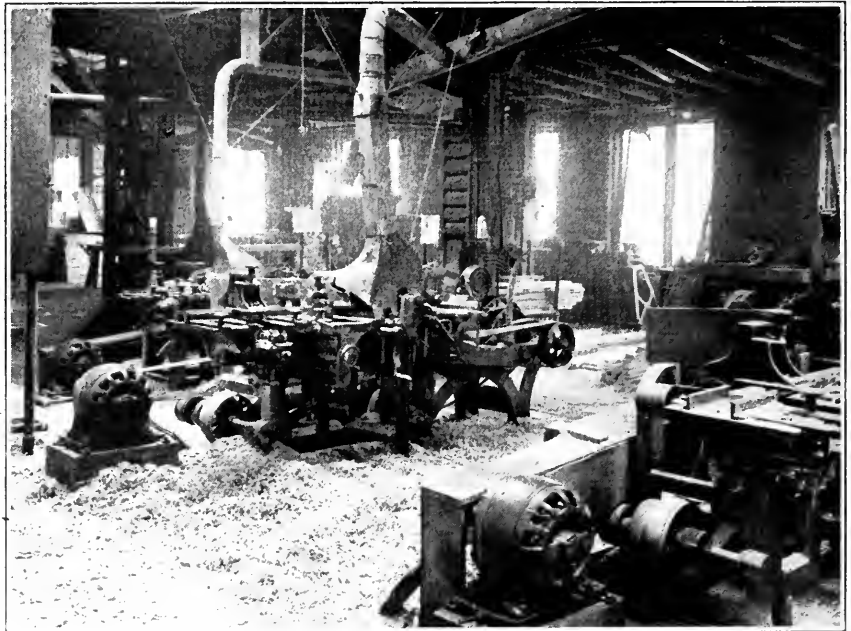


FIG. 4—GROUP OF SMALL MOLDERS BELTED TO BALL-BEARING MOTORS

Some small molders belted to ball-bearing motors are shown in Fig. 4. For this illustration the motor covers were removed to give a clear view of the motors. It is worthy of mention in this connection that with ball-bearing motors it is practicable to cover the motors as it is not necessary to remove the covers frequently for oiling.

A drive which required careful consideration before it was successfully worked out was that of a Linderman automatic dovetail glue jointer driven by a 15-hp., 1200-r.p.m. motor. In cold weather the high torque necessary to start required either a larger-size squirrel-cage motor or a motor of the wound-rotor type. With the larger squirrel-cage motor the starting current would have been objectionable and the power required would have only lightly loaded the motor after the machine had attained full speed. The wound-rotor type of motor with a secondary starter would have overcome the difficulty of operation but would have imposed the necessity of more care owing to slip rings, brushes and starter contacts.

The drive was very successfully taken care of with an internal starter motor. With this motor it was possible to obtain a high starting torque with a low starting current in a reasonably short starting period. The starting switch was simply a single-throw switch, and slip rings and brushes were eliminated. The installation has been in operation for over three years and has given perfect satisfaction.

A great deal has been written about the proper methods of mounting and the correct drive for the different classes of machines. In the above article the writer has endeavored to show how one company practically eliminated repairs and reduced power bills by the correct drive and by the correct mounting of its machines. What it has done can be equaled by any other company.

Lend a Hand—Buy Liberty Bonds

ACCOMPLISHING REDUCTION OF DUCT TEMPERATURES

Results of Investigation Carried On in Order to
Determine How Effective Air Blowers Are
in the Cooling of Cable Ducts

INVESTIGATIONS to determine how much air blowers can reduce the temperature of ducts used for high-voltage transmission cables have been made by William Keating and Carl H. Mueller of the Duquesne Light Company of Pittsburgh, Pa., some of the conclusions being presented herewith. Study along this line was precipitated by a rapid increase of load on the company's 11,000-volt system which caused whole sections of the duct line to become so badly overheated that numerous cable failures occurred.

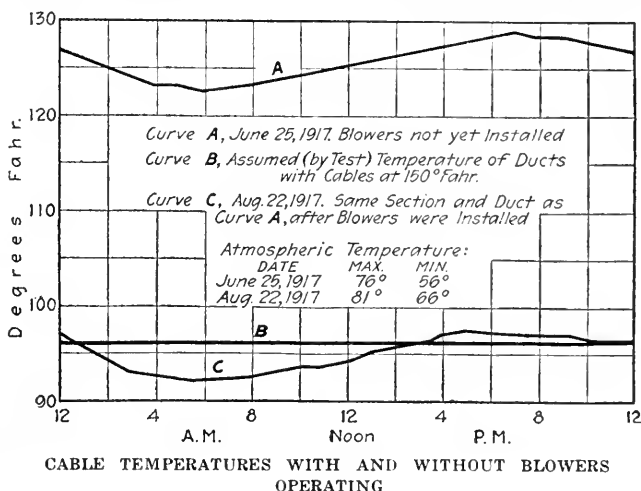
In commenting on the subject of safe operating temperature the investigators pointed out that cables must operate at a much lower temperature than any other kind of electrical apparatus to assure reliable service. It has been definitely determined by laboratory tests that the maximum safe working internal temperature of an 11,000-volt cable is 150 deg. Fahr. (65.6 deg. C.). Beyond that temperature a peculiar phenomenon is manifested. By reason of the high voltage a hysteresis effect occurs in the insulation that generates heat. Up to 150 deg. Fahr. this loss increases directly with the temperature, but after 150 deg. Fahr. is reached the curve takes a very sharp upward turn and quickly reaches the failure point. Safe operation depends, therefore, upon the ability to keep the internal cable temperature below 150 deg. Fahr. By laboratory tests it has been determined that the difference in tempera-

tures between the duct wall and the copper of the cable is approximately 54 deg. Fahr.

FACTORS AFFECTING CABLE LOAD

The number of cables in a given duct line and the character of the soil through which the ducts run are factors that determine the amount of load the cables can carry. The characteristics of the soil determine the rapidity with which the heat can be dissipated, while the number of cables determine the amount of heat to be dissipated. In general 35,000 kva. is the maximum load any duct line should be called upon to carry. Several parts of the Pittsburgh system have exceeded this safe maximum. It is at these points that trouble has developed.

In one section where trouble occurred there are ten tile ducts, built two wide and five deep, in which there are installed eight No. 4/0 three-phase, 11,000-volt cables. The street is narrow and its soil has poor heat-dissipating qualities. Several rolling mills with annealing furnaces are close to the street. Every cable



in the run is called upon to carry from 200 amp. to 220 amp. during the morning and evening peaks. In the summer the load factor is about 50 per cent and in winter about 75 per cent.

WATER VERSUS AIR FOR COOLING

During the summer of 1916 there were thirty-eight cable failures in this section, which is somewhat less than a mile long. All these failures occurred between June 1 and Oct. 1; in other words, during the hot weather. In order to relieve the situation, the man-hole covers were removed and left off day and night during this period. During the winter of 1916-1917 plans were formulated for the coming summer for cooling this section if it should be found necessary. Two plans were discussed—first, cooling by circulating water; second, by air from motor-driven blowers. The first idea was abandoned on account of the danger of cable failures from electrolysis, a trouble which has always been prevalent in this district.

At first the use of air blowers was not very favorably looked upon, as there were so few vacant ducts in the subway that there was very little free air to move. However, as this was the only plan left it was decided to try it out. Therefore eleven blowers, each having a capacity of 612 cu. ft. (17.1 cu. m.) per minute, were built into wooden frames to fit the manholes. Rubber-

covered wire was run through one of the spare ducts to supply energy to operate the blowers. At first the blowers were arranged to draw the air out of the duct line, but this overloaded the motors on account of the restriction of the passage of air through the duct line. The process was reversed and outside air forced into alternate manholes, the intervening holes being left open to allow the escape of the hot air. The effect produced is shown graphically in the accompanying curve. The average maximum temperature during the summer, with the blowers running, was 96 deg. Fahr. (35.6 deg. C.), which is just within the safe operating temperature.

By October the weather had become considerably cooler, so it was decided to shut down the blowers and close the manholes. This was done, and within a week the temperature had increased from 96 deg. Fahr. to 119 deg. Fahr. (35.6 deg. C. to 48.3 deg. C.). The manholes were opened and the blowers replaced. This increase, occurring as it did during cool weather, is due to the higher load factor on the cables. As the load is constantly increasing it may be possible that the blowers will have to be operated until the arrival of very cold weather.

Only two breakdowns have occurred in this section since the blowers were installed, and these were due to individual overloads on the cables caused by station failures at other parts of the system.

While the use of blowers is, no doubt, largely responsible for the decrease in the number of failures, the weather was cooler during the summer of 1917 than 1916. Furthermore, the load was slightly less, owing to the increase in the capacity of the transmission system at other points. The neutral has also been grounded, and this, it is believed, has aided in decreasing the number of failures in general as the voltage between conductors and ground has been decreased from 11,000 volts to approximately 6800 volts.

METHOD OF DETERMINING DUCT TEMPERATURE

The method of determining the temperatures in duct lines may be of interest and hence is given here. Several indicating pyrometers, depending on the change of resistance in a small coil, were purchased and drawn into the duct lines at the ends of 250-ft. (76.2-m.) leads. These instruments read within 2 deg. of accurate and are rugged enough to stand the service required of them. With these instruments surveys were made of all duct lines which might possibly become overheated and records kept of the temperatures. By this means the investigators have been able to determine where duct lines are already loaded to maximum capacity and thus to say where no more cables should be installed. Recording pyrometers built on the same principle as the indicating instruments were also used, but with little success. Such instruments were found so extremely delicate that they would not stand the service required of them. A number of twenty-four-hour charts were obtained at danger points, but the instruments could not be placed in regular service.

There is much to be done yet in the way of experimenting to secure data on which conclusions can be based. Heretofore this company has been restricted to the use of laboratory data compiled by cable manufacturers, which at best can only approximate actual conditions.

Bonds Are a Pledge—Buy Them

BUREAU OF STANDARDS AND ILLUMINATING ENGINEERING

Dr. M. G. Lloyd Addresses Chicago Meeting on Relation of the Bureau to Illuminating Engineering
—New Federal Lamp Specifications Given

In an address entitled "Relation of the Bureau of Standards to Illuminating Engineering," Dr. M. G. Lloyd of the bureau's engineering staff, Washington, D. C., presented to the Chicago Section of the Illuminating Engineering Society a thorough and valuable review of the activities of the bureau most interesting to illuminating engineers. The paper contains an analysis of the field of the illuminating engineer, an outline of the work of the Bureau of Standards, a discussion of the standards for the measurement of light both in this country and abroad, a statement of the bureau's work to determine a standard in color specifications, a detailed description of the bureau's method of testing lamps purchased by the government, a tabulation of the new government lamp specifications, a discussion of the properties of gas-mantle lamps, an analysis of the bureau's work in testing automobile headlight lenses, a description of an extensive investigation carried out to determine the sensibility of the eyes of different individuals to light of different colors, and a statement of the bureau's activities in connection with public utility standards.

In discussing the scope of the illuminating engineering field, Dr. Lloyd said: "Illuminating engineering involves not only the application of physics, but it must consider also the physiology and psychology of light; that is, the relation of light to the human being. Illuminating engineering also involves architecture, interior decoration, hygiene and therapeutics. The work of the illuminating engineer requires the adaptation of light from all available sources to all purposes to which it may be applied. The available sources include both daylight and artificial light from bodies made incandescent by heat or by the application of electrical energy."

After discussing in detail the equipment and methods used by the bureau to test lamps purchased by the federal government, Dr. Lloyd gave data on life testing and federal lamp specifications. These specifications are to be issued later as Circular 13 of the Bureau of Standards. They must be complied with in the case of government purchases of multiple incandescent lamps and are available to all private purchasers who wish to follow similar specifications.

In the discussion of public utility standards, Dr. Lloyd stated that the investigation of the bureau on the subject of street lighting has been delayed by the war and probably will not be completed until after the war's termination. The bureau has recently been engaged in helping to formulate safety standards for application in federal industrial establishments such as navy yards and arsenals. Among the standards are included requirements for illumination in these establishments.

Invest by Buying Liberty Bonds

Finding Best Character of Community Rate

Discussion of the Advantages of the Method Employed by the Public Utilities Commission of Illinois in Approaching a Decision on This Matter—Tabulated Data Showing How Conclusions Were Arrived At

BY BERT H. PECK*

Electrical Engineer State Public Utilities Commission of Illinois

HAVING prepared and presented data on the value of property, the next thing with which the engineer must supply the commission in a rate case is information bearing upon the character of the rates best suited to give the revenues which may be determined upon. The methods of the State Public Utilities Commission of Illinois for handling this work are unique and offer some elements of advantage over others which may be employed.

The determination of the specific rates applicable in a given instance presents a question having two aspects: first, the question arises as to the character of rates best suited to meet the conditions prevailing in a given case; second, the question arises as to specific numerical rates of the character determined upon which will give the certain revenues desired.

The Illinois commission early realized this fact and has always endeavored to secure opinions from the utility involved, from responsible representatives of the community concerned and from its own experts as to the character of the rate which is best suited to the particular conditions that prevail. The methods by which this information may be presented to the commission were at first subjects of quandary.

PLAN ADOPTED BY THE COMMISSION

If complete testimony were taken regarding valuations and operating expenses and the commission entered a finding as to the total annual revenues to be allowed and then reopened the case for the purpose of taking testimony as to the character of rates best suited, the case would be unduly prolonged. If a finding were entered as to the revenues and a determination of the rates left with a utility, one of the principal sources of controversy would still remain. After careful consideration of this entire matter the commission determined upon the plan of instructing its engineering staff to present in the record a schedule of rates which should give a revenue of an amount which might be indicated or assumed by the engineers. This necessitates that the engineering staff shall assume a valuation of the property, shall assume a rate of return, shall assume an amount of operating expense, and based upon these assumptions compute an amount of annual revenue and develop a schedule of rates which will meet it. This results in bringing into the record a specific character of rate schedule for discussion. It possesses the disadvantage from the witness's standpoint of compelling a number of assumptions which are somewhat without the range of his jurisdiction, and in a sense results in putting his testimony up for the sole purpose of being shot at. It has, however, proved successful for the purpose for which it was intended, namely, the securing of expressions of opinion by all concerned as to the best rate to meet a given case.

The second phase of the subject in which the commission is interested—namely, the numerical determination of a specific rate which will give a certain definite revenue—necessitates the introduction of consumer data to which a given rate schedule may be applied. These data are taken from the books of the utility by the accountants of the commission, who arrange and tabulate them in such form that they are applicable for the purposes intended. The working out of these forms and tabulations presented a pioneer field, and in handling the problem the engineer and accounting staffs of the commission collaborated, with the result that a form was developed, as shown in Table I, which is taken from an actual record placed before the commission in a rate-making proceeding. The data must be tabulated in such a manner that any form of rates may be applied thereto. The commission, in working out its schedule of rates, has relied upon its engineers for a computation of revenue which a given rate will develop. A superficial consideration will indicate the impracticability of applying a given rate to a total year's bills by multiplying each bill separately, and it was therefore necessary to develop a system whereby a revenue could be rapidly computed and changes contemplated in a schedule could be readily adopted without an entire recomputation (Table II). A table of this form is applicable only to a block or step schedule of rates. If rates of the Wright demand form are contemplated, the information must be worked up in the form shown by Table III. Having obtained information in these forms, it will be seen that a given rate may be applied in a very few minutes, with the result that the commission is at liberty to alter certain phases of the rate as frequently as desired, without entailing a large amount of work in the computations of changes of revenues which are involved. In a particular case that I have in mind fully sixty rates were worked up and applied before a final schedule was determined, and the amount of time involved was not a serious consideration.

ALLOCATING OPERATING EXPENSES AND FIXED CHARGES

The revenues thus derived are, of course, revenues for a specific year's consumption, and if the commission determines that it wishes to take into consideration certain increases or decreases in consumption, these can be readily cared for by obvious methods. In this discussion of forms of rates I have not taken up the matter of allocation of property values and operating expense to the different classes of service rendered. Such different classes of service frequently comprise residence service, business lighting service, flat-rate lighting service, direct-current power service, alternating-current power service and municipal street-lighting service. These classes of service are very frequently met, and in addition there are, of course, the

*Excerpt from a paper presented before the Western Society of Engineers and the Chicago Section, A. I. E. E.

almost limitless possibilities of limited-hour service and seasonal service which may arise. The proper allocation of operating expense and fixed-charge items is a large problem and requires further analysis of operating characteristics. In a solution of this problem the engineers of the Illinois commission, in handling electric rate cases, have usually presented load curves of

TABLE I—RESIDENCE CONSUMERS—CONNECTED LOAD AND MONTHLY CONSUMPTION

Year Ended Dec. 31, 1915

(Connected load, 400 watts; average actual connected load, 318 watts)

Consumption, Kw.-Hr.	NUMBER OF CONSUMERS												TOTAL
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Consumer-Months
0	1	1	4	6	7	5	11	10	11	8	8	10	82
1					2	4	3	5	3	2		2	21
2			1	4	3	6	11	7	3	1			36
3	1	2	7	9	8	10	11	7	3	8	4	3	73
4	3	6	11	11	14	11	5	12	11	6	5	3	98
5		6	4	3	8	7	7	9	10	8	8	7	85
6		6	8	5	4	2	5	7	5	9	12	8	75
7		6	4	6	4	5	4	10	7	8	2	6	66
8		2	6	6	7	10	9	2	2	3	8	8	70
9		5	5	9	6	4	4	6	5	4	7	1	63
10	4	7	8	4	4	7	9	5	6	7	5	5	71
11	5	1	1	6	3	4	2	7	5	4	5	10	53
12	2	6	4	3	8	2	2	3	4	6	3	9	52
13	3	5	2	4	5	2	2	5	4	3	5	2	42
14	2	1	10	5	3	5	2		6	8	7	8	57
15	4	3	1		3	5	3	2	4	2	10	3	40
16	6	10	1	4	2	3	2	5	1	5	9	7	55
17	2	2	5	2	4	2	3	2	2	2	2	5	33
18	2	2	5	4	2	2	2	2	3	3	4	1	32
19	2	1			3	2			1	1	5	7	22
20	5	3	1	3	1			2	3	2	2	4	26
21	4	3	2	1	2		3	2	1	4	3		26
22	2	2	2	3		3		2	2	3	1		20
23	3			2		1	1				5		15
24		7	1	4		1			2	2	1	1	19
25	2	1	1		2	1	1		1	1	2	2	12
26	3	6	2		1				1		2	2	17
27										2	2	1	5
28	1	1			1				1		3	2	9
29	1		1		2		1	1			3		9
30	1					1	1	2		2	2	1	8
31			1	1						2		2	6
32	1		2			2	1	1					7
33											1		2
34	1	1				2				1	1		7
35													
36					1					1			2
37	1						1	1			2		4
38	1								1		1		4
39	1		1										2
40													
41	1					1							1
42													
43											1		1
44										1			2
45													
46											1		1
47													
48													
49	1												1
50													
51													
52													
53											1		1
54	1		1										2
55													
56													
57													
58											1	1	2
59													
60													
61													
62													
63													
64													
65													
66													
67													
68													
69													
70													
Total consumers.....	92	99	104	108	110	110	110	111	115	123	131	134	1347
Total consumption.....	1470	1368	1212	1181	1102	1065	875	939	1165	1435	1726	2026	15,564

the electric system obtained from station log sheets of the utility.

The methods made use of for this allocation might well form the subject of a long discussion. In addition to the allocation of the various classes of electric service, in the case of a jointly operated property there usually arises the matter of the allocation of property and expense to a water property or a street railway or heating property.

I have discussed in the foregoing the issues which usually arise and may be expected to arise in every rate investigation. In many cases other issues entirely dissimilar will arise. In a recent instance a property was under investigation, and the usual study of values and operating expenses was conducted. In making some further investigation of general conditions it was discovered that the consumptions per consumer were materially less than those which had been found in other instances, and we came to the conclusion that the consumers' meters were registering in error. An examination developed that these meters, which were of the direct-current commutator type, had been in service for many years without inspection or adjustment. Mat-

TABLE II—TABLE SHOWING THE CONSUMER-MONTHS AND KILOWATT-HOUR CONSUMPTION OF BUSINESS CONSUMERS

Kilowatt-hour Monthly Consumption per Consumer	Consumer-Months	Total Kilowatt-hours
0-5	1,828	4,296
6	252	1,512
7	302	2,114
8	276	2,208
9	318	2,862
10	287	2,870
11-20	2,025	30,297
21-30	1,179	30,096
31-50	1,369	53,972
50-100	1,623	116,381
101-200	1,261	179,558
201 and over	1,225	634,060
Total	11,945	1,060,226

ters of this nature are certainly of vital importance in a rate consideration, and it behooves the engineer conducting an investigation to be thoroughly alive to unexpected possibilities of every nature. Studies of distribution efficiencies will often disclose defects in equipment of which the utility is not aware.

INVESTIGATION DISCLOSES FAULTY METER

In another recent investigation our examination disclosed distribution efficiency of approximately 85 per cent in a community of about 1200 population. This excited our suspicion, and we made a test of the meter under which the utility procured its energy over a

TABLE III—TABLE SHOWING THE CONSUMER-MONTHS AND KILOWATT-HOUR CONSUMPTION OF BUSINESS CONSUMERS

Hours' Use of Maximum Demand	Consumer-Months	Total Kilowatt-hours
First 30 hours' use	4,074	42,210
Next 30 hours' use	2,627	82,954
Excess over 60 hours	5,244	935,062
Total	11,945	1,060,226

transmission line. This test disclosed that the meter was in error. Clearly a matter of this sort should be corrected before the rates are fixed for electric service. I mention these points as indicating the very wide scope of action and investigation which in justice should be conducted in connection with proceedings for the determination of rates.

In the course of the commission's work, which has covered several years, we early saw the need of collecting data from every source available, even though its application to the case immediately in hand was of

oubtful import. Such data collected with care and copious notes as to the conditions which prevail often-times prove invaluable in their application to other cases where the need is more apparent but where the

ulations necessary, besides broadening the possible scope of the inquiries. Data shown in Tables IV and V were prepared for two cities from the results obtained by these methods in a form which I believe may be of

TABLE IV—STATEMENT SHOWING COMPARATIVE CONNECTED LOADS AND CONSUMPTION FOR VARIOUS CLASSES OF ELECTRIC CONSUMERS IN A CITY OF 10,000 POPULATION

Kind of Business	Average Active Consumers	Average Connected Load, Watts	AVERAGE CONSUMPTION IN KILOWATT-HOURS												Average Kw.-hr. per Year per Consumer
			Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Residences*	365	749	25	22	17	15	12	10	9	10	11	18	22	23	194
Saloons and poolrooms*	23	1128	135	125	92	95	88	112	106	117	92	111	117	130	1318
Restaurants	5	437	130	126	92	111	100	159	155	134	126	124	129	131	1516
Tobacco stores	80	1397	117	81	65	70	60	60	58	78	76	97	111	126	999
Dentists	6	342	11	13	10	4	3	6	8	7	6	8	12	11	97
Livery barns and feed stables	8	513	58	51	33	28	21	18	15	24	27	36	43	51	406
Picture shows	4	4641	568	601	573	563	607	632	520	555	553	551	1002	612	7335
Photograph galleries	3	1262	29	32	28	27	22	20	29	16	15	22	41	68	348
Lodge rooms and halls	12	1163	30	39	31	39	37	28	21	24	23	31	27	31	362
Printeries	4	1520	143	186	135	111	115	110	84	101	119	157	163	151	1574
Hotels and rooming houses	6	1692	259	243	162	158	160	155	112	125	144	176	195	227	2117
Hotels and saloons combined	4	3019	381	332	265	306	263	300	230	287	313	352	362	409	3801
Offices and banks	40	766	49	41	30	32	27	26	27	32	25	29	37	47	402
Schools	3	1663	23	48	22	12	17	19	2	1	4	16	20	36	219
Churches	13	3810	54	46	36	54	37	20	15	12	26	33	37	46	413
Club rooms, halls and skating rinks	2	643	21	16	17	9	6	5	5	7	5	26	44	41	201
Blacksmith, machine shops and garages	11	1056	43	17	8	18	22	29	61	41	43	48	53	36	419
Factories	2	2150	180	149	104	90	59	41	31	36	35	35	57	87	901
Lumber yards	1	150	5	4	1	1	2	3	14	22	2	3	3	4	64
Miscellaneous†	26	787	80	68	49	52	41	43	42	47	55	60	70	75	681
Average kw.-hr. per month of all consumers	620	1099	57	48	37	38	33	33	32	36	37	44	53	55	503
Average all, excluding those marked thus*	231	1227	99	82	64	68	68	62	60	68	64	80	96	98	908
Average kw.-hr. per month of all business consumers	255	1330	102	86	62	71	64	66	63	73	71	83	98	102	939
County jail	1	.....	481	555	475	198	319	277	247	280	432	410	501	447	4622
Public library	1	.....	538	452	227	525	358	122	14	34	247	383	644	541	4085
City hall and fire department	1	.....	583	569	539	429	375	306	207	447	368	485	594	687	5569

†Includes bakeries, greenhouses, tailor shops, post office, barber shops, railroad depots, laundries, gymnasiums and hallway lights.

facilities for securing the data are lacking. Thus in securing consumer data we have endeavored to analyze them so that they would be available to compare with other conditions which might be encountered. Data

interest and service, although not in the form most adaptable for our use. Comparisons of this nature are of interest in themselves and invaluable as a means of suggestion for discovering conditions which would

TABLE V—STATEMENT SHOWING COMPARATIVE CONNECTED LOADS AND CONSUMPTIONS FOR VARIOUS CLASSES OF ELECTRIC CONSUMERS IN A CITY OF 25,000 POPULATION

Kind of Business	Average Active Consumers	Average Connected Load, Watts	AVERAGE CONSUMPTION IN KILOWATT-HOURS												Average Kw.-hr. per Year per Consumer
			Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Residences	444	757	21	17	15	15	12	10	10	11	14	18	22	23	187
Saloons	74	897	94	82	75	73	58	63	92	99	99	82	80	101	998
Club rooms	22	2407	98	89	71	79	71	49	51	47	46	73	104	111	888
Barber shops	14	399	28	24	19	19	15	15	20	22	23	22	26	31	262
Livery barns and feed stables	6	716	60	56	42	36	28	22	22	27	30	38	56	63	478
Churches	10	1875	31	23	22	23	19	17	11	9	14	22	26	30	247
Tobacco stores	7	472	45	42	33	32	23	18	18	18	21	30	39	47	365
Schools	13	2425	55	63	45	56	32	27	14	18	21	29	61	43	464
Lunch rooms	3	530	53	43	34	37	31	33	40	40	40	44	49	62	506
Telephone offices	2	2315	285	251	219	230	203	174	279	269	233	232	303	302	2980
Confectioneries	9	809	80	64	55	65	63	76	97	101	106	85	87	86	965
Garage and automobile dealers	5	1062	90	71	61	91	75	72	82	81	99	80	92	94	987
Hospitals	2	8455	220	196	158	183	64	100	102	110	136	184	316	252	2121
Drug stores	9	1138	112	94	82	87	61	52	59	62	68	86	107	124	994
Miscellaneous retail business	221	1660	96	76	61	63	46	41	46	47	56	66	93	115	806
Hotels	2	2317	182	187	157	143	118	110	111	111	125	171	216	208	1839
Average kw., all business	399	.....	91	75	62	65	49	43	55	57	63	68	87	104	818
Average kw., less saloons	325	.....	90	74	59	63	47	41	46	47	55	65	89	105	780
Average kw., all	843	.....	54	45	37	38	29	27	31	33	37	42	53	61	487

regarding connected loads, monthly consumptions, load factors, etc., are invaluable for certain purposes and difficult to obtain if original sources must be consulted. We have a complete installation of Hollerith tabulating and sorting equipment with which to handle this information. This has immeasurably facilitated the tab-

otherwise not be unearthed. They have also frequently proved of value as a basis for estimate in cases where data as to consumptions were not available.

Safety First—Buy Liberty Bonds

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COAL-HANDLING METHODS IN SUBURBAN RESERVE YARD

Various Kinds of Electrical Apparatus Are Installed to Handle Coal at Minimum Cost and Greatest Efficiency

The United Electric Light Company of Springfield, Mass., maintains a reserve coal supply in a field recently equipped for this service at Indian Orchard, about 6 miles (9.7 km.) from its principal generating station. The storage capacity is about 50,000 tons, but as shown in the accompanying illustration, taken recently, the supply of coal has been heavily reduced by the stress of winter weather and the shortage of fuel common to the entire East. Coal is brought to the reserve field by rail, and the trackage facilities include



HOW RAILROAD AND COAL-GATHERING TRACKS ARE RELATED TO COAL PILES

a siding 320 ft. (97.5 m.) long for temporary car storage, a discharge and loading track about 406 ft. (123.7 m.) long running through the storage area from east to west, and a 405-ft. (123.4-m.) section of standard-gage track without connection to the remaining rails, upon which is operated an electric locomotive crane.

The tracks are in general supported on reinforced-concrete walls or a trestle. The trestle was designed for Cooper's E-60 loading, corresponding to heavy main-line service. The crane, which was built by the Industrial Iron Works, Bay City, Mich., has a rating of 6100 lb. (2766.9 kg.) at a radius of 45 ft. (13.7 m.). It is operated by a 75-hp. Westinghouse three-wire, two-phase, 440-volt induction motor of the variable-speed type. Resistors for this service are mounted in the cab and are wired in conduit to Cutler-Hammer control equipment of the solenoid type mounted on a switch-board in one corner. Crouse-Hinds condulets are used, and the wiring is unusually rugged and well laid out for the service. The motor-control cylinder can be rotated mechanically by levers and either of two handles at the right and left sides of the operator's stand.

Energy is supplied to the field from the company's Indian Orchard generating plant and substation, close by. The locomotive receives energy through a jumper cable plugged into any of seven jack boxes mounted on a guard pipe-rail run along the side of the trestle track. These boxes are also of Crouse-Hinds design, and each is fused by a 100-amp. fuse block set carried in a box designed by the Chicago Fuse Manufacturing Company. No loose wiring is employed, barring the flexible cable feeding the locomotive from the jack box. The jack boxes are held in place against the guard railing by 2-in. by 5/16-in. (5-cm. by 0.8-cm.) iron straps, and the rail is of 1.5-in. (3.8-cm.) pipe throughout.

Except under the most extreme conditions coal is transported to the city station of the United company by railroad cars loaded from the reserve pile by the locomotive crane, but last winter it was necessary for a time to haul this fuel by gasoline motor trucks. The crane is operated by an employee of the company ordinarily at the State Street station in Springfield, the Indian Orchard plant being a hydroelectric generating station only. The yard and its fixed facilities were designed by McClintock & Craig, engineers, of Springfield, Mass.

Trust the President—Buy Bonds

DETERMINING THE SIZE OF WATT-HOUR METER

Considerations That Should Be Taken Account of in Connection with Customers' Installations to Further Economy and Accuracy

According to a discussion on meters at the recent convention of the Minnesota Electrical Association, there is a very decided tendency toward the installation of meters of smaller sizes. Where there is any question about the size of meter to install some central-station companies are using small-size meters, leaving it to the new-business department to obtain as large a load as it can. This practice has led to practically no trouble. In Minneapolis 95 per cent of the meters installed are of the 5-amp. type. Even for electric ranges, meters of the 15-amp. variety are used there. It is never desirable to install a meter of higher rating than is necessary to register the load efficiently and economically. Putting in too large a meter not only increases the investment in meters but also results in a large loss of revenue owing to light-load inaccuracy.

In general, when installing a meter the class of service must be considered. What applies to one customer does not necessarily apply to another. For example, in churches, stores, lodge halls, saloons, etc., the total connected load is nearly always used and a meter rated at 80 per cent of that load should be installed. For electric signs and like loads meters rated for the total connected load should be installed. In residences only

a few lamps are used at one time, as a general rule, and they are usually not of large size. Occasionally during some special functions the total connected load will be used. At such times a small meter would have to carry considerable overload. However, most of the modern meters will carry 200 to 300 per cent overload without danger of damage to the meter and will carry 400 per cent for a few minutes. The meter will operate slow on overload owing to the fact that the series-coil laminations are oversaturated. However, the infrequent loss resulting from overload will be compensated for by the increased activity of the meter on small loads of one or two lamps. Hence it is always advisable to install a meter having a rating equal to 25 per cent to 50 per cent of the total load in a residence.

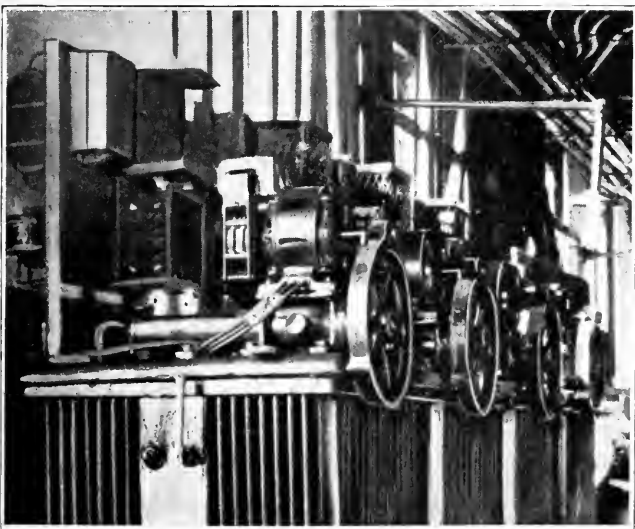
The same rule also applies to power customers having many small motors or one large motor. It is always advisable to install a meter with 60 per cent to 75 per cent of the rating of small individual drives and 75 per cent to 100 per cent for a large single motor. Experience has proved that this is the best practice except with motors operating elevators and cranes which are started and stopped frequently. These motors draw large starting current, so the best practice is to use a meter with 100 per cent to 125 per cent of the rating of the connected load.

Save Liberty for the World

CONVENIENT MOUNTING FOR REGULATOR ACCESSORIES

Current Transformers and Other Appurtenances
Supported on Panels Which Are
Attached to Regulators

Instead of mounting the current transformers and other appurtenances used in conjunction with voltage regulators in the usual manner, one of the Southern companies has employed the arrangement shown here-



PANELS ATTACHED TO REGULATOR CASES

with. The accessories are mounted on panels attached to the top of the regulators principally because there was no room for panels in front of or at the side of the regulators. However, this arrangement has most of the advantages of the usual method and besides saves some wiring.

BRACING LINE TOWER

Ordinary Straight-Away Tower Reinforced to Avoid Buying Angle Tower

By means of attaching a latticed structure to an ordinary straight-away line tower and then guying it



at right angles to the line a company in New England was able to use a standard tower where an angle tower would ordinarily have been required. By so doing it avoided buying a special tower which would have been more expensive than the structure used. As will be seen, a branch line is attached to the tower at right angles to the through line at this point. This arrangement has proved perfectly satisfactory from a structural point of view, and in these

days of compulsory economy it has, as will readily be seen, much to recommend it.

PREVAILING TREND IN GROUNDING PRACTICE

Discussion of Types of Ground Connections and Factors That Enter Into Establishing a Reliable
Connection with the Ground

The characteristics of different types of ground connections and the field to which each type is fitted for use were discussed by W. C. Wagner, electrical engineer of the Bureau of Standards, in a paper presented before a recent meeting of the Western Association of Electrical Inspectors. He also explained why the weather conditions and soil surrounding the ground connections are important factors. The methods of grounding in common use are driven pipes, plates, strips, water pipes and patented devices.

The driven-pipe ground connection is economical and reasonably satisfactory for lightning protection grounds and low-voltage circuits when high-potential and low-potential conductors are not likely to cross and when the resistance is not required to be less than a few ohms. Driven pipes are easily inspected, readily removed and do not require large ground areas.

The latter advantage is important in places where the ground must be installed in restricted space or under pavements. Mr. Wagner said: "A greater depth of penetration than 10 ft. (3 m.) in conducting soil is not, in general, economically advisable. An earth connection to be efficient must be below the frost line, because a variation in resistivity of more than 200 per cent may be expected in reducing the temperature from 20 deg. C. to -20 deg. C. Several driven pipes connected in parallel decrease the resistance of the ground connection when the pipes are separated from 1 ft. to 8 ft. (0.3 m. to 1.8 m.). A pipe ground should not be made near a pole because the pole exerts a shielding

effect and shuts off a large part of the current flow. Mechanical considerations will usually govern the choice of size of driven pipe, but it has been found that the best results can be obtained with pipe from 0.75 in. (19.1 mm.) to 2 in. (5.08 cm.) in diameter."

Buried plates are not used to any extent because the driven pipe grounds are more convenient and give the same results in most cases. The area of a single plate in ordinary conducting soil cannot be economically increased beyond 20 sq. ft. (1.8 sq. m.) and should not be buried deeper than 8 ft. (2.4 m.). It is usually better to bury two smaller plates some distance apart and connect them by a wire than to bury a larger plate of the same ground resistance. The surrounding soil greatly affects the use of buried plates, and an increase of conduction can be obtained by surrounding the electrode with salt or a bed of coke. Moisture changes do not affect a coke bed, because the coke bed constitutes virtually an extension of the electrode. Coke has the disadvantage as compared with salt of requiring excavation, as the latter can be carried into the ground by moisture from a pocket at the surface. Coke also exerts a corrosive action where iron is used and is generally considered more detrimental than salt. Copper electrodes should be used where long life and minimum attention is desired. Strips should be used where bed-rock is near the surface of the ground and it is impracticable to embed pipes or plates deep enough to provide an effective earth connection. This is especially true in soil of high resistivity because of the electrostatic capacity in the case of a strip is greatest for a given amount of metal. This method is also applicable, therefore, for use in high-resistance soil where driven pipes would be used.

Water pipes give less resistance to ground than any other of the methods discussed. "A water pipe in an average soil," Mr. Wagner said, "has approximately the resistance of from fifty to sixty driven pipes or buried plates in parallel. Pipe systems are easily accessible at the service entrance. Moreover, the areas covered by electric lighting systems are approximately the same as those covered by water mains. This method of grounding is therefore advantageous and in the case of low-voltage alternating-current circuits does not appreciably affect the water-piping systems."

In the discussion patented devices were grouped under one head and were not reviewed as to their reliability.

Safety First—Buy Liberty Bonds

ACTUAL CONSTRUCTION COST OF MEDIUM-SIZE STATION

Data Refer to a 4500-Kw. Plant—The Advance in Prices Since 1916 Is Not Shown by the Figures Reproduced

In the following table is given the itemized cost of construction of a Massachusetts central station situated on tidewater and including a building designed for one 500-kw. and two 2000-kw. turbo-alternators. Construction was begun in April, 1916, and the cost of the plant, including land and preliminary engineering, built to a capacity of 2500 kw. installed machinery (one 500-kw. and one 2000-kw. unit), and covering a building, boiler, coal-handling and piping installation adequate

for 4500 kw., approximates \$269,000. It is expected that the second 2000-kw. unit will add about \$40,000 to the station cost, making the probable complete cost of the 4500-kw. installation about \$309,000.

ITEMIZED COST OF PLANT BUILT TO 2500-KW. RATING (Building, boilers, piping, etc., provided for 4500 kw.)

LAND		
Land	\$25,000	
Docks, walls and filling	4,271	
Legal expenses for do.	348	
Surveying for do.	43	
Dredging and intake.	3,035	
		\$32,697
Preliminary engineering investigation		7,000
BUILDING		
Sub-surface foundations	\$9,404	
Steel for station building.	18,080	
Superstructure	27,641	
Stack, 200 ft. high, 9 in. inside diameter.	6,954	
Steam heating	772	
		62,851
SERVICE, EQUIPMENT		
Coal and ash handling.	\$11,594	
Coal and ash bunkers.	3,063	
Water supply and storage.	353	
Oil filters and storage.	48	
Crane	1,588	
		16,646
BOILER PLANT		
Four 342-hp. B. & W. boilers with superheaters and settings	\$24,074	
Four Taylor underfeed stokers and drive.	8,664	
Flues and air ducts.	459	
Pumps—turbine-driven duplicate set.	2,597	
Blowers—turbine-driven duplicate set.	1,674	
Feed-water heater (1500 b.-hp.)	866	
Instruments and regulators.	1,092	
		39,426
PIPING FOR 4500-KW. RATING		
High-pressure steam piping, steel valves and fittings	\$4,222	
Exhaust steam piping, valves, fittings, etc.	2,278	
Water and oil piping.	1,304	
Condenser piping, outside building.	9,337	
		17,141
TURBO-GENERATOR PLANT, 2000-KW. UNIT (500-kw. unit from old station, see later section)		
Turbo-generator, 2000-kw. rating, 80 per cent power factor	\$22,904	
Surface condenser, 3500 sq. ft.	9,054	
Condenser piping, inside.	1,423	
Air supply and cleaning.	935	
		34,315
SWITCHBOARD AND ELECTRICAL EQUIPMENT		
Switchboard, oil switches, instruments, etc.	\$12,567	
Exciter and 100-kva. auxiliary three-phase transformer	2,393	
Municipal station apparatus.	21	
Station wiring	1,075	
Connections to overhead lines.	5,400	
		21,456
MISCELLANEOUS		
Interest during construction.	\$3,706	
Fire insurance	680	
Liability insurance	162	
Steam coal used during building and in tests.	1,031	
Miscellaneous material, apparatus, tools, hardware, etc.	1,569	
Unclassified labor, watchmen, foremen, etc.	1,817	
General expenses, unclassified.	410	
		9,375
ENGINEERING		
Engineering architect	\$6,300	
Field supervision	2,860	
Drafting and blueprinting.	1,858	
Drafting and office expense.	259	
		11,277
500-KW. TURBINE TRANSFERRED FROM FORMER STATION		
Turbo-alternator, 500-kw.	\$10,000	
Piping for turbine.	2,752	
Wheeler condenser (second-hand)	1,000	
Air and circulating pump.	1,435	
20-hp. Terry steam turbine.	425	
25-kw. direct-current motor-generator exciter set.	1,220	
Instruments	85	
		16,917
Total		\$269,101

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

PUBLIC POLICY MESSAGES ON CUSTOMERS' STATEMENTS

Oregon Property Takes Up Each Month a Different Phase of the Relations Existing Between Utility and Public

The North Coast Power Company, Hillsboro, Ore., has inaugurated the policy of submitting to its customers with each monthly statement a public policy

Prompt Payments

All bills by the North Coast Power Company, due and payable the first of each month, are for services rendered the preceding month. Bills not paid by the 10th of the month become delinquent and the service subject to discontinuation without further notice.

It is necessary, in fact, required by state law, that public service utilities adopt definite rules and regulations pertaining to their service, and to observe a uniform system of rates and methods of collection.

The above rule is as necessary to the efficient and economic operation of the North Coast Power Company properties as is the continuous and reliable service given. It is as necessary as the personal service and industry of its employees. The accurate accounting and keeping of the many individual records require its enforcement.

Time wasted in carrying delinquent accounts and lost in enforcing their collection would otherwise be devoted to improve the service, to decrease the operating expense, and ultimately to reduce the cost of service to the consumers. Kindly keep these facts in mind and make remittances promptly.

"story" in which a definite phase of the relation existing between the utility and the public is analyzed.

War Savings Stamps

21,000,000,000 dollars!

This amount Congress appropriated the past year to carry out the great war of Democracy and Humanity.

From the birth of our country's freedom in 1776 to 1917, 141 years, the cost of operating its government has been 26,000,000,000 dollars. This sum includes all wars in that period.

Now, in less than a year, this World War of Freedom has caused our government to raise a sum almost as great as that which maintained our country's freedom nearly a century and a half.

2,000,000,000 dollars of this amount is to be in small sums, chiefly twenty-five-cent pieces. The annual saving of each American citizen is but \$50. It is evident that a great number have been unable to subscribe to Liberty Loan issues. To offer these people a chance to do their bit the government is issuing War Savings Stamps. 100,000,000 people in the United States to raise 2,000,000,000 dollars means \$20 per person—means 4 War Savings Stamps or 80 Thrift Stamps to each man, woman or child.

Don't fall below the average!

Sacrifice something !

Save something!

Be loyal, unselfish!

Help win the war!

The North Coast Power Company sells War Savings Stamps.

Office 1156 Second St., Hillsboro
Hours 8 A. M. to 5:30 P. M.

Telephone Day, Main 923
Night, Main 921

When remitting by check return this
stub only.

PUBLIC POLICY SERIES NO. 1

NORTH COAST POWER CO.

A Tri-Cornered Proposition

The public utility exists by reason of a need for the service for which it was created to render. This service is successfully and economically given only when the three prime factors entering therein, the investors, the operators and the public, each provides an adequate service at a fair return. No contract or agreement survives which does not provide a mutual aid and just transaction to all parties concerned.

The investors' need must provide sufficient funds to construct the skeleton around which the utility is to grow and to provide for its future extensions. Their return is a fair interest on the amount invested.

The operators provide the sinews by means of which the plant moves—becomes a growing concern. The employees, by reason of systematic methods, industry, loyalty and efficiency, produce reliable service at economic rates. Fair wages and humanitarian treatment attract and hold such employees.

The consumer provides the protoplasm by means of which the utility grows and prospers. A sick or impoverished horse plows a poor furrow. A constantly criticised employee fails to perform his duties properly. The public best serves itself by protecting the utility from unjust criticism and abuse and by eliminating unfair restrictions which tend to cramp the growth of the utility. Its fair return is reliable service at lowest possible rates which tend to upbuild the community, invite further investment of capital and maintain stable business conditions in general.

To NORTH COAST POWER CO. Dr.

Arrears, previously billed and now delinquent

LIGHT		
	Meter Readings	1918
	Meter Readings	1918
	KW-H @ '12 cents	
	KW-H @ cents	

POWER		
	Meter Readings	1918
	Meter Readings	1918
x	::	KW-H @ cts
x	::	KW-H @ cts

WATER		
	Meter Readings	1918
	Meter Readings	1918
	Cu. Ft.	Gallons

Note: Unless bill is paid prior to the 10th of the month service may be discontinued without further notice.

Total

Discount

Net

Arrears

Light

Power

Water

Total

Discount

Net

Number one of the series was printed on the January, 1918, bill, which is reproduced. Numbers two and three, February and March, entitled "Prompt Payments" and "War Savings Stamps" respectively, are also shown.

Liberty Protects You—Buy Bonds

THE INCREASED COST OF LINE EXTENSIONS

Chicago Companies Point Out Comparative Cost of Construction Under Present Conditions and Under Conditions and Prices in 1914

In testimony before the State Public Utilities Commission of Illinois, A. S. B. Cushing, statistician of the Public Service Company of Northern Illinois, presented figures to show how the cost of constructing service extensions has increased since the beginning of the great war. The data which he presented apply to the company's system, which supplies approximately 170 villages, cities and communities. Its lines extend over a territory of approximately 5000 square miles (1,295,000 hectares) in which there is a population of about 500,000. This system is supplied from eighteen plants, of which only eight are of importance.

In regard to the study of the investment in a two-pole line extension Mr. Cushing said: "First, we have a certain amount of copper wire and two 35-ft. (10.6-m.) poles, the expense of shaving and painting the poles, labor for delivering and setting the poles, the usual cross-arms, insulators, braces and other hardware, and then the labor of putting up the braces, putting up the cross-arms and stringing the wire, the present total cost of such items being \$77.40. To this amount we must add 10 per cent of the material cost for storeroom charges on the items which pass through our storeroom stock. This adds another \$5.49. Then 5 per cent of the \$77.40 must be added for drafting expense and general records. Another 5 per cent must be added for engineering and incidentals, which brings a total of \$90.63.

"Now, in a great portion of the company's territory the various telephone companies join in the investment for poles, and I have used in my calculations 35-ft. poles, because 35-ft. poles are required when the telephone company joins in the investment. Therefore I have subtracted from the aforesaid \$90.63 a half interest in the poles, and that half interest is figured at \$9 per pole. I have thus subtracted \$18, leaving the net cost for a two-pole extension \$72.63. This is the cost of such an extension with present prices.

"To this amount must be added," continued the speaker, "the customer's share of transformer capacity. That for a residential customer in the Public Service Company of Northern Illinois would average at the present time approximately \$5.25. There would also have to be provided a service drop that averages 189 ft. (57.6 m.) of No. 8 double-braided weatherproof copper wire at a present cost of \$12.68. Also, the weighted average cost of an electric meter for a residential customer at present costs would amount to \$8.51. All of such items would have to be added to the \$72.63, making a total of \$99.07. These items are all charged to the capital account."

For normal prices Mr. Cushing took the figures for

the year 1914, as prices at that time did not seem to have been affected by war conditions. The cost of a two-pole extension in those normal times was \$44.07 for a residential customer, as compared with \$72.63, an increase of about 70 per cent. The cost of transformer capacity per customer in normal times was \$3.55, as compared with the present cost of \$5.25, or an increase of approximately 48 per cent for the present time. The cost of a service drop in normal times was \$6.99, as compared with the present cost of \$12.68, making the present cost an increase of 81 per cent over normal-time prices. The cost of an electric meter in normal times was \$7.16, as compared with \$8.61 for the present time, making the present cost about 19 per cent more than in normal times.

Mr. Cushing stated that the total cost of line extensions of his company during the year 1916 was \$650,629.05. During that year the company issued approximately 5000 work orders for all line work, of which it was estimated 1500 were for two-pole line extensions. It was also brought out that about 92 per cent of the total two-pole extensions were for residences, the other 8 per cent being for commercial houses or factories.

Homer E. Niesz, assistant to the vice-president of the Commonwealth Edison Company, in the same case stated that the present cost of a two-pole line extension on the lines of the Commonwealth Edison Company is between \$75 and \$80, and that the cost of a two-pole line extension in 1914 was approximately \$50. These were average costs.

MAKING USE OF STICKERS TO HELP WITH COLLECTIONS

A Series That Are Used by an Eastern Lighting Company and Have Produced Favorable Results Show Individuality

The accompanying series of stickers are used by the Kingston (N. Y.) Gas & Electric Company in connection with its collections and have had good results.

WE believe this account has been overlooked and take this means of reminding you that same is due and trust you will remit promptly. No. 1

THIS account is small and has no doubt been overlooked by you. To save us sending you notice again kindly remit at once. No. 2

WE respectfully call your attention to this overdue account courteously asking you for a substantial payment by return mail. No. 3

PLEASE give this account your immediate attention. It is long past due so we must ask you for settlement promptly. No. 4

WE have repeatedly called your attention to this account and unless paid at once we will take other steps to collect. No. 5

THANK YOU!



STICKERS USED BY NEW
YORK STATE LIGHTING
COMPANY



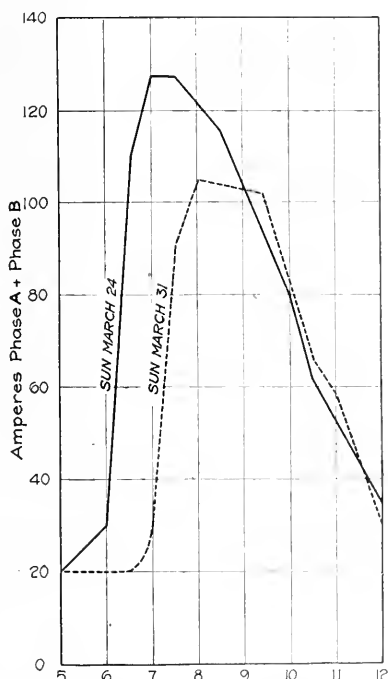
Such stickers lend individuality to the account. They are courteous yet firm.

The series is numbered, and different-colored papers help to distinguish the different numbers.

EFFECT OF DAYLIGHT SAVING

Load Curve of Residential Feeder Shows that Peak, Besides Being Shifted, Has Been Lessened

A decided shift in peak load accompanied by a reduction of the demand is shown in the accompanying curves taken on one of the residential lighting feeders of the Hartford (Conn.) Electric Light Company on the Sunday preceding the inauguration of daylight saving and the first day under the new program. The evening peak on March 24 occurred about 7 o'clock, while that of Easter Sunday was at 8 p. m., with a reduction of about 16 per cent. From 9 o'clock on the loads on the two days were almost coincident. On the morning of each day the conditions were reversed, the peak load (not shown on the diagram) reaching 30



HOW DAYLIGHT SAVING AFFECTS RESIDENTIAL LIGHTING

amp. on two phases of the circuit on the 31st, compared with a morning peak of 21 amp. on the 24th. The reduction in the evening peak following the institution of daylight saving is significant in view of the importance of keeping the investment down for this class of business.

Halt the Hun—Buy Liberty Bonds

NINETY PER CENT COLLECTIONS BY TWENTIETH OF EACH MONTH

Indiana Company with 1 Cent per Kilowatt-hour Discount Delivers Card Bill and Mails but One Delinquent Notice

Since the increase in postage the Indiana Railway & Light Company has been delivering the monthly bills to its 6000 creditors in Kokomo on the first of the month by meter readers at a cost of approximately \$35 per month, or, roughly, half a cent per bill. Bills are in card form, as illustrated, the cards measuring 3¼ in. by 5½ in. (8.25 cm. by 14 cm.). The back of the card is used for timely advertisements. A discount of

1 cent per kilowatt-hour is allowed for payment before the tenth, and it is noticed that approximately 80 per cent of accounts take advantage of this. On the twenty

INDIANA RAILWAYS & LIGHT CO.	
LIGHT AND POWER DEPARTMENT	
Office Hours: 7:30 a. m. to 5 p. m. Open Saturdays and 10th of Month until 8:00 p. m.	
112 E. Sycamore St.	Nov. 30, 1917
Phones 331-355	
Present Readings	_____
Last Readings	_____
K.W.H. Consumed	_____
per K.W.H. \$	_____
Less 1c per K.W.H. on	_____ until 10th
Net Bill for November	_____
Less Unread Meter Minimum	_____
Unpaid { Light { Balance	_____
Appliance {	_____
Total Amount Due	_____

Save Yourself Annoyance and Delay by bringing this Card.

Do It Electrically. Appliances on Easy Monthly Payments.

All claims for adjustment must be made by the fifth. All bills payable on or before the tenth. Positively no discounts allowed after that date. We have no collectors. Failure to receive bill does not entitle the consumer to exception to this rule.

November 30, 1917

MONTHLY BILL FORM USED BY MIDDLE WEST COMPANY

tieth delinquency notices, as shown, are mailed. Only one such notice is sent out.

Collections are as follows: Eighty per cent by tenth

Form 215. 2m 12-17

**INDIANA RAILWAYS AND
LIGHT COMPANY**
KOKOMO, INDIANA

Light and Power Department

No. _____ 191

M _____

As the bill presented for electricity on _____ 191, amounting to \$ _____ may have been lost in transit, mislaid or perhaps forgotten, we take the liberty of reminding you that the ten-day limit will expire _____ 191, at 12 o'clock, noon, after which date service will be discontinued without further notice.

A charge of \$1.00 is made for re-connecting.

Respectfully,
INDIANA RAILWAYS AND LIGHT CO.

Our consumers will save at least one month's lighting bill in the course of a year if they will take advantage of the discounts given by paying on or before the last day of the discount period.

DELINQUENCY NOTICE MAILED TO TARDY CUSTOMERS

of month following period energy was used; additional 10 per cent by twentieth of same month; additional 9 per cent by twentieth of following month—leaving approximately 1 per cent for disconnection delinquents.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Unique Three-Phase Transformer Connections.—The banking of transformers for different load conditions is discussed and illustrated.—*Power Plant Engineering*, April 1, 1918.

Materials and Their Arrangement in Transformer Construction.—Factors that influence the selection of conductors for primary and secondary windings, iron for the magnetic circuit and insulation for both of the foregoing are dealt with in the article.—*London Electrician*, March 22, 1918.

Notes on the Design of Electromagnetic Machines, Part II.—STANLEY PARKER SMITH.—A three-phase turbo-alternator is designed to give 2000 kw. at 3000 r.p.m. at a line pressure of 500 volts, and the mechanical stresses in the rotor are discussed.—*London Electrician*, March 15, 1918.

Lamps and Lighting

Recent Developments in Marine Lighting.—Illuminants, unattended lights and types of flashers, etc., are described.—*London Engineer*, March 8, 1918.

Survey of Methods of Directing and Concentrating Light.—LIEUT.-COMMANDER HAYDN T. HARRISON.—From two well-known laws the author concludes: (1) that with beams that are approximately parallel it can still be considered that the illumination is inversely proportional to the square of the distance from the source, provided that the illumination is measured at sufficient distance to eliminate any error due to the area of the secondary source or mirror; (2) that the luminous flux from a parabolic mirror, if focused so that there is little dispersion, is proportionate to the square of its area divided by the square of the area of the source. Included in the article is a table which gives the luminous value obtained by the concentration of light at angles of 270 deg., 180 deg. and 90 deg., being the equivalent of deep, medium and shallow reflectors. Such luminous value is calculated by dividing the solid angle of luminous flux by the solid angle of the beam produced.—*London Electrician*, March 8, 1918.

Generation, Transmission and Distribution

Control of Large Amounts of Power.—E. B. WEDMORE.—The increasing use of electrical energy and its economical production require the use of larger generating stations and the linking together of existing plants. These extensions involve something more than the use of larger units and the adding of unit to unit. The several factors that determine the new conditions are discussed in detail.—*London Electrical Review*, March 15, 1918.

Availability of Energy for Heat and Power.—JOHN BLIZZARD.—The article outlines the sources from which Canada receives supplies of energy and the extent to which each is utilized. In the course of a year Canada

burns 30,000,000 tons of coal, of which 60 per cent comes from the United States, the remainder being mined in Canada. Six million tons are used for industrial power. Water power is used for the most part to supply mechanical and electrical energy. About 2,000,000 hp. has so far been developed. The total available horsepower is estimated at about 18,000,000 hp., of which 8,000,000 hp. is estimated to be available within the present range of markets. An additional development of 6,000,000 hp., assuming an efficiency of conversion of 60 per cent and a plant factor of 40 per cent, would supply about 1,500,000 hp. continuously. This is much more than sufficient to supplant that generated yearly by 16,000,000 tons of coal. Different types of central stations are then considered: (a) Those in which the fuel is completely gasified by partial combustion and the energy distributed either as gas or electrical power; (b) those in which the fuel is carbonized and energy distributed in the form of solid fuel and gas or electricity; (c) those in which the fuel is completely burned and electrical energy and steam distributed; (d) those in which fuel is completely burned and electrical energy only distributed.—*Toronto Electrical News*, March 15, 1918.

Cables and Ocean Beds.—The problems that have to be met and the methods of solving them in the laying of submarine cables are discussed.—*Telegraph and Telephone Age*, April 1, 1918.

Outdoor Switching Apparatus.—H. G. MACDONALD.—The increase in distance covered by electric power transmission lines and the corresponding increases in voltages to make such transmission lines practicable are discussed and reference made to outdoor equipment which is suitable for this service.—*Electric Journal*, April, 1918.

Hydroelectric Industry in Scandinavia and in the Dutch East Indies.—(Abstract from a lecture given by A. Groothoff before the Royal Institute of Engineers in Holland.) The useful water power of Norway is estimated at 7,000,000 hp., of which the state owns by purchase one-seventh and utilizes about 1,000,000 hp. Sweden has about 6,000,000 hp., of which the state owns one-sixth and utilizes about 1,000,000 hp. While Norway's water power is fairly divided over the entire country, Sweden's is concentrated in the bleak, sparsely inhabited northern portion. The generating station at Nove transmits 210,000 kw. over 125 km. at a pressure of 110,000 volts. The cost of the entire station and system was \$3,000,000 and the cost of a kilowatt-year around \$1.50. During 1916 approximately half of the energy supplied by the state works of Sweden was utilized by the electrochemical industry.

Traction

New Type of Power Transmission for Berlin Railways.—Instead of using overhead wires or "third-rails," the engineers are planning to run high-tension

wires near the "inside" rail. Instead of scrapping the entire car equipment, the management has decided to build only trucks and to attach the old cars to the new electric trucks.—Abstracted in *Schweizerische Bauzeitung*, March 2, 1918, from an article in *Zeitschrift der Verein d. E. V.*

Gearless Locomotive for the St. Paul.—A. H. ARMSTRONG.—The article deals with the extreme simplicity in design offered by mounting the armature directly upon the driving axle, thus eliminating all gears, quills, jack shafts, side rods, etc. The article gives detailed information in connection with the 3000-volt gearless locomotive now under construction in the General Electric shops for the Chicago, Milwaukee & St. Paul Railway's extension to Seattle.—*Electric Railway Journal*, March 23, 1918.

Installations, Systems and Appliances

Industrial Controllers.—H. D. JAMES.—This article, which is the sixteenth installment of a series, includes various illustrations showing methods of connecting motors and controllers for industrial applications.—*Electric Journal*, April, 1918.

Discussion by the Faraday Society on Electric Furnaces.—The distribution of the heat in electric furnaces is discussed.—*London Electrician*, March 15, 1918.

The First Electric Steel-Melting Furnace in South Africa.—W. BUCHANAN and GEORGE H. STANLEY.—The author deals rather exhaustively with the subject of the quasi-arc process and embodies information of value related especially to electric steel-melting furnaces.—*Transactions of the South African Institute of Electrical Engineers*, November, 1917.

Wires, Wiring and Conduits

High-Voltage Condenser for Radio Transmitters.—Description of a type of high-voltage condenser which is said to have sufficient dielectric strength under the strain of the impressed voltage of the average wireless transmitter to prevent break-down. Another important feature of the condenser is that it is equally applicable to high and low voltages and may be used in radio-frequency circuits of a wireless-telegraph transmitter or for measurements in an experimental laboratory.—*Wireless Age*, March, 1918.

Electrophysics and Magnetism

Direct-Current Corona.—SYLVAN J. CROOKER.—The influence of series sparks on direct-current corona is discussed and the results of experiments are recorded. It was observed that a spark gap in series with the discharge tube affects the positive and negative corona in very characteristic and striking ways. The changes are due to intermittent currents. A hot-lime-cathode Braun tube was developed and used in observing the weak pulsating currents which pass through the spark and the corona tube. Evidence was given to show the relation of the corona to the arc discharge. An attempt at an explanation of the pulsating current has been made.—*American Journal of Science*, April, 1918.

Electrochemistry and Batteries

Processes for the Manufacture of Aluminum.—Alumina (Al_2O_3) in a bath of molten cryolite is subjected to electrolysis and yields metallic aluminum and free oxygen which burns the carbon electrode to form carbon monoxide, the latter in turn yielding carbon

dioxide. The supply of electrical energy which is used to effect electrolysis is also used to keep molten the salts, but since the consumption of energy necessary for the double purpose is excessive, the process can be used commercially only where very cheap energy is available. The chief phases of the complete manufacturing process are discussed.—*London Electrical Review*, March 8, 1918.

Units, Measurements and Instruments

Great Britain's Interest in the Metric System of Weights and Measures.—HARRY ALLCOCK.—The author compares the conditions in Germany and Great Britain with regard to the employment of the metric system, pointing out that the longer the adoption of this inevitable reform is referred the greater will be the magnitude and extent of the incidental difficulties to be overcome.—*London Electrical Review*, March 1, 1918.

Telegraphy, Telephony and Signals

Signaling and Interlocking of Keadby Railway and Bridge.—JAMES BENJAMIN BALL.—The article deals with interlocking and signaling as applied to the railway and bridge and also with certain safety and protective devices which were utilized.—*London Engineering*, March 1, 1918.

The Effects Produced Upon Audion Characteristic Curves by Various Kinds of Signals.—A. D. COLE.—The buzzer, electron relay and 60-cycle alternating current have been investigated to find out to what extent the magnitude of the plate and grid signals is influenced by the kind of excitation applied. It was found they produced different effects, which were embodied in curves involving plate current, grid current and grid signal. The experiments were conducted at the United States naval radio laboratory. The work is being continued at the Ohio State University.

Radio Inductive Interference.—LIEUT. ELLERY W. STONE.—The inductive interference from radio stations on telephone lines is discussed.—*Telephony*, March 30, 1918.

Miscellaneous

Nomenclature.—A. P. TROTTER.—A discussion of the electrotechnical terms in use in the English language as decided upon by the British national committee of the International Electrotechnical Commission is set forth.—*London Electrical Review*, March 22, 1918.

Engineering Evolution of Power Plant Apparatus, Section 27.—FRANCIS HODGKINSON.—Reviewing steam turbine development, this continued article deals with lubricating systems, exhaust passages, progress and future possibilities, etc. Performance curves are included.—*Electric Journal*, April, 1918.

Rusting of Boiler Tubes and Its Prevention.—BRUNO ZSCHOKKE.—The results of exhaustive tests indicate that there are five causes which produce rusting and corrosion of boiler tubes, viz., (1) acidity of feed water, (2) formation of detrimental quantities of free hydrochloric acid, (3) formation of fatty acids, (4) localized electrolysis effects, (5) chemical change due to the combination of water with the iron. Among the preventive means suggested are 0.05-0.10 per cent chrome-salt (bichromate-of-potassium) solutions, which show remarkable rust-preventing properties. Sodium bichromate would be just as effective and much cheaper for practical use.—*Schweizerische Bauzeitung*, March 2 and 9, 1918.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Investigations Under Way or Completed

(RESEARCH WORK REPORTED SINCE MARCH 16)*

AUDION CHARACTERISTICS.

Experiments are being conducted on the effect upon the audion of various kinds of signals, namely, buzzer, electron relay and 60-cycle alternating current. Three audions have been examined to find out how much the magnitude of the plate signal and of the grid signal depends upon the kind of excitation used. It was found that the magnitude of the effect, its law of change with variation of direct voltage on the grid, and even its sign, were different according to whether the signal emf. was produced by a buzzer, an oscillating audion or a 60-cycle alternating-current source.—A. D. Cole, Ohio State University, Columbus, Ohio.

CABLES, HEATING OF.

Experiments show that the maximum safe working internal temperature of an 11,000-volt cable is 150 deg. Fahr. By placing blowers in alternate manholes and forcing the hot air out of the ducts through the intervening manholes it was possible to reduce the duct temperature about 40 deg. Fahr. in one section containing heavily loaded cables.—W. A. Keating and C. H. Mueller, Duquesne Light Company, Pittsburgh, Pa.

Crude vaseline when used as a filler to replace the air in duct lines reduces the heating of a cable to a considerable degree, with the following advantages: (1) increased current-carrying capacity, (2) elimination of hot spots, (3) decreased electrolysis, and (4) mechanical protection. Dissipation of heat from cables now in service is limited by the high internal heat resistance in the cables themselves. Removal of heat by crude vaseline is practical commercially, as far as can be determined by laboratory test. It is recommended that the next step be a trial in some actual line duct.—E. O. Schweitzer, Commonwealth Edison Company, Chicago.

CABLES, VACUUM FORMATION.

Several breakdowns have occurred a few feet from splices, suggesting that a partial vacuum may have been formed there at low temperatures and that moisture was subsequently sucked into the insulation. A whistling sound has actually been reported by the workers after the removal of sealing caps in cold weather. Experiments have shown that if the pressure within a cable is atmospheric at say 90 deg. Fahr. an underpressure as high as 1.6 lb. per square inch (112.5 gm. per sq. cm.) may be developed at 32 deg. Fahr. Research is therefore desired to develop a method of splicing at a low temperature to prevent this suction of moist air when the cap is removed.—William A. Keating, Duquesne Light Company, Pittsburgh, Pa.

CONDENSERS, PRE-CHARGED.

A theoretical investigation of the properties of electrostatic condensers in series and in parallel, the condensers assumed to be pre-charged to different voltages before being connected into circuit. The theory as developed explains and generalizes the performance of the so-called Delon apparatus recently proposed in Europe for testing cables with high-tension direct current.—V. Karapetoff, Cornell University, Ithaca, N. Y.

CORE LOSSES IN MOTORS.

Iron losses in single-phase and polyphase motors have been studied. A two-phase motor having two complete single-phase pyramidal windings was tested and the losses carefully analyzed when operated on both two-phase and single-phase. The flux densities were the same for single-phase and for two-phase operation. The results show that the total iron losses were also substantially the same in both cases. There is a theory regarding single-phase motors according to which the motor has a double-frequency current in the armature when it is running at synchronous speed. This might lead one to think that there should be iron losses in the rotor of the single-phase motor when operating at or near synchronous speed. The above results, however, show conclusively that there are practically no iron losses in the rotor of a single-phase motor near synchronous speed.—J. L. Hamilton, St. Louis, Mo. [The writer probably has in mind the resolution of the pulsating magnetic field into two revolving fields of opposite rotation. The flux which glides against the rotor is wiped out by the secondary currents, and this probably accounts for the absence of iron loss in the rotor at synchronism.—Editor's Note.]

HIGH-VOLTAGE MEASUREMENTS.

Corona voltmeter constants are being determined from the measurement of the voltage in the high-tension circuit. A method has been devised which involves the use of a large air condenser of accurate construction and also of a kenotron rectifying tube, so that the values of alternating voltage may be measured by a direct-current method which permits a high degree of accuracy.—J. B. Whitehead, Johns Hopkins University, Baltimore.

INDUCTION MACHINES, TORQUE.

The effect of higher harmonics on the torque of induction motors is being investigated. The subject is of special importance in connection with large two-speed motors, for if the winding is connected for half speed the winding pitch becomes favorable for the development of higher harmonics in the gliding mmf. Some of these harmonics revolve against the direction of

the fundamental mmf., causing the machine to start at a poor torque, and occasionally to stick at any intermediate speed.—Alexander Gray, Cornell University, Ithaca, N. Y.

IRON ALLOYS, COBALT.

The effect of cobalt on the magnetic and other properties of iron alloys is being studied. Specimens of alloys have been prepared with percentages of cobalt ranging from small traces up to the maximum per cent that gives a workable alloy. We hope to have the results of this investigation ready for publication before the close of the present school year.—E. B. Paine, University of Illinois, Urbana, Ill.

OSCILLATIONS, INTEGRAPH FOR REPRESENTING.

Prof. E. Pascal of the University of Naples, Italy, has built several planimeter devices which graphically integrate linear differential equations of the first and second order. The device which integrates the first order equation is applicable to electric transient phenomena which involve resistances and inductances only, with any irregular applied variable voltage. When capacity is present the differential equation of oscillations is of the second order. It is very desirable to develop further Pascal's integraph so as to make its application easy to electrical problems. In the present form the device is suitable for cases when the resistance is so high that the current is aperiodic. An improved device would be extremely useful in the analysis of transmission line oscillations and in the study of some radio phenomena. For information relating to the above see Ernesto Pascal, "I Miei Integrati per Equazioni Differenziali," Naples, 1914, and A. Galle, "Mathematische Instrumente" (Teubner), 1912, p. 161. Several articles by Pascal have appeared since 1909 in the *Proceedings of the Accademia dei Lincei*. The paper on the second order equations is dated March 19, 1916.—Editorial Suggestion.

TRANSFORMERS FOR SERIES LAMPS.

Transformers designed to operate series incandescent street lamps are being studied to determine the variations in current resulting from abnormal conditions of the circuit, such as grounded lines, broken lamps, etc.—E. B. Paine, University of Illinois, Urbana, Ill.

VENTILATION OF ELECTRICAL MACHINERY.

Data on the pressure drop of air flowing through irregular passages are being obtained and collected; a simple method has been devised for measuring air velocities. The laws of heat transfer are being investigated both within the machine materials and from their surfaces to the cooling air. The specific purpose of the investigation is to enable the designer of an induction motor to predetermine accurately its temperature rise.—A. D. Moore, University of Michigan, Ann Arbor, Mich.

Suggestions for Research

LIGHTNING.

A miniature laboratory arrangement imitating a charged cloud and a transmission line, to study the effects of direct and indirect lightning strokes.—Editorial Suggestion.

MEASURING INSTRUMENTS.

An integrating kilovolt-ampere meter for measuring total apparent input. (Under some conditions, especially at low power factor, it is more equitable to charge a customer on the kva. basis than on the kw. basis. In a more general case the charge for service should consist of at least three parts, one proportional to the real input, one to the apparent input and one to the maximum demand. A kilovolt-ampere-hour meter would be serviceable in many cases in inducing the customer to maintain a high power factor, if for no other purpose.)

MINING APPLICATIONS OF ELECTRICITY.

Further development of explosion-proof motors for coal mines; suppression of arcing in mine-locomotive controllers; electrically operated reciprocating drill; self-contained portable electric lamp for miners and wider use of electricity in cutting coal and in other operations.—A. I. E. E. Committee on the Use of Electricity in Mines.

OSCILLATION PERIOD OF COILS.

Collection of data, mathematical or experimental, on the oscillation periods of inductance coils for use in radio apparatus. Some general conclusions should be made as to the variation of the periods of coils with changes in diameter, length, number of coils, etc.—Louis Cohen, Washington, D. C.

RESONANCE TRANSFORMER.

Solution for the differential equation of a resonance transformer such as is used in radio-work, with the electric spark included. The variable resistance of the spark is a function of the instantaneous current, time and possibly of other factors. Some simple function of this resistance should be assumed and substituted in the differential equation.—Louis Cohen, Washington, D. C.

TIE-LINE PROBLEM.

The following problem is of interest to operating companies, and it is desired to obtain a solution, analytical, graphical or combined, in such a form that even one not well versed in the intricacies of alternating-current vectors or complex quantities could apply it to his own case. Referring to the accompanying diagram, two substations are fed each with polyphase power from a station bus through one or more lines in parallel. The combined impedance of the feeders to substation No. 1 is Z_a , of those to No. 2 is Z_b . The loads W_1 and W_2 as well as the phase angles ϕ_1 and ϕ_2 at both substations are given. The feeders to substation No. 2 are overloaded, and it is desired to add a tie line marked Z_c . The problem is to find the new electrical conditions when the tie-line Z_c is of a given size in operation, or to find the size that would bring about the desired relief. Of particular interest are the currents in Z_b and Z_c . Readers are invited to contribute solutions to this problem.—Editorial Suggestion.

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SIR ADAM BECK ON THE PENDING WATER-POWER BILL

Chairman of Hydroelectric Power Commission of
Ontario Before Special Joint Committee
of House of Representatives

The special joint water-power committee of the House of Representatives held another hearing on the so-called "administration" bill on April 15, with Sir Adam Beck, chairman of the Hydroelectric Power Commission of Ontario, as the speaker.

Sir Adam Beck delivered an exhaustive analysis from his own point of view of conditions relating to water-power development in the Dominion and the sale of hydroelectric energy in Ontario as compared with what he knows of conditions in the United States, dealing in detail with the situation at Niagara Falls. He delivered a strong plea for monopoly in public utilities.

He presented a number of figures tending to show that under government control in Toronto the rate for electricity is about half the rate at Buffalo, and made other comparisons between rates in the United States and in Ontario. He said he had only a faint idea of the legislation proposed in the so-called administration water-power bill now in the House of Representatives.

The hearings before the joint committee will not be closed until the committee has heard Secretary Baker of the War Department, Secretary Houston of the Department of Agriculture and any members of Congress who desire to be heard. The framing of the final bill will therefore be delayed in the committee.

ONTARIO'S WATER POWER DEVELOPMENT

Sir Adam Beck said that Great Britain is dealing with water-power development very comprehensively at this time because of coal conservation, but that Ontario is surpassing the mother country in that respect. He has been identified with water-power matters in Ontario since 1903 or 1905. He traced the growth of legislation in Canada, saying franchises were originally granted to generate power at Niagara Falls on the Canadian side as follows: To the Canadian-Niagara Power Company, 100,000 hp.; to the Electrical Development Company, 125,000 hp., and to the Ontario Power Company, 180,000 hp.

The object of the boards of trade, merchants' associations, etc., in Ontario, he said, was to make this power available generally to the people of the district, and because of the great advance in the art of transmitting energy at high voltage economically to great distances, a desire was created in manufacturing districts to have this power available for them. Sir Adam pointed out that Ontario has no coal fields known at this time and that among the power difficulties there are the necessity for long transportation and the duty on coal. These difficulties have long continued.

In 1902, he said, various civic bodies appointed a committee to confer with the Legislature on steps to enable municipalities to undertake the generation of electricity. Two years previously the Legislature had refused the city of Toronto a franchise to develop power and instead had granted such a franchise to the Electrical Development Company, which had affiliated with it the Toronto Electric Light Company and the Toronto Street Railway Company. Finally the Legislature passed an act allowing the municipalities to borrow money on their own account for power and light development, and a commission was appointed to investigate. This commission, after eighteen months' work, practically said that power could be delivered at cost; but the practical difficulty of raising money was encountered, and further rights for development were granted to the Electrical Development Company.

Sir Adam then told of changes in the government following elections and of the passage of the present acts and amendments. He said:

DRASTIC POWERS OF THE COMMISSION

"We have power to acquire, by purchase or otherwise, on any terms and hold shares in any incorporated company carrying on the business of developing, supplying and transmitting electrical energy. We have power to appropriate the lands, waters, water privileges or water powers or works, machinery and plants or portions thereof of any person owning or operating under lease or otherwise or operating or using water-power privileges or transmitting electrical power or energy in Ontario which in the opinion of the commission should be purchased, acquired, leased, taken, expropriated and developed or used by the commission for the purposes of the act. Now, that is pretty drastic, but it is all subject to arbitration."

At the present time, the chairman of the Ontario commission said, that body has contracts with 225 municipalities. They pay all interest charges at 4 per cent and a sinking fund of 1.8 per cent, which retires in thirty years. They pay all charges of depreciation, operation, administration, etc. The chairman continued:

"We operate at the present time twelve systems. They will become interconnected eventually and form one great system. In this way we are attaining the object of the whole scheme, namely, that there should be one control only."

Sir Adam declared: "We want to create a real monopoly because we believe all these service undertakings should be a monopoly. There is little satisfaction in having competition in a telephone system, or a telegraph system, or even a railway system, and certainly not in an electric system in any community."

"The obnoxious poles and wires, the great dual cost of everything and the great dual investment that results because of the diversity created by these vari-

ous corporations covering the same field is undesirable from every standpoint."

As to the Niagara situation, Sir Adam said the principle laid down by the International Waterways Commission is that there should be an equal division of water for power purposes on all international streams, and pointed out that there is now pending an application that the United States government shall confer with the Dominion authorities regarding a proposal to allot another 10,000 second-feet to each government. This, he pointed out, is advanced as a war measure and will be justified even though the most efficient use is not made of the water.

Sir Adam said he believes that if this measure is carried through it would not be canceled after the war and would stimulate production after peace. He presented figures to show that the total power now being generated on both sides of Niagara is 653,000 hp. Of this amount, 265,000 hp., he said, is generated in the United States, which also receives 110,000 hp. exported from the Canadian side, making a total of 375,000 hp. available in the United States. This amounts to 40 per cent more for the United States than for Canada, he said, although the latter country generates 100,000 more horsepower than is generated in the United States.

The chairman of the commission went on to say that there is no intention on the part of the Canadian government or on the part of the commission to interfere with the present export arrangement, even though Canada is now short about 100,000 hp. of the amount that country needs. In order to permit a continuance of the export, Canada has arranged to do away with all sign lighting, window lighting and other uses of energy which in some quarters have been characterized as less essential. He said the power generated by the Province of Ontario has reduced coal consumption between 5,000,000 tons and 6,000,000 tons per annum. Motive power has been saved, use of cars has been saved, and duty on coal has been saved.

The estimated potential horsepower of hydroelectric energy in Canada, Sir Adam says, is about 50,000,000, and in Ontario alone about 5,000,000 or 6,000,000, with but 700,000 developed. At the beginning of the commission's work in 1910, he said, only 750 hp. was being delivered to the twelve municipalities interested. The commission has acquired up to date about eighty-six corporations through friendly negotiation and without resorting to the drastic powers given to it under the act.

Carry On—Buy Liberty Bonds

Irvington Varnish & Insulator Company Insures Irvington Citizens in War

The Irvington (N. J.) Varnish & Insulator Company, as a patriotic act, has paid for \$2,500 insurance under the government plan for each citizen of Irvington who has been called to the colors. The company volunteered to do this, not only for its employees who entered the service, but also for other citizens of the town. Under its offer insurance was taken for 460 people, including employees as well as other citizens of Irvington now with the military forces.

STUDY AND ANALYZE COST OF GIVING SERVICE

BY GERARD SWOPE,
Vice-President Western Electric Company

The electrical distributing business is becoming more and more one of service. The community expects good service and is willing to pay for it not only a price which will cover the cost of the service but one which will also provide a reasonable profit.

To-day, under the abnormal conditions that prevail, one of the dangers is that the business will not be studied and analyzed sufficiently. Increased expenses and extravagances will creep in, which will be difficult to reduce or eliminate when either normal or possibly for a time sub-normal conditions are at hand.

There is nothing more important for the industry than to have the individual members understand the elements that go to make up the cost of giving service to the community.

E. N. Hurley, when chairman of the Federal Trade Commission, emphasized this point and opened the eyes of manufacturers and business men in general to the great need of the recognition of its importance and the study and analysis of their own businesses.

The electrical manufacturers have worked up a comprehensive plan of cost accounting, and the electrical jobbers and the contractors are giving attention to this important phase of the work.

The electrical industry, as a whole, will be placed on a more permanently stable foundation if all the elements of the industry recognize the fundamentals involved in this question of scientific merchandising and cost of service.

DAYLIGHT SAVING

FOR PUBLIC SAFETY

Report of Committee of United States Chamber of Commerce Shows That Movement Had Support of State Committees

Daylight saving was one of the topics on the program of the United States Chamber of Commerce, which held its annual meeting in Chicago last week.

The report of the executive committee on daylight saving, of which A. Lincoln Filene, Boston, is chairman, showed that this movement had the direct support of a number of state committees on public safety and defense.

The committee was unanimous in its agreement that daylight saving ought to be a permanent measure to operate throughout the entire year, but it presented an alternate plan that if this suggestion were not feasible clocks should be advanced on April 1 and turned back on Nov. 30.

Since its last report the committee has received many communications from public utilities and others urging the all-year round plan as that which would bring about the greater saving.

The committee feels that the matter is well worth looking into further and suggested that it be empowered to go thoroughly into the question of extending the period of operation and take such steps as it may deem wise in carrying out its recommendations that daylight saving should be operated throughout the entire year. Already beneficial effects of daylight saving are felt and records of such savings are urged.

EXTENDING THE ELECTRIC OPERATION OF COAL MINES

Anthracite Operators Show that Great Saving of Fuel Will Follow Application of Electrical Energy in Mining

A bulletin issued by the operators of anthracite coal mines says, in forecasting larger use of electricity in their operations:

Millions of tons of coal now necessarily consumed in the mining operations would become available for general commercial uses should electricity be substituted for steam in operating the collieries of the United States. Earnest studies are now being made by experts in Washington and elsewhere to determine what can be done, and quickly, to expand electric power developments throughout the country, not only, nor even primarily, in connection with coal production, but also and mainly to meet the urgent requirements of war and other industries.

The anthracite industry is now consuming in its operations about 8,800,000 tons of the coal mined and prepared. Using steam there is no way to reduce this. It is estimated that with the entire industry turned over from steam to electricity for power, light and heat about 6,000,000 tons of such mine-consumed coal would be saved and be available to supply public demands.

Already substantial progress has been made in substituting electricity for steam in the anthracite operations. Latest complete figures show at the beginning of 1916 80,000 kw. of electric power used. This has been substantially increased since then, but there is yet a long way to go before electrical energy can be employed throughout and for all purposes.

Many anthracite companies have installed individual electric power plants to serve their own needs. It is an economic proposition, but the war demands upon electric manufacturing concerns have been so urgent that it is now virtually impossible to get additional machinery. Also it has been conclusively demonstrated, both in theory and in prac-

pendent business, and so is loath to install individual plants requiring large capital investment, which would be largely, if not entirely, lost when central power shall become available at lower cost.

Force to the Utmost—Buy Bonds

FLOOD CONDITIONS AT BINGHAMTON STATION

S. F. Bond Tells of the Precautions Taken to Protect Power House Under Severe Flood Pressure

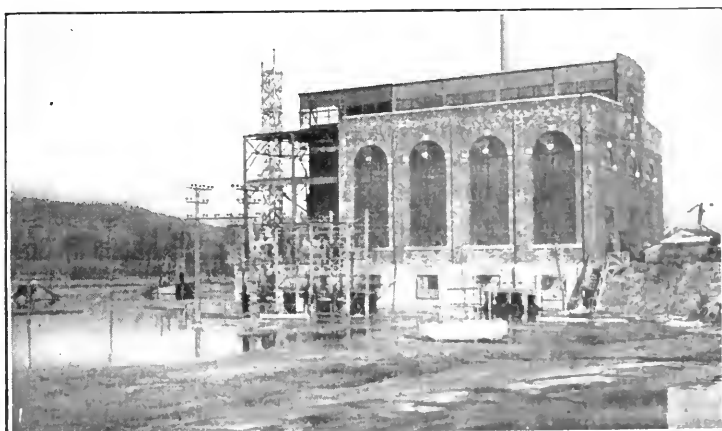
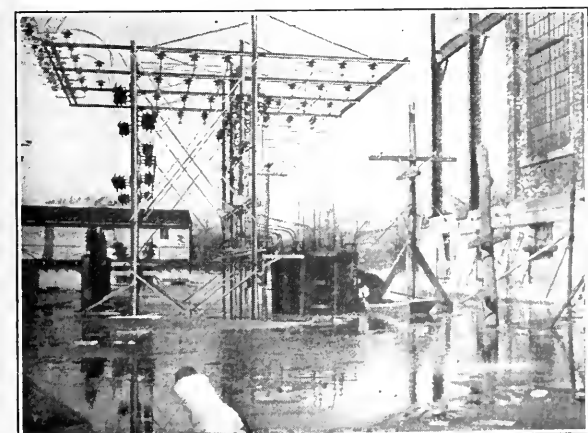
Complying with a request of the ELECTRICAL WORLD, S. F. Bond, general superintendent Binghamton (N. Y.) Light, Heat & Power Company, has furnished information regarding the conditions at the new power house during the recent flood.

The ice field in the river extended about 12 miles (19.3 km.) below the plant and contributed largely to the unusually severe flood conditions.

The accompanying general view of the power house was taken when the water outside of the building went 6 ft. (1.8 m.) higher than the basement floor level. The crest of the flood reached a point 1 ft. 2 in. (35.5 cm.) higher than this. The bottom of the basement windows is 7 ft. 8 in. (2.23 m.) above the basement floor, and as an additional protection flood shutters of 2-in. (5.08-cm.) plank were installed in all these windows.

The other illustration is a closer view taken at the same time, showing more clearly the condition of the 33,000-volt outdoor switching and transformer station.

The power-house building is of reinforced concrete



OUTDOOR 33,000-VOLT TRANSFORMER AND SWITCHING PLANT WITH FLOOD 6 FT. HIGHER THAN BASEMENT FLOOR; CREST OF FLOOD 1 FT. 2 IN. HIGHER THAN THIS

tice, by such leaders in electrical development as Samuel Insull of Chicago and S. Z. Mitchell of New York that the central power plant makes the best and lowest cost system of supplying energy.

This is because the central plant, as the great heart of a big distribution system, which may reach out through a radius of 100 miles and more, can send the living energy of electricity to supply any and every purpose. In this way there results economy, as one use comes on when another drops off. For example, the great part of the anthracite mining load is off in the afternoon before lighting and electric railway service make their heavy demands for energy.

The anthracite industry is counting upon a big development of the central power plant as a separate and inde-

pendent business, and so is loath to install individual plants requiring large capital investment, which would be largely, if not entirely, lost when central power shall become available at lower cost.

construction up to the engine-room floor level, the walls and floor being reinforced to withstand an upward pressure due to a 10-ft. (3-m.) head of water. As practically all of the auxiliaries are placed on the basement floor, the operation of the station depends on keeping water out of the basement. There was no failure of floor or walls and only a moderate seepage at any time during the flood. A number of small leaks were checked by the use of sand bags, and when this had been done a 2-in. (5.08-cm.) ejector was sufficient to keep the basement dry. A 2-in. electric driven and a 4-in. (10.16-cm.) turbine-driven pump were, however, held in readiness for emergencies.

The great electrical industries are a vital part of the life of our nation. Their large manufacturing or producing plants, their multitudes of employees and dependents are a wholesome influence in our national life. In the crisis of war these establishments and their working forces are called upon to do without stint what they can do for the national aim of victory and righteousness. Not all are asked to risk life, but those who stay at home are privileged without exception to lend as they are able. So I say, buy the Liberty Bonds and speed the victory.

THEODORE N. VAIL,

President, American Telephone & Telegraph Company.

ENGINEERING PROGRESS IN ENGLAND IS MARKED

H. M. Hobart Recounts the Efforts Under Way to Eliminate Unnecessary Plant Expenditure and Conserve Coal Consumption

Observations upon engineering progress in Great Britain during the war were the theme of a recent informal address by H. M. Hobart of the General Electric Company at a luncheon of the Boston Section of the American Institute of Electrical Engineers, following the speaker's return from abroad. The progress of engineering in Britain has for long been extremely individual in character, he said. The electrical industry has been split up into many more divisions than in America, and the greater proportion of the small firms have aspired to manufacture many different kinds of things. A prospective customer received a large number of competitive tenders, and it was not unusual for the order to go to the firm which through faulty estimates had bid below cost. Prior to the war the electrical industry in Britain was at a low ebb. Many firms found their salvation in substituting munitions and other war work for electrical machinery. In so far, however, as they continued to manufacture electrical machinery this was done under improved conditions owing to the cutting off of German product and to the sudden demands of the Admiralty and the War Department for large quantities of electrical apparatus.

The general convulsion has brought about a serious spirit of investigation which is leading to a complete change of policy. Many new associations of manufacturers have sprung into existence, and even in cases where actual consolidations may not have been effected or in contemplation a policy of seeking to avoid destructive competition is much in evidence.

A government committee on coal conservation has been formed, and its interim report, issued in December, is of intense interest to electrical engineers. The report calls attention to the enormous waste in English electrical supply under present conditions. The public supply is obtained from about 600 undertakings, and in the London area there are over 100 generating plants selecting electricity besides nine traction stations, each supplying one of nine different railways. Two of these have each an installed capacity three times greater than would be ample for its present train service, and neither can increase this train service materially before the conclusion of the war. The plants are within a few miles of each other and in a district already provided with large, expensive, underloaded stations.

The report recommends the division of Britain into sixteen districts. Each district is to be supplied from

one or more generating stations. The loads on each station will be so great as to require the installation of generating sets of some 50,000 kw. each. These super-power plants will be placed at whatever locations represent the most efficient compromise as regards condensing water supply and coal supply. Electro-chemical industries and other suitable activities will be located near these stations and their load factor will be very high.

The carrying out of this project would, according to the estimates in the report, reduce from its present value of 80,000,000 tons down to 25,000,000 the annual coal consumption for power purposes (including railways) in the United Kingdom. This is on the assumption that the same amount of power will be developed under the new plan. But the power per employee is now only half of that in the United States, and must be at least doubled if Britain is to compete successfully in the world's markets.

The report has drawn forth an enormous volume of criticism. Much of this is based on the contention that the right conditions as regards cheap and plentiful coal and plentiful water are rarely found near one another in Great Britain. Others contend that the transmission and distribution costs associated with the electric scheme will be greater than the costs of conveying the coal by rail to stations located, as at present, near densely settled areas. Others display deep concern for vested interests and protest that in any case the change ought to be spread over a very long period.

"But the prevalent temper of the British is comparable to a sort of great awakening," said Mr. Hobart, "and I venture to predict that something of this sort, or at any rate something thoroughly equivalent in bigness and boldness, will be 'pulled off.'"

Probably a leading reason for the adoption of the national policy was that it would permit of an orderly continuance of shipbuilding and the employment of large numbers of men after the war and a freedom from the consequences of such industrial fluctuations in the demand for labor as might have occurred had private shipbuilding firms unduly extended their plants.

Closing, Mr. Hobart said that he was much impressed with the rapid progress lately made in England in the use of built-up iron-clad switch-gear as contrasted with the panel and cell systems used in America. Signs are appearing of its competition with American outfits for high-voltage work in generating stations. Although the British have finally and reluctantly taken down the sign, "Business as usual," which they took pride in displaying during the early stages of the war, an enormous amount of engineering progress is being made in Britain even in these darkest of dark days.

NEW YORK JOVIANS BUY

\$271,600 OF LIBERTY BONDS

Enthusiasm Marks Luncheon Meeting, Which Responds Liberally to Colonel Greenwood's Appeal
—McGraw-Hill Company's Contribution

Bonds and then more bonds were bought by the New York Jovians at the inspiring appeal and demand

The Third Liberty Loan

Campaign

Begins April 6

Buy YOUR Bond
of an
Electrical Man

BUY ELECTRICALLY, SAYS THE NEW YORK COMMITTEE

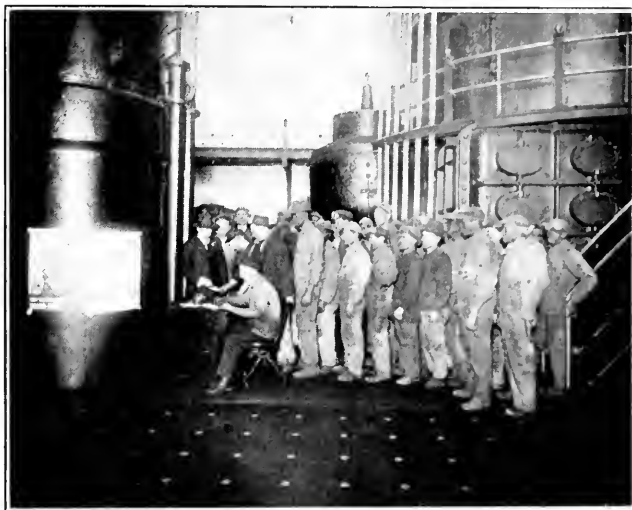
of Col. Moses Greenwood of the George H. Beach Service Company at a midday luncheon on April 17. Colonel Greenwood said that we are fighting the German people as well as the Kaiser. Every atrocious act of the German government has been approved by its people. We are fighting for something eternal, and civilization will be overthrown if we are defeated. He

placed every man in one of two classes and gave the reason why each should buy bonds. One class has relatives "over there" and should subscribe to its utmost to bring them safely home. The other class, which has no one at the front, must lend its money to keep the loved ones from going over.

The campaign for subscriptions was opened with an address by James H. McGraw, president of the McGraw-Hill Company, Inc., who pledged \$250,000 in behalf of the company. In an enthusiastic half-hour following \$21,600 was added to this amount by individual subscriptions.

Volunteers were called to pledge themselves to sell \$500 worth each of bonds during the remainder of the campaign. Nearly every one present stood up at this call, and it was estimated that if all "came through" a total of \$25,000 will be obtained.

All Over the Country Employees of Electrical Utilities Are Purchasing Liberty Bonds



STATION MEN OF THE COMMONWEALTH EDISON COMPANY, CHICAGO, IN LINE BUYING THE THIRD LIBERTY LOAN BONDS

The campaign for the third Liberty loan is now under way, and the opportunity is offered for the engineering profession in America to rise to the occasion with characteristic enterprise.

The success or failure of the engineer's part in this loan will depend not upon a few large subscriptions from some of the richer individuals in the engineering fraternity but upon the energetic co-operation of all the wiremen, draftsmen, linemen, rodmen, inspectors, superintendents, surveyors, foremen, laboratory men, students, calculators, testers and others who form the real backbone of the engineering forces of the United States; and it is to them that this appeal for subscriptions to the loan is addressed.

It is stated on good authority that there are 100,000 engineers in this country, broadly speaking. Surely every one of these men can afford the safe investment in a United States government bond of at least \$50, and probably much more. This would produce a substantial total.

Let every engineer take this loan to the limit of his ability as an investment for his own welfare and for his country and in that way become a partner in the greatest and most necessary engineering enterprise ever undertaken by the United States.

H. W. BUCK,
of Vile, Blackwell & Buck.

ZONE SYSTEM TO AID IN DISTRIBUTION OF COAL

Report of the National Committee on Gas and Electric Service Deals with the Plan
Effective on April 1

A report by the National Committee on Gas and Electric Service, of which J. W. Lieb is chairman, discusses in detail the zone system arranged by the United States Fuel Administration, in co-operation with the Director General of Railroads, to govern the distribution of bituminous coal during the coal year beginning on April 1, 1918.

The general effect of the zone system is to restrict Eastern coal to Eastern markets and fill the vacancy in the Central and Western States with nearby coal mined in those States.

In addition to the saving in transportation, the system will provide for the possible retention of something like 5,000,000 tons of coal for the Eastern States which heretofore has gone West, all rail. This tonnage can be readily utilized in the East. As an indication of the saving to be effected by the system, it will eliminate the movement of more than 2,000,000 tons of Pocahontas coal to Chicago and other Western points over a haul of about 660 miles. Chicago can obtain this tonnage of coal, and under this system must obtain most of it, from southern Illinois mines, with an average haul of 312 miles (502 km.). Allowing for the differences in quality in the two coals, there will thus be saved 11,400,000 car-miles or, very conservatively figured, 285,000 car-days. This will permit fourteen additional round trips of twenty days each from West Virginia mines to zone destinations, permitting an additional production of at least 700,000 tons of Pocahontas coal.

SAVINGS IN TRANSPORTATION

Similar comparisons show that on the movement of 550,000 tons annually from Kanawha districts to Wisconsin points there can be saved about 2,500,000 car-miles, with a consequent increased production of some 300,000 tons. On the movement from southeastern Kentucky to Chicago the saving will be about 800,000 car-miles and 50,000 tons in production. The elimination of the Indiana to Iowa movement will save 1,600,000 car-miles and add 100,000 tons in additional production. These are only a few of the instances of transportation saving to be effected by the system.

The movement of bituminous coal, which is regulated by the zone system, is about 300,000,000 tons, or 60 per cent of the total production. Based on this production, there will be saved on the round trip from and to the mines almost 160,000,000 car-miles. This will permit the same cars to make almost 300,000 additional trips from the mines, equivalent to an increase of 5 per cent in the production. The increase in total production in 1917 over 1916 resulting from all efforts was about 8 per cent.

A large part of the coal which the system will prevent from moving West out of the Eastern producing districts will be available for use in New England, in so far as it can be transported there. Production in the district supplying New England via all-rail routes can be increased somewhat, but there is difficulty in moving the amount of coal needed by all-rail routes,

and the capacity of the rail gateways to New England has been nearly reached. Improvements now being made will increase the capacity of the Poughkeepsie Bridge route, but it is impossible to escape the conclusion that provision must be made for a much larger movement by water in 1918 than in 1917, or New England and its people and industries will suffer. This situation will be made the subject of a separate study by a committee representing the United States Shipping Board, the United States Railroad Administration, the United States Fuel Administrator, coal operators in the territory involved, the railroads involved in the movement of this coal and consumers in the territory affected.

Under regulations of the Fuel Administrator, coal of particular quality or characteristics for special purposes, such as by-products, gas, blacksmith and metallurgical coal, will be permitted to move by permit beyond the limits imposed by the zone system.

The zone system affects all bituminous coal except:

1. Coal for railroad fuel, for which special arrangements will be made by the Fuel Administrator and the Director General of Railroads.
2. Coal for movement on inland waterways, which is in no way restricted by the system.
3. Coal delivered to Canada, which is subject to regulations of the Fuel Administrator.

Other matters covered are:

The National Committee on Gas and Electric Service has been requested by the Quartermaster's Department to furnish considerable information regarding power and other equipment for the different activities of this department now under way or contemplated throughout the United States and other countries. This is also true regarding the Ordnance Department.

The notice sent out some time ago regarding the possible cancellation of all coal contracts made previous to Aug. 23, 1917, has caused considerable anxiety among public utilities and others who have such contracts. This, in connection with the zone plan, has made the situation a very serious one, and the committee has been making every effort to secure definite action and decision.

The priorities committee of the War Industries Board is endeavoring to arrange to furnish sufficient steam and electrical machinery to the several nitrogen fixation plants and powder plants that the government is erecting. This committee has been called upon in an advisory way to furnish all information possible regarding the delivery to electric light and power plants of turbine units that are now under order at the manufacturer's as it will be absolutely necessary to requisition some of this apparatus for the government. The priorities committee is particularly anxious to interfere as little as possible with the operations of public utilities, and it is in extreme cases only that it will find it necessary to take over machinery ordered by the central stations.

The information that this committee was requested by Dr. Garfield, United States Fuel Administrator, to procure as to the addresses of isolated plants operating in the territory served by central stations is being tabulated as rapidly as received. There are still many localities to be heard from.

Many communications have been received from electric light companies asking if the Fuel Administration is considering rescinding the lightless nights order, now covering Sundays and Thursdays. This matter has been under consideration with a view to possible modification for the next four months. Such action is however, being opposed by a majority of the state and local fuel administrators.

The committee will within the next few days send out to all public utilities a letter calling attention to the additional money which is to be raised by the American Red Cross and asking that every assistance possible be given to this worthy cause.

MAKE OUR WATER POWERS AVAILABLE AT THE EARLIEST DAY

[This resolution was passed by the United States Chamber of Commerce at its meeting in Chicago last week.]

Whereas the Chamber of Commerce of the United States by an overwhelming vote in its referendum No. 24 indorsed recommendations which, in its opinion, would best bring about the utilization of the potential water powers of the country; and

Whereas the war needs of the government require a large increase in power for industries, for the conservation of fuel and for transportation;

Therefore, be it resolved, that the Chamber of Commerce of the United States hereby earnestly urges upon Congress the immediate passage of legislation which will make available at the earliest possible date the water powers of the country.

ELECTRICAL CONDITIONS IN EUROPEAN COUNTRIES

Stephen Q. Hayes Tells of His Observations in Great Britain, France and Italy—Electrical Distributing Centers

"Intense activity along electrical lines has followed the course of the war in England, France and Italy, and the need of the services of the electrical engineer behind the battle lines is constantly increasing," said Stephen Q. Hayes of the Westinghouse Electric & Manufacturing Company in a talk before the Boston Section of the A. I. E. E. on April 9. Mr. Hayes recently returned from a six months' trip in England and on the Continent, where he performed electrical work for the Allied governments. Mr. Hayes said that in England business conditions are in general better than before the war. Last year England did a larger export business than before the conflict began. All efforts are concentrated on speeding up production and cutting out non-essentials.

The control boards are doing most useful work handling the output of the factories and apportioning the production of war materials of different kinds. These boards, for instance, decide what percentage of materials shall go to English, French or Italian manufacturers.

Electrical factories in England are now working up to their limit. More than twice as many persons are in the employ of the English Westinghouse shops as before the war. About one-third of the output of these shops is munitions and the rest electrical machinery and equipment. From 20 to 25 per cent more electrical work is being turned out by the factory than before the war. The demand is tremendous throughout Europe for steam turbines and small motors, and prices are fabulous.

Great interest now exists in England regarding the proposed establishment of some sixteen electrical distributing centers with large modern generating plants and interconnected networks of transmission lines for the saving of fuel. Depending upon load conditions, it is expected that the line pressures required will range

from 6600 volts to 60,000 volts. There are about 600 separate municipal plants at present supplying the country which average only 5000 kva. in rating. It is estimated that 55,000,000 tons of coal could be saved yearly by interconnection and the use of units of 20,000-kw. to 50,000-kw. rating.

In the first three years of the war the electrical output in France has doubled. Hydroelectric energy is extensively used in connection with the operation of munition plants. The total estimated available water power of France is about 9,000,000 hp., and in 1916 about 1,500,000 hp. had been developed. Included in the latter were 750,000 hp. in the French Alps, 180,000 hp. in the Pyrenees district and 135,000 hp. in central France. Under construction in 1916 was 1,100,000 hp. in hydroelectric plants.

Mr. Hayes described the extensive railroad electrification work of Italy, and said that while figures of development are inadvisable for publication at this time, since the war began much has been accomplished in electrification. A point of interest is that when the British and French reinforcements were rushed to the Italian front after the collapse of the lines in the Trentino the electric locomotives on the Mont Cenis and other tunnel lines sustained from eight to ten times their normal traffic without failure. Portable power plants mounted on flat cars are used on lines near the front, the steam-generating and turbine-generator and switching equipment on separate cars. Some 100,000-volt portable substations on railway cars are in use in the war zone, and these require that the high-tension bushings of the transformers and oil switches be taken down for clearance reasons when moved. American electrical engineers are needed in the war zone.

RELIEVE THE UTILITIES FROM EXCESSIVE WAR BURDEN

[A resolution passed by the United States Chamber of Commerce at its meeting in Chicago last week.]

Whereas the maintenance of the country's public utilities in the highest possible state of efficiency is essential not only to the war program of the United States, but also to the nation's business, industrial and public interests; and

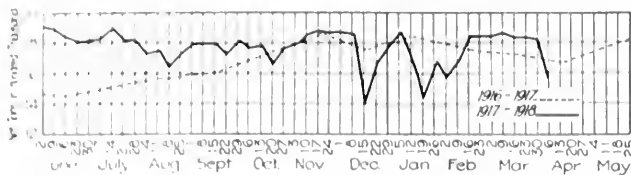
Whereas such efficiency depends upon the preservation of the credit of the companies providing public utility service; and

Whereas the increase of costs and the unusually onerous conditions of operation brought about by the war seriously threaten the ability of the public utilities to continue the furnishing of the necessary services they perform; and

Whereas the protection of the credit of public utilities is very largely in the hands of regulatory commissions and other public authorities, rather than in the utilities themselves;

Now therefore be it resolved, that the Chamber of Commerce of the United States recommends to state and local authorities that they recognize the unusual and onerous conditions with which public utilities are contending, and that in the interest of the nation, of business and of the public they give prompt and sympathetic hearing to the petitions of such utilities for assistance and relief.

Big Drop in Bituminous Coal Production



RATE OF BITUMINOUS COAL PRODUCTION IN LAST TWO YEARS

Dr. H. A. Garfield, Fuel Administrator, in a public statement declares that "unless there is immediate and material improvement in car supply efficiency the country faces the certainty of a serious shortage of bituminous coal."

Our "Will to Power"—Buy Bonds

RAISING RATES IN ORDER TO MEET HIGHER COSTS

Advance in Retail Power Rates by Minnesota Gas & Electric Company to Yield 20 Per Cent More Revenue

In making an increase in retail electric power rates the Minnesota Gas & Electric Company, Albert Lea, Minn., sent a circular letter to the customers affected and also advertised in the local newspapers, telling about the higher cost of fuel and other supplies.

H. T. Nichols, the manager, states in his letter that, after operation for months under most extreme conditions as to abnormal costs of fuel, material and labor, it is found absolutely necessary to obtain some degree of relief in the way of increased revenue to help offset very large operating expense increases. He gives the following increases:

Coal, 64 per cent; copper, 80 per cent; line hardware, 30 per cent; iron and steel wire, 35 per cent; meters, motors and transformers, 30 per cent; poles, 20 per cent; equipment and supplies, 35 per cent.

Mr. Nichols says in his letter, in part:

We had hoped that by increased efficiency and rigid economy and with an increase in the volume of business it would not be necessary to ask our customers for any assistance, and we have in this expectation carried the entire burden during the past year. Conditions have grown steadily worse, however, until we have arrived at a point where it is absolutely necessary to state the case frankly to our customers and ask them to pay an increased rate.

In the case of some customers a reduction will result in their cost per kilowatt-hour due to this rate revision, to others the increase will be almost negligible; but in the aggregate an increased revenue of something like 20 per cent should result for this part of the company's electric output.

As a matter of good business and of fairness both to yourself and the company the previous verbal agreements are to be replaced by written contracts.

It is sincerely hoped that present extreme generating costs will not long continue, and your company will receive the benefit of whatever proportionate reduction may be possible in the rate under this schedule immediately the company's fuel and material costs decrease.

For your reference we will state that the present average rate for all retail electric power customers in Albert Lea is approximately 3.3 cents per kilowatt-hour.

The new schedule will raise this average to nearly 4 cents per kilowatt-hour.

MEETING OF THE A. I. E. E.

IN CITY OF NEW YORK

Methods of Teaching Theory of Operation of Single-Phase Induction Motor Discussed—Liberty Loan Enthusiasm

To present to the engineering student "a physical conception of the operation of the single-phase induction motor" was the object of a paper presented by B. G. Lamme before the three hundred and thirty-ninth meeting of the American Institute of Electrical Engineers on April 12 in New York. Mr. Lamme said that most engineering students are able to visualize the operation of three-phase induction motors but are utterly lost in conceiving the operation of the single-phase type. The paper gives a method of explaining the single-phase motor in terms of the polyphase machine. The action of the motor is based upon the assumption of two equal and oppositely rotating primary magnetomotive forces combined with a synchronously rotating secondary magnetomotive force such as would be produced by direct-current excitation. Under load conditions a comparison is made between a two-motor unit, consisting of two similar polyphase motors coupled together and connected for opposite rotation, and the straight single-phase induction motor. Discrepancies between the resultant actions of two outfits were removed through extensive testing.

A. M. Dudley, in the absence of the author, abstracted R. E. Hellmund's paper on "No-Load Conditions of Single-Phase Induction Motors and Phase Converters." The paper is eighty-five pages in length and is written so that it can be read without following the mathematical data. A vertical line is printed next to calculations that may be omitted without harm to the coherence of the paper. Formulas for the determination of the fields, the stator and rotor magnetizing currents and the tertiary voltages for phase converters and single-phase induction motors are derived in the paper and methods for arriving at the results are given. "The case taken by the author is extreme," Mr. Dudley stated, "but there is considerable work to be done along these lines, and it is hoped that a start has been made by the presentation." The entire paper was based on calculated results, but it was shown by tests made after the work was completed that the calculated curves agreed very closely with actual oscillogram curves.

The two papers were discussed by B. A. Behrend, consulting engineer, Boston; Dr. M. I. Pupin, Columbia University; E. L. W. Alexanderson, General Electric Company; L. W. Chubb, Westinghouse Electric & Manufacturing Company; Prof. A. M. Gray, Cornell University; Selby Harr and C. A. M. Weber, Westinghouse Electric & Manufacturing Company.

W. A. Joubert, who spoke in behalf of the third Liberty loan, was applauded for several minutes, and B. A. Behrend, who was in the chair, told of the activities of the Institute in the loan. Return cards are to be mailed to every one of ten thousand members to ascertain the amount that the electrical engineering profession subscribes. Mr. Behrend expressed a hope that the subscription would be greater than that of any other organization in the United States.

For Freedom on Sea Buy Bonds

Back Those Bayonets with Bonds

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

South Dakota Electric Power Association.—The annual convention of this association will be held at the Carpenter Hotel, in Sioux Falls, on May 15 and 16.

O. E. L. A. Annual Convention.—A convention of the Ohio Electric Light Association will be held at Cedar Point, Ohio, this year. Although the time is not definitely settled, July 10, 11 and 12 have been tentatively decided upon for the meeting.

A. I. E. E., Philadelphia Section.—“Electrification of Railroads in Its Relation to Communication Lines” was the subject of an address given by H. S. Warren before the Philadelphia Section of the American Institute of Electrical Engineers on April 8.

A. S. M. E., Cincinnati Section.—“The Economic Use of Coal by Communities” was the subject of an address before the joint meeting of the Cincinnati Section of the American Society of Mechanical Engineers and the Engineering Society of Cincinnati.

A. I. and S. E. E., Pittsburgh Section.—“The Electric Furnace for Annealing Treatment and Forging of Steel” is the title of a paper to be presented to-day by W. S. Scott before the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers.

A. I. E. E., Baltimore Section.—On April 12 A. E. Bauhan, station superintendent Pennsylvania Water Power Company, delivered an address on “Power-Station Operation and Maintenance” before the Baltimore Section of the American Institute of Electrical Engineers.

San Francisco Electrical Development League.—At the regular weekly meeting of the league on April 10 Lieut. James S. Dagger, formerly of the Twenty-ninth Battalion, Canadian Expeditionary Forces, spoke on “The War on the Western Front” and “Labor and Its Relation to War.”

New York Electrical Society.—Major O. O. Ellis and Major E. B. Garey gave a joint address on “Using the Motion Picture to Train the Officers and Enlisted Men of the Army” before the New York Electrical Society meeting on April 18. Hudson Maxim spoke on “High Explosives in Modern Warfare.”

I. E. S., Philadelphia Section.—“Progress in Illuminating Engineering During the Past Year” was the topic of discussion by F. E. Cady of the National Electric Lamp Works, Cleveland, Ohio, and R. Pierce of the Welsbach company before the Philadelphia Section of the Illuminating Engineering Society on April 19.

Utah Society of Electrical Engineers and Dealers.—The spring convention of the Utah Society of Electrical Engineers and Dealers was held in Salt Lake on April 5 and 6. Among the important papers presented were: “The Goodwin Idea,” by C. B. Hawley, Inter-Mountain Electric Company; “Merchandising of Lamps,” by E. A. Evans, Westinghouse Lamp Company; “Trade Stimulation,” by W. R. Putnam, Utah Power & Light Company; “Credit Conditions,” by H. P. Stewart, Western Electric Company, and “The Trade Acceptance,” by A. D. McMullen, Capital Electric Company.

A. I. E. E. Section Meetings.—The following are some of the important papers presented before section meetings of the American Institute of Electrical Engineers: At Pittsfield, Mass., A. C. Crehore, “Modern Consumption of Matter and Energy,” April 11; Ann Arbor, Mich., Prof. J. C. Parker, “Hunting,” April 12; Boston, Stephen Hayes of the Westinghouse Electric & Manufacturing Company, “European Electrical Business in War Times”; Los Angeles, J. C. Ward, superintendent of generation of the Southern California Edison Company, “Fuel Oil Conservation,” April 9; Toronto, Paul Ackerman, “High-Tension Insulators from the Operating Viewpoint,” April 19. Officers nominated for the Toronto Section were A. H. Hull of the Hydroelectric Power Commission, chairman, and E. C. Pannell of the British Aluminum Company, secretary.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Concurring Negligence.—Concurring negligence of a grading contractor did not absolve a city from its liability for personal injuries from electric shock caused by the city's negligence, according to the Supreme Court of Washington (170 P. 140).

Discrimination Owing to Free Service to City.—Discrimination by public service corporations is contrary to public interest, and where a requirement in a franchise that a telephone company shall furnish a municipality with free service necessitates overcharging other patrons the state, through the Public Service Commission, may modify or declare void such agreement, the Supreme Court of Indiana held (118 N. E. 531).

Contributory Negligence.—Where an employee of a cement company, while putting up steel handrails, was warned by the chief electrician of the cement company that if he touched certain power wires with the steel pieces it would kill him, as there were 22,000 volts on the line, in reversing a section of the handrail that it might be properly put in place touched the power line and

was killed, he was guilty of contributory negligence, relieving the power company from liability for his death, it was held by the Supreme Court of Alabama in *Dorough versus Alabama Power Company* (76 S. 963).

Jurisdiction of Commission.—A proceeding by a property owner to prevent an electric light company from disturbing the surface of a street for the construction and maintenance of a conduit for electric wires, on the ground that the permit for the work issued by the board of public improvements of a city was void because of nonconformity with the conditions of the ordinance upon which it purported to be founded, and, if valid, required a certificate of public utility from the public service commission, was not within the jurisdiction of the public service commission, the Supreme Court of Missouri held in *Missouri Valley Realty Company versus Cupples Station Light, Heat & Power Company* (199 S. W. 151).

Discontinuance of Service Though Amount Owed Is on Deposit.—The act of a lighting company in discontinuing service without notice upon user's default for past month's service was held proper where contract provided for discontinuance on default, and it was immaterial that the amount due was not in excess of the amount deposited by user to secure faithful performance of contract, the Court of Civil Appeals of Texas held (201 S. W. 205). That one became angry because of his light service being cut off for non-payment, the service being renewed immediately upon payment and request, does not entitle him to recover for mental suffering alone, there being no personal injury, damage to property or other loss sustained.

Franchise Validity.—Under Statutes 1901, p. 265, as to granting by municipality of privilege to locate poles or wires for light or power transmission, and Sections 3 and 5, as to publication of the application for the franchise and percentage to be paid to the municipality, an ordinance purporting to grant a franchise to construct and maintain poles and wires for the purpose of transmitting and selling electricity for “light and power” was void in so far as it attempted to confer the privilege of furnishing electricity for lighting purposes, and a charge could only be made for the latter or “power” franchise, in view of the Constitution, Articles 11, 19, granting to public service corporations engaged in the sale of electricity the right to enter the streets of a city and use them for laying down pipes, etc., for the purpose of supplying electricity to the inhabitants for “illuminating” purposes, the California District Court of Appeal held in *Town of Sunset versus Pacific Gas & Electric Company* (170 P. 1078). As plaintiff town had no power to charge a percentage on the gross annual receipts arising from the operation of an electric system for lighting, defendant, owner of the system, would not be estopped from denying that so much of an ordinance as attempted to impose such charge was unenforceable.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Commonwealth Edison Men in Service.—On April 6, just one year after the United States entered the great war, 710 employees of the Commonwealth Edison Company had entered the military service of the United States. Men from the company are now in every branch of the military service. The company has published a complete list of the names of these men, together with their organizations.

Helping in the War by Watching the Mail.—A bulletin issued by the General War Service Committee of the Electrical Manufacturing Industry, addressed "To every electrical manufacturer," calls attention to the importance of avoiding unnecessary demands upon the government mail service. The Post Office Department has urged the committee to impress upon its associates the great advantage to both the department and the public of depositing mail matter earlier in the day and more frequently, and of having letter and circular mail, catalogs, etc., properly faced for cancellation and the short and long letters separated.

Report on General Policies of the War Trade Board.—The general policies followed by the War Trade Board and an outline of the board's labors for 1917 in the control of export and import trade are indicated in the first annual report to the President, which the board now makes public. The board has regarded trade agreements as being particularly important in the case of those European neutrals which are in trade relations with the enemy. Against these European neutrals, the report goes on to say, "temporary embargoes have been enforced pending the securing of information indispensable to permit the board to issue licenses." "The elimination of enemy advantage from our trade," says the report, "and to a considerable extent from that of the world, the securing and conserving of commodities essential to ourselves and those associated with us in the war, the bringing of shipping generally into the services most useful to us—these results cannot be accurately stated or appraised at the present time, nor have they been accomplished by any single act or agreement." The Bureau of Exports has handled approximately 425,000 applications for licenses to export and was at the date of the report passing upon between 4000 and 5000 applications per day. The Bureau of Imports, of more recent formation, had received to Jan. 1 5279 applications for licenses to import, upon which 4719 licenses, covering commodities of an aggregate value of \$237,810,949, had actually been issued. The personnel of

the War Trade Board numbered 1526, the report shows. The total financial obligation incurred up to Dec. 31 is \$541,498.80.

Pacific Gas & Electric Directors Re-elected.—At the annual meeting of stockholders of the Pacific Gas & Electric Company on April 9 all directors were re-elected and resolutions were passed ratifying all their official acts in 1917. A detailed report on operating conditions was presented by John A. Britton, vice-president and general manager. Mr. Britton also satisfactorily answered the questions propounded in an open letter to stockholders criticising the management which was recently circulated by a former auditor of the company. The re-elected directors are: Frank B. Anderson, Henry E. Bothin, John A. Britton, William H. Crocker, Frank G. Drum, John S. Drum, F. T. Elsey, D. H. Foote, A. F. Hockenbeamer, Norman B. Livermore, John D. McKee, John A. McCandless, C. O. G. Miller, W. G. Henshaw and George K. Weeks.

Enlistment of Students of Electrical Engineering.—The Provost Marshal General has sent the following telegram to the governors of all states: "Notify all local boards of the following amendment to Section 151, Selective Service Regulations. An additional sub-paragraph is added to paragraph 'e' as follows: 'Under such regulations as the chief signal officer may prescribe, a proportion of the students in institutions in which the Signal Corps has established a course in electrical communication who have completed at least two and one-half years of the course in electrical engineering, or its equivalent, in one of the approved technical engineering schools listed in the War Department may enlist in the Signal Enlisted Reserve Corps, and thereafter, upon presentation by the registrant to his local board of a certificate of such enlistment, such certificate shall be filed with the questionnaire and the registrant shall be placed in Class 5.'"

Research Information Committee Formed.—The following statement is authorized by the Council of National Defense: By joint action the Secretaries of War and Navy, with the approval of the Council of National Defense, have authorized and approved the organization, through the National Research Council, of a research information committee in Washington, with branch committees in Paris and London, which are intended to work in close co-operation with the officers of the military and naval intelligence, and whose function shall be the securing, classifying and disseminating of scientific, technical and industrial research information, especially relating to war problems, and the interchange of such information between the allies in Europe and the United States. The Washington committee consists of (a) a civilian member, representing the National Research Council, Dr. S. W. Stratton, chairman; (b) the chief of the Military Intelligence Section; (c) the Director of Naval Intelligence.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Purchase of Lighting Companies by Public Utility.—The Indiana Public Service Commission has authorized the Indiana General Service Company, controlled by the American Gas & Electric Company, to buy the Marion Light & Heating Company, Marion, Ind., and the Muncie Electric Light Company, Muncie. The purchase price consists of the exchange of securities and the refunding of bonds heretofore issued by the companies purchased. Included in the price is \$1,000,000 capital stock of the Indiana General Service Company for each of the purchased companies and the refunding of bonds of each company at par and an issuance of bonds to cover floating indebtedness of the companies. The commission announced that the transfer represents no increase in total capitalization of the companies concerned. The commission staff made a valuation of the properties to be merged, and the commissioners said that the appraisal showed that the bonded indebtedness of all companies under the merger, plus the floating indebtedness, is not increased and that this total represents only about 50 per cent of the total physical valuation of the properties concerned.

Commission Power in Ohio.—The Ohio Supreme Court is expected to hand down in a short time a ruling on the power of the Public Utilities Commission to hear appeals on utility rates from cities which operate under special charters, or so-called "home rule" cities. Should the decision of the Supreme Court be in favor of the cities, the usefulness of the commission will be impaired greatly. The case originated in the natural-gas controversy at Cincinnati. The City Council first set the rate at 35 cents. The ordinance was submitted to vote of the electors and was defeated. The Council fixed a rate of 30 cents, and the Union Gas & Electric Company appealed to the commission. This was followed by an attack on the commission's jurisdiction and the objection was overruled. The case was then taken to the Supreme Court. Oral arguments were submitted on March 6. C. A. Radcliffe, attorney for the commission, asserted that if the court holds that the commission is without jurisdiction, its usefulness will be practically ended, as there will be nothing for it to do. Lawrence Maxwell, attorney for the company, derided the plea of home rule and said that if there is not state control there will be federal control. If cities adopt confiscatory rules, he said, companies will appeal to federal tribunals and invoke the United States Constitution in the effort to maintain their rights.

J. D. Ross has been reappointed as superintendent of lighting in Seattle by the City Council.

Walter D. Sultan, electrical engineer with the Pacific Gas & Electric Company for many years, has been commissioned a lieutenant in the Aviation Corps..

John B. Miller, president of the Southern California Edison Company, has, as a result of the change in titles, become chairman of the board of directors. This involves no change in his connection with the company, however.

W. Nelson Smith, who was for some years electric traction engineer with Westinghouse, Church, Kerr & Company, and recently efficiency engineer of the American Agricultural Chemical Company, is connected for the time being with Sydney E. Junkins & Company, engineers and constructors of Vancouver, B. C., as electrical engineer.

Clarence Floyd Hirshfeld, head of the research department of the Detroit Edison Company, has been commissioned a major in the Ordnance Department, Washington, D. C. He went to Detroit early in 1915 from Cornell University, where he was a member of the engineering faculty, to devote a considerable portion of his time to studying problems of electric industrial heating.

Henry D. Jackson, formerly of Timothy W. Sprague & Henry D. Jackson, consulting engineers, has joined the organization of Monks & Johnson, engineers and architects, Boston, as power engineer, taking charge of their power plant and heating work. Mr. Jackson's experience includes two years in the instrument and meter departments of the General Electric Company, four years with the Boston Elevated Railway Company, a short time with the Old Colony Street Railway Company of Massachusetts, investigation of the condition of a number of lighting plants and supervision of the changes made and consulting engineering work on power-plant construction, operation and maintenance.

Philip E. Edelman of St. Paul, Minn., has been awarded the Research Corporation fellowship in applied science on competition by a jury consisting of the president of the National Academy of Sciences, the secretary of the Smithsonian Institution, the president of the American Chemical Society, the president of the Research Corporation, and the chairman of the Engineering Foundation, upon evidence of scientific attainments, inventions and special fitness for advanced work. Mr. Edelman is an electrical engineering graduate of the University of Minnesota and has served as electrical engineer for important radio-communication interests. He is the author of "Experimental Wireless Stations" and other popular technical books, and has since February, 1917, devoted his time principally to research development work directed to increase the efficiency of the military power of the United States. He is at present working principally on important radio problems by special arrangement with the government.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

F. W. Prince, for eighteen years employed by the Hartford (Conn.) Electric Light Company, has resigned as lighting superintendent to become quality expert for the Franklin Manufacturing Company. Mr. Prince was graduated from Trinity College in 1900, going with the Hartford company immediately on graduation as a lamp tester. In 1907 he became superintendent of the meter department and five years later lighting superintendent.

Townsend H. Soren, who, as reported in these columns on March 9, has been elected a vice-president of the Hartford (Conn.) Electric Light Company in charge of construction, was born in



T. H. SOREN

Boston and educated at the Boston Latin School and Harvard. He graduated with the degree of A.B. in 1893. Immediately after graduation he was employed by the General Electric Company at Schenectady and remained with that company until July, 1916, when he left to become assistant to the vice-president of the Hartford Electric Light Company. Mr. Soren's duties with the General Electric Company for a period of eighteen years were largely confined to the general supervision of the work of that company in connection with large electric railway developments in New York City. This work started with the equipment of the Ninety-sixth Street power station and substations of the Metropolitan Street Railways in 1897 and was followed by the equipment of the Manhattan Elevated Railway, the Interborough Rapid Transit Company and the Hudson & Manhattan Railway Company and the electrification of the main line of the New York Central & Hudson River Railway Company, including the construction and electric equipment of the locomotives.

J. H. Galt has been appointed assistant engineer of distribution for the Public Service Electric Company of New Jersey. He will have charge of the southern division at Camden.

Frank W. Frueauff, vice-president of Henry L. Doherty & Company, celebrated his forty-fourth birthday on March 29 at Delmonico's, New York, as the guest of 125 friends, the majority being business associates.

J. C. Rockwell has been promoted from manager of the light and power department to general manager of the Manila (P. I.) Electric Railroad & Light Company. Mr. Rockwell was graduated in 1914 from Cornell University with the degree of mechanical engineer. Following his graduation he engaged in track construction work. In 1906 he became superintendent of transportation of the Syracuse (N. Y.), Lake Shore & Northern Railroad Company. He was appointed general superintendent in 1909 of the Charleston (W. Va.) Interurban Railroad Company, and the following year was elected general manager of this company. In 1911 he joined the operating organization of the J. G. White Management Corporation, New York City, and was assigned to the Manila Electric Railroad & Light Company as manager of the light and power department.

N. J. Neall, consulting engineer, Boston, has received an appointment as major in the Quartermaster's Corps and is closing his office for the duration of the war. Major Neall was born in Philadelphia in 1875 and was graduated from the Massachusetts Institute of Technology in electrical engineering in 1900. Thereupon he entered the employ of the Westinghouse Electric & Manufacturing Company, later becoming engineer of protective apparatus for high-voltage transmission lines for the company. In 1906 he resigned from the Westinghouse company to take up consulting engineering work at Boston. Mr. Neall has been considered one of the best authorities on lightning protective equipment, and while with the Westinghouse company was associated to a considerable extent with Alexander J. Wurts, who was an authority on and inventor of lightning protective devices.

Obituary

Harry Herbert Trowbridge, general counsel for the Southern California Edison Company and head of its legal department since 1905, died suddenly at his residence in Pasadena on March 21. Before going to Los Angeles Mr. Trowbridge was connected with the legal department of the New York Central & Hudson River Railroad. The successful career upon which he had entered in New York City had to be abandoned on account of ill health, but even greater distinction awaited him upon the Pacific Coast, where as the legal representative of the Southern California Edison Company he soon became widely known as an authority upon corporation and public utility law.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

JANUARY EXPORTS LOWER THAN THOSE OF DECEMBER

Drop Noticed in Volume of Trade in Wire and Cable,
Batteries and Motors—Total Exports for
January Reach the Sum of \$4,656,611

Electrical exports during the month of January, 1918, showed a considerable falling off from the month of December, besides being less than during the month of January, 1917. The total amount exported was \$4,656,611. There was a considerable drop in the exports of wire and cable as well as a considerable decrease in the export of batteries and of motors.

Figures for the seven months ended with January show a total of \$31,536,493, in comparison with \$28,217,968 for the corresponding period for the year previous. The figures in the following table were compiled by the Bureau of Foreign and Domestic Commerce:

	January		Seven Months Ended	
	1917	1918	1917	1918
Batteries	\$379,781	\$295,520	\$1,542,053	\$2,072,340
Carbons		93,543		*830,260
Dynamos or generators	271,742	252,429	1,466,111	1,249,074
Fans	43,660	68,541	188,521	353,481
Heating and cooking apparatus		59,652		*316,185
Insulated wire and cable	808,579	548,931	4,030,688	3,766,907
Interior wiring supplies, including fixtures	133,140	104,710	623,672	877,386
Arc lamps	973	671	6,951	1,315
Carbon-filament lamps	15,470	9,567	83,702	107,486
Metal-filament lamps	181,785	200,420	894,699	1,654,007
Magnetos, spark plugs, etc.		380,098		*2,137,946
Meters and measuring instruments	94,575	124,192	576,034	779,780
Motors	659,620	555,842	3,267,139	3,758,563
Rheostats and controllers		13,007		*106,619
Switches and accessories		271,196		*1,296,199
Telegraph apparatus, including wireless	24,808	9,208	173,388	174,102
Telephones	132,807	249,992	997,312	1,373,230
Transformers	133,539	174,001	656,341	1,179,228
All other	2,032,445	1,245,091	13,711,357	9,496,385
Total	\$4,912,924	\$4,656,611	\$28,217,968	\$31,536,493

*Included in "all other" prior to July 1, 1916.

of Boston, a grocery house of national reputation which has always taken unusual pride in its horse-drawn trucks. A national advertising campaign bearing upon the electric truck is about to be inaugurated, according to well-informed sources. The Boston fire department is seriously considering the purchase of an electrically driven ladder truck and possibly other equipment, based on the success of the Couple-Gear installations at Springfield, Mass., and elsewhere. Many of the trucks lately sold are turned over on the battery service basis, the Boston Edison company carrying the battery investment and meeting charging requirements according to an established rate schedule.

Will You Lend for Human Freedom?

LOOKING FORWARD TO WORLD TRADE AFTER WAR

Banks in Monthly Letters Point Out the Steps That
Are Now Being Taken by Europe, Urging
Action Here

That there will be a tremendous export market after the declaration of peace is taken for granted. To what extent the United States will be represented in that market is doubtful. England and France are openly making preparations to enter it in a big way, and it is generally believed that Germany is not without some well-laid plans. In the United States little of note has been done. The Webb bill is still hanging fire, needing some real interest and enthusiasm to push it through.

This state of affairs is recognized by the banks, which are urging the manufacturers of this country to face the situation and take some action. The following excerpts are from the regular monthly letters of two of the more prominent New York City banks.

The American Exchange National Bank in urging that American manufacturers and exporters organize to take advantage of the Webb bill for pushing foreign trade in competition with other countries says:

"Germany is strengthening her cartel system, and England and France are organizing syndicates for this purpose. It will not do to wait until peace is restored. Hereafter competition in international markets will be national rather than individual, and the race is likely to be won by the nation that is best prepared before the declaration of peace."

The Guaranty Trust Company describes in its monthly letter the strenuous efforts being made by Great Britain to restore her commercial and financial position after the war. No secret is made of the fact that she expects a period of intense competition for the markets and the carrying trade of the world, the letter states, nor of her intention to be as fully prepared for it as possible. It goes on:

"In preparation for this intensive development of her resources, Great Britain is taking what is probably the most remarkable inventory ever attempted. Under the general direction of the Ministry of Reconstruction, the Ministry of Munitions, Department of the Foreign Office and Board of Trade, and other governmental agencies, nearly a hundred committees are busy collecting information regarding agricultural, mining, industrial and commercial conditions within the empire. The inquiries of these committees touch the life of the British people in all its phases."

The British banks are preparing for the demands which will be made upon them for capital to finance the program of restoration and new developments. By amalgamations, the letter says, they are concentrating great reserves of capital for a vast credit structure.

Our Boys Go—Shall Money Fail?

ELECTRIC TRUCKS ARE IN HEAVY DEMAND AT BOSTON

Increased Cost of Skilled Labor and of Horse Feed
Are Important Factors—Deliveries in
Good Condition

Despite the fact that very little publicity has been given to the campaign, electric road trucks have come to be in extraordinary demand of late in the Boston district. One of the best-known dealers has sold no fewer than sixty-eight trucks within the last three months, ranging in size from 6 tons to 1 ton. In some cases deliveries have been made within two weeks of receipt of order. The increased cost of skilled labor and of horse feed are important factors in the advance of the electric truck in this territory. Recent purchasers include forwarders, grocers, iron and steel dealers, confectioners, coal merchants, milk dealers and newspaper-stock handlers. A 5-ton General Vehicle machine has just been purchased by the S. S. Pierce Company

VARIOUS OUTLOOK UPON ELECTRICAL GLASSWARE

Scarcity of Labor and Fuel Supply—New Discounts and Packing Charges Formulated by Producers

Scarcity of labor and curtailment in the supply of fuel are having a restrictive effect on the output of glassware of every description. Opinions differ as to just how far current conditions may affect the stock and supply of electrical glassware for this or succeeding seasons. Wages of skilled labor in the hand and machine glass works have been advanced 25 to 30 per cent, this having become effective when the new "fire" was started early in December. Production during the temporary federal fuel schedule down to 75 per cent of capacity. It is also reported there are some sizes and sizes of glass that are already out of the market. The statement that no new electrical glassware will be obtainable in this market before April is flatly denied.

Prices are also said to be subject to a sharp rise. Inquiry at sales agencies in the East of the principal glass works of the Pittsburgh and other districts confirmed this opinion to some measure. Either higher lists or shortened discounts may be expected to prevail.

Prices quoted are f.o.b. factory, and there is no insurance of delivery or against breakage. There was a time when breakage was insured with the packing charge, but this practice has been abolished. On Feb. 1 the packing charge was increased by producers from 25 to 33 1/3 per cent. Deliveries are now six months in arrears, with the embargoes rendering shipments decidedly uncertain.

The advance spring business is stated as exceeding expectations, especially in fixture lines; in fact, representing an improvement over last year. Export trade is reported as enormous. On the other hand, plants have been running a part time only. It has been difficult to obtain as strong a skilled force of workmen as was desired, while the question of fuel has been a problem and raw material is none too ample.

METAL MARKET SITUATION

Wire Prices Will Probably Remain Unchanged—Tin Quotations Running Wild

If manufacturers of wire products for electrical uses are figuring on a higher figure for copper, and therefore an advance in the selling cost of their goods, it looks as if they are to be disappointed, with the possible exception of weatherproof. An authority of accepted standing in the metal world says that the large profits realized by the copper industry in 1917 go a long way toward offsetting the claims and arguments that are being advanced for a higher price on copper. The truth is that there is hardly a producer of standing who will go on record as saying that anything more than 23.50 cents for the metal is necessary for the welfare of the industry or the country. There is said to be no price for Straits tin, and quotations for the other kind are in consequence running wild.

NEW YORK METAL MARKET PRICES

	April 8	April 15
Copper:	£ s d	£ s d
London, standard spot....	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25 to 26.75	26.25 to 26.75
Lead, trust price.....	7.25	7.00
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter....	Govt. price 15.00	Govt. price 15.00
Aluminum spot	7.17 1/2	6.92 1/2 to 7.02 1/2
Strait Straits	*85.00	*85.00
Aluminum, 98 to 99 per cent.	Govt. price 32.10	Govt. price 32.10

OLD METALS

Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Cass, heavy	14.00 to 15.25	13.50 to 14.00
Cass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	6.00 to 6.25	5.75 to 6.00
Iron, old scrap	5.00 to 5.62 1/2	5.50 to 5.62 1/2

*Nominal.

THE WEEK IN TRADE

HOW much the electrical trade is hampered by the slow and indefinite delivery of merchandise is not easily determined. From general reports, however, the embargoes on certain material produce trying conditions at times. Possibly this trouble may be relieved, to some extent at least, by the recent order of the Priorities Board placing on preference list No. 1 "plants manufacturing electrical equipment." The delays in shipments on electrical goods other than specified for government requisitions are occasioning shortages bordering on the acute.

Nearly every section reports that conduit is selling in excess of the supply, which also seems true of lamps (with the demand increasing in the far West), rubber-covered wire and large motors. There is also a satisfactory demand for motor sewing machines and other household devices. Jobbers are also stocking up heavily on fans, anticipating a summer of protracted heat to follow the long and cold winter.

Collections are universally conceded to be up to the mark, with credits closely looked after.

NEW YORK

Sales in regular lines for commercial uses have been halted to an appreciable extent by unusual weather conditions. The storms which have prevailed, of extreme severity for this time of year and extending over the entire eastern section of the country, have, jobbers generally say, had a deterrent effect on business. Government orders for equipment are still a ruling factor. Prices have not been affected, but stocks are far from ample.

Freight congestion has not been greatly relieved, and deliveries are the main topic of discussion. Shipments of iron and steel products are far behind. Labor shortage at the factories is also the cause of some anxiety.

Collections are reported as in fair condition, with some sections of the trade well pleased with the situation. No relaxation in the scrutiny of credits is noticed.

PAPER AND CLOTH INSULATION.—Very little change has occurred recently in paper insulation, and trade is steady. In respect to cloth, however, an entirely different state of affairs exists. With the rapid advances in cotton the price of cloth insulation has also been fluctuating rapidly. Within the last two weeks the cost was marked up from 20 to 25 per cent, and selling figures, according to influential authorities, are likely to change in forty-eight hours. Stocks are of fair size in the hands of leading producers, but with jobbers and dealers they are described as low.

COLLECTIONS AND CREDITS.—Throughout the metropolitan territory, where accounts and regular settlements receive the attention due their importance, collections are mentioned as good if not uniformly favorable. Credits are closely looked after, and the commercial rating of the buyer, especially on new accounts, is carefully weighed and considered.

LAMP FIXTURES.—Quite a volume of business is recorded for replacements and renewals of civilian equipment.

GLASS INSULATORS.—Buyers and distributors report no further price advances, and manufacturers, whose productive capacity is reduced 50 per cent by government order, seem to have enough stock to meet the demand. Of course transportation facilities are hampered by embargoes and other restrictions.

MOTORS AND GENERATORS.—On the larger sizes deliveries are yet far in arrears. Sales of the smaller-horsepower apparatus and machines, out of stock and second-

hand, represent a steady movement, the demand far exceeding the supply. Prices have not changed.

POLE AND LINE MATERIAL.—Spring work, caring for replacements, maintenance and general wear and tear of the long and trying winter in central stations, power houses and transmission lines, is well under way. Pole and line material and hardware are selling in volume up to expectations.

PORCELAIN.—No general advance has materialized, although one was anticipated by several jobbers who had been advised of a pending change by manufacturers. It seems that quite a large stock of knobs, clats and bushings is held at the plants awaiting shipment.

CONDUIT.—With the government in the market for rigid conduit, shipments out of Pittsburgh to Eastern points are small and uncertain. The lowering of prices noted before is also reflected in flexible-steel armored conductors.

CHICAGO

The volume of the jobbers' business continues about the same, with a spotty condition particularly prevalent during the last week. Prices remain firm with no change. There is much evidence, however, which points to an upward revision of steel prices at the next revision date. These indications are taken very seriously in the Chicago district. The movement of goods still continues along the same line, with industrials active and central stations quiet. The passing of the Finance Corporation bill is expected to help central stations largely engaged in war business, but a few large plants in this territory see no way in which it will be of direct benefit to them.

CONDUIT.—The condition of the conduit market remains unchanged, the demand exceeding the supply, especially for the larger sizes.

WIRE.—One manufacturer of weatherproof wire has just placed an order for cotton at 62.5 cents a pound. With cotton at such prices it is reasonable to expect changes in wire prices.

FANS.—Some Chicago jobbers are taking on extraordinarily large stocks of fans. It is believed that a hot summer such as usually follows a cold winter will produce a market for fans this year which will clean the shelves of the industry. It may be pointed out that fan manufacturers have been limited in their production this year on account of the lack of material for making fans. When jobbers placed their orders last winter they were told by the manufacturers to state at that time their entire year's requirements, as the manufacturers would guarantee absolutely no more. Jobbers are pointing these facts out to the dealers in a spirit of helpfulness, as it is considered to be a certainty that a hot summer will produce a fan shortage that will find unprepared the dealer who has not put in his stock in advance. The most popular types of fans, judging from the jobbers' stock, appear to be the 9-in. and the 10-in. The 9-in. fan is considered a happy medium between the 8-in. and the 12-in., especially in view of the high prices of the 12-in. fans.

ELECTRIC SEWING MACHINES.—There is considerable activity in the electric sewing-machine market. Established makes are moving with a continued rapidity, and some new makes are coming into the market.

ELECTRIC RANGES.—The change in the character of the central-station load curve caused by the daylight-saving movement makes the electric range, the manufacturers contend, a more desirable load builder than ever, since it will help fill in that new and deep valley created in the load curve between 5 and 8 o'clock in the evening.

AUTOMOBILE ACCESSORIES.—The trade in automobile accessories is starting off well this spring. A very good business is expected for the year owing to the fact that most people are paying more than usual attention to the repair of existing equipment.

CENTRAL-STATION BUYING.—While financing difficulties have slowed up central-station purchasing, there are one or two projects of fairly large character in the Middle West which, it appears, may find a solution of this problem.

BOSTON

Trade continues extremely active. Collections do not show much recession on account of the Liberty loan drive, although credits are being more carefully watched than for some time. It is still very difficult to find any jobber or dealer who will testify that the freight delivery situation on the railroads shows much improvement. A movement toward increasing the coastwise shipping facilities to and from New England is taking shape, and this should supplement the railroad service in time to a most helpful degree. With the exception of conduit and porcelain, jobbers are pretty well stocked up. Little change in price was noted during the week except an advance on Hunt industrial electric trucks to conform to an increase of about 10 per cent in alkaline storage-battery prices, April 10. The contract under which William F. Kearns & Company of Boston are to construct a twenty-million-dollar United States Army waterfront terminal at Boston during the next eight months was signed at Washington April 11. A large quantity of electrical equipment for lighting and power service will be required by this great installation.

LAMPS.—The supply is slowly increasing, but the manufacturers are far from having caught up with orders. Seasonal conditions are favorable to the overtaking of demand by production in due course.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are well maintained, with government or closely allied business the basis of most orders. Shipments range in a general way from two weeks upward, depending upon the extent of departure required from standard equipment. A moderate price advance on Hunt trucks is reported, effective April 10.

VACUUM CLEANERS.—A flood of orders is pouring into the factories, and it is difficult to accumulate any considerable stock. One representative factory, visited within a few days, is working day and night and is far behind on orders. Business is being handled from the Orient, South America and the Antipodes, as well as in this country. Railroad and express shipments are slow, and many damage claims are being received. Women are being utilized in this class of production up to the point where highly technical assembly work begins. Men are required for the heavier setting-up work, and for duties of an engineering nature in vacuum-cleaner manufacture.

FANS.—The manufacturers have completed about all of this season's production, according to reliable advices. Large shipments are at present en route between the factory and the jobber, and the retailers are getting pretty well stocked up from the initial and succeeding distributions by the jobbers.

MOTORS.—A fair supply is now reported in standard equipment up to and including 20 hp. Prices are firm, with no change in sight. The demand for motors is apparently falling off slightly, but any permanent recession is hardly to be expected during the period of the war.

CONDUIT.—Nothing very optimistic can be said about the conduit situation at this time. Over and over one encounters the plaint of deferred deliveries on purchases made six to nine months back. Building operations are very flat. Fortunately temporary wiring is possible in many industrial installations handling war orders, and the needs of the international situation do not depend, so far as this class of work goes, upon putting all circuits in pipe. Ship construction is likely to demand more and more conduit within the coming summer, and the drain upon stocks is likely to be heavy even in some of the smaller sizes at present accumulated through the stagnation in house-wiring activity.

MOTOR CONTROLLERS.—Manufacturers are well ahead of the motor makers, speaking generally, on controller deliveries. Most orders can be traced to government requirements. Good shipments can be had from the factory on standard equipment, but delays are being experienced in transportation. Prices are steady, and a slight slowing down is noted in business.

INDUSTRIAL HEATING EQUIPMENT.—Despite the lateness of the season, a considerable demand is noted for heating units for out-of-the-way service.

ATLANTA

The market for large apparatus through the central stations has been comparatively dull of late, the tendency for the week being along the same line. Of course, there are exceptions, where a few companies are buying equipment for government or quasi-government account in connection with nitrate and shipbuilding work. Turbine shipment promises show no improvement. Several water-power developments have been held up temporarily owing to incomplete financial arrangements and uncertainties regarding public service commission decisions on rate increases. Although quite a number of operating companies have increased their rates so far, it is expected that the various state commissions in the Southeast will be literally deluged with applications in the near future, as it is imperative that some of these companies secure immediate relief.

The great demand for textile products from both government and commercial channels continues actively in mill construction. The Franklin Cotton Mills, Concord, N. C., have been capitalized for \$1,000,000. While general building work is away off in the Southeast, certain areas show a stimulated movement, as reflected in the spotty demand for staple electrical supplies. Speaking generally, shipments are coming in slightly better when compared with the last two weeks. Jobbers report that standard goods are moving more freely. The week has witnessed a good demand from outlying sections for circular loom, knobs, tubes and standard rubber-covered and weatherproof wire.

FIXTURES.—The volume of sales as recorded in the larger cities is substantial, but a sag is noticeable in the requirements from the less populous sections. Deliveries on the whole are poor.

PORTABLE LAMPS.—Business is excellent. A singular trend of the trade which it is interesting to note is the increasing demand for floor lamps, with a corresponding decrease in the call for table portables. Shades are active, the mixed colors appearing to be growing more popular for both floor lamps and living-room portables. The solid-colored shades for small and boudoir types of portables are moving briskly as well. Deliveries on shades are reasonable compared with those now being obtained on portables.

WASHING MACHINES.—It has taken a long campaign of education for this device to "break in," as it were, but the volume of business now being transacted justifies the efforts on the part of the manufacturers and jobbers. There is no doubt that activity will continue to increase, especially as the servant problem grows more difficult each day.

SEATTLE

Despite a general lay-off to participate in the drive for third Liberty loan honors, a gratifying and sustained volume of business is reported by both jobbers and retailers. Collections were excellent and demands for credit exceeded the past several weeks. From the electrical jobbers' standpoint the past week is unmarked by any unusual developments. Sales to shipyards and allied industrial plants were heavy. New building is maintaining the pace set early in the year. The government buying dropped off considerably, but heavy sales of the past few weeks will easily offset any decrease.

Lamp, rubber-covered wire, large-motor and conduit shortages still exist. This shortage particularly is causing concern, as the demand, contrary to expectations, is still on the increase. This shortage is especially acute on lamps of larger sizes. The wire situation is accentuated materially by a heavy demand for house and industrial wiring purposes. The arrival of several large shipments recently relieved the situation temporarily, but stocks are tightening again. While the shortage in motors exists, particularly in the larger sizes, the demand is considerably less in the last two weeks. Fresh demands from two Puget Sound shipbuilding cities are anticipated shortly. Eastern manufacturers report an available supply of conduit for coast distribution, but local shortages are increasing owing to the lack of closed freight cars. Prices remain steady, with no increase or decrease expected in the near future.

Labor shortage in the Sound cities has never been so

serious, according to authorities. This applies to practically every industry, and the electrical trade is not excepted. The employment of women in certain industries has afforded a measure of relief, but their capacity for work in war industrial establishments in this section is very limited. The Inland Empire Spokane district reports that unless conditions change before harvest the present labor supply will be sufficient for the increased work then. It is stated that there will be no need to bring soldiers from cantonments to help with the spring work. This step was considered.

New wooden shipbuilding companies of Seattle signed contracts for eight ships of 3500 tons capacity with French interests. Work will begin as soon as the project is sanctioned by the United States Shipping Board. An increase of 151 industrial plants under the factory inspection law in the State of Washington was last year shown by actual figures. The figures show 44,000 more men employed in industries and an increase of 2500 female employees.

Substantial progress is being made toward relief from the shortage of cars to move lumber and other products from Washington and Oregon.

SAN FRANCISCO

During the past week the momentum of electrical business, which had slowed down, again became accelerated, and several contractors whose lists of jobs on hand had dwindled to the finishing point suddenly found a long list ahead of them. The most noticeable feature of the past week's business has been the number of calls for household electrical appliances, particularly washing machines and vacuum cleaners. An increase in the range business was also reported, probably as a result of effective and patriotic advertising, for little regular effort has been made this year on account of power shortage.

Los Angeles reports that the Harbor Commission, in accordance with its determination that harbor industries are to be supplied with municipal power, has decided to refuse permits to electric lines crossing tidelands under its control, and this decision will affect a score of private power lines unless they retire from the field.

Industrial work reported during the week includes a 300,000-bag rice mill at Marysville, a new cannery at Biggs, an addition to the American Can Company's plant in San Francisco and electrical dredging and steam crane work along the Oakland estuary.

The southern California campaign having been definitely launched after the preliminary ground work, and investigation being under way in the rest of the State, a noticeable increase in the quality of electrical merchandising is evident. There is plenty of spending money on account of top wages by industrial plants and the good wages to be paid fruit and berry pickers because of scarcity of help. These facts are a stimulus to the country dealer, combined with the decreasing number of house-wiring jobs.

SEWING MACHINES.—A nation-wide advertising campaign, carried on by the largest manufacturer of portable electric sewing machines, has resulted in a tremendous business that is diverted through electrical dealers. Red Cross work and its demand for speed are chiefly responsible, but the low price of the portable electric machine has resulted in many sales. Similarly there has been a demand for sewing-machine motors only so great that local jobbers can secure only a portion of their quotas of orders at the factory. Several times there has been no Pacific Coast stock even on certain types of electric machines, this condition being attributed, first, to lack of sufficiently seasoned wood for the bases, and, second, to shortage of motors.

SWITCHES.—Knife-switch sales fall below those of last year, and a large portion of the present year's sales are attributed to the filling of back orders, based on previous demands.

ELECTRICAL FIXTURES.—Designers and manufacturers of house and hotel fixtures report that their business is poor. On the other hand, there never was such a large sale for industrial reflectors, and it is conservatively estimated that this business is running 25 per cent in advance of 1918. Stocks and deliveries are good.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor		List per 1000 Ft.
B. & S. Size		
No. 14 solid		\$61.00
No. 12 solid		71.00
No. 10 solid		90.00
No. 8 solid		106.00
No. 6 solid		145.00
No. 10 stranded		95.00
No. 8 stranded		115.00
No. 6 stranded		160.00
No. 4 stranded		205.00
No. 2 stranded		266.00
No. 1 stranded		315.00
Twin-Conductor		
No. 14 solid		104.00
No. 12 solid		135.00
No. 10 solid		185.00
No. 8 stranded		235.00
No. 6 stranded		370.00
No. 4 stranded		575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor		No. 14 Solid
Less than coil		List to \$61.00
Coil to 1000 ft.		10% to 57.25
		No. 12 Solid
Less than coil		List to \$71.00
Coil to 1000 ft.		10% to 66.75
Twin-Conductor		No. 14 Solid
Less than coil		List to \$104.00
Coil to 1000 ft.		\$97.75 to 10%
		No. 12 Solid
Less than coil		List to \$135
Coil to 1000 ft.		10% to \$126.80

DISCOUNT—CHICAGO

Single-Conductor		No. 14 Solid
Less than coil		15% to + 10%
Coil to 1000 ft.		10% to 20%
		No. 12 Solid
Less than coil		15% to + 10%
Coil to 1000 ft.		10% to 20%
Twin-Conductor		No. 14 Solid
Less than coil		15% to 10%
Coil to 1000 ft.		10% to 20%
		No. 12 Solid
Less than coil		15% to + 10%
Coil to 1000 ft.		10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to \$21.00
1/5 to std. pkg.	20% to 19.80
Std. pkg.	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	20% to List
Std. pkg.	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3175-.3195	.3275-.3295
Barrel lots	.2875-.2895	.2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 100 FT.—NEW YORK

Less Than Coil		Coil to 1000 Ft.
3/8-in. s. stp.	Net to \$75.00 —15% to \$69.75	
3/8-in. d. stp.	+10% to 75.00	List to 72.00
1/2-in. s. stp.	List to 100.00 —15% to 93.00	
1/2-in. d. stp.	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil		Coil to 1000 Ft.
3/8-in. single strip	\$75.00	\$63.75
3/8-in. double strip	78.25-78.75	71.25-71.75
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in. — \$25.00-\$55.00	\$20.50-\$24.50	\$20.00-\$21.50
1/4-in. — \$28.00-\$60.00	\$22.50-\$27.00	\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in. — \$36.00-\$55.00	\$25.00	\$22.50
1/4-in. — \$40.00-\$60.00	\$27.00	\$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38		Conduit, List per Foot
Size, In.		
1/4		\$0.08 1/2
3/8		.08 1/2
1/2		.08 1/2
3/4		.11 1/2
1		.17
1 1/4		.23
1 1/2		.27 1/2
2		.37 1/2
2 1/2		.58 1/2
3		.76 1/2
Couplings, List		Elbows, List
1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	4% to 12%	3/4 in. to 3 in. 7% to 15%
2500 to 5000 lb.	6% to 14%	9% to 17%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

Less than 2500 lb.	5.3% to 8.9%	3/4 in. to 3 in. 8.3% to 11.9%
2500-5000 lb.	7.3% to 10.9%	10.3% to 13.9%
(For galvanized deduct six points from above discounts.)		

FLATIRONS NEW YORK

List price	\$5.00 to \$6.00
Discount	30%

CHICAGO

List	\$5.00 to \$6.00
Discount	25% to 30%

FUSES, INCLOSED.

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	20% to 30%
1/5 to std. pkg.	38% to 40%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28% to 30%
1/5 to std. pkg.	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Per 100 Net

Less than 1/5 std. pkg.	\$5.00
1/5 to std. pkg.	4.50
Standard packages, 500. List, each,	\$0.07.

CHICAGO

Per 100 Net

Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard packages, 500. List, each,	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List.	Each
10 to 40-watt-B	100	\$0.30	
60-watt-B	100	.35	
100-watt-B	24	.70	
75-watt-C	50	.70	
100-watt-C	24	1.10	
200-watt-C	24	2.20	
300-watt-C	24	3.25	
Round bulbs, 3 1/4 in., frosted:			
15-watt-G 25	50	.53	
25-watt-G 25	50	.55	
40-watt-G 25	50	.55	
Round bulbs, 3 3/8 in., frosted:			
60-watt-G 30	24	.77	
Round bulbs, 4 1/8 in., frosted:			
100-watt-G 35	24	1.10	

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

Per 1000 Ft. Net

Less than coil (250 ft.)	\$31.00 to \$34.90
Coil to 1000 ft.	26.20 to 27.90

CHICAGO

Per 1000 Ft. Net

Less than coil (250 ft.)	\$29.00 to \$30.00
Coil to 1000 ft.	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	\$24.00
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CHICAGO

Net per 100	\$21.75 to \$24.75
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OUTLET BOXES

Nos.	List.
per 100	
101—A, A1 1/2, 4 S.C., 6200, 320	\$30.00
102—B.A., 6200, S.E., 300, AX, 1 1/2	
4 S.	30.00
103—C.A., 9, 4R, B 1 1/2	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.	25%	20%
\$10.00 to \$50.00 list.	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.	40%	35%
\$10.00 to \$50.00 list.	50%	45%

PIPE FITTINGS**DISCOUNT—NEW YORK**

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

Per 1000 Net

Less than 1/5 std. pkg.	\$20.00 to \$38.00
1/5 to std. pkg.	19.00 to 20.00
Standard package, 2200.	List per 1000, \$20.

CHICAGO

Per 1000 Net

Less than 1/5 std. pkg.	\$15.80
1/5 to std. pkg.	14.80
Standard package, 2200.	List per 1000, \$20.

PORCELAIN KNOBS**NEW YORK**Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGOPer 1000 Net Std. Pkg. 3500 Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10 to \$11.40	24.20

SOCKETS AND RECEPTACLES

Std. Pkg. List

1/4-in. cap key and push sockets.	500	\$0.33
1/4-in. cap keyless socket.	500	.30
1/4-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	24% to 25.00
1/5 to std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.	List to + 5%
\$10 to \$25 list.	11%
\$25 to \$50 net.	14% to 15%
	Low Grade
Less than \$10 list.	5% to 10%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.	+5%
\$10 to \$25 list.	10% to 11%
\$25 to \$50 list.	14%
	Low Grade
Less than \$10 list.	5%
\$10 to \$25 list.	16%
\$25 to \$50 list.	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List
No. 155	Each
No. 160	\$0.34
	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List 40%	Net to 30%
\$2.00 to \$10.00 list	10% to 50%	5% to 40%
\$10.00 to \$50.00 list	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25%	20%
\$2.00 to \$10.00 list	25%	20%
\$10.00 to \$50.00 list	25%	20%

TOASTERS, UPRIGHT**NEW YORK**

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR**NET PRICE—NEW YORK**

	Per Lb. Net
No. 18, less than full spools.	\$0.41 1/4 - \$0.44 1/4
No. 18, full spools	0.36 1/4 - 0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/2 to \$0.65
No. 18, full spools	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net
	Less than 500 to 1000 to
No.	500 Ft. 1000 Ft. 5000 Ft.
11..	\$15.00-\$18.00 \$12.50-\$13.00 \$9.85-\$11.50
12..	23.25-25.40 21.30-21.80 15.95-19.35
10..	32.40-35.20 29.70-30.20 22.10-27.00
8..	45.70-49.15 41.90-42.10 30.88-38.00
6..	72.40-77.85 66.35-66.75 48.95-60.30

CHICAGO

	Price per 1000 Ft. Net
	Less than 500 to 2500 to
No.	500 Ft. 2500 Ft. 5000 Ft.
14..	\$18.00 \$13.00 \$11.50
12..	25.33-\$26.28 22.02-\$25.33 18.35-\$20.93
10..	30.49-36.54 27.94-31.26 22.88-29.23
8..	42.54-51.57 38.99-44.13 31.90-41.36
6..	66.46-88.38 56.15-75.61 50.53-70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 5 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$35.42 to \$40.35
25 to 50 lb.	34.42 to 39.35
50 to 100 lb.	33.42 to 38.36

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

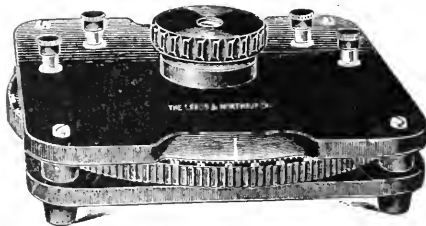
Brass Canopy Fixture Switch

Pass & Seymour, Inc., of Solvay, N. Y., are marketing a compact brass canopy fixture switch. The porcelain base of this device is arranged to be used on both 3.25-in. (8.25-cm.) and 4-in. (10-cm.) outlet boxes, and is fitted with an insulating lip which prevents the grounding of the brass canopy. It therefore needs no insulating ring or insulating joint. This feature makes it especially desirable for metal ceilings or walls. It is possible to loop the line wires over the terminals of the switch and carry them directly to the terminals of the unit without splicing. The brass canopy snaps on or off instantly without the use of tools. It is fastened to the base by twin spring lugs, easily located by the unobtrusive buttons on opposite sides of the canopy. It can be equipped with a nipple, porcelain bushing or fixture loop for supporting the glassware.

Variable Self and Mutual Inductometer

The inductometer produced herewith consists of two pairs of stationary coils and one movable coil, the latter being mounted on a disk placed between two outer plates holding the stationary coils. The disk may be rotated and has two scales, one calibrated in millihenries reading self-inductance, and the second in degrees. The instrument is ordinarily provided with a maximum inductance of 50 millihenries, but instruments with higher maximum values or lower values can be obtained.

The inductometer has six link-shaped coils. The four fixed coils are mounted in pairs in the two outer fixed plates, which are held together by four screws and separating pieces to form the body of the instrument. The two movable



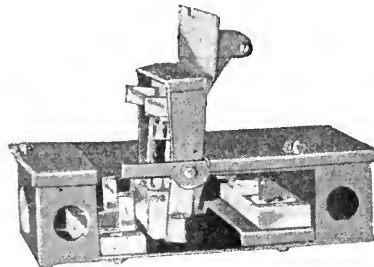
ROTATING DISK CALIBRATED IN DEGREES
AND MILLIHENRIES

coils are mounted on the inner disk and are placed with their long axes at right angles to a diameter. The outer plates and the disk are made of molded bakelite. To use the instrument as a variable mutual inductometer the fixed and movable coils are used as primary

and secondary respectively and no connection is made between them. The mutual inductance is found by subtracting a constant from the scale reading and dividing the remainder by two. This constant is given with each instrument, although it may be readily determined by the user at any time. It is claimed that errors due to stray field effects are eliminated and that the meter has a desirable ratio of maximum inductance to minimum inductance. It is made by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia.

Cut-Out Switch with Interchangeable Knock-Out

A service cut-out which consists of a knife-blade switch inclosed in metal box with interchangeable knock-outs for conduit connection is being manufactured by the Palmer Electric & Manufacturing Company of Boston. The fixed jaws of the switch are secured to the bottom of the box. The cut-out



NO CURRENT-CARRYING PARTS ARE
WITHIN REACH

block and the movable jaws of the switch are secured to a hinged cover pivoted at the middle point of the box and having a flange like a letter box. When the circuit is broken by opening the hinged cover, the cut-out and fuses are exposed without making any current-carrying parts accessible. The half-tone of the box in the open position shows that it is impossible to make a "fished" connection to the service contacts. When the switch and cut-out are mounted in connection with a meter adapter the service wires are protected by conduit and no current-carrying parts are accessible although the service switch and fuse are easily accessible.

Flange-Type Cable End-Bell

The Electrical Engineers' Equipment Company, 710 Madison Street, Chicago, has made improvements upon its cable end-bell, consisting principally of a flange which is cast about the neck of

the bell where the lead-covered cable enters. This flange is arranged so that adapters can be bolted to it for mounting the bell upon any size of conduit or for any size of clamp or wiped cable joint. In case the bell is to be mounted upon conduit, a brass bushing is provided, which is clamped in between the bell flange and the flange upon the pipe adapters. The brass bushing forms the ground connection. With this arrange-



BRASS BUSHING FOR CONDUIT MOUNTING
FORMS GROUND CONNECTION

ment the bell can be installed without being turned, which is an advantage, especially when the bells are to be installed in limited spaces where there is not sufficient room to revolve them. All cable end-bells being manufactured by the Electrical Engineers' Equipment Company have this feature.

Ornamental Gas-Filled Lamp

The accompanying illustration shows a unique ornamental gas-filled lamp manufactured by the Victoria Lamp



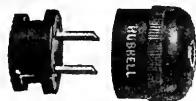
NEW GAS-FILLED LAMP COMBINES ORDINARY
LAMP BULB AND SHADE IN ONE

Works, 507 Union Place, Union Hill, N. J. It is claimed that this lamp produces an indirect non-glare light which will not injure the eyes. The lamp is interesting in that it combines an ordinary gas-filled bulb with an ornamental lamp shade. The lamp, known as the

"Liberty," is made of plain white glass with ornamental decorations in green, gold, blue and other shades that will harmonize with chandeliers or room decorations.

Motor Attachment Plug for Home Devices

The accompanying illustration shows an exploded view of a motor attachment plug now being placed upon the market by Harvey Hubbell, Inc., of Bridgeport, Conn. The part to which the contact blades are attached has

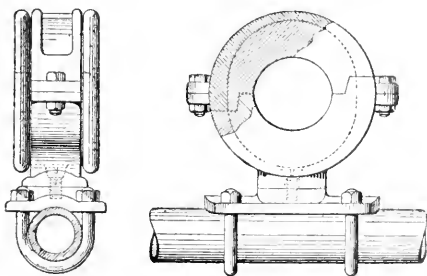


ATTACHMENT PLUG THAT FITS IN ENERGY-CONSUMING DEVICE

slots or grooves that fit into the energy-consuming device. All current-carrying parts of the detachable portion are carefully concealed within arcing chambers to prevent accidental contact therewith. The plug is constructed of heat-proof composition and measures 1.62 in. (4.1 cm.) in length and 1.3 in. (3.3 cm.) in diameter at the bottom of the base. The plug is especially designed for use with devices employing small motors such as vacuum cleaners and floor scrubbers.

Bus Support Equipped with Adjustable Base

Busbar supports which are designed to fit several sizes of insulated cable and which are also equipped with adjustable bases are being manufactured by the Lewis & Roth Company, 1012 Liberty Building, Philadelphia, Pa. The support, which is made of malleable iron, is provided with an oval hole in which various size porcelain insulators can be fitted. Thus different diameter cables can be accommodated between certain minimum and maximum limits. The insulator is constructed slightly thicker at the top and bottom than at the sides to prevent breakage when the clamp is tightened.



BUS SUPPORT MADE ADJUSTABLE TO FIT SEVERAL SIZES OF CABLE

The tapered joint between the insulator sections permits considerable adjustment and allows for creepage of the cable. The part holding the insulator sections can be moved freely about an axis perpendicular to the bottom clamp, but is held in any desired position by

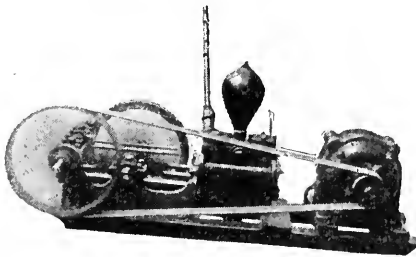
means of a cap-screw shown in the diagram. All of the insulators are tested with two and one-half to five times actual working voltage for dielectric strength.

Transformers for Industrial Plant Illumination

The Bay Point Electrical Supply Company of Berkeley, Cal., is marketing a line of auto-transformers especially adapted for use in industrial plants. The auto-transformer changes the potential from 440 volts, the pressure usually carried on industrial-plant power circuits, to 220 or 110 volts for the lighting circuits. The transformers are made in single-phase and three-phase units, and for large sizes they are oil-cooled. In capacities of under 7500 kva. they are air-cooled.

Cam-Driven Electric Pump

A double-acting cam-driven electric pump manufactured by the Luitweiler Pumping Engine Company of Rochester, N. Y., is shown in the accompany-



DOUBLE-ACTION PUMP CAN BE SUSPENDED BY CHAIN OR PLACED ON ANY FLOOR

ing illustration. The double-acting feature equalizes the load pressure upon the camshaft bearings at all stages of the cycle. The absence of water-load friction in the camshaft bearings is a particular feature of the pump. The pump is geared directly to a motor on the same base and operates with practically no vibration at speeds of 75 to 250 r.p.m. when unattached to the floor. It can also be operated when hanging suspended from chains or when supported on rollers without showing vibration. The driving mechanism is inclosed within a metal case and is lubricated by the splash system.

Direct Lighting Non-Glare Piano Lamp

A piano lamp that has the advantage of direct lighting and produces no objectionable glare is being manufactured by the Play-O-Lite Company, Inc., of Buffalo, N. Y. The hood is so constructed that the light rays are released only in a downward direction so as to fall upon the music rack and the entire keyboard. The "Play-O-Lite" piano lamp is made of metal and can be finished to harmonize with the woodwork of any piano. It can be easily attached to the piano and will not scratch it, because all exposed surfaces are covered

with felt. The socket is of the pull-chain type and is detachable so that the bulb can be replaced at will. Another advantage that the piano lamp has is that it may be quickly removed from the piano and attached to a bed for reading after retiring.

Flexible Metallic Packing

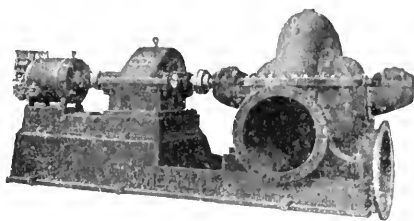
The Crane Packing Company, 29 South Clinton Street, Chicago, is marketing a flexible and compressible packing that is made of long, thin, continuous strips of metal foil and wrapping. Each strip is lubricated with oil which impregnates the sheet and permits it to slide on the adjoining strips. This construction also permits bending the packing around small-diameter bodies and gives it a compressibility sufficient to compensate for wear. It is claimed by the manufacturer that these spirally wrapped sheets form perfect barriers through which steam cannot penetrate. It is also said that this packing will reduce the rod friction and wear on the packing.

"Daylight" Glass for Reflectors and Shades

The Laco-Philips Company of 131 Hudson Street, New York City, has placed upon the market a glass product under the trade name of "Laco-daylite," which, it claims, will permit correct determination of color values. It is made by chemically treating plain glass and is made to fit standard sizes and shapes of all reflectors on the market. It is equipped with holders permitting it to be easily attached to any reflector. The advantage of this glass lies in the fact that it can be used for display purposes in department stores, and for industrial lighting where color values or accurate measurements are required.

Centrifugal Pump with End Suction

A new design of centrifugal pump manufactured by the Wheeler Condenser & Engineering Company, Carteret, N. J., is illustrated herewith. The pump is interesting because of the posi-



END-SUCTION CENTRIFUGAL PUMP THAT OCCUPIES SMALL SPACE

tion of the suction opening, which is directly below and in line with the end bearing. This arrangement, it is pointed out, makes it possible to place the pumping unit in a small room. Furthermore, it is convenient for inspection and upkeep.

Trade Notes

Changes in Western Electric Company's Staff

The following changes in the staff of the Western Electric Company of New York City have been announced:

G. T. MARCHMART, who has been assistant sales manager of the house at Richmond, Va., for the last four years, is now sales manager.

J. H. SYMONDS, for nearly twenty years in the service of the company, is the new stores manager at Minneapolis, Minn., where he has been for four years past.

R. A. GRIFFIN, for fourteen years manager of the pole department, on April 1 became vice-president of the National Pole Company of Spokane, Wash., with headquarters in New York.

W. P. HOAGLAND, who has been appointed sales manager of the company's Chicago house, has been connected with that branch since 1900, having been head of the supply sales work for the last seven years.

WILLIAM F. BANCKER on April 1 was made general purchasing agent of the company in New York City. He has been with the concern since 1899. C. A. Merrill, who also dates his connection with the company from that year, was promoted to be assistant general purchasing agent at the same time.

CLARK H. MINOR, whose connection with the company dates from 1902, he having been successively manager of the Kansas City (Mo.) and Omaha (Nebr.) branches and more recently at Antwerp, Belgium, has been assigned to special work in China and Japan. Mr. Minor will report to G. Swope, vice-president and general sales manager in the New York City office.

HOWARD W. HALL has been transferred from Richmond, Va., to Atlanta, Ga., where he becomes Southern district manager. Mr. Hall has been with the company since 1901 and in 1906 was made manager at St. Louis, Mo., later going to Nashville, Tenn., and Denver, Col. Jay B. Odell, who has been with the company in New York City since 1904, succeeds Mr. Hall in Richmond.

GEORGE M. DUNN, manager of the company's Pittsburgh house since 1913, has been made manager at Philadelphia, succeeding Jerome D. Kennedy, who takes charge of the general sales department at Hawthorne, Ill., with the title of assistant contract sales manager. Mr. Kennedy's services with the Western Electric Company began in 1899 as an engineer in New York City. Joseph L. Ray takes Mr. Dunn's position in Pittsburgh, where he has been sales manager since 1913.

FRED B. GLEASON, for the last sixteen months Southern district manager of the company, with headquarters in Atlanta, Ga., comes to New York City as contract sales manager. He has been with the company since 1904, was manager at Dallas, Tex., four years later went to San Francisco and then to Japan, where he was Far Eastern manager. Henry L. Grant also comes to New York from Chicago for special work in the sales department. He has been with the company in various important capacities since 1905.

THE GOODYEAR TIRE & RUBBER COMPANY of Canada, Ltd., has removed its office from Toronto to New Toronto.

THE SOUTHERN CORPORATION, engineer, 40 Exchange Place, New York, announces that it has closed its office, at least for the period of the war.

THE ELECTRICAL ENGINEERS' EQUIPMENT COMPANY of Chicago on April 4 gave a dinner to seventy-five of its employees and their wives, after which the entire party went in a body to hear "Billy" Sunday speak at his Lakeside Tabernacle.

ROBERT S. BLAKE, formerly connected with the Condit Electric & Manufacturing Company of Boston, as its Pittsburgh (Pa.) representative, is now district manager for the Duquesne Electric & Manufacturing Company in its Chicago office at 230 South LaSalle Street.

THE GENERAL INSULATOR COMPANY of Brooklyn, N. Y., which some years ago inaugurated a bonus system among its employees that has produced excellent results, has now gone a step further and become a co-operative concern. Henceforth all employees of the company will participate in its net earnings.

THE SCHROEDER HEADLIGHT COMPANY of Evansville, Ind., has acquired control of the L. R. Jones Company of Kansas City, Mo., and will consolidate the two concerns at the former place. R. B. Holliday, formerly with the Worthington company at Milwaukee, Wis., will be the new superintendent, and E. D. Goodell, representing the Toledo (Ohio) Sales Company in Cleveland, Ohio, will be the sales manager.

THE BINDER ELEVATOR & ELECTRICAL COMPANY of Birmingham, Ala., has removed its offices from the plant and warehouse, 209-211 Twenty-second Street, North, to 305 Twentieth Street, North, where a new store has been opened. All office work for the plant, construction department and retail establishment will be handled at the Twentieth Street address, while the old building will be devoted exclusively to the electrical repairing, motor and elevator work.

THE GILHAM-SCHOEN ELECTRIC COMPANY, INC., is opening an electrical jobbing house in Atlanta, Ga., at 22 Luckie Street. The company consists of P. C. Gilham, who has been associated with the electrical jobbing interests in the South for many years, being connected with the Western Electric Company and Carter Electric Company of Atlanta, and George F. Schoen, who has since 1902 acted in the capacity of a manufacturers' agent. The company expects to be ready for business by June 1.

Trade Publications

LAMP CHANGERS.—W. N. Matthews & Brothers, Inc., of St. Louis, Mo., are distributing a circular describing their easy lamp changer and the "Fuswitch."

SHADE ATTACHMENT.—An attachment for holding two-unit shades is described in a folder issued by the E. W. Ham Electric Company, Worcester, Mass.

SWITCH PLATE.—Bulletin 574, issued by the Peerless Light Company, Halsted, Adams and Green Streets, Chicago, illustrates its combination switch and receptacle plate.

FACE AND HAND DRIER.—The Groton Electrical Devices, Inc., Groton, N. Y., is distributing a circular describing its "Airdry" electrical drier. The circular illustrates the method of drying the hands and face with the device.

FORGE BLOWERS.—Roth Brothers & Company, Adams and Loomis Streets, Chicago, are distributing a circular describing the Rothmotor forge blowers. Other electrically operated machines are also illustrated in the circular.

SPRAY-HEADS.—The Yarnall-Waring Company, Chestnut Hill, Philadelphia, has issued Bulletin No. N601, describing its adjustable spray-heads for cooling tanks. The construction and operation of the spray-heads are outlined in the bulletin.

MARINE FITTINGS.—This is the title of a circular being distributed by the V. V. Fittings Company of 1910 North Sixth Street, Philadelphia, describing its vapor-proof marine fittings for shipbuilding purposes. The bulletin shows the complete line of standardized parts.

ELECTRIC ELEVATORS.—The Indiana State Soldiers and Sailors' Monument at Indianapolis, Ind., is illustrated in a circular distributed by the Warner Elevator Manufacturing Company of Cincinnati, Ohio. The balcony, which is 228.5 ft. above the ground, is reached by a Warner electric elevator.

RECTIFIERS, INSTRUMENTS AND CONTROLLERS.—The General Electric Company of Schenectady, N. Y., has issued several bulletins describing its "Tungar" rectifier for public garage and battery-charging stations, miniature direct-current instruments and drum-type controllers for railway service.

AUTOMOBILE LAMPS.—A "National Guide to Proper Lamps for Gasoline Passenger Automobiles" is the title of a booklet being distributed by the Electric Appliance Company, Chicago. Tables are presented which give the proper lamps for all cars manufactured in the United States from 1914 to 1918.

BUS SUPPORTS.—This is the title of a bulletin distributed by Lewis & Roth Company of Philadelphia, describing and illustrating a line of bus supports. The bus supports are made adjustable to accommodate various cable sizes within specified minimum and maximum limits, and are equipped with adjustable bases.

ELECTRICAL APPLIANCE CODE.—A code for construction and tests of electrical appliances has been issued by the National Board of Fire Underwriters, 207 East Ohio Street, Chicago. The book gives general information concerning the Underwriters' Laboratory and its organization, including the electrical council, the industry council and methods of procedure in examining, testing and reporting upon electrical appliances. Codes are given for wires, conduits, armature cables, cartridge fuses, map switches, cable and cut-out boxes, signs, panelboards, knife switches, cut-out bases and lugs. The book is bound in a loose-leaf leather binding and is designated as volume one.

New Incorporations

THE SPEED ELECTRIC COMPANY of Poplar, Mont., has been incorporated with a capital stock of \$10,000 by M. A. Erickson and others.

THE JEFFERSON (KY.) LIGHT & POWER COMPANY has been chartered by G. E. Maddy, Fred Bobeck and R. V. Cowger. The company is capitalized at \$2,000.

THE AL-CO OIL, GAS & ELECTRIC COMPANY of Aline, Okla., has been incorporated with a capital stock of \$100,000 by L. J. Dixon, L. H. Stephens and I. A. O'Shaughnessy.

THE IRVINE (KY.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of \$80,000. The incorporators are: John J. Langan, Minnie Langan and J. Floyd Rogers.

THE MINGO COUNTY UTILITIES COMPANY of Williamson, W. Va., has been incorporated with a capital stock of \$5,000. The incorporators are: S. G. Kilburn and others.

THE LEONE DUAL LIGHTING & IRRIGATION COMPANY of Seattle, Wash., has been incorporated with a capital stock of \$50,000 by C. P. Gorman, J. G. Brown and W. H. Angel.

THE NORTH McDONOUGH LIGHT & POWER COMPANY of Good Hope, Ill., has been incorporated by J. E. Lowe, Alvah Allison and G. W. Staph. The company is capitalized at \$10,000.

THE AUTOMATIC CHANGEABLE ELECTRIC SIGN COMPANY of Gettysburg, Pa., has been chartered with a capital stock of \$5,000 to manufacture electric signs. H. L. Snyder is treasurer.

THE APPLIANCE SALES COMPANY of Williamsport, Pa., has been incorporated with a capital stock of \$9,000 to manufacture electrical appliances, etc. J. P. Haag of Williamsport is interested in the company.

THE J. L. BERTSCH COMPANY of Boston, Mass., has been incorporated by J. L. Bertsch, R. B. Walsh and J. J. Murphy. The company is capitalized at \$15,000 and proposes to manufacture electric and gas fixtures.

THE MICHIGAN VALLEY LIGHT CORPORATION of Grand Rapids and Detroit, Mich., has been chartered with a capital stock of \$40,000 by R. H. Williams of Detroit, R. E. Becker and Thad Manning of Grand Rapids.

THE INTERNATIONAL ELECTRIC COMPANY of Indianapolis, Ind., has been chartered by Gordon B. Tanner, Fred Sterling, Jr., and M. H. Tanner. The company is capitalized at \$20,000 and proposes to manufacture electrical machinery.

THE PENN MILLS, JEFFERSON, AND BERNVILLE LIGHT, HEAT & POWER COMPANIES of Bernville, Berks County, Pa., have been granted charters. Each company is capitalized at \$5,000. William Kalbach is treasurer of all the companies.

THE GALENA (MD.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by Allison P. and Raymond Prettyman, Lawrence R. Vansant, James D. Davis, Harry A. Bolton and Harry S. Dempsey. The company is capitalized at \$10,000.

THE DYNAMO & MOTOR EXCHANGE, INC., of Buffalo, N. Y., has been incorporated by Frank Martin, John H. Farrell and Albert J. Bissonette, 314 Wyoming Avenue. The company is capitalized at \$10,000 and proposes to deal in dynamos, electrical equipment, etc.

THE MILFORD (N. H.) COMPANY has filed articles of incorporation with a capital stock of \$5,000,000 for the purpose of building a hydroelectric power plant in the southern part of New Hampshire. The incorporators are: Joseph C. Donovan, J. Edward Flynn, Peter J. King and Robert Upton, all of Concord.

New England States

RUMFORD, ME.—Work has begun on the construction of a plant to manufacture ferrosilicon in Rumford. The company has entered into a contract with the Rumford Falls Power Company for 3000 hp. (electrical) to operate the proposed plant. Dudley Harde of New York, N. Y., is promoter of the project.

GOFFSTOWN, N. H.—The Manchester (N. H.) Traction, Light & Power Company has begun work on the construction of its new power house and dam in the Greggs Falls district at Goffstown. French & Hubbard, 88 Pearl Street, Boston, Mass., are engineers.

BRATTLEBORO, VT.—The Village Commissioners are considering a proposal submitted by the Twin State Gas & Electric Company for installing a new street-lighting system. The company offers to remove the arches of 20-cp. lamps and the 100-cp. lamps on poles now in use and to substitute 250-cp. lamps.

MIDDLEBURY, VT.—Plans are being prepared by the Horton Power Company of Rutland for the construction of a new power house, 25 ft. by 90 ft., at Middlebury. Grover & Connor of Rutland are engineers.

BOSTON, MASS.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a new power plant at the local navy yard, to cost about \$35,000.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has awarded contract for the construction of addition to its boiler plant to the John F. Griffin Company, 17 Milk Street, Boston, Mass. The cost is estimated at about \$20,000.

LEE, MASS.—The Pittsfield Electric Company has taken over the control of the Lee Electric Company. No change, it is understood, will be made in the local service at present.

SHERBORN, MASS.—Bids will soon be asked by the Director of Prisons, State House, Boston, for the construction of a central heating plant in the Sherborn Reformatory, to cost about \$63,000. The proposed work will include power house, tunnel for pipes, etc. The R. D. Kimball Company, 6 Beacon Street, Boston, is engineer.

WESTFIELD, MASS.—At a special town meeting held April 8 the citizens voted to close down the municipal electric generating plant and to purchase energy to operate the local system from the Turners Falls Power & Electric Company. The town also voted to appropriate \$42,000 to purchase the necessary equipment to enable the Municipal Light Department to utilize power from the Turners Falls plant.

HARTFORD, CONN.—The Arrow Electric Company is contemplating the construction of an addition, 80 ft. by 125 ft., three stories, to its plant, and also a concrete coal pocket, 35 ft. by 60 ft.

NORWICH, CONN.—The Eastern Connecticut Power Company has acquired what is known as the Rogers farm at Browning Beach, on which, it is said, it will erect a large power plant immediately. This is the power plant which the company is reported to have intended to build at Thamesville.

NORTH GROSVENOR DALE, CONN.—Contract has been awarded by the Grosvenor Dale Company to the J. W. Bishop Company of Worcester, Mass., for alterations in its power house, to cost about \$35,000.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received by Dr. Herman M. Biggs, commissioner of health, Department of Health, Albany, until May 8, for heating, sanitary and electric work for the Laboratory Building, Division of Laboratories, State Department of Health. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

COOPERSTOWN, N. Y.—The Southern New York Power & Railway Corporation has petitioned the Public Service Commission for authority to execute a first mortgage to the Equitable Trust Company of New York as trustee, to secure an issue of \$5,000,000 in bonds. Also for an amendment to a prior order of the commission to authorize the immediate issue of \$952,000 in bonds in exchange for outstanding bonds and the issue of \$48,000 additional bonds upon the acquisition of a like amount of the capital stock of the Southern New York Power Company. The remaining \$4,000,000 in bonds is to be issued from time to time

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

for the acquisition of additional property and for extensions and improvements to its system.

CORTLAND, N. Y.—Plans have been filed by the New York Telephone Company for the erection of an addition to its local exchange building, to cost about \$25,000. The contract for the work has been awarded to the Pulford & Dempsey Construction Company, 157 Flack Street, Elmira.

GLENS FALLS, N. Y.—Plans are under consideration by the Adirondack Power Company for the construction of a new power station near Utica.

OGDENSBURG, N. Y.—The local power house of the New Jersey Zinc Company was recently destroyed by fire, causing a loss of about \$300,000. Plans are being considered by the company for rebuilding the plant immediately.

PORT CHESTER, N. Y.—Contract has been awarded by the Liberty Electric Corporation for the construction of an addition to its plant, 60 ft. by 100 ft., one story high, to cost about \$8,000.

SCHENECTADY, N. Y.—Contract has been awarded by the General Electric Company to the Austin Company, Euclid Avenue, Cleveland, Ohio, for the construction of a 300-ft. extension to its plant.

YONKERS, N. Y.—Contract has been awarded by the National Sugar Refining Company, foot of Main Street, for addition to its boiler plant to Lynch & Larkin, 127 Downing Street, Yonkers. The building will be about 85 ft. by 95 ft., and will cost about \$40,000.

CAPE MAY C. H., N. J.—The Board of Utility Commissioners has issued notice to the Vulcan Heat, Light & Power Company to continue service to customers already connected with its system; also to make improvements to the equipment in its plant.

ELIZABETHPORT, N. J.—Contract has been awarded by the Singer Manufacturing Company, 149 Broadway, N. Y., to the Austin Company, Bulletin Building, Philadelphia, for the construction of an addition, 200 ft. by 600 ft., to its works at Elizabethport, to cost about \$300,000.

PERTH AMBOY, N. J.—The Public Service Electric Company has recently completed the installation of new equipment, consisting of a new exhaust steam condenser, having a cooling surface of 16,500 sq. ft., a 10,000-kw. turbo-generator and auxiliary apparatus. The company, it is said, is planning further extensions to the plant.

WEST ORANGE, N. J.—Plans have been filed and contract awarded by Thomas A. Edison, Inc., Lakeside Avenue, to the Underpinning & Foundation Company, 290 Broadway, New York City, for the construction of foundations and superstructure for a new power house, 100 ft. by 100 ft., one story high.

BRISTOL, PA.—The Town Council is considering changing the motive power of the municipal pumping station from steam to electricity.

ERIE, PA.—Bids will be received by the Board of Education, Erie, until April 29 for general work, heating, plumbing and electric work for the new East High School shop wing. Plans and further information may be obtained on application to the board at Erie or to William B. Ittner, architect, St. Louis, Mo.

MAUCH CHUNK, PA.—Plans are under consideration by the Town Council for improvements to the electric street-lighting system.

MIDDLETOWN, PA.—The War Department is contemplating the construction of a new ordnance plant at Middletown, near Harrisburg. The plans provide for the erection of 30 buildings.

NEW CASTLE, PA.—The South New Castle Electric Company, recently incorporated with a capital stock of \$5,000, proposes to operate an electric plant in New Castle. J. C. Chesnut is interested in the company.

NEW CASTLE, PA.—The Grasdelli Powder Company of Cleveland, Ohio, is contemplating the construction of a new powder plant in New Castle. The proposed plant will cost about \$750,000 and will consist of eight individual units, with power plant.

PHILADELPHIA, PA.—Plans are being considered by Hugo Bilgram, 1217-33 Spring

Street, for the construction of a new machine shop, to cost about \$100,000.

PHILADELPHIA, PA.—Contract has been awarded by the George W. Smith Company, Forty-ninth and Botanic Avenues, to John N. Gill & Company, Otis Building, Philadelphia, for the construction of an addition to its boiler house, to cost about \$35,000.

PHILADELPHIA, PA.—The contract for electrical work in connection with the new school building now being erected at Fifty-seventh and Haverford Avenues has been awarded to James F. Buchanan Company, 1719 Chestnut Street. The cost of the building is estimated at \$113,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 22 under specification 2867 for furnishing three electrically operated traveling cranes for air craft factory. Extension of date from March 28. The cost is estimated at \$56,000.

PHILADELPHIA, PA.—The Louis Walther Manufacturing Company, Torresdale Avenue and N Street, has awarded contract for erection of addition to its boiler plant and other improvements to George H. Thirsk, 1919 West Berks Street, Philadelphia. The cost of the entire work is estimated at \$21,000.

PHILADELPHIA, PA.—Tentative plans have been prepared for generating electrical power at the mines and transmission of same to Philadelphia, New York and other cities. The proposed plans provide for extension of some of the plants as soon as possible at the mines to develop at least 100,000 hp. as the first step. The second step will be to construct two or three plants of 100,000 kw. capacity. It is proposed to connect with the transmission lines of the Philadelphia Electric Company and those of the Public Service Corporation of New Jersey. The plan also embraces a proposal to connect with the lines of the large power stations in New York and Newark. Nothing definite has yet been decided upon. William Potter, state fuel administrator, Charles E. Stuart, public utility engineer of the fuel administration, S. Z. Mitchell and R. J. McClelland of New York, N. Y., are interested in the project.

READING, PA.—The Metropolitan Edison Company has begun work on the extension of its transmission line to the mine of the E. & G. Brooke Iron Company at Birdsboro, a distance of 6 miles. The company has recently equipped the mine for electrical operation and will require about 500 hp.

BALTIMORE, MD.—Plans have been submitted by the Consolidated Gas, Electric Light & Power Company to contractors for estimates for the construction of an additional unit at its Westport plant. The plans call for a building, 220 ft. by 100 ft., four stories, of concrete and steel construction.

ALEXANDER, VA.—Contract has been awarded by the American Shipbuilding Company of Alexandria, recently incorporated with a capital stock of \$10,000,000, for the erection of its proposed shipbuilding plant at Jones Point, on the Potomac River, near Alexandria. The present plans provide for six shipways, a steel fabricating plant, 200 ft. by 400 ft., and a machine shop, 75 ft. by 200 ft. Colon H. Livingstone of Washington is president.

WILLIAMSBURG, VA.—The capital stock of the Williamsburg Power Company has been increased from \$25,000 to \$150,000, the proceeds to be used for extensions and improvements.

WASHINGTON, D. C.—Contract has been awarded by the War Department, Washington, amounting to about \$800,000, for airplane works at Montgomery, Ala., West Point and Americus, Ga. The total cost of the plants is estimated at over \$2,000,000. They will consist of assembling and repair work shops, including machine, foundry and other shops.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 1774—205,000 ft. rubber-insulated lighting and power wire, 600 volts and less. Mare Island, Cal., Schedule 1776—100 yards plain muslin insulating tape. Various, Schedule 1771—121 electrically driven, 110 and 120-volt sewing machines. Applications for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—The War Department, it is reported, is considering the construction of additional nitrate plants, involving an expenditure of \$500,000,000, in addition to the \$30,000,000 and \$5,000,000 plants at Muscle Shoals. One of these plants, it is understood, will be erected at

or near Lock Twelve on Warrior River and another at Kingsport, Tenn. The cyanamid process will be used. Electricity will be obtained from the Alabama Power Company of Birmingham, Ala., for the plant at Kingsport, and the Georgia Power Company of Atlanta, Ga., for the Lock Twelve plant.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 22, for furnishing at the various navy yards and naval stations supplies as follows: Eastern navy yards, Schedule 1010½—portable electric hand lanterns. Mare Island, Cal., Schedule 4015½—5000 ft. telephone cable and a miscellaneous quantity of electric cable; Schedule 1075½—3719 ft. three-conductor cable. Brooklyn, N. Y., Schedule 1027½—20 electrically driven winches; Schedule 4076½—20,000 ft. electric wire. Washington, D. C., Schedule 1072½—telephone cable. Bids will be received also until April 22 as follows: Washington, D. C., Schedule 4023½—for 20 motor-driven lathes. Mare Island, Cal., Schedule 4034½—magnet wire, 22,000 ft. rubber-insulated lighting and power wire, 200 lb. slow-burning wire, 2000 ft. lighting and power wire, 700 ft. switchboard cable and 1600 ft. ignition copper cable. Eastern navy yards, Schedule 4045½—battery charging panels. Eastern and Western navy yards, Schedule 4050½—2000 turret lighting fixtures and 1000 magazine lighting fixtures. Washington, D. C., and Brooklyn, N. Y., Schedule 4083—eight reels antenna wire, 600 ft. each, for Brooklyn and 100 radio spark transmitters. Charleston, Mare Island and Philadelphia, Schedule 4088½—3850 lb. brass tubes and sheet copper. Philadelphia, Pa., Schedule 4089½—electrical supplies. Bids will also be received until May 3 for the following supplies: Washington, D. C., Schedule 4098½—for four electric centrifugal machines. Applications for proposals should designate the schedule desired by number.

North Central States

CHARLEVOIX, MICH.—At an election held recently the proposal to issue \$55,000 in bonds to purchase the hydroelectric plant at Bellaire was carried.

ONSTEAD, MICH.—A new electric-light plant has recently been installed in Onstead.

CINCINNATI, OHIO.—The plant of the Hamilton & Rossille Company, west of North Front Street, will be removed from its present site in Cincinnati to the Baltimore & Ohio Railroad Company. The company, which formerly furnished water power, is planning to supply electricity in the near future.

CLEVELAND, OHIO.—Plans are being considered by the Cleveland Hardware Company for the construction of an addition, 40 ft. by 200 ft., to its machine shop.

SALEM, OHIO.—The Salem Lighting Company, which has been constructing a large addition to the local electric power plant and erecting a high-tension transmission line to supply energy to the plant of the Morgan Engineering Company in Alliance, 14 miles distant, it is reported, has received instructions from Washington to cease the work. A large part of the addition has been built and several miles of poles set between here and Alliance.

SAVANNAH, OHIO.—The local electric-light plant, town hall and a number of other buildings were recently destroyed by fire. The total loss in estimated at about \$50,000.

TROY, OHIO.—The electrical plant, owned by Hobart Brothers, was recently destroyed by fire, causing a loss of about \$10,000.

MOUNT OLIVET, KY.—The Mount Olivet Electric Light & Power Company is contemplating the installation of either a storage battery or a smaller (15-hp.) engine and a 10-kw., 220-volt direct-current generator. Joseph H. Kain is owner.

WHITESBURG, KY.—The Powell Coal Company, recently organized with a capital stock of \$300,000, has leased several thousand acres of coal land which it will develop. The plans provide for the installation of an electrically driven plant and establishing a town site, to cost about \$500,000. Charles Powell, Louisville, president.

INDIANA HARBOR, IND.—Contract has been awarded by the Standard Forging Company, East Jackson Street, Chicago, Ill., for construction of a new engine house and other buildings at Indiana Harbor, to cost about \$15,000.

HARRISBURG, ILL.—The Southern Illinois Light & Power Company has been granted permission by the Public Utilities Commission to issue \$94,300 in bonds.

MATTOON, ILL.—The Public Utilities Commission has authorized the Central Illinois Public Service Company to issue \$75,000 in gold notes.

APPLETON, WIS.—The Standard Manufacturing Company is planning to erect a new factory building, 120 ft. by 120 ft., to cost about \$75,000. New equipment, including electric motors, etc., is being purchased.

MILWAUKEE, WIS.—A brick and steel forge shop, 150 ft. by 200 ft. and 175 ft. high, for the production of propulsion shafts for government shipbuilding, is being erected by the Allis-Chalmers Manufacturing Company. The new shop is being built around the present forge shop. An 80-ton electric traveling crane with a runway of 200 ft. will be installed.

SHEBOYGAN, WIS.—Plans are being prepared by Juhl & Smith, architects, for a new power house, machine shop and garage, 76 ft. by 130 ft., for the Badger State Tanning Company. Bids for the work, it is understood, will soon be asked.

MINNEAPOLIS, MINN.—Contracts will soon be awarded by J. C. Thompson, 118 North Broadway, for construction of garage and machine shop, 66 ft. by 140 ft., to cost about \$35,000.

NORWOOD, MINN.—Arrangements are being made by the Northern States Power Company of Chicago, Ill., to supply electrical service in the town of Norwood. The local municipal gas plant has been ordered closed down by the state fire marshal.

FARGO, N. D.—The City Commission has authorized J. J. Jordan, city engineer, to prepare estimates of the cost of installing an electric light plant at the municipal waterworks station for lighting the city streets. The city attorney has also been instructed to draw a bill to be presented in the next State Legislature empowering cities to own and operate municipal electric-light, heat and power plants and to sell direct to consumers. Under the present law cities can only operate lighting plants.

ABERDEEN, S. D.—Bids will be received by W. E. Johnson, president of the regents of education of the State of South Dakota, Aberdeen, until April 27 for construction of Lincoln Hall on the grounds of the Northern Normal and Industrial School, Aberdeen, including arcade, boiler house, lighting fixtures, etc. Plans and specifications are on file in the office of George F. Foster, architect, Aberdeen.

SIoux FALLS, S. D.—The contract for electric wiring for parish house and sacristies of the Sioux Falls cathedral has been awarded to the Olsen-Boettger Electric Manufacturing Company, 413 North Franklin Street, St. Paul.

Southern States

OLDSMAR, FLA.—The Oldsmar Electric & Ice Company, recently organized, contemplates the installation of an electric-light plant and ice factory. Jacob Bornstein is president.

KINGSFORT, TENN.—Arrangements are being made by the War Department, Washington, D. C., for the construction of a nitrate plant on a 2000-acre site on the Carolina, Clinchfield & Ohio Railroad and the Kingsport Farms Corporation property, to cost about \$10,000,000.

NASHVILLE, TENN.—The Cumberland Power Company, recently incorporated with a capital stock of \$100,000, proposes to construct and operate an electric plant in Nashville. K. E. Longfield, F. D. Buck and others of Wilmington, Del., are interested in the project.

ALEXANDER CITY, ALA.—At an election held recently the proposal to issue \$10,000 in bonds for improvements to the municipal electric-light plant was carried.

EUFULA, ALA.—Contract has been awarded by the Eufaula Farm Products Company for a fireproof building, to cost about \$40,000. New equipment, including elevator machinery, engine, boiler, feed mill, dryer, peanut sheller, corn shucker and steam plant, will be installed.

CORINTH, MISS.—Bids will be received by the Board of Supervisors of Alcorn County, Corinth, until May 8 for heating, plumbing, lighting and clocks for the new court house, now under construction at Corinth. Plans and specifications may be obtained from N. W. Overstreet, Jackson, upon deposit of \$10.90.

PURVIS, MISS.—The City Council has engaged Xavier A. Kramer, engineer of Magnolia, to prepare plans for the installation of an electric lighting system in Purvis.

HARRISON, ARK.—The Harrison Gas & Electric Company, recently reorganized

with R. M. Fellows, president, is planning to extend the electric-lighting system, and to enlarge the cold storage plant and ice factory.

POWHATAN, I.A.—The Yarbrough Company of Powhatan is contemplating the purchase of Scotch boilers and other power plant equipment.

HARTSHORNE, OKLA.—The Choctaw Power & Light Company of McAlester is contemplating installing an electric-lighting system in Hartshorne.

KIOWA, OKLA.—The Kiowa Ice, Light & Water Company, recently incorporated with a capital stock of \$50,000, it is reported, is planning to install an electric plant and ice factory. L. T. Sammons, Mile T. Crane and others are interested in the company.

PERRY, OKLA.—The Council is considering calling an election to submit the proposal to issue bonds for improvements to the municipal electric-light plant and water-works system.

STILLWATER, OKLA.—Plans have been prepared by H. A. Pressy, engineer, Oklahoma City, for improvements to the municipal electric-light system, to cost about \$30,000. Improvements will be made to the waterworks, involving an expenditure of about \$101,000, and will include four 8-in. three-stage centrifugal pumps, reservoir, filtration plants, etc.

STILLWATER, OKLA.—Bids will be received by F. M. Gault, president of the State Board of Agriculture, Capitol Building, Oklahoma City, until May 2 for construction of science hall and armory-gymnasium building at the Agricultural and Mechanical College. Separate bids to be submitted for heating and plumbing. The general contract includes electrical work, etc. The cost of the building is estimated at about \$200,000. F. W. Redlich of Stillwater is architect.

BREMOND, TEX.—The Calvert (Tex.) Water, Ice & Electric Company is contemplating extending its electric power transmission lines to Bremond and installing an electric distributing system here.

DALLAS, TEX.—Smith & Whitney, 1405 Southwestern Life Building, Dallas, it is reported, would like to receive prices on a 300-kw., 250-volt, two or three-wire, direct-current generating set; engine to be cross compound, non-condensing, non-releasing Corliss type. An engine type generator without engine, but for direct connection to engine of above type, would be considered.

PLEASANTON, TEX.—The City Council has taken over the plant of the Pleasanton Ice & Electric Company and will install additional equipment and machinery.

Pacific and Mountain States

CENTRALIA, WASH.—The City Commission has awarded contract to the Devore Electric Company for furnishing street lamps to the city for one year.

SEATTLE, WASH.—The City Council has granted the National District Telegraph Company a franchise to install and operate a system in Seattle.

SNOHOMISH, WASH.—Among the improvements being made at the plant of the Snohomish Dairy Products Company is the installation of electric motor in several departments. Energy is supplied by the local company. An electric laboratory, with testing appliances, including an electric vacuum oven and computing instruments, has also been installed.

COTTAGE GROVE, ORE.—Machinery has been received by the Cottage Grove Electric Company which, when installed, will double the present output of the plant.

MONDOVI, ORE.—The Washington Water Power Company of Spokane is contemplating extending its electric transmission lines to supply electrical service in Mondovi and surrounding territory.

PORTLAND, ORE.—The Northwestern Electric Company has awarded contract for waterproofing the foundation walls for the power plant under construction in South Portland to the Portland Roofing Company.

FRESNO, CAL.—In order to meet the increasing demands of the oil companies for electrical service in the Kern River field the San Joaquin Light & Power Company is erecting a new substation just east of the Standard reservoir farm. This station will transform current transmitted from the Crane Valley power house district at 60,000 volts to the lower voltage required in the oil field operation. The equipment will consist of four 1000-kva. transformers with necessary switches, etc.

LOS ANGELES, CAL.—Plans and specifications for competitive bids for ornamental

lighting of more than 50 miles of the streets of Los Angeles have been approved by the Board of Public Works. Resolutions have also been submitted for supplying aqueduct power for the ornamental lamps on Broadway from California to Tenth Streets. The Municipal Power Bureau will be awarded this contract as there were no bids submitted when called by the board. The contract amounts to more than \$30,000, as globes and other equipment for the ornamental lighting system on Broadway will be included.

LOS ANGELES, CAL.—Funds to the amount of \$79,000 have been provided by the City Council for the completion of the distribution of municipal hydroelectric power at the harbor. The skeleton of the system, including the high tension feed wires, has been installed, but the money was lacking for installing the laterals and local distributing wires. The Power Department will expend \$34,000 in extending the system to the fish harbor and the balance will be utilized in gridironing the tidelands with service wires. Under a recent order of the Mayor and the Harbor Commission none but municipal power can be used at the harbor.

PASADENA, CAL.—The City Commission has approved the proposed contract with the Southern California Power Company whereby the city of Pasadena will lease the distributing system of the Edison company for a period of two years, with the privilege of buying it at the expiration of the contract. If approved by the State Railroad Commission the contract will become effective May 3.

RIALTO, CAL.—The Railroad Commission has granted the Rialto Light, Power & Water Company permission to sell its properties to the Southern Sierras Power Company for \$25,734. The Rialto Company furnishes electricity in and about Rialto. The Southern Sierras Power Company has joined with the Corona (Cal.) Gas & Electric Company, the Bishop (Cal.) Light & Power Company, the Coachella (Cal.) Valley Ice & Electric Company and the Rialto Company for authority for the Southern Sierras Power Company to purchase the last four corporations.

SAN FRANCISCO, CAL.—An agreement has been reached under which the Pacific Gas & Electric, the Great Western Power and the Sierra & San Francisco companies have consolidated (as a war measure) to operate their electric plants, both steam and hydroelectric, under one head. It was made

primarily for the purpose of conserving fuel oil and has the sanction of the State Railroad Commission and will last for the period of the war.

WESTON, UTAH.—Application has been made by the citizens of Weston to the Public Utilities Commission asking for an extension of the service lines of the Utah Power & Light Company to Weston. The town is at present without electrical service. A 5-mile extension of the Utah Company's line would be necessary, the cost of which is estimated at \$16,000.

LUSK, WYO.—Contract has been awarded by the town of Lusk to the Fairbanks-Morse Company for a 100-hp. semi-Diesel oil engine and a 60-kva., 60-cycle, three-phase, 2300-volt generator (directly connected), and a 50-hp. motor for water works, to be installed in May. L. S. Berry is consulting engineer.

BEOWAWA, NEV.—The electric plant of the Beowawa Electric Light Company has been purchased by the Nevada Valleys Power Company, which owns and operates the plant at Battle Mountain. The equipment of the local plant will be transferred to Battle Mountain and installed in the plant there.

Canada

GLADSTONE, MAN.—The Town Council is considering the installation of an electric distributing system to supply electricity for commercial, domestic and street lighting purposes.

ALVINSTON, ONT.—The project for a hydroelectric development on the Svidenham River, to cost about \$28,000, is being held in abeyance until an effort is made to secure service from hydro system.

HAILEYBURY, ONT.—The Dickson Creek Mining Company is considering the installation of electrically driven drills at its property on Dickson Creek.

HAMILTON, ONT.—E. R. Gray, chief engineer, is preparing a report to be submitted to the Board of Control in connection with the project suggested by T. J. Stewart that the transmission lines of the Toronto & Niagara Power Company be connected up with the Beach pumping station to insure a supply of energy in case of breakdown of the Hydro-Electric service.

OTTAWA, ONT.—Bids will be received by John Pearson and J. O. Marchand, Center Block, Parliament Hill, Ottawa, until April 23, for electric conduit and fittings required in the reconstruction of the Parliament Buildings. Specifications and further information may be obtained at the office of P. Lyall & Sons Construction Company of Ottawa.

TIMMINS, ONT.—A new electric generating unit, consisting of a 3750-kva. Canadian Westinghouse generator with a 4000-hp. Morgan-Smith waterwheel, is being installed in the power plant of the Northern Canada Power Company. E. S. Noble is superintendent.

TORONTO, ONT.—The Hydro-Electric Power Commission has taken over the property of the Essex County Light & Power Company of Leamington, which supplies electrical service in Amherstburg, Kingsville, Essex, Leamington, Harrow, Canard River and Cottam, at \$226,000. The system of the Essex company consists of 55 miles of 26,400-volt transmission lines in addition to distributing systems in the municipalities named and was owned and operated by the Detroit Edison Company of Detroit, Mich.

CHAMBLY, QUE.—The local dam of the Montreal Light, Heat & Power Company was recently carried away by floods.

ARCOLA, SASK.—The Arcola Light & Power Company is contemplating changing its system from single-phase, 110 volts, to three-phase, 2300 volts, and establishing a day service for a power circuit. H. Forbes Robert is manager.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until May 2, for furnishing, under circular 1214, sheet and flat steel, marine telegraphs, transformers, electric switches, testing blocks, marine brackets, carbon brushes, condulets, connectors, cut-outs, marine fixtures, plugs, rosettes, steel and copper wire, etc. Further information may be obtained at the above office.

SAN JUAN, HONDURAS.—The iron pipes furnishing water for operating the electric plant at San Juan have been blown up by dynamite. The plants have a daily generating capacity of 7000 hp.

(Issued March 26, 1918.)

1,260,424. COMMON-BATTERY TWO-WIRE REPEATER SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed July 12, 1909. Improvements.

1,260,441. HEATER FOR INTAKE MANIFOLDS OF INTERNAL-COMBUSTION ENGINES; Bert N. Parrish, Jackson, Mich. App. filed May 23, 1917. Heat generated is efficiently transmitted to the walls of the manifold.

1,260,450. ELECTRICALLY CONTROLLED INDICATOR; Earl S. Rau, Elkins Park, Pa. App. filed Nov. 29, 1916. Improved.

1,260,461. FIRE-ALARM-BELL RINGER; Wilton S. Schuyler, Savannah, Mo. App. filed July 7, 1916. Efficient and serviceable.

1,260,463. ALTERNATING-CURRENT RECTIFIER; Ray F. Seitz, Portsmouth, Ohio. App. filed July 3, 1917. For charging storage batteries.

1,260,472. STORAGE-BATTERY ELECTRODE; Thomas Spencer, Philadelphia, Pa. App. filed Aug. 21, 1915. Means for retaining the active material.

1,260,480. ELECTRICAL SYSTEM OF DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed July 8, 1916. Improvements.

1,260,481. ELECTRICAL SYSTEM OF DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed March 8, 1913. Improvements.

1,260,482. ELECTRICAL SYSTEM OF DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed May 27, 1915. Improvements.

1,260,483. ELECTRICAL SYSTEM OF DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed May 27, 1915. Improvements.

1,260,556. AUTOMATIC WEIGHING DEVICE; Frank E. Layman, Milwaukee, Wis. App. filed April 8, 1912. Accurate results when small amounts of material are weighed.

1,260,564. ELECTRIC HEATER; Carl E. Magnusson and Leslie F. Curtis, Seattle, Wash. App. filed Sept. 26, 1917. Induction type.

Record of Electrical Patents

Notes on United States Patents

1,260,591. SNAP SWITCH; Clarence C. Stirling, Hartford, Conn. App. filed June 22, 1917. Improvements.

1,260,592. JUNCTION TERMINAL BLOCK; Guy F. Sturgeon, Chicago, Ill. App. filed Feb. 10, 1915. Improvement.

1,260,607. COMBINATION LOCK SWITCH; Samuel S. Ward, Vienna, S. D. App. filed April 21, 1917. Automobiles.

1,260,613. SYSTEM OF CONTROL; Charles C. Whittaker, Wilkesburg, Pa. App. filed March 4, 1916. For governing the operation of the driving motors of an electric locomotive.

1,260,617. RAILWAY SIGNALING; Henry S. Young, Wilkesburg, Pa. App. filed Dec. 24, 1915. Improvements.

1,260,630. LIGHTNING ARRESTER; Quincy A. Brackett, Pittsburgh, Pa. App. filed June 16, 1916. Outdoor service.

1,260,647. REGULATOR AND CUT-OUT; Frank Conrad, Swissvale, Pa. App. filed April 2, 1913. Automobiles.

1,260,648. ELECTRICAL SYSTEM; Frank Conrad, Pittsburgh, Pa. App. filed Dec. 31, 1913. Controlling the rate at which storage batteries may be charged to correspond to the degree to which the batteries are charged.

1,260,649. REGULATOR AND CUT-OUT; Frank Conrad, Pittsburgh, Pa. App. filed Aug. 7, 1914. Automobiles.

1,260,661. METHOD OF RECOVERING METALS FROM ALLOYS; Julius H. Gillis, Toronto, Ont., Canada. App. filed Sept. 4, 1917. Electrolytic method.

1,260,665. CONTROLLER; Arthur J. Hall, Wilkesburg, Pa. App. filed Dec. 4, 1913. Used with switching apparatus of the rotatable drum type.

1,260,669. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Oct. 7, 1915. For effecting power-factor corrections.

1,260,666. CONTROL SYSTEM; Arthur J. Hall, Wilkesburg, Pa. App. filed Jan. 5, 1915. Dynamo-electric machines.

1,260,670. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 5, 1916. Ventilation of heavy-duty motors of the inclosed type.

1,260,674. COIL WEDGE FOR DYNAMO-ELECTRIC MACHINES; Ray P. Jackson, Edgewood Park, Pa. App. filed Jan. 2, 1915. Used in the coil-containing slots.

1,260,675. REGULATOR FOR ELECTRICAL CHARGING SYSTEMS; Edward B. Jacobson, Pittsfield, Mass. App. filed Dec. 3, 1913. Improvements.

1,260,708. ELECTRIC SWITCH CONSTRUCTION; Clarence D. Platt, Bridgeport, Conn. App. filed July 21, 1917. Inclosed type.

1,260,712. STREET AND STATION INDICATOR; Fred B. Robison, Fort Winfield Scott, Cal. App. filed Feb. 6, 1917. Improvements.

1,260,721. CONTROL SYSTEM; Francis H. Shepard, New Rochelle, N. Y. App. filed Dec. 26, 1913. Multiple-unit type.

1,260,729. METAL-FILAMENT LAMP; Johann E. C. Struve, Hamburg, Germany. App. filed March 27, 1914. Represents the contour of letters.

1,260,730. CONTACT MEMBER; Emmett W. Stull, Wilkesburg, Pa. App. filed June 18, 1913. For electrical apparatus.

1,260,742. ELECTRIC INCANDESCENT LAMP; Manfred Aron, Charlottenburg, near Berlin, and Wilhelm Keppel, Berlin, Germany. App. filed Dec. 19, 1913. Improvement.

1,260,715. TRANSFORMER AND METHOD OF MAKING THE SAME; Subo Attila, Frankfurt-on-the-Main, Germany. App. filed July 22, 1909. Adapted for use with metallic filament lamps.

1,260,717. ELECTRIC-ARC LAMP; Frederick R. Boardman, Richard V. Boardman and Frank Boardman, Upton Park, England. App. filed Dec. 17, 1913. Plurality of pairs of carbons.

1,260,750. LIGHTNING ARRESTER; Stanley C. Bryant, Chicago, Ill. App. filed July 21, 1916. Open or exposed air gaps, with the line protected by the arrester not grounded in case the exposed air gaps are bridged or filled with foreign particles.

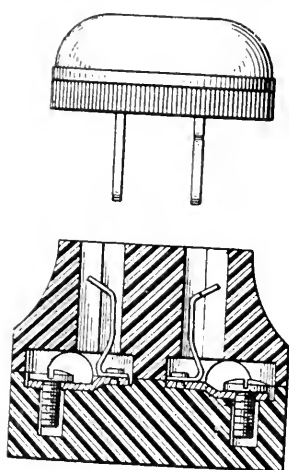
1,260,785. ROTARY RECTIFIER OF ALTERNATING CURRENT; Constantine D. Macropoulos, New York, N. Y. App. filed Jan. 21, 1914. Eliminates sparking.

1,260,809. CIRCUIT BREAKER; Lewis T. Rhoades, Mont. Chure, Pa. App. filed Sept. 25, 1917. Employs mechanical and magnetic means to interrupt the current through the induction coil.

1,260,819. APPARATUS FOR WINDING COIL CONDENSERS; Wolfgang E. Schwartzmann, Long Meadow, and Charles M. Wild, Springfield, Mass. App. filed May 16, 1916. Improvements.

1,260,830. ELECTROLYTIC DEPOSITION OF COPPER FROM ACID SOLUTIONS; Franz E. Studt, London, England. App. filed July 18, 1916. Improvements.

1,260,843. END PLATE FOR COMBINED IGNITING AND LIGHTING GENERATORS; James M. Wilson, Newark, N. J. App. filed June 30, 1915. Improvements.



1,261,649—Attachment-Plug Receptacle

1,260,853. ELECTRIC LIGHT FIXTURE; Lincoln C. Bair, Kansas City, Mo. App. filed March 26, 1917. Means for suspending bowls of different sizes from the same device.

1,260,875. ELECTRIC ARC WELDING FOR BRAZING; George W. Cravens, Westfield, N. J. App. filed July 23, 1915. Improvements.

1,260,866. BURGLAR ALARM FOR AUTOMOBILES; Thomas F. Burke, Philadelphia, Pa. App. filed June 5, 1917. Improvements.

1,260,889. SYSTEM FOR MOTOR CONTROL; Lionel Fleischmann, Berlin, Germany. App. filed April 16, 1915. Brake which is automatically applied when the motor circuit is opened.

1,260,913. RAIL BOND; Bruce C. Kixmiller, Bicknell, Ind. App. filed May 21, 1917. Electrically connecting.

1,260,930. ALARM SYSTEM; Carl F. Mead and Louis E. Richmond, Cleveland, Ohio. App. filed March 7, 1914. Fire alarm.

1,260,940. APPARATUS FOR WELDING TUNGSTEN INGOTS; Carl A. Pfanstiehl, Waukegan, Ill. App. filed July 12, 1915. Provides an electric furnace.

1,260,971. AUTOMATIC TELEPHONE SYSTEM; Alfred H. Dyson, Chicago, Ill. App. filed Nov. 13, 1906. Improvements.

1,260,982. VOLTMETERS; Frank A. Laws, Salem, and Chester L. Dawes, Cambridge, Mass. App. filed Feb. 6, 1914. Enables extreme points reached by an alternating voltage wave to be indicated and measured.

1,260,985. IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES; Carl T. Mason,

East Orange, N. J. App. filed Sept. 29, 1916. Sparking voltage is furnished by a high-tension magneto.

1,260,989. ELECTRIC ARC WELDING OR BRAZING; George W. Cravens, Garwood, N. J. App. filed July 23, 1915. Improvements.

1,260,994. ELECTRIC REGULATOR; Joseph Bijur, New York, N. Y. App. filed Dec. 1, 1909. Improvements.

1,260,995. ELECTRIC REGULATOR; Joseph Bijur, New York, N. Y. App. filed July 1, 1910. Extreme variation in a resistance element is efficiently utilized.

(Issued April 2, 1918.)

1,261,024. ELECTRIC FIXTURES; Gustav A. Harter, Chicago, Ill. App. filed March 18, 1916. Semi-indirect fixture.

1,261,048. DISTRIBUTOR FOR IGNITION DEVICES; Charles T. Mason, Sumter, S. C. App. filed Sept. 15, 1916. Improvements.

1,261,069. POWER TRANSMISSION; John G. P. Thomas, Chiswick, London, England. App. filed Oct. 11, 1913. Improvements.

1,261,079. GOVERNING DEVICE FOR MAGNETOS; Robert M. Warten, Sumter, S. C. App. filed Feb. 19, 1917. For gas engines.

1,261,086. MEANS FOR REGULATING TEMPERATURE; John C. Wilson and Horace H. Packard, Milwaukee, Wis. App. filed Aug. 16, 1912. Thermal fluid motors.

1,261,091. SAFETY ELECTRIC-CIRCUIT BREAKER FOR AUTOMOBILES; Charles Alcon, Indianapolis, Ind. App. filed Dec. 5, 1916. Means for protecting automobiles and motor-driven vehicles.

1,261,096. TESTING APPARATUS; Otto B. Blackwell, Maplewood, N. J. App. filed Oct. 2, 1916. For determining the transmission losses occurring in electrical transmitting paths.

1,261,102. CENTRIFUGAL SWITCH; Joel R. Cook, Wilkesburg, Pa. App. filed Feb. 17, 1913. For single-phase induction motors.

1,261,126. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed April 1, 1915. Magnetizable core members for dynamo-electric machines.

1,261,140. ELECTRICAL BOND FOR RAILWAY RAILS; John C. Lincoln, Cleveland, Ohio. App. filed Feb. 25, 1916. Readily attachable.

1,261,169. CONTROL APPARATUS; Karl A. Simmon and Arthur J. Hall, Wilkesburg, Pa. App. filed April 6, 1914. For dynamo-electric machines and liquid rheostats.

1,261,178. METHOD AND MECHANISM FOR REDUCING RESISTANCE OF AIR GAPS; William W. Strong, Mechanicsburg, Pa. App. filed Jan. 14, 1913. Method of deriving a unidirectional current.

1,261,193. TERMINAL FOR DYNAMOS; Harry R. Van Deventer, Sumter, S. C. App. filed June 10, 1916. Ignition dynamos.

1,261,239. GENERATING SYSTEM AND GENERATOR THEREFOR; Edward B. Jacobson, Pittsfield, Mass. App. filed Nov. 9, 1914. Battery charging.

1,261,250. STREET OR STATION INDICATOR; John O. Lough, Montreal, Quebec, Canada. App. filed March 9, 1917. Improvements.

1,261,251. ELECTRICALLY OPERATED CROSSING SIGNAL; Chester L. Lynch, Seattle, Wash. App. filed Sept. 19, 1916. Improvements.

1,261,256. THERMAL ELECTRIC CUT-OUT; Roy H. Maple, Indianapolis, Ind. App. filed Nov. 20, 1914. For use on low-voltage circuits.

1,261,266. PERMUTATION LOCK FOR AUTOMOBILES; William H. Mitchell, St. Louis, Mo. App. filed Feb. 26, 1917. One permutating-indicating device controls the valve and the switch simultaneously.

1,261,269. BATTERY; William Morrison, Chicago, Ill. App. filed Nov. 2, 1917. Storage battery.

1,261,272. APPARATUS FOR SYNCHRONIZING MUSIC AND MOTION PICTURES; Edward W. Myers, Los Gatos, Cal. App. filed Aug. 21, 1916. Improvement.

1,261,290. TELEGRAPH SYSTEM; Paul M. Rainey, Glen Ridge, N. J. App. filed May 15, 1915. Multiplex telegraphy.

1,261,345. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; Joseph Bijur, New York, N. Y. App. filed March 9, 1915. Improved.

1,261,347. ELECTRIC LIGHTING SYSTEM; William L. Bliss, Niagara Falls, N. Y. App. filed Aug. 24, 1912. For use with steam or electrically driven system.

1,261,376. MAGNETIC CONTROLLING DEVICE FOR RAILWAYS; Austen H. Fox and Arnold W. Lenderoth, Stapleton, N. Y. App. filed Nov. 8, 1915. Improvements.

1,261,386. DYNAMO-ELECTRIC MACHINE; Rudolf Hellmund and Charles W. Starker, Pittsburgh, Pa. App. filed Dec. 4, 1914. Internal ventilation during operating condition.

1,261,391. TELEPHONE DIAPHRAGM; Fred Hoyt, Seattle, Wash. App. filed Oct. 25, 1916. Improved means for mounting a vibrating diaphragm in a sound transmitter.

1,261,395. ELECTRODE AS USED FOR WELDING PURPOSES; Malcolm M. Irvine, Glasgow, Scotland. App. filed Sept. 17, 1917. Improvements.

1,261,456. SWITCH; Clarence C. Stirling, Hartford, Conn. App. filed June 22, 1917. Improvements.

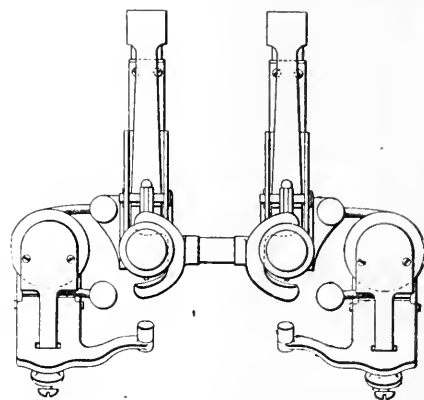
1,261,470. INDUCTION WATER HEATER; Charles A. Backstrom, Crafton, Pa. App. filed Sept. 12, 1916. Loss in the return magnetic circuit is utilized for heating the water.

1,261,477. ELECTRIC LIGHTING FIXTURE; George A. Boomer, Waterbury, Conn. App. filed Nov. 22, 1917. Improvement.

1,261,490. APPARATUS FOR RECORDING AND COMPILING STATISTICAL DATA; Wyland B. Clark and Frederick J. Pritchard, Washington, D. C. App. filed June 12, 1916. Improvements.

1,261,492. TELEPHONE SYSTEM; Hiram D. Currier, Richard I. Utter and Michael B. Stazak, Chicago, Ill. App. filed July 27, 1914. Trunking system.

1,261,510. RAILWAY-TRAFFIC-CONTROL APPARATUS; Robert M. Gilson, Pittsburgh, Pa. App. filed Aug. 11, 1916. Improvements.



1,261,677—Circuit Interrupter

1,261,578. ELECTRICAL CONTACT SHOE; William W. MacFarlane, Philadelphia, Pa. App. filed April 20, 1916. Improvements.

1,261,593. STARTER MECHANISM; William Morrison, Chicago, Ill. App. filed Feb. 14, 1916. Double rotor dynamo-electric clutch.

1,261,636. FUSE; Ray Smith, Dayton, Ohio. App. filed March 2, 1917. Fuse elements may be readily replaced.

1,261,644. ELECTRIC MOTOR CONTROL; Walter C. Strang, Yonkers, N. Y. App. filed April 4, 1913. Improved means for slowing down and stopping electric motor.

1,261,649. ATTACHMENT-PLUG RECEPTACLE; George B. Thomas, Bridgeport, Conn. App. filed July 5, 1917. Proper engagement between the jack blades and the receptacle terminals is insured.

1,261,673. ROTOR FOR DYNAMO-ELECTRIC MACHINES; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed July 28, 1916. High speed.

1,261,677. CIRCUIT INTERRUPTER; Winfield A. Atwood, Schenectady, N. Y. App. filed June 14, 1915. Movable members interconnected by an interlocking device.

1,261,698. BRAKE-OPERATED STOP-SIGNAL SWITCH FOR AUTOMOBILES; Emil Carlson, Pasadena, Cal. App. filed March 8, 1917. Signal apparatus mounted beneath the floor of a motor vehicle.

1,261,708. ELECTRON-DISCHARGE DEVICE; William D. Collidge, New York, N. Y. App. filed June 13, 1916. Improvements.

1,261,711. PROTECTIVE DEVICE; Elmer E. F. Creighton, Schenectady, N. Y. App. filed May 2, 1912. For electric circuits.

1,261,744. ELECTRICAL SWITCHING DEVICE; Arthur O. Dady, New York, N. Y. App. filed April 12, 1916. For ignition circuits of internal-combustion engines.

1,261,745. FIRE-ALARM APPARATUS; Vernon Durbin, Brookline, Mass. App. filed July 25, 1916. Improvements.

Electrical World

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Number 17

Service Restrictions on Less Essential Industries

LESS essential industries which find difficulty in procuring coal have in many instances found relief by the adoption of central-station service. This practice is fraught with great danger to public utility interests. While it is the purpose of the Fuel Administration to allow public utilities 100 per cent of their coal requirements, the administration has a right to expect that any policy it may adopt toward non-essential industries will not be thwarted in the manner above indicated. Otherwise, it may be necessary for the government to assume control over the distribution of electricity as well.

Our Great Activity in Manufacturing

TOTALS of a very impressive amount of business are being rolled up in the electrical manufacturing industry. They are the direct result of war activity demanding the largest volume of production from every essential manufacturing resource. Evidence of tremendous gross business which is most conspicuous is that furnished by the General Electric Company through the annual report issued this week. Without war munitions, which entered into the figures of 1915 and to a small extent into 1916, the value of electrical and mechanical orders received in 1917 was \$246,700,000. By comparison with the orders of the same class received in 1916, this represents a gain of 47.6 per cent, and the increase over the corresponding business in 1915 was 150.8 per cent. In other words, the electrical and mechanical orders received in 1917 were two and one-half times those of 1915. The amount of sales billed was of course substantially smaller. But the 1917 total reached the satisfying level of \$196,925,318, representing a gain of 47 per cent over 1916. One qualifying consideration should be kept in mind. That is, that in a period of sharp increase in commodity and labor costs the values mount rapidly. While undoubtedly the increase in quantity of apparatus and supplies is very great, it is not so large as the increase in values in a rising market. In round figures, this one company received orders for \$50,000,000 more than the total sales billed. This is roughly one-quarter of the production capacity represented by sales billed in the whole of last year. In general, the figures are a striking testimony to the unparalleled growth presented by the central stations, which have doubled their output since the European war started four years ago in the summer of 1914.

The Enormous Cost of Niagara as a Spectacle

PROGRESSIVE men on both sides of the Niagara frontier are agreed that even before the war a greater diversion of water from the Niagara River was justifiable and that the present emergency merely changes the word justifiable into obligatory. Sir Adam Beck in his testimony at Washington last week presented an official Canadian viewpoint with reference to Niagara, and an American viewpoint is reflected in this week's issue. It is possible, however, to present the situation very clearly, so that any layman may grasp it. In round numbers, the flow of water and the head at Niagara Falls represent 5,000,000 continuous horsepower. Even at the low price of \$10 a horsepower year, the spectacle has a potential value of \$50,000,000 per annum. Can any nature lover contend that the view is worth any such sum, and would any government be justified in appropriating \$50,000,000 yearly to reproduce the attraction? With these self-evident facts in mind, it is difficult to understand why this profligacy continues, especially when there is such urgent need of the power, a willingness to use more water on both sides of the border, and apparently nothing to stop it except the inertia of governmental bodies. Certainly this inertia is extremely costly; it even borders on the criminal and should be overcome at once.

Higher Rates Will Keep Utilities Strong

IMPARTIAL testimony as to the high value of public utility service to the community and to the nation has been forthcoming recently. The national government through various officials, American business as represented by the Chamber of Commerce of the United States, and regulating bodies such as the Public Service Commission of New York, are agreed that it is in the public interest that the utilities be kept in a condition of solvency and efficiency. This tribute is well merited, deserves to be cherished and to be advertised broadly. It is well known that, owing to constant pressure from commissions, the average price obtained for electricity has steadily diminished all through the era of rising prices that preceded the war and even up to the moment when the United States stood on the brink of hostilities. Even now, with conditions more acute, we have still to hear of a single case of ostentatious shutting down to impress upon the public the gravity of the issue. Not only have the utilities been harassed by increasing prices of all material, of labor and of money,

but added to these has been the uncertainty of the coal situation, and now the losses incident to daylight saving. That measures for relief are imperatively needed is beyond question. The government can very properly lend a hand in securing the necessary capital on reasonable terms, especially where extensions are necessary to meet the calls of war. The companies for their part are spontaneously turning to such economies as are feasible, but no permanent relief is possible without an increase in the price of electricity commensurate with the increased costs of serving the public at this time. Commissioner Whitney's statement, we trust, reflects the opinion of most of the public service commissions. At any rate, it is a good omen. The central-station industry faces a financial crisis which calls for immediate relief.

Stimulating Production by Good Lighting

THE advocates of artificial lighting curtailment as a war measure in industrial plants have received very little encouragement from lighting experts of the country. Those who have studied lighting for years realize that as an aid to rapid and efficient production, accuracy of work, prevention of accidents and keeping up the morale of a force of workers lighting is one of the first things to be considered and that the present cost of good artificial lighting either in dollars or in pounds of coal is very small balanced against loss of production efficiency of the workers due to poor light. These matters have been discussed in these columns repeatedly of late, because we conceived it to be an important war duty to aid the speeding up of production in this country by advocating lighting which will help every worker to do his best.

Frederick J. Pearson at the April meeting of the Chicago Section of the Illuminating Engineering Society briefly mentioned some commercial experiments in lighting which are full of interest both commercially and scientifically. That it has been demonstrated by a large mercantile establishment that illumination intensities considerably in excess of the intensities required for easy vision when applied to one department of a store showed increased sales traceable to no other cause than the increase in illumination is full of interest both to merchant and psychologist. It immediately brings up the question whether there is not something more than the mere improvement in visual acuity, however important that may be, to be considered in connection with increases of illumination intensity. The stimulating effect of sunshine and the depressing effect of cloudy weather are well known and in large organizations are directly reflected in the performance records of employees. If brighter lighting stimulates the customer to make purchases, may it not likewise in the office and factory stimulate the worker to more rapid and better work? In so far as it enables him to see better undoubtedly it will help, but beyond that there is an unexplored region of considerable promise, if we are to judge from Mr. Pearson's results supplemented by some well-known facts of human psychology. Just how far it may be worth while to go in the direction of brighter lighting to get this effect is, of course, as yet altogether uncertain, but when the over-all efficiency of a manufacturing establishment is the thing

most sought, rather than petty saving in one relatively small item such as artificial lighting, this is a point well worth studying and of immediate commercial importance in these times of forced production.

Standardizing Distribution Construction

IN SMALL plants no very systematic records of construction methods and material are generally to be found. A complete and systematized scheme of construction seems to be, and often is, somewhat burdensome, and there is a constant tendency to leave too much to loose memoranda or to the memory of the foreman. As the distribution system gets more extensive, lack of records leads sooner or later to an indefinite amount of annoyance. Construction departments will find H. E. Wulff's account of the standardized methods employed by the Commonwealth Edison Company a very useful guide in doing their work in an orderly and efficient manner. To establish a standard is in itself no easy matter, since every place and almost every job has its own individual character.

Perhaps the best scheme is to do the work gradually, settling down upon a few types as the dominant ones in ordinary practice and endeavoring as far as feasible to make others conform to them. If construction gangs are thoroughly saturated with the idea of doing work in a perfectly regular manner according to orderly standards, even if very simple ones, their work will be much facilitated and costs will run lower than they generally do. The system worked out for the Commonwealth Edison Company has, of course, to be elaborate by reason of the immense number of details with which it has to deal. That for the ordinary company is relatively simple, but the same general principles can be carried on throughout with admirable results. Only in a few cases will it be found necessary to adopt in its completeness a scheme based on extensive and diverse work. The plan described by Mr. Wulff seems to cover effectively about every case which is liable to arise even in the operation of a very large system. Of course, the details of the classification will differ from place to place; but the system of symbols and numbers reduced to terms of local necessities seems to be a very efficient one. Especially to be commended is the plan laid out for standardizing transformer installations, the effect of which is to obviate the necessity for troublesome and expensive changes when the size of transformers is increased to meet the burdens of added load.

Inspection and Care of Transformers

THE distribution transformer is the main stay of lighting and power service. It is likewise the element of distribution which on the whole requires the most careful watching. The paper in our current issue on the systematic inspection and care of the many transformers that come back from the lines for one reason or another is one in which central-station men should have particular interest. The most serious source of trouble with transformers is, of course, in the coils themselves; but there are subsidiary causes of trouble in the bushings, leads, oil and casings which

are often annoying. The first three of these are especially likely to be in evidence with the higher-voltage transformers. Bushings in such cases are rather large and run some considerable risk of breakage, particularly in handling the transformers. The least sign of break or looseness should be remedied by replacement at the earliest possible moment. There is constant danger of electrical leakage from a combination of dirt and oil, especially in the older type of bushings, and when repairs have to be executed the chance should be taken of replacing out-of-date forms with the later ones, which are likely to give less future trouble. To this end a good supply of spare bushings should be kept on hand so that there may be no temptation to adopt makeshifts which are very likely to prove unsatisfactory. In sealing in the new bushings particular care should be taken to see that no cracks permitting leakage are established by hasty replacements.

The transformer leads are likewise common sources of failure. They become soaked with oil, which in the case of rubber-covered leads brings serious damage to the insulation; leads are frequently broken in handling, or cut too short, and when the transformers are removed trouble is imminent. Of course, the main difficulty is with the primary leads, and constant watchfulness is required to see that the leads substituted for the old ones are adequate and are installed with particular care to avoid siphoning the oil, which stranded leads tend considerably to encourage. The oil itself cannot receive too close inspection; sooner or later it accumulates sludge and frequently absorbs moisture. It is a popular error that oil and water do not mix. They do, as every electrical man knows to his sorrow, and the utmost caution is necessary to see that the older oil has not absorbed water, and that the supply used to replace it has not been so stored as to expose it to the same risk. The higher the voltage of the transformer the more consideration must be given to this particular thing. Many a transformer has failed merely as the result of a leaky case. Constant inspection is the only road to safety. Of course, the coils themselves are always to be watched; sometimes a transformer coming in from the lines is clearly and evidently burned out beyond repair. Then, if small and old, it is probably cheaper to scrap it than do anything else with it. If only secondary coils chance to be involved and the transformer is a new one, it may sometimes be rewound at home. But the standard types can most frequently be returned for repair or exchange to the makers to the best advantage. In high-voltage transmission transformers, however, a supply of coils, kept carefully dry, is needed, inasmuch as the windings are usually of a somewhat special character and cannot be obtained without considerable delay.

The Performance of Polyphase Induction Motors

THE polyphase induction motor possesses the peculiar property that the electrical conditions which favor good performance at starting are opposite to those which favor good performance at full-speed running. In order to secure a powerful starting torque, with, say, rated-load current strength taken from the mains, the resistance of the secondary element should be relatively high; whereas, on the contrary, in order to secure good speed regulation and efficiency under normal running conditions, the resistance of the secondary element should be low. If, then, the secondary resistance is to remain unchanged, a compromise value may have to be effected, which limits good performance both during starting and during running. Advantage is sometimes taken, however, of the relatively low frequency of the secondary currents at full speed by making the secondary conductors in the form of straps, so as automatically to offer higher resistance, by edge effect, to the full alternating-current frequency encountered at starting.

The article by Justin Lebovici, beginning on page 866, discusses the relative advantages of different types of induction motors. In the case of squirrel-cage motors a strong and hardy mechanical construction is arrived at; but with no change made in the secondary resistance a compromise between starting and full-speed performance is ordinarily aimed at. If, however, the secondary is phase-wound and connected to external adjustable resistances, through strip rings and brushes, the performance can be made satisfactory during both starting and running, but the machine costs more.

An intermediate type of induction motor has long been used in which resistances carried around within the rotor secondary are short-circuited by means of a hand-operated lever when full speed is reached. The article points out the advantages which pertain to motors of this type when the secondary resistance control is made automatic by means of a centrifugal device. The starting resistances within the rotor are thus cut out of the secondary circuit as soon as the rotor attains an assigned fraction of synchronous speed.

Induction-motor designers very generally employ the phrase "torque expressed in synchronous watts." This expression is well understood, but is most unfortunate from a logical standpoint, since a torque cannot properly be expressed in watts, a torque being a couple of forces, whereas watts are power. Since, however, a torque multiplied by synchronous angular velocity develops watts, the self-contradiction would disappear if the phrase were changed to "torque expressed in watts per synchronous angular velocity."

THE current-limiting reactor is rapidly becoming an indispensable adjunct to electric service systems. In view of this fact the ELECTRICAL WORLD will tell in an early issue what considerations should be taken into account in installing it and how it should be maintained to secure the maximum effectiveness. Another article will dwell on the features of recent additions to the Northwest station of the Commonwealth Edison Company, which will shortly be equipped to generate 165,000 kw. with

The Coming Issues

six units. Some of the problems connected with the support of long-span conductors will be discussed in another article contributed to by several prominent Pacific Coast engineers. Factors which must be taken into consideration in selecting, installing and operating motor and control apparatus for industries which are found in nearly every section of the country will also be discussed. A precision method of measuring alternating currents will be explained.

Waste of Power at Niagara

Company Trying to Co-operate in Winning the War, but Continued Unwillingness of Congress to Act Means Insufficiency of Power for Growing Industrial Requirements

AT NIAGARA, the scene of the mighty cataract, there is a power famine. While water falls away over the cliffs great industries, most of which are busy on war work, suffer for lack of sufficient power to operate their plants at the full capacity for which they were designed.

The Niagara Falls Power Company, says Stacy C. Richmond, the president, "is endeavoring in every way to co-operate with the United States War Department to make Niagara power of the greatest possible service toward winning the war."

CONGRESS IS HELD TO BE TO BLAME

Yet in his annual report to stockholders Mr. Richmond is forced to explain that the insufficiency of power at Niagara to supply present requirements is due largely, if not wholly, to the continued unwillingness of Congress, since the question of federal control of Niagara diversion was first raised in 1906, to enact permanent provision for the subject and to fix the status and the rights of the companies which had constructed expensive plants pursuant to authority of New York State and had been lawfully operating for many years before their rights were first called into question.

During this time the Niagara company has stood ready upon any reasonable permanent settlement of its rights at least to complete its original undertaking, says Mr. Richmond. This would have substantially doubled the present output of the American plant with little, if any, diversion of water above the amount now in use by it under the existing temporary permit.

The permit for the additional diversion and the authority of the Secretary of War to grant like permits will expire with June 30, 1918, unless meantime Congress shall take further action, as the resolutions of Congress expressly provide that a diversion of any water from the Niagara River after that date in excess of the limitations of the expired Burton law shall be a misdemeanor subject to punishment by heavy penalties.

President Richmond refers to the Secretary of War's order of Dec. 28, 1917, under which the President of the United States requisitioned until further notice the total quantity and output of electric power produced or capable of being produced by the company as well as that delivered to it in the United States from Canada. The order provides that it must be given precedence over any and all orders theretofore placed with the company. Its effect deprives, therefore, some customers of power heretofore delivered them under contracts of long standing and for long terms, increasing the supply to others whose products the federal administration considers more essential to the successful conduct of the war.

Increases in the demands for the indispensable products of Niagara power have been caused by the war. "The federal authorities now have recognized

the fact," comments Mr. Richmond, "that the amount of Niagara power available is wholly inadequate for use in the production of sufficient quantities of the articles required to supply the nation's needs and at the same time to supply ordinary business requirements."

Operations in Canada are affected by the attitude of the authorities there. The tenth unit in the plant of the associated Canadian Niagara Power Company was completed and placed in commercial service in January, 1917. The generating installation of that company is now somewhat in excess of 100,000 hp. As showing that more energy could be generated in this plant the company says that its present head works, power house and tunnel are adequate for the installation of another large generating unit.

"The Ontario government, however," says Mr. Richmond, "now claims that the present rights of the Canadian company are limited to the production of 100,000 hp. In this view the company finds itself unable to concur."

Some changes in the Niagara situation are promised by the proposed consolidation of the Niagara Falls Power Company, the Hydraulic Power Company and the subsidiary of the latter company, the Cliff Electrical Distributing Company. This consolidation is authorized in a bill which has been passed by the New York Legislature. Under its terms the rearrangement of securities is subject to the approval of the Public Service Commission.

FIFTEEN MILLION DOLLARS FOR NEW PLANT

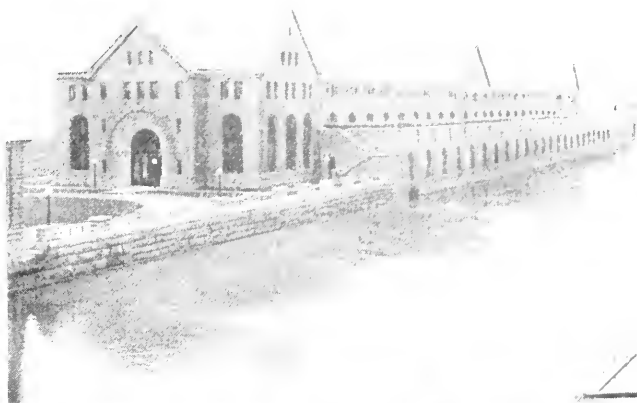
It is estimated that this consolidation will be followed by the expenditure of \$15,000,000 for new plant and equipment and that with co-ordination of the properties there will be a total resultant increase in output of 170,000 hp. over the energy that is now generated by the existing properties. Unification of the properties was favored by a representative of the War Department who testified at the hearings before a committee of the Legislature. It is, therefore, as a war measure that the matter has been subjected to investigation and urged before the Legislature with such effect that that body took action.

It is calculated by the Niagara Falls Power Company that for at least the period of the war double the present output of all existing plants could be sold in the districts reached by the power supply.

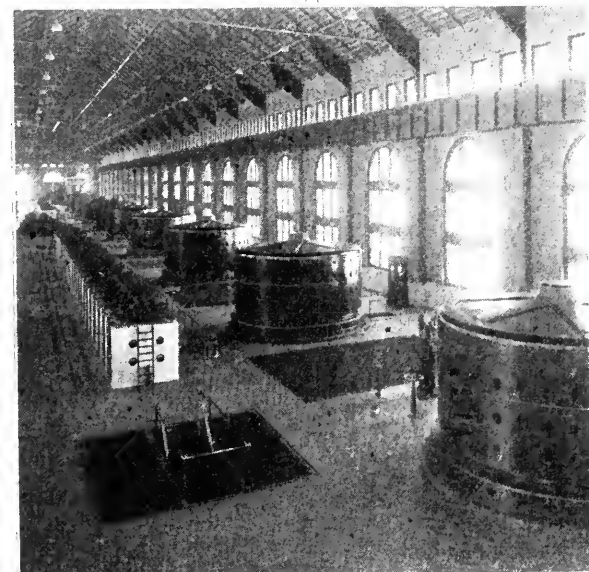
No one will minimize the present urgent demand for power for industries vitally necessary to the war. The industries at Niagara and in the nearby cities reached through transmission lines require power in peace or war time. Grave need of conservation of coal supplies and of the time of labor and the service of transportation point to the logical conclusion that unessential waste should stop. The scenic beauty of Niagara can be preserved while at the same time more water is diverted and conservation made a fact.



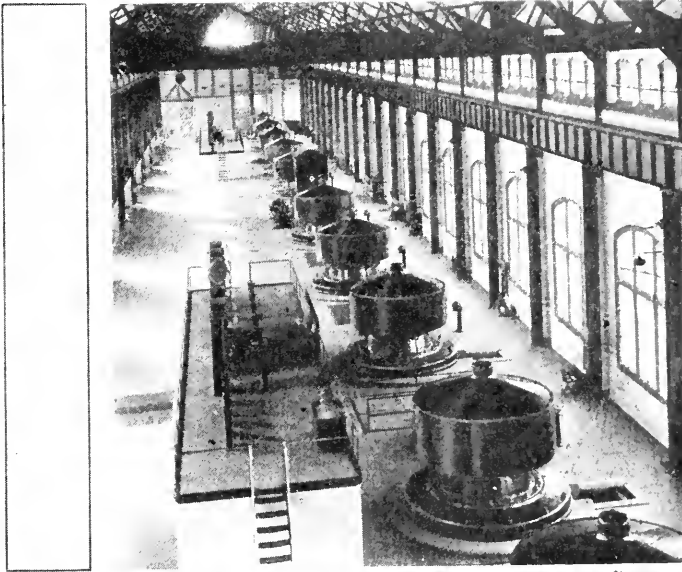
Power House of the Canadian Niagara Power Co.



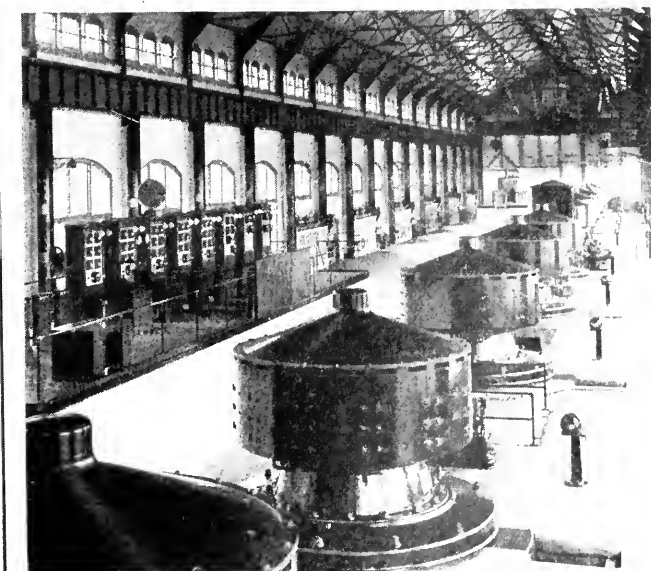
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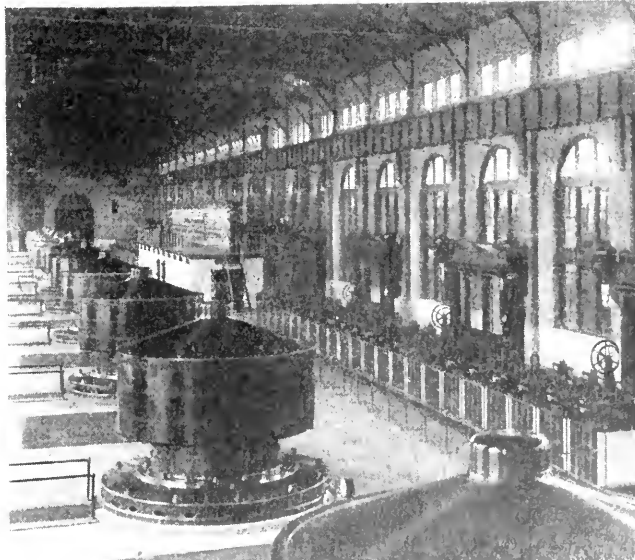
Interior Power House, Canadian Niagara Power Co.



Interior Power House No. 2, The Niagara Falls Power Company



Interior Power House No. 1, The Niagara Falls Power Co.



View in Power House No. 2, The Niagara Falls Power Co.

Performance of Polyphase Induction Motors

Choice Should Depend on Nature and Magnitude of Load, Allowable Starting and Running Current, Frequency of Starting and Efficiency of Operation

BY JUSTIN LEBOVICI

Designing Engineer, Triumph Electric Company

TO DETERMINE what type of induction motor is best suited to a particular application it is, of course, necessary to know the nature and magnitude of the load, the allowable starting and running current, the frequency of starting and the relative characteristics of the different types of motors. In what follows the writer will therefore compare some of the commonly used types of polyphase induction motors, taking into consideration different methods of starting them.

SQUIRREL-CAGE MOTORS

I. *Resistance in Series with Primary Winding.*—The torque T in synchronous watts is given by

$$T = M_s I_s^2 R_s / S \quad (1)$$

where M_s represents the number of phases in the secondary winding, I_s is the secondary current per phase at full load, R_s is the resistance per phase, N is the ratio of starting current to full load current, and S is the slip. In starting $S = 1$, and assuming $I_{\text{start}} = NI_s$ and substituting in (1) the starting torque

$$T_1 = M_s N^2 I_s^2 R_s \quad (2)$$

Combining (1) and (2),

$$T_1 = SN^2 T. \quad (3)$$

Allowing a full-load slip of 4 per cent and a starting current equal to three times full-load current, $T_1 = 0.04 \times 3^2 \times T = 0.36T$, or about one-third normal torque will be developed with three times full-load current taken from the line.

When started with resistance in series with the primary winding, a squirrel-cage motor having 4 per cent slip at full load will take at least five times full-load current from the line in order to develop full-load torque. Evidently this method of starting is inefficient when a torque of from two to three times normal value is needed, but it does not affect the generator regulation so severely as an auto-transformer. Since the resistance is cut out gradually there is no rush of current such as occurs in motors started by means of an auto-transformer when the handle is thrown over from the starting position to the running position.

II. *Auto-Transformers.*—When an auto-transformer is used in starting squirrel-cage motors it reduces the voltage at the motor terminals and the value of the locked current in the same proportion. The primary winding of the auto-transformer will draw less than the motor current from the line, the amount being inversely proportional to the reduction in voltage.

For a normal 50 hp. squirrel-cage motor with a locked current of six or seven times normal, three times full-load line current will be obtained on approximately the 65 per cent tap. The motor current is greater than the line current by the ratio of transformation ($3/0.65 = 4.6$ times normal current) and for a full-load slip of 4 per cent the starting torque $T_1 = 0.04 \times 4.6^2 \times T = 0.85T$. This exceeds double that in case I for the same

line current, so this method is not advisable when two to three times full-load starting torque is needed and the line current limit is three times full-load current (Fig. 1).

For the sizes of motors under consideration (5 hp. to 75 hp.) the scheme of connections shown in Fig. 2 is in common use. The auto-transformer is Y-connected, the motor being a normal star-connected or delta-connected motor. There is no appreciable drop in phase I between the terminal A and the line L_1 , but there are drops in the auto-transformers between the line L_1 and the terminal B and between the line L_2 and the terminal C. The result is that the voltages AB, BC and AC applied to the motor terminals are unbalanced, which results in a reduction of the starting torque of the motor per ampere taken from the line as shown in Fig. 3.

III. *Star-Delta Connection.*—A delta connection of the primary winding for the running condition and star during the starting period is equivalent to a 58 per cent tap on the auto-transformer and reduces the starting torque and line current to about one-third of full-voltage values. The purpose of the starting device

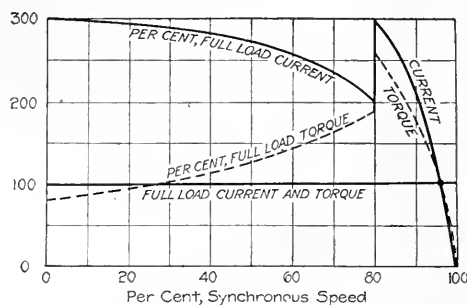


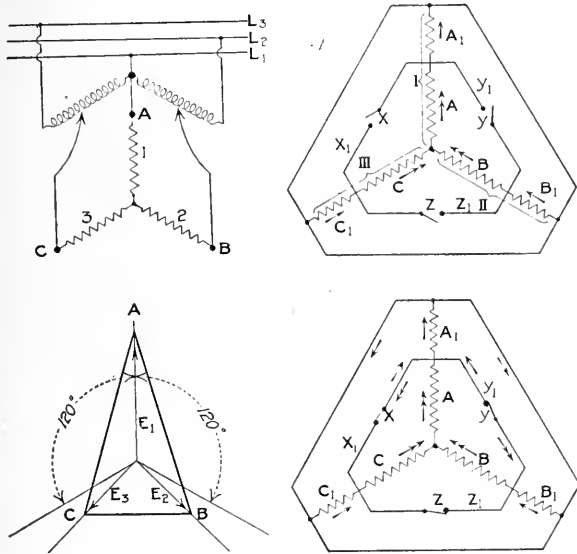
FIG. 1—STARTING CHARACTERISTICS OF SQUIRREL-CAGE MOTOR ON 66 PER CENT TRANSFORMER TAP.

Current and torque in per cent of full-load values based on the assumption that a tap is used on the auto-transformer limiting the line current to three times normal. The lever is thrown over to the running position at 80 per cent of full-load speed, which results in a rush of current just before the motor reaches full load speed of four to five times normal current. This does not take into account the drop in voltage in the auto-transformer itself, which may easily reach 15 per cent of the voltage applied at the motor terminals, owing to the intermittent service for which this apparatus is designed.

is to limit the line current to such a value as not to cause fluctuations in voltage which might affect other apparatus on the same circuit.

General Remarks.—The undesirable fluctuation in voltage when a squirrel cage motor is started may be due either to the excessive current taken from the line or its low power factor affecting the regulation of the alternator and the transformer. An auto starter introduces a considerable wattless component of current, owing to the leakage of the auto-transformer and to the high magnetizing current made necessary by the intermittent duty for which auto-transformers are built. Auto-transformers require the attention of a skilled operator to prevent their burning out owing either to maintaining the lever in the starting position

too long or to line disturbances caused by changing over too quickly. If line disturbances are to be avoided, it is impossible to start induction motors by any of the above methods when a starting torque of one and one-half to three times full-load torque is required. To pre-



FIGS. 2, 3, 4 AND 5—USE OF Y-CONNECTED AUTO-TRANSFORMER FOR STARTING AND UNBALANCING OF VOLTAGES PRODUCED; SELF-STARTING MOTOR CONNECTIONS IN STARTING AND RUNNING CONDITIONS

The rotor shown in Figs. 4 and 5 is connected in a single star winding, each phase being split in two parts of unequal resistance. Phase I is divided at A and A_1 ; phase II into two parts, B and B_1 ; phase III into parts C and C_1 . Variable resistances are obtained by winding A , B and C with a different-size wire of unequal number of turns and wound with a different resistance material from A_1 , B_1 and C_1 . During the starting period the groups A and A_1 , B and B_1 , C and C_1 are connected in series as shown in Fig. 4. From the junction point between windings A and A_1 , B and B_1 , C and C_1 , leads X_1 , Y_1 , Z_1 are brought to one side of the switches X , Y and Z , the other sides of the switches X , Y and Z being connected to a short-circuiting ring. While the motor accelerates from zero speed to about 80 per cent of full-load speed, the switches X , Y and Z are open, but at the latter speed they are automatically closed.

vent the rotors of the squirrel-cage motors sticking at a subsynchronous speed when starting, it is necessary to make the resistance of the end rings sufficient to give the motor a torque above the friction torque. The starting torque can be improved by using deep slots and bars in the rotor, as this construction will increase the effective resistance at or near stand-still. On the other hand, if the bars are too deep the secondary slot leakage is increased, resulting in a low power-factor motor. Hence advantage can be taken of the deep rotor bar only to a limited extent if the normal load characteristics of the machine are to be maintained.

PHASE-WOUND ROTOR

Resistance in the Secondary.—From equation (2) it can be seen that increasing the secondary resistance R_2 raises the starting torque of the motor. As soon as the pull-out torque is reached, however, a further increase in resistance will reduce the starting torque, because I_2 drops faster than R_2 increases. Starting wound-rotor induction motors with resistance in the secondary is efficient and desirable as it is possible with a skilled operator to keep the current to a minimum during the entire starting period. The efficiency of the motor is not affected by the high starting resistance because it is cut out of circuit when the machine is operating under full-load conditions.

Since this method of starting necessitates the use of a phase-wound rotor, slip rings, brush holders and

brushes, however, it is more expensive than using a squirrel-cage motor with auto-starter control in the primary. On the other hand, the wound-rotor controller is more durable, having only to short-circuit the resistance steps instead of breaking the circuit. There is less burning out of controller fingers, and the starting operation is quieter, but if the controller handle is moved too quickly over the contacts sudden rushes of current are liable to occur. In order to minimize the cost of the complete outfit, one single resistance step can be used in each phase and assembled on the rotor, thus eliminating slip rings and brush rigging.

For most industrial applications, such as the operation of motor-generator sets, pumps, blowers, line-shafting, cotton mills, wood-working machinery, etc., the internal secondary resistance must not be too high because the efficiency of the machine is directly affected by the copper losses in the secondary; and a slip as high as 6 to 8 per cent is considered prohibitive in such motors.

STARTERLESS MOTORS

Several types of starterless motors have been developed which will be briefly described before comparing them with the motors mentioned. For instance, Boucherot employs two separate fields, one of which is capable of rotation (either mechanically or by means of an induction regulator), the fields opposing each other during the starting period, one being gradually rotated

RELATIVE ENERGY CONSUMPTION, HEATING DURING ACCELERATION, AND TIME TO ACCELERATE FOR SQUIRREL-CAGE AND STARTERLESS MOTORS*

Speed (Per Cent Synchronous Speed)	Input to Accelerate (Hp.-sec.)	Average Power Available (Hp)	Time to Accelerate (Sec.)	Average Line Current (Per Cent Full-Load Current)	Loss (Kw.-Sec.)			Temperature-Rise in Rotor (Deg. C.)	
					Rotor	Stator	Total	Bars or Copper	End Rings
0-10	9.6 9.6	2.05 7	4.60 1.37	300 286	177 105	87.5 9	264.5 114	10 18	36 ...
10-20	28.8 28.8	6.7 16	4.32 1.80	296 266	160 120	79 10	239 130	8.2 19	32.4 ...
20-30	47.8 47.8	13.3 29.8	3.60 1.60	293 240	135 87	66.5 7.5	201.5 94.5	7.6 10.5	27.5 ...
30-40	67.8 67.8	18.85 38.3	3.60 1.76	282 215	130 73	64 7	194 79	7.2 12.5	26.2 ...
40-50	86 86	27.2 43.5	3.16 1.98	272 185	105 64	52 5.5	157 69.5	5.9 11.5	21.2 ...
50-60	106 106	37.3 45.8	2.84 2.32	265 145	85 46	42 4	127 60	4.8 8.5	17.3 ...
60-70	121 124	45.7 45	2.72 2.76	247 120	71 37.5	35 3	106 40.5	4 6.8	14.4 ...
70-80	145 145	57.6 39.8	2.51 3.65	200 70	43 17	21 1.5	64 18.5	2.4 3	8.8 ...
80-90	165 165	118 58.5	1.12 2.83	367 230	61 47.5	31.5 12	95.5 59.5	3.6 ...	13 ...
90-100	180 180	95 65.0	1.90 2.77	180 130	26 15	13 4	39 19	1.5 ...	5.3 ...
Squirrel cage total			30.37				1487.5 †	55.2	202.1
Starterless total			22.84				684.5	89.8	

*Bold face type refers to starterless motor.

†Does not include auto transformer losses, which would probably be 20 per cent more, or 1790 kw.-sec.

until it coincides with the other in rotation. Another type of motor which is extensively used involves a high-resistance squirrel-cage or phase winding for starting and a low-resistance polyphase rotor winding which is open during the starting period but closed when the

motor is nearing full speed. Another scheme proposed by Boucherot is to use two squirrel-cage windings, one of high resistance and low reactance active during the starting period, and one of low resistance and high reactance (at the high rotor frequency which occurs during the starting period), to assist the first squirrel cage after the motor has attained full speed. The use of

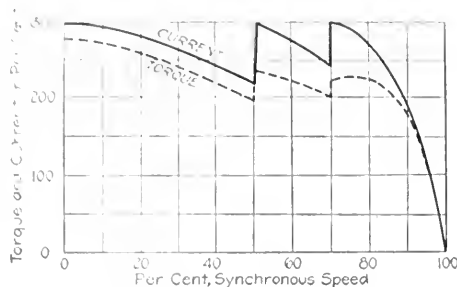


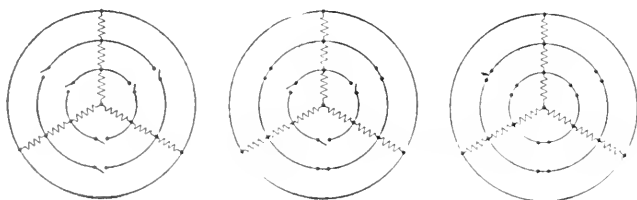
FIG. 6—STARTING CHARACTERISTICS OF SELF-STARTING MOTOR

Motor operates on principle shown in Figs. 4 and 5. The curves are obtained from a 50-hp., 1200-r.p.m., 60-cycle motor and are counterparts of those shown in Fig. 1 obtained from a squirrel-cage motor of the same rating.

deep narrow slots has been mentioned to increase the skin effect during starting and thus increase the starting torque.

To prevent the crawling of squirrel-cage motors at subsynchronous speeds Punga has proposed using a combination of a phase winding and a squirrel-cage winding in which the coils are embedded in slots and connected to an end ring. The pitch is so chosen that one side of one coil lies under a tooth and the other side of the coil lies under a slot opening. The pitch of the coil is such that the seventh harmonic is avoided. J. Fisher-Hinnen had proposed tubes having high specific resistance material as rotor bars, these being connected to end rings in the usual manner. Rods of low-resistance material fitting into these tubes are gradually inserted in the tubes as the motor is speeding up. Use is also made of a three-phase rotor of normal construction equipped with carbon-disk resistors in each phase. As the rotor speeds up centrifugal weights increase the pressure between the carbon disks, thus decreasing the rotor resistance.

A self-starting motor which works on the principle shown in Figs. 4 and 5 has just recently been developed. With this type the initial investment can be minimized and in many instances greater efficiency can be obtained.



FIGS. 7, 8 AND 9—SELF-STARTING ARRANGEMENT OF ROTOR WINDING FOR LARGE MOTORS

The starting torque (Fig. 6) can be made any value up to the pull-out torque of the motor by properly selecting the resistance of A , A_1 , B , B_1 , C and C_1 , and the slip under normal operating conditions can be made relatively low. The practicability of operating the motor by remote control and where it will not receive expert attention is another feature.

By properly selecting the pitch of the rotor winding the tendency to creep or stick at a subsynchronous speed is eliminated. If for any reason the supply voltage fails, the motor stops and the rotor connections automatically return to the starting connections and no damage to the motor due to the supply voltage results. It is this feature which makes this type of motor applicable for remote control.

With the arrangement shown all of the rotor windings are active during the starting period and also while running, but not to the same extent. The completed rotor winding is not different from an ordinary phase-wound rotor, and any difficulties due to assembling the revolving resistance units are eliminated. The centrifugal device for changing the rotor connections from the starting to the running condition is simple and rugged, there being only three rotating switches to be closed. The switches X , Y and Z never break a circuit, thus eliminating burning at the contacts, a most troublesome feature of switches operating in air. In larger machines the windings A_1 , B_1 and C_1 of Figs. 4 and 5 are split and short-circuited successively. The performance of a 75-hp. motor having the rotor winding divided as shown in Figs. 7, 8 and 9 is shown in Fig. 10. The torque is equal to $M_2 N_2^2 I_2^2 (R_2' + R_2'')$, where

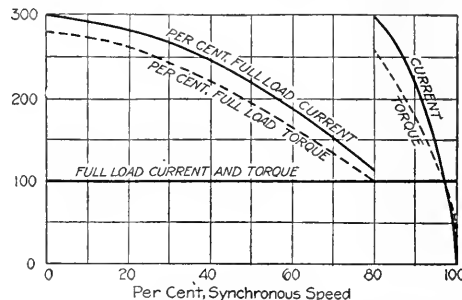


FIG. 10—PERFORMANCE OF MOTOR STARTED BY PRINCIPLE SHOWN IN FIGS. 7, 8 AND 9

R_2' and R_2'' are the resistances of A , B , C and A_1 , B_1 , C_1 respectively.

COMPARISON OF ENERGY CONSUMPTION AND HEATING DURING ACCELERATION

Data on the relative energy consumption and heating of squirrel-cage induction motors and the self-starting motor just described are given in the accompanying table. To permit comparison it is assumed that the entire weight to be accelerated is concentrated in a flywheel on the rotor shaft, a 60-in. (152-cm.), 750-lb. (340-kg.) flywheel being selected for this example. Three-phase, 60-cycle, 50-hp., 1200-r.p.m. motors having the characteristics shown in Figs. 1 and 6 are considered. In both cases it is assumed that the starting current is limited to three times the full-load current. This puts a premium on the inefficient motor, but in the case under consideration the full-load efficiency and current are approximately the same for both motors, although the distribution of losses is different.

Owing to the fact that the cost of the auto-transformer is eliminated with the starterless motors, it is possible for the same expense to design this machine with somewhat more liberal dimensions than the squirrel-cage motor, use higher rotor resistance, lower primary resistance and obtain lower core losses, thus permitting the same over-all efficiency but improved starting characteristics.

From the data it can be seen that the squirrel-cage motor plus a starter consumes 2.73 times as much energy as the starterless motor to accelerate the same load to full speed. A slip-ring motor, if properly handled, will effect a still greater saving, but the starterless motor is cheaper in first cost and simpler to operate and maintain.

A squirrel-cage motor having the bars and end rings correctly proportioned would give nearly the same results during the starting period, but the full-load slip would be high, the full-load efficiency low and the heating of the machine under continuous operation prohibitive. Such motors are limited in their application to elevator and allied intermittent use.

Government Wages to Electrical Men

Analysis and Classification of Compensation Provided for Next Fiscal Year for More Than 1200 Men Engaged in Different Electrical Occupations That Contribute to the Nation's War Program

IN THE estimates of appropriations required by the several United States government offices and executive departments for the fiscal year to end June 30, 1919, are found the salaries and wages for electrical men of all kinds.

Compensation is not at all regular. Some salaries are on an annual basis, some are monthly, some per diem, and still others on an hourly rate. The list runs all the way from a salary of \$4,800 per annum for an electrical engineer to \$1.04 per diem for electricians.

Provision is made for a total of 860 electricians, wiremen and helpers. Chief electricians are to receive as high as \$2,280 per annum and as low as \$1,400 per annum. Electricians are to receive on the annual basis as high as \$1,800 and as low as \$360; on the monthly basis from \$60 to \$150, and on the per diem basis from \$1.04 to \$6. Wiremen are to receive annual payment as high as \$1,950 and as low as \$900; on the per diem basis from \$2.52 to \$4.80, and 74 cents hourly. Helpers in a few cases are provided for at an annual or monthly rate. They are generally on the per diem basis, which ranges in their case from \$2 to \$4. The hourly basis rate is 42 cents.

Electrical engineering talent is generally provided for on an annual salary basis. These salaries range from \$1,200 to \$4,800. Electrical experts are to receive as high as \$12 per diem and as low as \$4. Electrical draftsmen will average \$5.35 per diem, ranging from \$3.76 to \$12.48. In the electrical engineering class positions are made for 193 men.

To take care of the various kinds of plant and line work provision is made for 223 men. Generally speaking, these places call for annual or monthly salaries.

All told, the estimates call for the employment of 1276 electrical men. The detailed figures on the number to be employed, the different groups, and the average compensation to be paid, together with the upper and lower limits, are to be found in the accompanying tables:

Number of Electricians and Rate	High	Low
5 chiefs, average \$1,776 per annum.....	\$2,280	\$1,400
263, average \$1,122 per annum.....	1,800	780
20 from \$360 to \$1,000 per annum.		
3 from \$480 to \$900 per annum.		
8, average \$119 per month.....	150	100
2 from \$60 to \$90 per month.		
3 from \$90 to \$140 per month.		
349 from \$1.04 to \$6 per diem.....	6.00	2.40
9 assistants, average \$1,129 per annum.....	1,240	1,000
8 helpers, average \$857.50 per annum.....	1,080	720
26 helpers, average \$2.81 per diem.....	3.25	2.50
20 helpers, from \$2 to \$3 per diem.		
3 electricians and helpers from \$4.50 to \$6 per diem.		
5 electricians and helpers, from \$3 to \$3.80 per diem.		

Number of Electricians and Rate	High	Low
1 electrical worker, \$75 per month.		
2 electrical workers from \$480 to \$600 per annum.		
14 wiremen, average \$1,176 per annum.....	1,950	900
7 wiremen, average \$4.18 per diem.....	4.80	2.79
6 wiremen from \$2.52 to \$2.76 per diem.		
94 wiremen, at 74 cents per hour.		
4 helpers, from \$2.50 to \$4 per diem.		
5 helpers at 42 cents per hour.		
3 wiremen and helpers, \$600 to \$840 per annum		
ENGINEERING		
57 electrical engineers, average \$2,136.....	\$4,800	\$1,080
3 electrical engineers and mechanical engineers, average \$2,017.....	2,250	1,800
1 electrical engineer and draftsman, \$1,400.		
1 chief electrician and mechanical engineer, \$2,500.		
4 electrical expert aides, average \$9.64 per diem..	12.00	4.00
1 electrical expert aide at \$1,800 per annum.		
1 assistant electrical expert aid at \$5.76 per diem.		
23 electrical draftsmen, average \$5.35 per diem...	12.48	3.76
1 draftsman and electrical expert, \$8 per diem.		
6 electrical copyists, \$2.92 per diem.		
1 assistant engineer and electrician, \$1,800 per annum.		
8 engineers at \$1,375 per annum.....	1,600	1,200
17 electrical machinists or machinists and electricians, average \$1,294 per annum.....	1,400	1,200
10 electrical assistants, average \$1,280 per annum.	1,500	1,200
67 electrical inspectors, average \$1,740 per annum.	2,000	1,200
1 electrical inspector, at \$8.40 per diem.		
PLANT AND LINE WORK CONSTRUCTION		
1 foreman at \$1,100 per annum.		
1 wire chief at \$1,875 per annum.		
8 cable splicers, average \$142 per month.....	\$165	\$74
1 cable erector at \$1,800 per annum.		
1 superintendent of maintenance and construction, \$300 a month.		
1 chief lineman at \$1,200 per annum.		
1 foreman lineman at \$7½ cents per hour.		
1 foreman lineman at \$900 per annum.		
15 linemen, average \$155 per month.....	150	110
6 linemen, average \$1.24 per diem.....	4.96	3.75
4 from \$4 to \$6 per diem.		
33 at 70 cents per hour.		
2 high-tension linemen at \$175 per month.		
PLANT		
5 supervisors, average \$225 per month.....	\$250	\$200
23 foremen, average \$169.50 per month.....	200	135
2 power superintendents, average \$225 per month.	300	150
2 stationary engineers at \$225 per month.		
1 electrical recorder at \$200 per month.		
3 wiremen operators, at \$165 per month.		
21 switchboard operators, average \$155.28 per month.....	187.50	140
3 substation operators, at \$1,200 per annum.		
2 telephone operators, average \$97.75 per month.	103.50	92
2 operators, from \$75 to \$90 per month.		
3 operators, at \$90 per month.		
25 chauffeur-operators, at \$75 to \$120 per month.		
14 dynamo tenders, average \$995 per annum.....	1,080	875
7 dynamo tenders, at \$4 per diem.		
8 skilled laborers, at \$2.50 per diem.		
6 wheel tenders, at \$2.50 per diem.		
9 battery repairmen, average \$151.40 per month..	162.50	137.50
1 instrument repairman, average \$165 per month.		
7 signal maintenances, at \$150 per month.		
1 engine man and erector, at \$900 per annum.		
3 switchboard men, at \$360 per annum.		

Standardization of Overhead Construction

Considerations That Were Taken Into Account in the Determination of the Types of Line Construction Now Used—A Numerical System of Specifying That Has Been Found of Assistance in the Reduction of Costs

BY H. E. WULFING

Commonwealth Edison Company, Chicago

STANDARDIZATION of construction in any line of work results in decided advantages at any time, but especially so under present conditions. There are a few advantages peculiar to overhead line construction which will bear emphasis. First, standardization eliminates the carrying in stock of special material to satisfy the ideas of the several foremen or

for the Commonwealth Edison Company of Chicago are given in the following paragraphs.

In this program of standardization, which extended over a period of two years, several requirements were considered. They were safety, simplicity, neatness in appearance, uniformity, practicability, fitness for a progressive construction program, and cost.

HOW CABLE POLE CONSTRUCTION WAS STANDARDIZED

In order to give a concrete illustration of the manner in which some of these requirements have been met, the steps followed in standardizing a cable pole will be explained. When the standardization of cable poles was considered it was found that there were several types of construction in existence. This condition existed because men in charge of work in various districts had followed their own ideas and worked independently. The best type was selected, and the question of safety was first considered. This pole contained six alley arms and three buck-arms and was designed to carry twelve potheads. It was found that the safety of the pole could be improved by adding another arm, on which the linemen could stand while inspecting lightning arresters. This further loaded the already overburdened and unsightly pole. While the question of safety had thus been taken care of, simplicity of construction and neatness in appearance had been neglected. In order to attain this it was necessary to reduce the number of arms on the pole.

It was found that the number of cases in which it was necessary to install twelve potheads on a cable pole were few. Therefore it was decided to design the cable pole for eight potheads, taking care of the cases in which twelve potheads were needed by setting another cable pole. This permitted the reduction of the

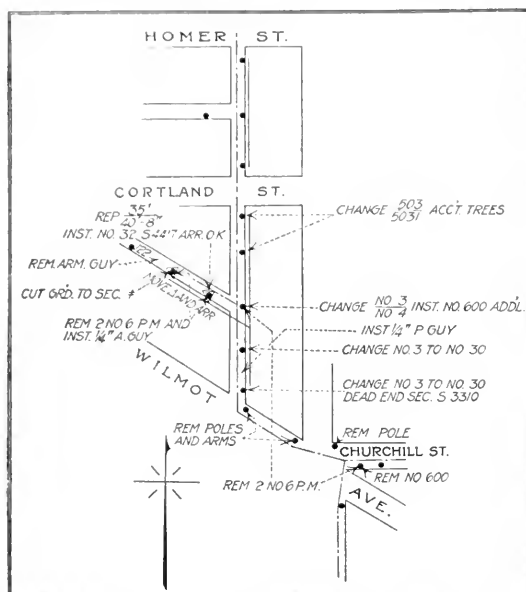


FIG. 1—TYPICAL METHOD OF INDICATING WORK ON JOB ORDER

superintendents engaged in the work. Next, it reduces the amount of material which has to be carried in stock by reducing the number of kinds of units needed. Third, it permits of accurately determining in advance the correct amount of material needed on each job, since the material for each standard is definitely known and the material for a job will be equal to the sum of the material for the standards in connection with the job. In addition, it increases the efficiency of the gang, owing to the fact that the repeated performance of a job in a definite way increases the speed with which it is done. Again, it establishes uniform construction throughout the system. Sixth, it permits a comparison of the relative value of the gangs, as each gang does the same units of work in the same manner. And last, but not least, it reduces the cost of doing the work.

The establishment of standards for overhead construction is not so simple as in most other work, however. No two jobs are alike and, while the elements of a job may be similar, the conditions under which it will be done are different in each case. However, if overhead line work is to be made uniform, simple, neat in appearance and easy to designate, there must be standards. The method of establishing such standards

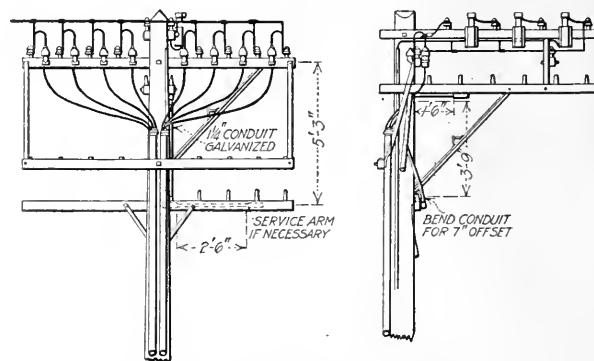


FIG. 2—STANDARD CABLE-POLE CONSTRUCTION ADOPTED

number of buck-arms by one. The standing arm, which was originally installed for safety in inspecting lightning arresters, was then eliminated by installing the non-inspecting type of lightning arresters. Further consideration resulted in the elimination of services from the cable pole, and a standard was finally adopted having only three buck-arms and four line-arms as

against the old type, which had four buck-arms and seven line-arms. The new standard (Fig. 2) is safer, simpler, neater in appearance, more practicable and costs less than any construction which was formerly used.

A good illustration of progressive construction is given by the present type of standards for transformer

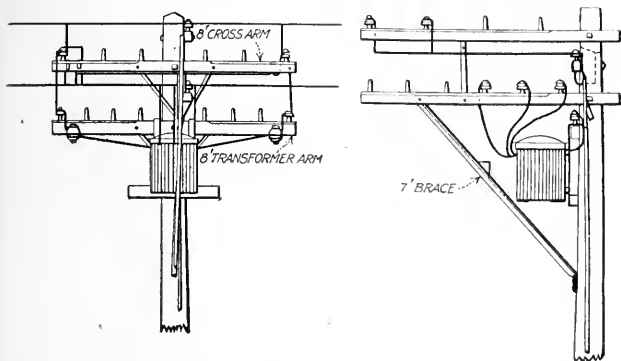


FIG. 3—TYPICAL CONSTRUCTION FOR SMALL TRANSFORMER INSTALLATIONS

installations. An investigation of the different types of construction brought out the fact that, as was found with the cable poles, there were many methods of installing transformers. It was also found that as the load on a transformer increases, and it is necessary to increase its size and therefore increase the strength of the equipment for holding the transformer, it would be practically necessary in most cases to dismantle the previous construction and rebuild the transformer pole. Safety and appearance were already fairly well taken into consideration, so that the main question was one of progressive construction.

In the plan which was finally adopted the transformers are divided into groups with a type of installation for each group. The installations are so planned that when it is necessary to increase the size of a transformer of one group to the next larger it is merely necessary to add another arm without disturbing the existing equipment other than the transformer itself. Incidentally, simplicity and neatness in appearance were attained by providing heavier arms to sup-

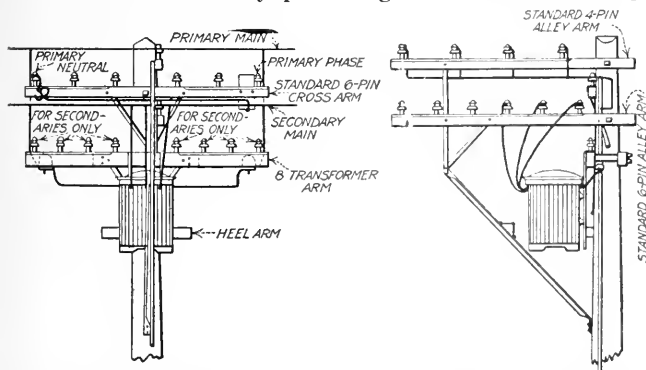


FIG. 4—AMPLE SPACE IS PROVIDED FOR LARGE TRANSFORMER BY BRACING USED, WHILE EXTRA STRENGTH IS AFFORDED BY DOUBLE BUCK-ARM HOLDING TRANSFORMER

port the transformers rather than by doubling the smaller sizes of arms (see Figs. 3 and 4). A change from the construction shown in Fig. 3 to that in Fig. 4 can be made by merely adding a short buck-arm for additional strength without any change in wiring.

Once having established a standard, there are two things to be accomplished in order to put this standard

into effect: First, to familiarize the man on the job with the construction standard; second, to devise a scheme for specifying the standard on the job print. In order to keep the man on the job in touch with standard construction, each gang foreman is supplied with a book of standards known as the "Overhead Construction Specifications." This book is pocket-size and contains a description of the methods of construction and prints of all the standards commonly used, together with a list of material for each type of construction. The foreman is thus furnished with authoritative information on whatever work he has in hand.

On account of the large number of standards of overhead construction, it was evident that some system of symbols must be adopted in order that the standards

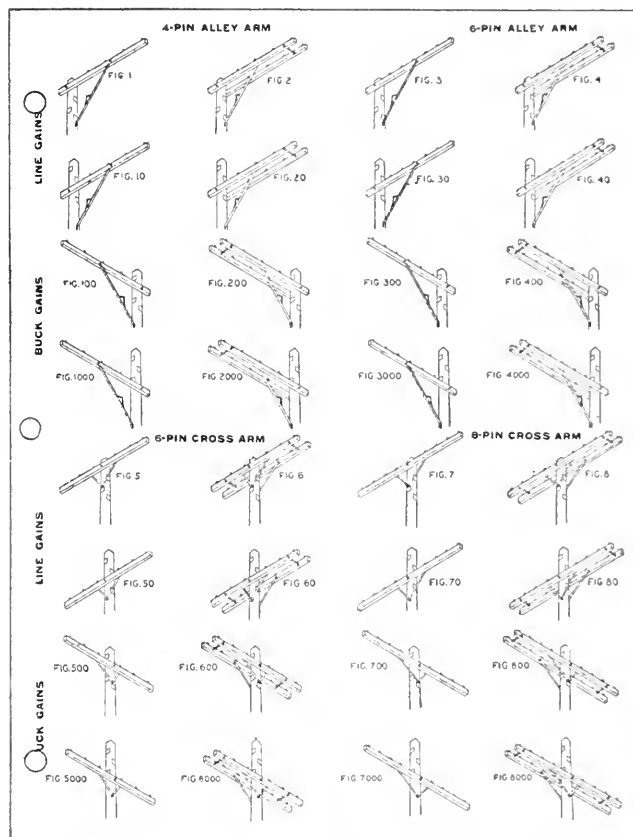


FIG. 5—POLE-TOP CONSTRUCTION CLASSIFIED BY POSITION OF CROSS-ARMS ON POLE

might be classified and to permit ease of reference and specification on the job print. For this purpose the standards are divided into groups according to types—for example, cable poles in one group, transformer poles in another, line poles in another, etc. To each group is given a series of numbers sufficient to take care of the present standards and to allow for future standards that may be established. These symbols or numbers for designating the different types of standard construction permit ready reference to the various groups and allow the use of simple specifications on the prints and job sheets. The foreman and men soon become familiar with the symbols and refer to the types of construction by symbol numbers instead of by description.

In attempting to establish standards for the overhead work, it was found that they naturally divide themselves into two groups—one line poles, the other special

poles. The number of special poles is limited, and it was a simple matter to assign symbol numbers to them; but when it came to the question of assigning symbol numbers to line poles it was found that there were so many possible combinations of arms on a pole that the making of a sketch and assigning symbols to each combination was out of the question. It was therefore necessary to establish some scheme that would permit the definite designation of the arming of a line pole without the necessity of assigning to each group of arms a separate sketch and symbol.

Study on a scheme of this kind resulted in the application of a decimal system (Fig. 5) for designating the arming of line poles. For instance, referring to the group of small figures in this illustration, Fig. 1 is a four-pin alley arm on the top line gain. When placed on the second line gain it is called Fig. 10; on the first buck gain, Fig. 100, and on the second buck gain, Fig. 1000. The arm doubled is designated by the next even number. In other words, the number designates the arm, and the units, tens, hundreds or thousands in a figure designate the position of the arm on the pole. For example, Fig. 30 represents a six-pin alley arm on the second line gain—the figure 3 identifying it as a six-pin alley arm, and its being in the tenth position identifying its location on the second line gain.

The specifying of the arming of a line pole is thus reduced to a symbol consisting of no more than four digits, and any combination of four arms, either single or double, on any of the four positions can be specified by means of the decimal system shown. To illustrate further: Fig. 632 designates the arming of an ordinary line pole from which a service is taken and specifies that a double four-pin alley arm is installed on the top line gain, a single six-pin alley arm on the second line gain and a double six-pin buck-arm on the first buck gain. The simplicity of the designating of the arming of line poles should be evident.

STATUS OF POWER SUPPLY IN THE JAPANESE EMPIRE

Installed Capacity of Electrical Plants Is More Than 500,000 Kw., with 460,000 Kw. Additional Under Construction at Close of 1917

According to the official publication of the Department of Communications, the status of electrical industry in Japan at the close of 1917 was as follows: Central stations, 582; electric railways, 40; central stations and railways, 48, a total of 670, or an increase over 1916 of 42.

Total capital for central stations, \$182,347,955; for railways, \$21,423,985; for railway and central stations, \$159,443,346, making a total of \$363,215,285, an increase over 1916 of \$31,038,335.

The generating capacity in kilowatts at the close of 1917 for the different classes was as follows:

	Central Stations	Railways	Central Stations and Railways	Total	Increase Over 1916
Completed:					
Water	327,458	180	73,799	401,439	26,553
Coal	49,251	1,175	64,936	115,362	5,667
Under construction:					
Water	278,911	850	17,307	297,068	44,738
Coal	118,419	3,450	41,400	163,269	137,674
Total:					
Water	606,369	1,030	91,106	698,505	71,291
Coal	167,670	4,625	106,336	298,631	132,007
Both	774,039	5,655	197,442	977,136	203,298

Safest on Earth—Liberty Bonds

Book Review

THE LIGHTING ART. By M. Luckiesh. New York: McGraw-Hill Book Company, Inc. 230 pages, 43 illustrations. Price, \$2.50 net.

This latest of Mr. Luckiesh's admirable little books on light and color deals particularly with the artistic side of the subject in its various forms of application. The engineering technique of lighting has been many times dealt with in other specialized books, but, since Mrs. Gordon's "Decorative Electricity" many years ago, this is the first which has been devoted chiefly to the artistic finesse of artificial lighting. It therefore forms an admirable supplement to the literature of illumination. Particular attention should be directed to Mr. Luckiesh's consideration of artificial daylight and other special color modifications of illuminants. He is, perhaps, a little optimistic regarding artificial daylight and its applications, a most interesting development which has not yet proved especially fruitful. There is a subtle psychological situation which lies back of simulated daylight. To the ordinary eye all varieties of so-called artificial daylight look blue if anywhere nearly fully developed toward their ideal. The north sky is, of course, notorious for its large proportion of blue light, but this tone is strongly modified in interiors, so that if an artificial illuminant matches real north-sky light it still appears, if at all concentrated, strongly blue to the eye. None of the artificial daylights as yet produced is entirely free from objection, but they can be and are made to produce all degrees of approximations to the various phases of natural light. It is not so much the amount of variation from natural light that is important as it is the kind, and Mr. Luckiesh points out that certain devices producing an apparently good simulation are still bad on account of their weakness in certain colors. A given tint can be very closely matched by lights varying enormously in spectral composition. If the variation is in the usual direction suggested by a comparison between north sky and sunset, the eye, accustomed to just this particular kind of variation in its daily life, takes relatively little cognizance of it.

Another modification that enters into the subject and is briefly discussed by Dr. Luckiesh is the toning of relatively white electric lights to the warmer and to many eyes more pleasant hue produced by candle flame or oil lamp. The interesting point about this special problem is that the illumination thus toned can be obtained at a very much higher efficiency than that actually obtained for a similar color in using the old carbon lamps. This fact depends on the nature of the color filtering, which has proved to be a very difficult task, particularly since the most efficient color screens are of dyes which have been found to be somewhat fugitive. Mr. Luckiesh's volume should prove interesting to the general reader and particularly valuable to architect and decorator.

Buy Bonds, Still More Bonds

Condition of Electric Utilities in the War

Economic Factors Are Menacing, but They Are Balanced to a Certain Extent by Position of Companies as "Essential" Industries and Assurance of Great Demands for Power

WAYS of meeting the unprecedented conditions under which public utilities labor are discussed in reports to stockholders. Many details of special interest to the companies are presented from experience and they show that great care and wise forethought are needed to guide the properties through the troublesome problems of the present year. While readjustments of rates have been made in many communities, these changes alone have not removed all difficulties. Even where these increases have been approved by the state regulating commissions, they are not always adequate. The paramount issues of insufficient generating capacity to meet war demands, of cost as well as scarcity of materials, of uncertainty as to revenues and of depletion of forces by the national military exigency remain menacing. The shifting conditions which these influences promise for the future look serious, but they are certainly balanced to some extent by the fact that the utilities are in no doubt as to their rank as "essential" industries. Whatever else happens, the great electrical generating and distributing systems are assured that their output is one of the first products required for public service and winning the war.

PUBLIC SERVICE CORPORATION

Reviewing the 1917 operations, President Thomas N. McCarter of the Public Service Corporation of New Jersey said:

"The enormous increase in the cost and the shortage of labor; the vast increase in the cost of every commodity used in the operation of these properties, and the difficulty of obtaining materials all combined to create an unprecedented situation which is reflected in smaller depreciation charges and net earnings. The fuel bill alone of the three operating companies was approximately \$2,500,000 in excess of what it would have been for the same amount at 1916 prices."

The amount spent in maintenance, however, says Mr. McCarter, "largely exceeded that spent in previous years, owing to increased cost of labor and materials, and the properties have been well maintained."

Reference is made to the application for rate increases. A new electric schedule was authorized recently by the New Jersey commission.

The services of 833 trained men were lost to the operating companies, that number of employees having joined the army and navy. "While their loss is felt, this manifestation of loyalty to country is a source of gratification," Mr. McCarter adds.

In addition to serious difficulty in securing coal, the subsidiary Public Service Electric Company was materially handicapped "by the failure of manufacturing contractors, owing to war conditions, to deliver apparatus and supplies as promised." Nevertheless, much new construction was completed or begun.

"The policy of furnishing power in large amounts to customers at transmission voltage was continued, and

the tremendous demands made upon the company for war purposes necessitated a number of important installations of this character," writes Mr. McCarter. "It may be interesting to note that it is estimated that 67 per cent of the company's connected power load is being utilized indirectly in war business."

The net charge for capital expenditures by the Electric Company in the year was \$4,880,463.

NORTH AMERICAN COMPANY

President James D. Mortimer of the North American Company says that the process of procuring adjustments to compensate for increased costs of labor, fuel, supplies, taxes and money is very slow.

He declares that "public utilities are confronted with that same psychological inertia which has for years confronted the steam railroad carriers and brought about the congestion of facilities which reached its climax during the winter."

Mr. Mortimer expresses the hope that it will prove fortunate in the long run that the regulating commissions having jurisdiction over the utilities in the states in which the subsidiary utilities operate have not hesitated to assume jurisdiction over applications for increased rates.

Concerning financing and new construction, Mr. Mortimer writes:

"Immediately after the decision which resulted in the United States joining in the world war all the subsidiary companies put into effect changes by which their plans for expansion of plant and facilities were greatly contracted. Only that construction work was continued which was necessary to avoid losses or to carry out contracts incurred in prior months. Permanent financing of much of their capital expenditures has been impossible except at interest rates higher than the returns yielded by the business during even normal times. Depreciation reserves accrued during the year have been invested in additional plant and facilities and in materials and supplies. A very restricted construction program during the year 1918 and subsequent years as long as the war continues will leave reserve accounts available for the gradual payment of the indebtedness incurred during the year just closed."

Coal price fixing, says Mr. Mortimer, "has granted only partial relief. Operating expenses have been raised to a high plane from which complete relief is not yet in sight. Unit operating revenues have as a rule continued to decline, and the margin between revenues and costs has been contracted from both directions."

A temporary increase in electric rates of the Milwaukee Electric Railway & Light Company has been authorized by the Wisconsin Railroad Commission.

In discussing the affairs of the Missouri subsidiaries Mr. Mortimer mentions the acquisition by the Union Electric Light & Power Company of St. Louis of 3200 acres of coal lands. The property is near Duquoin, Ill.,

75 miles from St. Louis. The amount of workable coal is estimated at 36,000,000 tons, and the development of production is planned during 1918.

Referring to the successful policy adopted by the Union company of selling preferred stock to customers, Mr. Mortimer says that up to Dec. 31, 1917, a total of \$1,903,300 was subscribed.

As indicative of capital expenditures in 1917 the reports of some of the principal North American Company subsidiaries may be given. Expenditures of the Milwaukee Railway & Light Company, for additions, extensions and betterments, other than purchase of the Commonwealth Power Company system, amounted to \$2,328,405. Milwaukee Light, Heat & Traction Company expenditures were \$1,068,292, and those of the Wisconsin Gas & Electric Company were \$920,128. For the Union Electric Light & Power Company of St. Louis the total, excluding purchase of the Electric Company of Missouri, was \$3,537,012, but because of the removal from service of property valued at \$829,208 the net amount was \$2,707,804.

CITIES SERVICE COMPANY

The radical change in operations of the Cities Service Company is pointed out by President Henry L. Doherty in a statement showing the sources of gross revenues. In 1915 public utilities furnished 95 per cent of the \$4,479,800 total and oil operations 5 per cent. In 1916 public utilities contributed 55 per cent of the \$10,110,343 total and oil 45 per cent. In 1917 the aggregate amount was \$19,252,493, of which public utilities furnished 24.6 per cent and oil 75.4 per cent.

Speaking of fuel and labor costs and the cost and difficulty of delivery of supplies, Mr. Doherty said:

"Government restrictions and regulations regarding decorative and sign lighting and the development of the federal policy of safeguarding and extending service to essential industries by the curtailment of supply to non-essential users have introduced additional problems into an already difficult situation."

It became apparent, Mr. Doherty continues, that "service, earnings and investments could be protected only by increasing rates." Nearly every subsidiary was called upon to make adjustments. While this work was complicated by variations in rate-making authority in different states, consent was obtained during the year to adjust power and industrial rate schedules for practically every property.

After speaking of the new plant construction at Toledo, Mansfield, Ohio; Joplin, Mo., and Warren, Ohio, Mr. Doherty says: "Extensions to meet large industrial war requirements are under consideration. Progress on these, however, will be affected by plans for financing such requirements."

More than 750 employees entered government service, and President Doherty remarks that "it should be a source of patriotic satisfaction to all stockholders that the business of the subsidiaries is of essential usefulness in the prosecution of the war."

SOUTHERN CALIFORNIA EDISON COMPANY

The last year was one of material expansion for the Southern California Edison Company, Los Angeles.

Acquisition of various properties makes the company, with its constituents, President John B. Miller writes, "one of the largest in size of the great central-station

systems of the United States." The ramified system serves approximately 1,500,000 population. The electric properties comprise seventeen hydroelectric and eight adjunct steam-generating stations with combined capacity installed of 302,430 hp.

"In general," Mr. Miller says, "we have endeavored to administer the affairs of your corporation along public-spirited, patriotic lines." In addition to the 280 officers and employees who have joined the colors, two directors are "dollar-a-year" men in Washington.

W. A. Brackenridge, vice-president and general manager, notes that the interconnection of systems, putting into fullest use all developed hydroelectric power in Southern California, will result, based on average water conditions, in a saving of 781,000 barrels of oil per annum, equal to 75 per cent of the 1917 oil consumption by these properties.

Power is needed, water powers are running to waste. Mr. Brackenridge declares that to provide for increasing demand the work of completing and placing in operation additional plants "should be undertaken at the earliest possible moment." More than 800,000 undeveloped hydroelectric horsepower is available in watersheds in which the company's principal power plants are located. Immediate necessities could be met by two installations providing 60,000 hp. more for \$8,500,000.

"Their output in substitution for steam power," adds Mr. Brackenridge, "would conserve approximately 1,100,000 barrels of oil per annum during average water years."

At request of the federal Fuel Administrator, the company has signified its willingness to distribute the output of additional small hydroelectric plants of the city of Los Angeles over its system in substitution for steam-plant generation with fuel-oil consumption.

"All necessary and reasonable requests for service received prompt attention," Mr. Brackenridge says, although financial conditions were not favorable for heavy expenditures during the latter part of the year.

While power was in demand from every quarter it is significant that the greatest increase in demand has been for agricultural purposes.

"There is every indication," Mr. Brackenridge states, "that the demand for electric energy for power service in southern California will be unusually heavy in 1918. The agricultural business has been enormously stimulated. The question with the average farmer to-day is, not, Shall electric power be used for pumping water? but, rather, Can electric power be obtained?"

"Along industrial lines every present condition in connection with fuel costs, scarcity of materials and increased operating expenses indicates that electric energy is what every manufacturer wants and must eventually have. Under existing conditions the principal problem for the company will be to obtain deliveries of material and equipment to keep up with the increasing demand for energy which must surely come."

That part of the total load which might, on a war basis, be termed "non-essential" does not exceed 10 per cent, the remaining 90 per cent being for transportation, agriculture, shipbuilding and general manufacture essential to the successful prosecution of the war.

It is necessary, continues Mr. Brackenridge, "to provide for considerable extensions to distributing systems and for additional hydroelectric equipment." Capital expenditures in 1917 were \$3,716,092.

Transformer Inspection as Economic Measure

Chances of Failure Are Decreased if Transformers Are Issued Thoroughly Clean and Dry and with Leads and Bushings Intact—Practical Methods of Caring for Apparatus and Detecting Flaws

THOROUGH inspection of all distribution transformers returned from the lines should be made before they are again issued for service, first to lessen the chance of failure after replacement on the lines, and second to minimize the labor required in making the installation. Chances of failure are decreased if transformers are issued thoroughly clean and dry and with leads and bushings intact. Moreover, it is evident that minor repairs and adjustments can be made better and cheaper in the shop than by the installation crew in the field.

BUSHINGS NEED CLOSE ATTENTION

Bushings should always be carefully examined, as they are a frequent cause of failure. This is particularly true of the higher voltage classes (11 kv. to 22 kv.) owing to their sizes and greater liability to breakage. A break is not always evident from a casual examination, and each bushing should be shaken to disclose any looseness. A broken or loose bushing, especially a primary bushing, should always be repaired before the transformer is again utilized, since it is almost certain to break down in wet weather and may, under certain conditions, cause a burn-out of the transformer windings.

As most bushings are broken in handling transformers after shipping crates have been removed, means should be provided for protecting them. This is especially necessary with the corner bushings of the flaring petticoat type used in transformers designed for moderately high distribution voltages since the insulators project beyond the re-entrant corners in the case. Some companies provide wooden angles which are bolted to the hanger lugs and encircle the bushings, thus eliminating breakage when the transformer swings against an obstruction.

Although more liable to breakage, double petticoat bushings with long leakage surfaces and deep recesses seem to give better service than the straight or corrugated types. The recess seldom becomes entirely filled with oil and dust, regardless of how much the lead may siphon oil. Furthermore, leakage will not occur across the clean surface between the two parts of the shell. On the other hand, the cylindrical types, whether plain or corrugated, usually become coated with dust whenever there is any oil leakage, and breakdown often results.

In renewing bushings in any line of transformers advantage should be taken of the most recent designs that may be accommodated in the outlet holes. Thus it will be found that the early white cylindrical types may in some instances be replaced with corrugated brown glazed bushings, which, having a longer leakage surface, are less liable to break down.

It is important that bushings which are suitable for the service be chosen. Substitutions should not be made unless the new type is superior to the old. A full supply of spare bushings should be carried in stock so that

makeshifts will be unnecessary. A blue-print schedule showing the catalog numbers of primary and secondary bushings required for each tank number should be prepared with the assistance of the manufacturers for each line of transformers handled. This will be found of service both in expediting purchases and in selecting repair parts from store-room stock.

When installing new bushings a grade of sealing compound such as is specially recommended by the manufacturers for this purpose should be used. All of the old compound should be removed before the new bushing is placed. If the bushing is of the type set in with babbitt (those inserted from the outside are usually set in with babbitt, paper lock washers or some similar device), this metal also should be completely removed. In chipping out old bushings and compound provision must be made for catching the scraps to prevent their falling into the coils or bottom of the case. Bushings of the curved styles are best made up complete with leads before insertion in the transformers. The more simple styles, which are easily filled with compound, may be filled in place.

HEATING COMPOUND TO RIGHT TEMPERATURE

Care must be taken to heat the compound to the proper temperature before pouring; otherwise cracks will result. The entire corner of the case in which the bushing is placed should be heated so that the compound will not be chilled on striking the metal. To chill the compound will often result in a leak between it and the case. Much of the oil leakage which occurs around leads and bushings is not caused entirely by siphon action along or through the lead, but may be due to cracks between the bushing and the sealing cement or between the latter and the case. This leakage will not occur unless oil is slopped onto the compound, but it is practically impossible to avoid this in handling a filled transformer. To avoid leaks of this character, not only should hot compound be used, but the surface of the compound above the bushings should always slope in toward the center of the case. This can be effected by tilting the transformer while the compound is being poured as well as while it is hardening. Where the compound must be built up a temporary paper dam may be installed, and after the cement has set it can be removed. This scheme also makes it possible to raise the level of the cement above the top of the bushing so that the bushing and recess may be filled in one operation.

Bushings should be kept clean. It is a good plan to incorporate in all directions covering the installation of transformers a note to wipe bushings carefully after the transformer is in place. Most of the oil and dust which, if left on a bushing, are so likely to cause breakdown are accumulated during transportation from the store room to the job. If the bushings are cleaned after the transformer is hung, this cause of trouble is largely avoided. When transformer tanks are being painted care must be taken not to get paint on the bushings, as

the rough paint surface will tend to gather dust. Bushings of the larger types should be wrapped with cloth or paper while cases are being painted.

HOW TROUBLE WITH LEADS MAY BE PREVENTED

Next to bushings, leads require most frequent attention. They are often broken in handling or are cut short when transformers are removed. In addition, they deteriorate because of the siphoning of oil. Secondary leads of the types of transformers under discussion are invariably rubber-covered. Primary leads are usually rubber-covered, although some manufacturers have recently used varnished cambric insulation for voltages of 11 kv. and up. Each material has its advantages. Rubber withstands weather and moisture well, but it is deteriorated rapidly by oil. This weakness is its most serious defect as oil is often siphoned over the leads. Varnished cambric, on the other hand, while benefited by oil, does not withstand weather well when protected only by a braid covering. It is easily dried out by hot weather and is liable to absorb moisture in wet weather. These remarks apply, of course, only to the leads outside of the case; those inside are always insulated with varnished cambric.

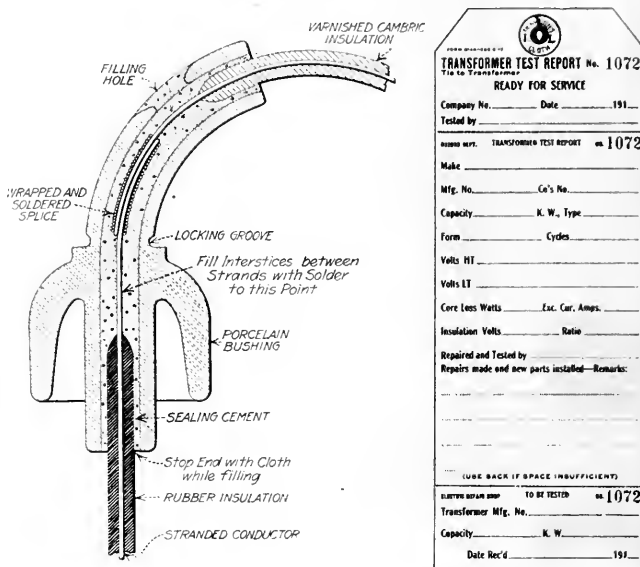
In arranging for shop repairs to transformer leads it is first necessary to prepare a schedule of cables to be used in making renewals, in order to secure uniformity in purchases and repairs. This is preferable to attempting to replace the old lead with one precisely similar in size, insulation and stranding to that installed at the factory, since in the past manufacturers have differed considerably as to these details in transformers having identical ratings. To follow these deviations would require an unnecessarily elaborate stock of cable. A schedule which has proved satisfactory in practice is given herewith for two classes of transformers, for an 11,000-volt and a 2300-volt line. The cables selected, especially those used for primary leads, have not been chosen exclusively on a basis of their usefulness as transformer leads, but also with a view to their use in the wiring of substations and similar work, in order to avoid the carrying of overlapping stocks. All cables are specified as single-braid, rubber-covered. However, if any are to be used extensively in outdoor work, as for instance in wiring between cut-outs and transformers, they may be specified as single-braid and tape. The rubber insulation is 30 per cent Para for the 11-kv. leads and N. E. C. for the others.

It is evident that cable much smaller than No. 6 might be used for the smaller sizes of 11-kv. transformers. However, the expensive part of cable is the insulation, therefore little saving per foot can be effected by ordering a smaller size. Since this size is used extensively in transformer installation wiring, short pieces are usually available for leads which might otherwise be wasted.

The greatest difficulty in installing leads is to prevent the siphoning of the oil. If this happens, the oil will rapidly deteriorate the rubber of the leads and in addition will gather dirt on leads and bushings and thus increase the danger of breakdown. Where the primary terminal blocks are under oil, as is the case in most recent types of transformers, solid conductors may be inserted between terminal block and bushing to prevent the siphoning which would be caused if stranded leads were used. Where stranded conductors are used the

splice between the inside portion of the lead (which is insulated with varnished cambric) and the outside rubber-insulated part, as well as all interstices between strands for a short distance on each side of the splice, should be thoroughly filled with solder.

The splice in primary leads should be placed so as to be completely surrounded by sealing compound, and the short, bare and solder-filled portions on each side of the splice should likewise be covered (Fig. 1). A wrapped splice is generally used. Secondary splices and some of the simpler primary splices are placed above the compound. The varnished-cambric insulation of the secondary should be started above the oil level. After filling a bushing with compound, tape should be wrapped around the outgoing lead at the point where it leaves the bushing to prevent the compound from running out before it has set. After the cement has hardened this tape should be removed; otherwise all the oil which may leak between lead and compound will gather at this point and rapidly eat away the insulation.



FIGS. 1 AND 2—BUSHING CONSTRUCTION THAT PREVENTS SIPHONING; THREE-PART TRANSFORMER TEST REPORT

Instructions should be issued to line crews cautioning them against handling transformers by the leads. Transformers are frequently dragged along the ground or truck bed by the leads or are kept from swinging into the pole when being raised by lines attached to the leads. This practice results in many broken leads and bushings.

When new leads are installed they should be made long. In some types of pole installations one additional foot of primary lead will permit direct insertion of the lead into the primary cut-out without a splice.

Some line foremen make use of the connectors provided on the leads by manufacturers, and use care in handling them; others appear to consider them superfluous and often cut them off. Instructions should be given to use these whenever present, as they are considerable labor savers, especially in the larger sizes, and will give no trouble if properly installed. Any connectors which are not used should be left taped to one of the leads so that they will be available if necessary in some future installation. In removing transformers foremen should be cautioned to cut the feeds between the connectors and the line and not the leads between

the connectors and the transformers. The connectors may then be saved in the shop. Many leads are cut so short through carelessness that they must be replaced before the transformer can be reissued for service.

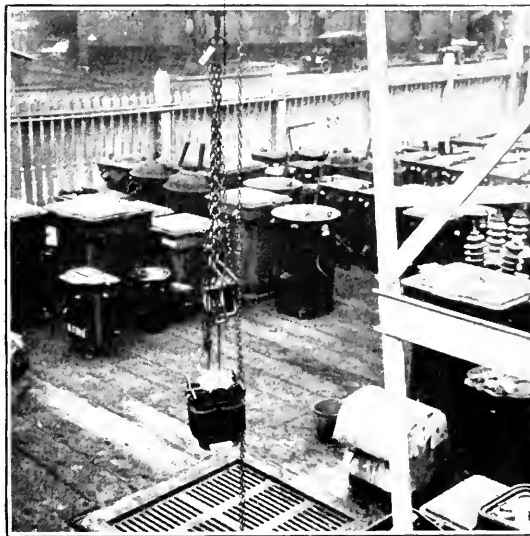
PAINTING OF CASES AND CARE OF OIL

Cases should be repainted whenever transformers are brought in from the lines, unless they have been installed only a short time. Sheet-steel cases especially will deteriorate rapidly unless protected by paint and if rusted should be given two coats. Before paint is applied it is necessary to clean the case thoroughly with distillate and a steel-wire brush to remove all dirt and oil. A good quality of turpentine asphaltum paint will be found serviceable for this work. If a system of company numbers is in use, numbers should be restenciled on transformer cases as soon as they are slightly obliterated. A white-lead and linseed-oil paint should be used for this purpose. Stencils $2\frac{1}{2}$ in. (6.35 cm.) high may be readily deciphered from the ground, still

before they leave the storeyard; this, however, is not always possible. If the old oil is not removed when transformers are returned from the lines, an inspection should be made to see that the oil is up to the proper level. Schedules of transformers showing tank symbols and quantity of oil required for each line of transformers in service should be readily available. It should be noted that transformers of the same make and type but of different form may require quite different quantities of oil.

CLEANING OF TRANSFORMERS AND DETECTION OF FLAWS

The cleaning of the coils of transformers removed from the lines requires careful consideration, especially if they have been installed a considerable time and sludge has been precipitated by the oil. The elimination of oil deposits from the circulating ducts is particularly essential since their effects are cumulative. By impeding the oil circulation they cause the transformer to overheat with a given load, which in turn



FIGS. 3 AND 4—TRANSFORMER STORAGE YARD WITH CRANE FOR HANDLING APPARATUS AND GRID-COVERED PIT IN WHICH TRANSFORMERS MAY BE LOWERED FOR DRYING OUT

they are small enough so that four or five figures may be placed on the smaller-size cases.

If the transformer has been installed for several years, it is preferable to draw off the oil for testing and treatment as soon as it arrives on the testing platform. On the other hand, if the transformer has been on the lines only a short time and the oil seems clear and without a burned odor, it need not be removed. In the case of the larger sizes of distribution transformers, a sample should be drawn from the bottom of the case with a "sneak" for a moisture test. All transformer oil should be carefully tested, handled and stored in accordance with the recommendations* of the apparatus committee of the National Electric Light Association. Linemen cannot be cautioned too often against handling oil in the open in damp or foggy weather. Companies utilizing distribution transformers of two voltages, as, for instance, 13,200-volt and 2300-volt equipment, will do well to reserve new oil for the higher-voltage equipment and use the second-hand treated and filtered oil in the lower-voltage apparatus.

When possible, transformers should be filled with oil

increases the sediment. An air-transil-oil spray is effective in flushing the ducts. When the oil is drained off it will also clear any moisture which may be present at the bottom of the case.

Many transformers cannot be properly cleaned without removing the coils from the case; this is especially true where the sediment has thickened. Some of the older types of transformers which have no oil ducts between coils should always be removed and cleaned by scraping, as a thick coating is generally to be found on the coils caused by the lack of circulation. Care must be used in scraping to avoid damaging the insulation. An air-distillate spray will be found effective for this kind of cleaning, but should not be used unless the transformer is dried out before being placed in service. A distillate spray should not be used within the test room, owing to the fire risk. A cast-iron grating with removable containers should be provided on the transformer platform for draining coils and cases; otherwise oil will be scattered about (Fig. 4). By this means considerable oil or distillate can be saved as the oil can be filtered for re-use.

Cases should be examined for leaks. A crack in a cover may permit the entrance of sufficient moisture to

*Proceedings N. E. L. A., 1917, Technical and Hydroelectric Section, page 281. Also available in booklet form.

cause breakdown. Cast-iron cases when cracked may be welded with an oxy-acetylene torch; sheet-steel cases may be repaired by brazing or welding. Drain plugs should also be examined and set in with red lead if leaky. Felt strips should be carried in stock so that when those in service are lost or worn they may be replaced. It is important that these be kept effective.

Hanger irons and lugs should be examined for cracks and flaws. When transformers are returned from the lines it is advisable to arrange some system by which the hangers are kept with them or properly marked so that they cannot be mixed with others. If an improper hanger iron is shipped unnoticed with the transformer, it may cause an expensive delay to the line crew.

If a transformer has taps, connecting lugs, nuts and bars should be checked for missing parts. If they are

local shop, or coils may be ordered from the manufacturer. In any case the decision will largely depend on the voltage class of the transformer, its age and type. Antiquated types having operating characteristics inferior to those of modern transformers should seldom be rewound. Transformers of the 2300-volt class can usually be returned to manufacturers for credit on a basis that is more economical than rewinding. On the other hand, it pays to order new factory-made coils for the higher-voltage classes. If a factory repair shop is available within reasonable distance, it may be cheaper to have the factory make complete repairs. When the coils are installed in a local shop, care must be taken to shellac and dry them thoroughly. Some form of drying oven should be available, and the transformer should be placed therein at a temperature of

SCHEDULE OF CABLES TO USE IN RENEWING TRANSFORMER LEADS

PRIMARY LEADS					SECONDARY LEADS					SECONDARY LEADS				
Class	Transformer Size (Kva.)	Size of Lead	Insulation (ths of In.)	No. of Strands	Class	Transformer Size (Kva.)	Size of Lead	Insulation (ths of In.)	No. of Strands	Class	Transformer Size (Kva.)	Size of Lead	Insulation (ths of In.)	No. of Strands
11,000-volt	1 to 100	6	16	7	160-230-115-volt	1 to 3	8	3	7	2300-460-volt	1 to 20	6	8	7
2,300-volt	1 to 5	12	8	7		5	6	4	7		25 and 30	4	8	7
	7½ and 10	10	8	7		7½ and 10	4	4	7		37½	2	8	19
	15 and 20	8	8	7		15	2	4	19		50	1-0	8	19
	25 and 30	6	8	7		20 and 25	1-0	5	19		75	2-0	8	37
	37½ and 50	4	8	7		30	2-0	5	37		100	4-0	8	37
	75	2	8	19		37½ and 50	4-0	5	37					
	100	1-0	8	19		75	176,000 e.m.	6	37					
						100	500,000 e.m.	6	61					

missing, they will usually be found in the bottom of the case, where they were dropped while taps were being changed in the field. Spare connecting links should be taped to leads.

It should be ascertained that coils and core are firmly held in place by the bolts and wedges. To send a transformer out loose in the case will often result in damage to coils and consequent breakdown.

TESTING FOR BURN-OUTS

The most difficult of all repairs are those to coils. When a transformer comes in which is suspected of being burned out, unless it is evident from a superficial examination that the coils are completely ruined, tests should be applied with caution. A breakdown insulation test should never be applied until a megger is used. A premature insulation test may injure a transformer beyond repair. If the megger shows the insulation to be in bad condition, the transformer should be dried out by one of the usual methods and the test repeated. Such a dry-out will often correct the difficulty. Often a careful examination of the coils will reveal only a few damaged turns; these may be replaced or reinsulated if carefully handled. If necessary, all coils should be disconnected so that each may be "meggered" to the core separately. The megger test is of course a preliminary step only for the purpose of trouble location. No transformer should be reinstalled which cannot withstand an appropriate insulation test. Ratio, core loss and exciting-current determinations should also be made on each transformer before it is considered ready.

When it has finally been proved that a transformer is burned out it becomes necessary to decide upon its disposal. Several courses are open: It may be scrapped; it may be returned to the manufacturer on some exchange proposition; new coils may be wound in the

about 85 deg. C. (185 deg. Fahr.) for at least twenty-four hours.

Transformers should be stored in such a manner that they will be easily accessible. If platforms rather than racks are used, ample aisles should be provided between rows to avoid breakage of bushings (Fig. 3). Transformers of similar ratings should be grouped together. Burned-out transformers awaiting disposition should not be mixed with the others, and to eliminate any chance of their being taken out by a repair crew in an emergency they should be given a dash of colored paint or otherwise conspicuously marked.

Some recording system should be adopted in order that transformers returned from the lines shall be assured of proper attention and that no transformer shall be taken out until it is inspected and repaired if necessary. The three-part linen tag (Fig. 2) has been successfully used by one company for this purpose. Upon arrival the yard foreman issues a tag for each transformer. The lowest section is torn off and sent to the shop as a notification of work to be done; the remainder is attached to the transformer. When inspection, repairs and test are completed the middle section is torn off and sent to the record department as a notification of work done, and also that the transformer may be again placed on the active list. The upper portion of the tag remains attached to the transformer until it is reinstalled. The condition of each tag shows at all times the status of the transformer to which it is attached, and regardless of the method pursued in ordering out transformers for use, no transformer will be taken which has not received attention.

Liberty Is in Peril—Will You Lend?

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PREVENTION OF SLEET ACCUMULATION ON LINES

The Operation of Conductors at High-Current Density Serves to Melt Sleet—Unloaded Lines Are Heated by Wattless Current

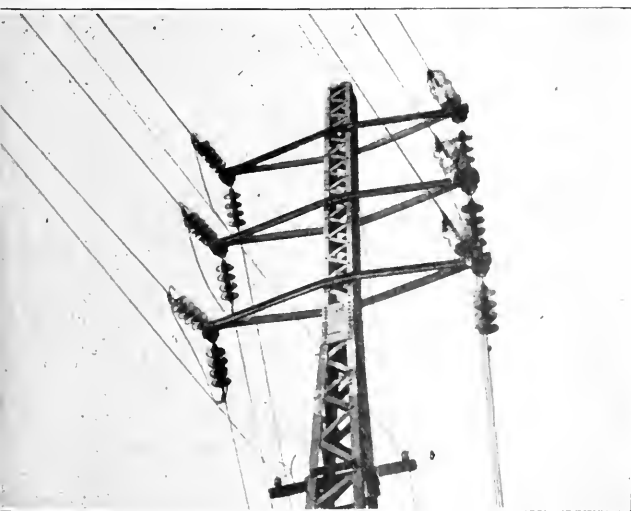
One company in the East has adopted the practice of circulating enough current through its lines during sleet storms to melt any sleet which may adhere to the conductors. Experiments show that about 250 amp. to 300 amp. is sufficient to keep sleet from sticking to 00,000-circ. mil aluminum cables. If ice has already been deposited, considerably more current may be required. Of course, 1 amp. per 1000 circ. mils is maintained only during storms. When the load is light all of the energy is transmitted over one line (duplicate lines being provided), so the conductors in that circuit will be heated sufficiently to melt the ice. The other is connected therewith at the delivery end and a wattless current forced through the cables by the reserve generators.

Lend or Pay Higher Taxes, Which?

HORN GAPS PROVIDED ON TELEPHONE LINES

Used at Frequent Intervals Where Communication Circuit Parallels High-Tension Transmission Line

To relieve the stresses on telephone lines paralleling high-tension transmission lines a Southern company installs horn gaps between the communication circuits



TELEPHONE LINE PARALLELING POWER LINE EQUIPPED WITH HORN GAPS

and ground at frequent intervals. With this construction numerous "safety valves" are offered to high-voltage surges which may be induced in the lines, so

there will not be the tendency to break down insulators. Furthermore, damage to telephone equipment and hazard to persons using it are thus reduced. This additional equipment is relatively inexpensive as the towers are grounded anyway and the horn gaps are easily installed.

Lend Freely for Liberty's Sake

CONDENSER RATING NECESSARY TO IMPROVE POWER FACTOR

Method of Using Chart to Determine Rating of Synchronous Condenser Required to Raise Power Factor to Any Value

BY H. H. GETTER

Many times in connection with industrial applications or when correcting distribution conditions it is desirable to have some quick method of determining the synchronous-condenser rating necessary to bring the power factor up to some higher value. The accompanying chart gives this information.

Since most synchronous motors are not designed to carry their total kva. rating in reactive power the chart is intended to give the particular kva. rating of condenser which will change the power factor to any value and also carry 71 per cent of its kva. rating in power load. It is assumed that the power load placed on it is taken off the motors formerly used; in other words, that the synchronous motor is used to replace some of the motors producing the low power factor. In this connection it must also be pointed out that it is assumed that replacing part of the induction motors by synchronous motors will not change the power factor of the remaining induction motor load. The scales on the chart may be multiplied by ten or any multiple thereof if both are similarly multiplied.

To show how this chart is used, suppose the load is 500 kva. at 50 per cent power factor and that it is desirable to increase the power factor to 95 per cent. Follow the 500-kva. ($5 \text{ kva.} \times 100$) circle to the point *a* where it intersects the 50 per cent power-factor line. then drop vertically to the 95 per cent power-factor line. Directly below is the actual kw. load ($250 = 2.5 \text{ kw.} \times 100$). The diagonal distance *de* laid off on the kva. scale indicates the rating ($200 \text{ kva.} = 2 \text{ kv.} \times 100$) of the synchronous condenser which will correct the power factor and also carry a part of the original power load equal to kva. 71 per cent of its rating. The power load it can be made to assume is equal to the projection of *de* on the kw. scale, or 125 kw. (1.25×100). This leaves 125 kw. to be carried by the induction motors.

. As another example of the use of the chart assume that there is a 500-kva. load at 50 per cent power factor and that 250 kw. more load must be carried. By using a synchronous motor to best advantage—i.e., by making the wattless load equal to the power load—how

much can the power factor be improved and what will condenser rating be?

On the vertical line extending from the intersection of the 500 kva. (5 kva. \times 100) circle with the 50 per cent power-factor line lay off with dividers a distance *ag* equal to 250 kw. Point *g* will fall on the radial line indicating the power factor that will be obtained, 80 per cent. The rating of the condenser required to carry the 250-kw. load and raise the power factor from 50 per cent to 80 per cent will be found by laying off the length of the diagonal line extending from 250 kw. on the horizontal scale to the vertical one through 0 on the kva. scale; in other words, 350 kva.

Where replacing part of the induction motors would change the power factor of the induction-motor load the wattless power necessary to improve the power factor can be determined by scaling the vertical distance

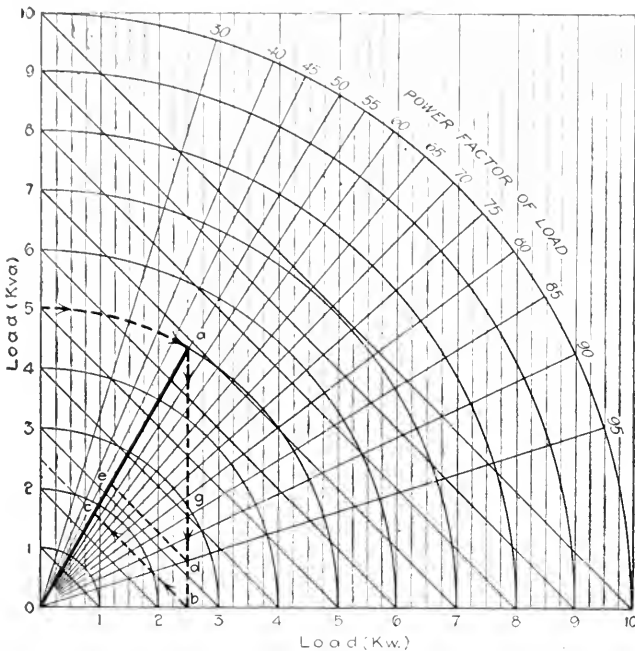


CHART FOR DETERMINING CONDENSER RATING NECESSARY FOR CORRECTING POWER FACTOR

between the improved power-factor line and the intersection of the kva. circle and the original power-factor line.

A Bond for Freedom's Cause

PREVENTING ICE STICKING TO THE TURBINE-RUNNERS

Heating Metal Parts Slightly Above Freezing May Avoid Trouble—Deep Forebays Are Also Found of Benefit for This Purpose

To prevent ice from sticking to the screens, gates and turbine runners it is necessary to keep them at a temperature slightly above freezing. To do this effectively the metal parts must be heated before the gates are opened, for if a coating of ice once forms it will be much more difficult to prevent its building up. Steam, hot-water or electric coils can be placed in contact with the affected part, the metal of the turbine casing and shaft being used to conduct the heat to the surfaces exposed to water. No figures can be given

on the amount of heat which will be required, as two similar plants taking water from the same source have been known to be affected differently.

In the opinion of one turbine manufacturer, a large deep reservoir very close to the turbines will prevent to a great extent the adherence of ice to runners. The greatest trouble occurs where the canal or river is very long and shallow and where there is no pond or reservoir to bring the water to rest and allow it to warm slightly before entering the turbines. The arrangement of penstock intakes also has some effect on the amount of anchor ice which will form. If the ice can be deflected from the opening, the trouble may be reduced.

Bonds—Uncle Sam's or the Kaiser's?

ITEMIZED COST OF LINE CONSTRUCTION

Data Apply to 35,000-Volt Two-Circuit Line Built Under War Conditions—Based on the Prices Current in 1917

In the accompanying table are given the itemized expenses of building 12 miles (19.3 km.) of two-circuit, 35,000-volt transmission line from Attleboro, Mass., to East Providence. The transmission line, consisting of two No. 00 three-phase circuits of bare copper wire, is erected on 40-ft. (12.2-m.) class "A" chestnut poles, set at intervals of 42 per mile (26 per km.). The cross-arms, which are of hard pine, are 10 ft. 6 in. (3.2 m.)

COST PER MILE OF TWO-CIRCUIT, 22,000-VOLT TRANSMISSION LINE IN NEW ENGLAND

Kind and Size	Quantity	Unit	Price per Unit	Total Cost of Material	Cost of Labor
40-ft. chestnut poles.....	42	Pole	\$10.00	\$420.00	\$126.00
H. D. standard bare No. 00 copper.....	13,000	Lb.	0.335	4,355.00	150.00
Tie wire, No. 4 solid.....	530	Lb.	0.36	190.80	.....
No. 6 arms.....	50	Arm	1.75	87.50	25.00
No. 7 arms.....	50	Arm	1.75	87.50	25.00
Thomas insulators, No. 2118.....	300	In.	0.85	255.00	.....
Strain insulators, No. 506.....	120	In.	0.154	18.48	.....
Lee pin, No. 9007.....	300	Pin	0.43	129.00	.....
Line-wire protector.....	36	Protector	6.44	231.84	.....
Line hardware.....	.....	.....	.....	20.00	.....
Anchor rods and cones.....	60	Rod and cone	1.25	75.00	.....
Cartage.....	.....	.....	.....	150.00	.....
Freight.....	.....	.....	.....	50.00	.....
Total.....	.....	.....	.....	\$6,070.12	\$326.00

Total material and labor..... \$6,396.12

long. Thomas' No. 2118 insulators, supported on Lee No. 9007 pins, are employed. Crossings over streets and other wires are protected by Thomas line-wire protectors. While the line is built to transmit 20,000 kw. at 35,000 volts, it will be operated for the present at a load of 5000 kw. and 22,000 volts.

The estimated cost per mile, including material and labor (exclusive of right-of-way), of the two-circuit overhead 22,000-volt line is \$6,396.12, as set forth in the accompanying table of statistics based upon the prices of 1917.

DESIRABLE CHARACTERISTICS AND FUNCTIONS OF CUT-OUTS

Various Types of Transformer Cut-Outs Are Considered from the Viewpoint of Their Suitability to 2200-Volt to 6600-Volt Circuits

In order to be satisfactory for operation on circuits operating at potentials between 2200 volts and 6600 volts a transformer cut-out must have the following characteristics, said C. A. Harrington of the Mahoning & Shenango Railway & Light Company recently:

1. When operated manually there should be no danger of flash, burn or shock to the lineman. This requirement applies also when re-fusing or re-closing the circuit after an interruption of service.
2. The automatic opening of the circuit in case of overload should be positive and reliable, and should occur while the current is within a few per cent of the rating.
3. The rupturing capacity as well as the current-carrying capacity should be stated by the manufacturer. The rupturing capacity should be several times the normal carrying capacity and the cut-out should break an arc of this magnitude without serious damage to itself.
4. There should be an external and clearly discernible indication of the condition of the cut-out so that it will not be necessary to open the circuit to determine whether the fuse has blown or not.
5. It should be possible to re-fuse the cut-out easily and quickly, even under adverse weather conditions, such as rain or snow.
6. First cost and maintenance cost should be moderate as compared with the value of the equipment protected.

Applying the foregoing tests to existing types of fuses shows that some are not perfect and that the manufacturers have much to accomplish yet. From the standpoint of safety, Mr. Harrington said, it is not safe to open any existing cut out like a disconnecting switch at more than a very small fraction of its rated carrying capacity. As to reliability of calibration, probably those types using specially formed links are best. The use of ordinary lead fuse wire may be sufficiently accurate, however, in the general case. The oil-immersed fuse type of cut-out is about the only type to which manufacturers will give a definite rupturing rating. This type can rupture at least ten times the rated current, they claim.

Expulsion cartridge-fuse type cut-outs have the advantage of giving an indication when they blow, and this indication can be made visible from the ground. Filled cartridge fuses and expulsion fuses inclosed in blocks of insulating material give indications which can be seen on close inspection and without opening the circuit. The common porcelain-plug type cut-out and the oil-fuse type give no indication, Mr. Harrington said.

The re-fusing of practically all types can be made a simple matter if spare removable parts are kept on hand which can be fused on the ground or in the shop. The work on the pole is thus reduced to a minimum, but the troubleman is obliged to carry more apparatus about with him.

The common porcelain-plug type of cut-out of course has the lowest first cost and the lowest maintenance. It is inexpensive even for the smallest sizes of transformers. Next comes the expulsion type having a ribbon fuse within insulating blocks. The cartridge type cut-outs follow, while the oil-immersed type is most expensive of all. The maintenance expense on this latter type is also the highest.

Bonds Speak Louder than Words

SUBSTITUTES FOR COAL AND OIL BEING TRIED

"Hogged Fuel," Pulverized Coal and Natural Gas Are Now Being Used by Pacific Coast Companies in Standby Plants

The high price of California fuel oil and the difficulty of getting coal under present conditions of rail and water transportation facilities has made the Pacific Coast power producers turn to water power. However, all along the coast there was less than normal precipitation in the early part of the winter, and the packed snow or ice in the mountains is less than usual. There will therefore probably be a shortage of stored water in the late summer.

In southern California natural gas is being used to some extent. One company (San Joaquin Light & Power) is building a 26½-mile (43.4 km.) 6-in. (15.2 cm.) pipe to bring in the gas. Central California companies have applications before the Railroad Commission for permission to raise rates, to enable them to meet the expense of coal or oil in auxiliary stations.

In Washington the promising substitute is pulverized coal. The Puget Sound Traction, Light & Power Company has done more pioneer work on this than any other company.

In Oregon the preferred substitute has been "hogged fuel," the material which used to be sent to the refuse burner, but now in increasing quantity is being run through a grinder known as a "hog," which cuts it up into small chunks. This is usually mixed with sawdust, shavings and small chips as they come from the mill machines.

The hogged fuel is sold in "units" of 200 cu. ft. (5.7 cu. m.). A "unit" weighs about 2 tons, fresh from the mill, and is calculated as the equivalent of two barrels of fuel oil, or say 400 kw.-hr.

The Portland Railway, Light & Power Company is trying the experiment of storing hogged fuel in piles to be used during the low-water period of late summer, thereby reducing the use of fuel oil. Two piles, in which 30,000 units are to be stored, are expected to develop, roughly, 12,000,000 kw.-hr.

Formerly refuse burners were maintained by the lumber mills at considerable expense to destroy the large quantities of waste produced. Therefore the use of this waste as fuel not only conserves coal and oil, but also saves the cost of its destruction. As it is bulky material to handle, the power plants are usually placed close to the mills, where conveyors can deliver the fuel direct to the boiler-feed chutes.

The Northwestern Electric Company of Portland is building a steam standby plant adjoining a sawmill which has entered into a contract to supply hogged fuel at a price that would be about the same as fuel oil at 27 cents per barrel. The first unit, now en route, is for 9380 kw. and capacity is to be increased later. In addition to generating electricity, the plant will supply steam to the company's steam-heating system in Portland, delivering 180,000 lb. to 200,000 lb. (81,647 kg. to 90,718 kg.) of steam per hour at 250 lb. (17.6 kg. per sq. cm.) to the main supply line.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

POWER SHORTAGE AFFECTS ELECTRIC RANGE POLICY

Western Property Now Allows But \$20 on Installation Cost, Besides Cutting Down Installment Period from Twelve to Four Months

The plan under which the Pacific Gas & Electric Company of San Francisco formerly sold electric ranges called for 10 per cent cash and the remainder in twelve monthly payments. The company paid the installation cost, which was figured to amount to \$50, and this amount was allowed on all ranges installed on the company's lines whether sold by the company or by outside agencies. If the customer desired to pay cash for the range, a discount of 10 per cent was allowed.

Since the power situation in California has grown acute through the increase in the price of oil, abnormally low stored water supply and rapidly increasing demand for power, the range policy has been revised so that it will no longer be a burden to the commercial department. The present plan is to sell at manufacturers' list less \$20 per range, which is deducted as an allowance on cost of connection; the average installation cost is about \$50, or \$60 including water heater. The terms of payment are 25 per cent cash and the remainder in three monthly payments. If the customer desires to pay cash, a 5 per cent discount is allowed. The connection allowance of \$20 is made only if the range is sold by the company.

The rates remain the same as before (averaging slightly less than 4 cents per kilowatt-hour), and the same service to consumers will be continued. Under the new plan the cost to the consumer will be greater, but it is hoped that the electric range department will be self-sustaining.

Do Your Fair Share—Buy Bonds

EXODUS OF SERVANTS BRINGS BIG APPLIANCE BUSINESS

When New York Manufacturing Concern Took Labor from Homes an Immediate Demand Arose for Labor-Saving Devices

A very interesting evidence of the influence of the domestic-servant problem on the market for electrical appliances was seen last month in Elmira in an experience of the Elmira, Water, Light & Railroad Company. One of the chief local manufacturing concerns lost a large number of young men at about the same time that considerable additional labor was needed in its plant. Much of this labor was required for the operation of automatic machines and for performing other tasks suitable for women. As the local demands on labor have been very heavy for the last two years, there seemed to be small chance of securing men for these jobs. The firm therefore advertised for 600 girls,

giving its appeal a patriotic touch and making a particular effort to secure women who had been in domestic service. There was an immediate response, and a general exodus from the kitchen followed, with the result that hundreds of Elmira families found themselves servantless and compelled to adjust their household methods to the situation.

The Elmira Water, Light & Railroad Company has been actively advertising and selling household appliances for years and has been featuring the electric-servant idea. The influence of this effort was immediately seen, for inquiries began to pile in and there has been an almost continuous demonstration of washing machines, vacuum cleaners and other labor-saving household appliances in the company's salesroom ever since. So acute has been the crisis that the husbands as well as the wives have been taking an active hand in seeking out this household machinery, and a great many of the demonstrations and sales have been made to men. A large amount of business has resulted and the demand continues.

Liberty Bonds Are Safe and Sure

THE SALES MANAGER'S SITUATION IN WAR TIME

Analysis of Tactics of Different Men Confronted with Problem of Reducing Sales Forces for Economical Reasons

The sales manager of a manufacturing company recently made a circuit of a number of important central-station cities in the West and Middle West. In discussing with his firm the impressions gained on the trip he laid special emphasis on the different manner in which different central-station commercial men had met the recent announcements of their superiors that the commercial department would "have to stand a cut."

In his analysis of the tactics of these men under fire he divided them into two classes—first, those who accepted the order unquestioningly and proceeded to discharge their men; second, those who looked at the proposition squarely and met their superiors with an array of sound facts to show the folly of absolutely eliminating commercial work. He had seen and talked to men in both classes and knew how they handled their jobs. His observations and opinions should be of interest and of value to central-station sales managers as presenting an outside viewpoint. The following are approximately his words:

"As typical of those of the second class, take a man in the West who had been spending \$112,000 annually in new-business operations. His profit on that expenditure was \$98,000. In other words, it had actually been costing the company in cash expended \$14,000 a year to acquire all of the load it added to its lines,

including in the term load all power, residence, range and appliance business. The edict was that that expenditure would have to be stopped because of the shortage of capital and because the company did not want to increase its peak materially. The plan proposed by the officers was to curtail the activities of the department by materially reducing the sales forces. But the sales manager demonstrated, first, that 40 per cent of the expense incident to operating the new-business department was not at all new-business expense but was expense incident to keeping existing customers satisfied and on the lines. He assumed, and it was granted, that the company wanted to retain its cordial relations with the public and to retain its existing load. This being true, it was evident that if the entire sales force was disposed of 40 per cent of the cost of running it would need to be expended somehow in order to maintain service. The sales manager contended, however, that the sales department as then organized could do this work better than any other agency. In addition to this he showed how he could by eliminating certain more or less gratuitous services reduce his expenses to \$84,000 and how by extending the duration of certain intensified sales efforts he could increase his profits on sales to \$120,000. He pointed out strongly that the financial stringency was within the company and certainly was not with the potential customers of the company, and that this could be turned to good account by intelligent solicitation of appliance and range business without greatly increasing the peak load of the central station.

"There was considerable doubt as to his ability to increase sales to the extent promised, but nevertheless permission was given to try out the plan. At the rate sales are being made now, the department will make \$147,000 instead of \$120,000 as promised. That gives an indication not only of how well the plan worked but also of the truth of the statement that the public has more money now to spend for electrical goods and service than it ever had before.

"That is the important point which has been all too easily overlooked in the cities where the sales forces were peremptorily discharged. Activities were stopped just at the time when the least effort was required to make sales. In such cities it is notable that the public relations of the central-station companies are none too desirable. This is traceable largely to the fact that the company has no commercial force with which to placate the complaining customer. With him a trivial grievance that could at one time have been glossed over with a jolly word has grown to a deep-rooted grudge that it will take years of effort to eradicate.

"Now, the big thought back of these two different methods of meeting a situation is that the one sales manager knows his job and the other is incompetent in certain respects. The one realizes that the sales manager's job is to advise accurately on commercial policy as well as to see that goods and services are sold. The other sees only that part of his duty which involves the actual selling. The former type of sales manager is certainly the more desirable, for even though he may be less expert at selling, he will get farther in the long run."

LONG INTERCITY HAUL WITH ELECTRIC TRUCK

Five-Ton Truck with Load Makes the Trip from New York to Baltimore Over Very Bad Roads and Arrives in Good Form

As a result of the abnormal conditions of rail transportation the use of trucks for intercity haul is receiving the support of government officials and trade generally. The electric truck is hardly considered as suitable for this type of service, but the accompanying data indicate that it can overcome the difficulties in the way.

A 5-ton truck consigned to the American Tobacco Company in Durham, N. C., by the General Vehicle Company was denied all shipping accommodations east of Washington, and it was found necessary to drive it over the road to Alexandria, Va., then ship it by boat and rail to its destination. As the embargo affected other merchandise also, the truck was loaded with seventy-five cases of tinfoil for a branch of the



ELECTRIC TRUCK EN ROUTE FROM NEW YORK TO BALTIMORE

tobacco company in Baltimore and made the 226-mile (363-km.) trip successfully late in March, notwithstanding the bad road conditions and poor charging facilities en route. After delivering its load the truck made the 38-mile (61-km.) run from Baltimore to Washington on one charge and in good running time.

The heavy traffic over the roads of New Jersey, Pennsylvania and Maryland at the present time has played havoc with the road surfaces in many sections of these States, and when a truck gets mired in a bad spot it frequently ties up scores of other trucks for hours. Some idea of the condition of these roads, particularly in Delaware and Maryland, may be gathered from the fact that this 5-ton truck, which on city streets requires a current of 9 amp. per mile, consumed 240 amp. in going 12 miles (19 km.) in Delaware, or 20 amp. per mile.

On its trip the truck encountered charging conditions anywhere from 90 volts to 140 volts and at from 10 amp. to 110 amp. The forty-four-cell, nineteen-plate battery had a rating of 298 amp., but 380 amp. was taken from the battery in one case and full charge in Baltimore took 420 amp. Neither motor nor battery, it is stated, was heated during the trip, though the current draw was excessive for hours at a time.

Join the Army of Bondholders

COMPARING GAS SERVICE AND ELECTRIC SERVICE

Aspects of the Competition Between the Two Commodities Analyzed by One Who Has Been Studying the Situation

In a paper presented before the Indiana Gas Association, C. N. Chubb, formerly manager of the South Bend district of the Northern Indiana Gas & Electric Company, tried to convince the gas men that they had electric competition in every line of their business.

He pointed out that in the electrical industry half a dozen large companies do national advertising, and that in the gas field no such work as this goes on to keep the consumers of public-utility service thinking about the gas company as they think about the electric company.

"In the lighting field," Mr. Chubb said, "the electric man has not only developed efficient lamps but has developed artistic fixtures and lighting effects. He has also made electric lighting convenient for use and easy to maintain, with the result that consumers are willing to pay more for electric service than for equivalent gas service. The convenience and easy-maintenance problems are the hardest for the gas man to meet in lighting." The same holds true in the small domestic-appliance field, the speaker said, lamenting particularly that the gas industry had not sooner appreciated the value of auxiliary outlets.

Speaking of cooking, he said that the electric range does not have to go through the educational period, for the public is ready to take up electric cooking just as soon as it can be convinced of the practicability of the electric range. The electric range is advocated as easy of operation and control by means of automatic heat regulators and time-limit devices, heatless and odorless because of good insulation, and economical owing to better efficiency. Easy control, said Mr. Chubb, is certainly an advantage which should be shared by the gas range. The speaker further pointed out that the electric range is more efficient than the gas range, and declared that gas-range manufacturers should build more efficient gas ranges even at a greater expense.

In his review of the industrial field Mr. Chubb said that the gas industry had been content to let its customers struggle along with inefficient apparatus until the various fields were invaded one by one by the electric companies. As the situation now exists, the gas industry stands to lose considerable industrial business which it might have retained by beginning earlier to develop efficient utilization apparatus.

Giving Wider Publicity to Federal Viewpoint on Utilities

On a pink folder which is 3 in. by 5 in. in dimensions the Commonwealth Edison Company of Chicago has mailed to its customers copies of the letters on the importance of public utilities recently exchanged between President Wilson and Secretary of the Treasury William G. McAdoo. This folder is being distributed to the customers of the company with the idea of giving more widespread publicity to the viewpoint of the federal government on the utilities as essential factors in the national welfare.

STOP FLAT-RATE SERVICE TO PREVENT ENERGY WASTE

Worcester Company Feels that Uncertainties of Fuel Situation Demand Utmost Economy in Use of Electricity

On April 1, 1918, the Worcester (Mass.) Electric Light Company discontinued flat-rate service on its system, about 900 customers going over to the metered basis. All of these were residence customers, the commercial flat-rate service to stores and other business establishments having been done away with several months before. Practically no complaint was received from the residence customers, whose monthly bills on the flat-rate plan ranged in general from \$1 to \$3. The company announced the change when it mailed its February bills, each bill carrying a 1¾-in. by 5½-in. yellow sticker as reproduced herewith.

To the local press representatives officials of the company explained that under the old flat-rate plan considerable energy was being wasted. War conditions demand the elimination of all unnecessary waste, and the anticipated uncertainties of the fuel situation later

ALL FLAT-RATE CONTRACTS WILL BE DISCONTINUED APRIL 1, 1918

We will install a meter for you and charge you in future for our service at our regular lighting rates. Some meters will be installed before April 1 to enable us to complete all changes as near that date as possible. Should your meter be installed earlier we will gladly rebate any amount you may have paid in advance for your service.

Yours truly,

WORCESTER ELECTRIC LIGHT COMPANY

March 1, 1918

11 Foster Street

in the year require the utmost economy in the utilization of electricity. The company also wished to do away with the maintenance of current-limiting equipment used in connection with flat-rate installations. Then, too, a good deal of time and trouble had been experienced in connection with trips to homes to sign up new contracts for small increases in connected load. The time of year was favorable to the change, with a decreasing consumption of energy for lighting purposes. The flat rates were inaugurated about six years ago, when the company's residential lighting rate was about 12 cents per kilowatt-hour, while the present rate is 8 cents. The flat-rate plan was based on a charge of 1 cent per watt connected per month.

In order to make the change as easily as possible, customers were informed that if a meter should be installed during the month before the first of April customers desiring to go over to metered service then and there would be allowed to do so; but if any one wished to retain his flat-rate service until April 1, the reading of the meter on that date and not on the date of setting would mark the beginning of the new system of charging. In many cases the change to the metered rate was accepted on the spot, the public taking the company's explanation without objection. Data are not yet in hand as to the total effect of the change, but it is known that many customers' bills will be no larger under the metered rate than on the flat rate.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Replacing Direct-Current and 25-Cycle Alternating-Current Motors by 60-Cycle Designs in an Industrial Plant.—Operating results have shown that the total cost of the installation will be recovered in a few years through increased production and economies effected by standardizing motor drive and change in service arrangement to use three-phase, 60-cycle, 440-volt alternating-current motors and power purchased from a central-station company in replacing the original equipment, which consisted of steam and gas-engine-driven generating units, furnishing 125-volt direct-current and 25-cycle alternating current service to different parts of a plant.—*Electrical Record*, April, 1918.

Rotary Converters.—Self-starting two-phase and three-phase rotary converters are described and their wiring diagrams are shown.—*Southern Engineer*, April, 1918.

8750-Kva. Compounded De Laval Turbo-Generator at Vasteras.—The nickel-steel rotor is forged in one piece, the windings being held in place by long wedges. Provision is made for the inlet of ventilating currents below the windings. Illustrations accompany the description.—*London Engineering*, March 29, 1918.

Mechanical Design and Specification of Turbo-Alternator Rotors.—S. F. BARCLAY.—Stresses in the solid and laminated types of rotor are discussed. The desirability of high-tensile strength and cold working, also the relative mechanical and electrical features of nickel-chrome steel and solid forged carbon-steel rotors, are discussed.—*London Electrical Review*, March 29, 1918 (abstract of paper read before the Institution of Electrical Engineers).

Aluminum in Transformers.—Aluminum has been suggested as a substitute for copper in transformer windings. Dealing with heat dissipation, temperature rise, comparative costs of the different materials and other important factors, it appears that the advantages are still with copper.—*London Electrical Review*, March 29, 1918.

Armature Reactance of Polyphase Alternators.—F. S. NEWBURY.—Drop in voltage due to an increase in load is caused by three factors, viz., the resistance of the armature winding, the reactance of the armature winding and the armature demagnetization or reaction. These factors are discussed in reference to polyphase alternators, the article embodying several useful illustrations.—*Electric Journal*, April, 1918.

Lamps and Lighting

Electric Lighting of Ecclesiastical Buildings.—WILLIAM WILSON.—There are few tasks so difficult as that of providing suitable artificial lighting for a church or cathedral, says the author. It involves the introduction of what is virtually a novelty into one of the most

conservative situations in existence. The article deals with the special advantages of electricity for church lighting, the requirements to be met, electric fittings, and the general details pertaining to the subject.—*Journal of the Institution of Electrical Engineers*, March, 1918.

Incandescent Lamps.—H. W. MATEER.—Data relating to the different kinds of lamps, color quality of light and the effect of improvements are discussed in this article.—*Toronto Electrical News*, April 1, 1918.

Generation, Transmission and Distribution

Transmission-Line Practice.—LIEUT. E. T. DRIVER and E. V. PANNELL.—Sixth article on this subject, dealing with some high-voltage problems. Conductor spacing is the principal subject discussed.—*Toronto Electrical News*, April 1, 1918.

Electric Power Supply and Coal Conservation.—To improve transmission and distribution conditions in England the following plans are proposed: (1) the establishment of a central body of electricity commissioners; (2) the division of the country into districts; (3) the appointment of boards to control the generation and transmission in these districts, leaving the detailed distribution of electricity and sale of electrical energy more or less in the hands of existing authorities; (4) the installation of large power plants in order to obtain the maximum economy in capital outlay, efficiency in operation and diversity of demand; (5) the provision of extra high-tension mains which should interconnect the various stations.—*London Electrical Review*, March 22, 1918.

Double Overhung Francis Turbines.—ARNOLD PFAU.—The article deals with use of large single hydroelectric units, particularly the double overhung Francis turbine, which is used in the White Salmon River powerhouse.—*Journal of Electricity*, March 15, 1918.

Electrical System of the Rand Power Companies, with Special Reference to Methods of Operation and Experience.—BERNARD PRICE.—Use of cables in series with overhead line, running up rotary condensers, temperature rise of generators, cooling of transformers, steam governing, generator relays and use of generator transformers as coupling transformers are among the subjects discussed in this paper, which refers particularly to methods of operation.—*Transactions of the South African Institution of Electrical Engineers*, December, 1917.

Interconnection and New Power Development.—P. M. DOWNING.—There is an abundance of undeveloped hydroelectric power on the Pacific Coast, where it could be economically transmitted to markets, says the author, but it has been permitted to lie idle for no other reason than that capital could not be interested in its development. These projects are unattractive not because of physical or engineering reasons, but solely because their development and utilization are

unattractive financially.—*Journal of Electricity*, March 15, 1918.

Water Power in Bavaria.—Two companies have been formed in Bavaria for the purpose of developing the water powers of the kingdom, one on the upper Inn and the other on the middle Isar. One section of the latter—between Mossburg and the Danube—has been turned over to the Allgauer Elektrizitaets Gesellschaft, which is providing for about 70,000 hp.—*Journal du Four Electrique*, March 1, 1918.

Tamarack Mills Power Plant.—CHARLES H. BROMLEY.—The chief features of a new oil-burning plant furnishing light, heat and power to the Tamarack Mills, Pawtucket, R. I., are discussed. Some interesting performance figures are given.—*Power*, March 26, 1918.

Physical Data of a High-Voltage System.—H. A. BARRE.—The article deals with the Big Creek hydroelectric development and transmission system of the Southern California Edison Company, one of the most impressive systems of high-voltage transmission in existence. The article will be found of timely interest in these days of interconnection and hydroelectric conservation. Valuable data on high-tension design, standard anchor and angle tower construction, steel-cored aluminum cable, ground wires, insulators, routine tests, etc., are given. The specification details involved in this article are of especial value.—*Journal of Electricity*, March 15, 1918.

New Station of the Rochester Company.—P. B. FINDLEY.—The article deals with a 32,000-hp. hydroelectric generating station operated to carry the load peaks of the combined systems. It describes the location and general scheme of the station, the dam and gate construction and hydraulic and electrical features of the plant.—*Chicago Electrical Review*, March 23, 1918.

Traction

Locomotives for the St. Paul Railway.—F. H. SHEPARD.—The article deals with the construction of ten Baldwin-Westinghouse locomotives for the Chicago, Milwaukee & St. Paul Railway, gives a method of minimizing rheostatic losses, explains how three sources of supply can be provided for the auxiliaries, and outlines considerations favoring the twin-motor quill drive over other kinds of motors.—*Electric Railway Journal*, March 23, 1918.

Fast Service Line.—The system extends from Niagara Falls to Buffalo, operates at 600 volts and cost approximately \$170,000 per mile. Features of the overhead construction and substations with cost data are set forth in this article.—*Toronto Electrical News*, April 1, 1918.

Savings Effected by Automatic Substations.—H. E. DAVIS.—Light-load losses are minimized by stopping the rotary converters during prolonged light loads. The automatic substation permits three-car trains to pass without overloading the machines. The article describes the New York State Railways (Utica-Syracuse lines) system, which purchases automatically controlled energy for its Manlius Center substation.—*Electric Railway Journal*, April 13, 1918.

Why the Automatic Substation Saves Materials and Labor.—CHARLES F. LLOYD.—Advantages and disadvantages of automatic substations are analyzed, the

article describing details of equipment and referring to economies that can be effected.—*Electric Railway Journal*, April 13, 1918.

Installations, Systems and Appliances

Automatic Switching Equipment.—R. J. WENSLEY.—This article deals with the automatic operation of synchronous substations, taking up starting, polarity, synchronism, protective devices, etc.—*Electric Journal*, April, 1918.

Electrical Shoemaking.—G. BASIL BARHAM.—One of the first shoe factories in the world to be electrically equipped throughout is described.—*London Electrical Review*, March 8, 1918.

Overwinding and Controlling Devices for Winding Engines.—H. NEWBURY.—A discussion of the relative merits of the different types of winding engines that goes into detail of the conditions to be met and how they should be met.—*Transactions of the South African Institute of Electrical Engineers*, November, 1917.

Water Pumping by Electric Power.—R. L. YATES.—This is the continuation of an article which discusses the characteristics of motor-driven pumps and gives suggestions for selection of pumps for municipal water pumping. The author points out that economies in plant operation and efficiencies of the pumping equipment used do not necessarily parallel each other. The efficiencies of reciprocating pumps are, as a general rule, in excess of the efficiencies to be obtained by the use of centrifugal pumps. The comparative efficiencies of triplex and centrifugal pumps operating under the best conditions and for capacities up to 1500 gal. (5678 l.) per minute are discussed.—*Chicago Electrical Review*, March 23, 1918.

Warrior River Steam Plant of Alabama Company.—W. B. WEST.—Brief description of a stand-by steam station for taking care of emergency loads. One 25,000-kw. turbo-generator unit is installed, but additional units are to be provided. Coal is obtained from a mine only a few hundred feet distant. Details of the layout and other interesting features are given.—*Power*, March 19, 1918.

Wood, Steel and Concrete Pole-Line Costs.—F. L. HAUSHALTER.—The comparative costs of treated and untreated wood poles are discussed in this article, which is a continuation of an article in the April 6 issue.—*Chicago Electrical Review*, April 13, 1918.

Practical Alternating-Current Engineering Problems.—W. R. BOWKER.—Different methods of interconnecting rotary converters and transformers, also their operating characteristics, are discussed. The article embodies several circuit diagrams.—*New York Electrical Engineering*, April, 1918.

Standardization of Pin-Type Insulators.—L. M. KLAUBER and R. E. CUNNINGHAM.—The standardization of supplies and the consequent cost reduction, improved service and economies resulting therefrom are described in this article.—*Journal of Electricity*, April 1, 1918.

Wires, Wiring and Conduits

Mechanical Working of Underground Cables.—CHARLES F. STREET.—The mechanical strength of the hauling tackle and also of cable, including a determination of the force required to draw cables of varying dimensions into different classes of ducts, the ability of

lead-covered, air-spaced and paper-core cable to withstand a tensile force without injury and the relative properties of lead and an alloy of lead and tin as a sheathing material, are discussed.—*Telephone Engineer*, April, 1918.

Electrophysics and Magnetism

Simplest Hardening Equipment for Carbon Steel.—At a certain temperature, called the temperature of recalescence, carbon steels become non-magnetic. The temperature at which this condition occurs is also the temperature at which carbon steels should be quenched in order to obtain the finest grain and most desirable mechanical properties in the hardening metal. Thus, in order to obtain an indication of the best temperature for quenching, it is only necessary to have an indication when the steel becomes non-magnetic. A description and an illustration of the furnace embodying this principle are given in the article.—*London Electricity*, March 22, 1918.

Electromagnetic Induction and Relative Motion.—S. BARNETT.—A paper was presented before the American Association for Advancement of Science on this subject in which the author considers a short-circuited parallel-plate air condenser in a magnetic field parallel to its plates. If the condenser is moved parallel to the plates but at right angles to the induction, certain conditions will exist, whereas others will exist if the condenser is held stationary and the agent producing the magnetic induction is moved parallel to the plates but at right angles to the induction. A very complete discussion is given of the results observed that may clear up hazy ideas regarding the generation of electromotive forces by motion of conductors in a magnetic flux.

Units, Measurements and Instruments

Measurement of Permeability.—FRANK SHAW.—Permeability is influenced by the layer of scale formed on mild steel during the process of rolling. A number of experiments are described that were conducted to determine the permeability of laminated specimens of steel by the Ewing double bar and yoke method.—*London Electrician*, March 22, 1918.

Telegraphy, Telephony and Signals

New Swedish Radio Station.—At Karlsborg, Sweden, a wireless station has been completed which is capable of sending messages over a distance of 3150 miles (5000 m.). The masts, weighing only 25 tons each, are 684 ft. (210 m.) high. They are insulated at four different places from base to top and are erected with the bases embedded in black granite blocks, impregnated with paraffin. The antennas are 1476 ft. (450 m.) long and composed of sixty phosphor-bronze wires hung from steel tubes. The capacity of the station is increased by covering the territory between the masts with a phosphor-bronze wire netting.—*Schweizerische Bauzeitung*, Feb. 9, 1918.

Inclosed Arc with Novel Characteristics.—The device consists of a low-expansion glass envelope such as a sodium-magnesium boro-silicate glass. The cathode consists of a high refractory material such as tungsten, tantalum or carbon. The anode is made up of metallic calcium, magnesium, titanium or other metal highly reactive chemically to gases other than the inert so-called rare or monatomic gases. Certain chemical

effects and electrical effects are dealt with in the article.—*Wireless Age*, March, 1918.

Transmission Efficiencies of Cord Circuits.—WALTER C. FREEMAN.—The efficiencies of different kinds of cord in operation upon different kinds of circuits are discussed. The article is illustrated with circuit diagrams.—*Telephone Engineer*, April, 1918.

Loading Coils Versus Repeaters.—W. N. FURTHMANN.—Properly designed and correctly installed loading coils are adequate for all long-distance work, says the author. The reasons for arriving at this conclusion are embodied in the article.—*Telephone Engineer*, April, 1918.

Miscellaneous

Combustion Characteristics of Coal and the Selection of Suitable Stoker Equipment.—JOSEPH WORKER.—Many factors that enter into the success or failure of equipment selected for various kinds of coal are discussed. The article is well illustrated and contains considerable data on the various effects of coal and also on the performance of various kinds of stokers.—*Electric Journal*, April, 1918.

New Insulating Material.—A new composition proposed as a substitute for porcelain, marble, slate and vulcanized fiber, etc., consists of 52 per cent pulverized asbestos, 14 per cent of sifted mica, 20 per cent mineral caoutchouc, 10 per cent rubber solution, 3 per cent of sulphur and 1 per cent of resin. It is claimed that the finished material is hard and nearly fireproof, and that it can be molded, machined and wrought.—*London Electricity*, March 22, 1918.

Water Power in Great Britain.—ALEXANDER NEWLANDS.—Data relating to the rainfall, river discharge, ratio of ordinary to flood discharge, catchment areas, horsepower available, etc., in the British Isles, with references to many available sources of information on these points, are embodied in this article, which is an abstract of a paper read before the Royal Society of Arts.—*London Electrical Review*, Feb. 8, 1918.

New Views of the Combustion of the Volatile Matter in Coal.—S. H. KATZ.—The volatilization of the hydrocarbons in coal and the burning of the volatile matter in the combustion space of the furnace are discussed in the following order: (1) physical influences of the chemistry of volatilization of coal matter; (2) primary products of distillation; (3) mechanism of the combustion of hydrocarbons, which includes the speed of the reaction, with a table giving the cracking effect of temperature on oil at atmospheric pressure, and finally the hydrocarbon equilibrium in coal fires.—*Technical Paper* 183, Department of the Interior, Washington, D. C., 1918.

Description of the Works of White's South African Cement Company, Ltd.—H. CAMPBELL.—The article gives interesting details in connection with the power plant and certain statistics pertaining to the laboratory, repair shops, limestone quarry, ropeway, wet mill, mixer, kiln plant, coal plant, cement mills, silos, etc.—*Journal of the South African Institution of Engineers*, January, 1918.

Fuel-Oil Burners.—J. F. SPRINGER.—Essentials of the two principal methods of burning oils and details of the equipment are described.—*Southern Engineer*, April, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

ENERGY SUPPLY FOR MUNITION FACTORIES

President Joseph B. McCall Says that Philadelphia Electric Company Furnishes More for War Industries than Any Other Utility

Reporting concerning the operations of the last year, Joseph B. McCall, president Philadelphia Electric Company, says that stockholders will be interested in knowing that the company, in addition to supplying the general needs of the communities served, is now furnishing more energy to munition factories and other war industries than any other utility in the United States and is second in supplying transportation.

"The electrical energy for all additional transportation requirements for Hog Island and other points supplied by the Philadelphia Rapid Transit Company and the additional electrification of the Chestnut Hill branch of the Pennsylvania Railroad are furnished by this company," says Mr. McCall.

A "WINNING THE WAR" N. E. L. A. CONVENTION

President Lieb Calls Attention to the Fact that the Atlantic City Meeting Will Be Devoted Entirely to War Problems

President John W. Lieb of the National Electric Light Association has sent the following notice to members:

The thirty-fourth annual meeting of the National Electric Light Association and its forty-first convention, to be held at the Hotel Traymore, Atlantic City, June 13 and 14, 1918, will be devoted entirely to problems of the war.

This will be a strictly business meeting, without entertainment of any kind. It will concern itself entirely with the vital problems of the industry arising out of the war, toward the winning of which the thoughts and energies of every public utility must be consecrated.

No papers will be read. Reports from committees and individuals and discussions will be confined to matters of major importance, and the brief two days will allow no time for the usual helpful discussions on general topics relating to the progress of the art. Everything said and done must be keyed to a victorious conclusion, and an early one, of the great struggle on which our nation has entered and in which our industry is taking a part of continually growing importance.

There will obviously be a reduced attendance, far below the numbers in pre-war years. Naturally, member companies, large and small, will endeavor to be represented by at least one of their officers or executives; and others in attendance would preferably be selected from among those dealing directly with the member company's activities affecting war work or civilian co-operation with the national government.

Our industry, increasingly a permeating factor in the national life, is now subjected to abnormal strains on its personnel and resources. It is the desire at such a vital juncture to devote the time and energies of the association and of those at the convention to only one enterprise which now counts—winning the war.

LIGHTLESS ORDER SUSPENDED BY FUEL ADMINISTRATION

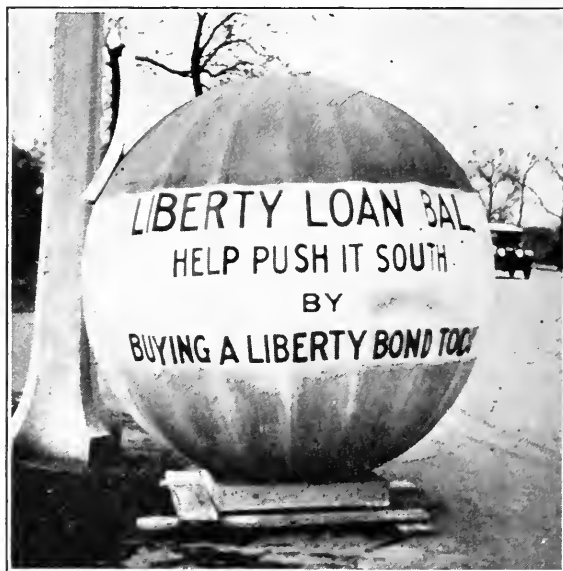
Dr. Garfield Withdraws Restrictive Regulations Until Sept. 1 at the Urgent Request of the Liberty Loan Committee

United States Fuel Administrator Garfield sent to all state fuel administrators on April 22 an order suspending until Sept. 1 the so-called lightless night order which went into effect last November, when extraordinary street and sign lighting was prohibited on Thursday and Sunday nights of each week. The order is:

"At the urgent request of the Liberty loan committee I have decided to suspend operation of the lightless night order beginning next Thursday night. [The lightless order was therefore suspended beginning April 25.—Eds.] By reason of the late hour of lighting brought about by the daylight saving law the lightless night order will remain suspended until Sept. 1 next, when it will again become effective."

Reports to Washington say the restrictions throughout the country on lighting, etc., have been modified by the state fuel administrators from time to time as weather conditions changed. Many of the modifications have been of purely local interest and have been dealt with in detail by the various state administrators.

Aiding the Sale of Liberty Bonds Electrically



During the Liberty loan campaign at Chicago a unique method of acquainting riders in automobiles with the progress of the local drive was worked out. A space on a North Side boulevard was marked off to represent Chicago's quota of bonds. As the sales force progressed with the sale a ball was moved over this marked section by an interval representing the number of thousands of dollars' worth of bonds sold. The ball was electrically lighted at night.

MEETING IN NEW YORK ON
PUBLIC UTILITY CONDITIONS

Conference Held by the Committee with Advisory
Committee Representing Electric, Gas and
Electric Railway Properties

A meeting of the National Committee on Public Utility Conditions was held in New York on April 18. It was called for a conference with the advisory committee. The National Committee on Public Utility Conditions is composed of P. H. Gadsden, E. K. Hall and H. H. Crowell.

The advisory committee consists of:
Representatives from National Electric Light Association—J. W. Lieb, New York Edison Company; Joseph B. McCall, Philadelphia Electric Company; Henry L. Doherty, Cities Service Company, New York.

Representatives from American Gas Institute and National Commercial Gas Association—Randal Morgan, United Gas Improvement Company, Philadelphia; A. P. Lathrop, American Light & Traction Company, New York; M. B. Daly, Eastern Ohio Gas Company, Cleveland.

Representatives from American Electric Railway Association—T. N. McCarter, Public Service Corporation, Newark, N. J.; L. S. Storrs, Connecticut Company, New Haven, Conn.; A. W. Brady, Union Traction Company of Indiana, Anderson, Ind.

Mr. Lieb has been elected temporary chairman of the advisory committee and T. C. Martin temporary secretary.

The National Committee on Public Utility Conditions is the committee which presented recently the facts showing increased costs of operation and the need of higher rates to officials of the Treasury Department, through whom they were referred to President Wilson.

This committee, composed of representatives of electric, gas and electric railway properties, will represent the utilities associations on matters common to the entire industries. It is not the intention to handle matters affecting individual companies.

Employees of New York Companies Doing
Their Share



Between 600 and 700 employees of the New York Edison Company in the Bronx district and of the Yonkers Electric Light & Power Company held a Liberty loan rally at 140th Street and Rider Avenue on April 22. Frank W. Smith, vice-chairman of the committee carrying on a campaign for bond subscriptions among the employees of the Consolidated Gas and affiliated gas and electric companies, presided. Addresses were made and the orchestra of New York Edison Company employees rendered several patriotic selections. The audience sang the "Liberty Anthem." Although 80 per cent of the audience had already subscribed, \$5,000 more was turned in. This brought the total subscriptions in the affiliated companies to \$870,000, with 11,607 employees out of 14,265 subscribing.

Congress to Consider Further Taxation Soon

Representative Kitchin, chairman of the House ways and means committee, during a debate in the House of Representatives, announced that Congress must soon consider whether further taxes are to be imposed.

Employees of Large Electrical Manufacturing Companies Helping to Win the War
by Buying the Liberty Bonds



AT SCHENECTADY WORKS OF THE GENERAL ELECTRIC
COMPANY



AT EAST PITTSBURGH WORKS OF THE WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY

LARGE TOTAL OF BUSINESS OF GENERAL ELECTRIC COMPANY

Electrical and Mechanical Orders in 1917 Reach
\$246,700,000 and Sales Billed Aggregate
\$196,900,000 in the Year

"In the year 1917 the volume of your company's business far exceeded that of any previous year," is the modest statement of C. A. Coffin, chairman of the board of the General Electric Company, in the annual report to stockholders. Values of orders received, compared with preceding years, were:

	Electrical and Mechanical	War Munitions	Total
1917.....	\$246,778,491	.....	\$246,778,491
1916.....	167,169,058	\$2,416,000	169,585,058
1915.....	98,385,891	33,980,000	132,365,891
1914.....	\$3,748,521	.....	\$3,748,521
1913.....	111,819,142	.....	111,819,142

The value of electrical and mechanical orders received last year increased 47.6 per cent over 1916 and 150.8 per cent over 1915.

Sales billed, \$196,926,318, increased 47 per cent over the previous year. Earnings compare as follows:

	Year Ended Dec. 31		
	1917	1916	1915
Sales billed	\$196,926,318	\$134,242,289	\$85,522,070
Less: Cost of goods billed. Including all operating, maintenance and depreciation charges	167,921,778	118,948,198	76,898,183
Balance	\$29,004,540	\$15,294,091	\$8,623,887
Interest and discount....	\$1,433,317	\$1,539,499	\$1,434,269
Income from securities owned	2,661,150	1,844,645	1,554,843
Sundry revenues	417,322	482,738	694,996
	\$4,512,289	\$3,866,882	\$3,684,108
Total	33,516,829	19,160,973	12,307,995
Less: Interest on debentures	571,645	571,445	570,085
Interest and discount on notes payable	541,356	.....	.....
	\$1,113,001	\$571,445	\$570,085
Balance	\$32,403,828	\$18,589,528	\$11,737,910
Less excess profits tax estimated	5,500,000	.....	.....
Available for dividends..	\$26,903,828	\$18,589,528	\$11,737,910
Dividends paid	*11,165,882	8,121,646	8,129,918
Net surplus for the year..	\$15,737,946	\$10,467,882	\$3,607,992
Previous surplus.....	34,160,753	23,692,871	20,084,879
Surplus	\$49,898,699	\$34,160,753	\$23,692,871

*Includes 8 per cent cash, 1 per cent cash "Red Cross" and 2 per cent stock.

Mr. Coffin says in part in the report:

A substantial portion of the large increase for the past year consisted of orders for ship propulsion and other apparatus placed by and for the United States government, but the increase extended to nearly every line of the company's product. Higher prices, due to increased cost of material and labor, were also a factor in the larger total value of orders.

The large increase in sales during the last two years has made it necessary to add to manufacturing facilities to an extent entirely without precedent. During the year \$22,320,895 was expended for land, buildings and other structures, tools, machinery and smaller equipment and fixtures. In view of the prevailing high prices of all material and other unusual conditions, the sum of \$13,287,249 has been charged against income and general reserve as depreciation and additional plant reserves, resulting in a net in-

crease, in the book value of plant and equipment, of \$9,033,646.

Although previous reports to the stockholders have only shown the net book value of the plant account, it has been the company's practice for years to maintain a record of the cost of property investments, confirmed by a careful appraisal. The difference between the gross and net book values has been carried on the general ledger in a "general plant reserve." It is now deemed desirable to set forth both items in the published report.

The large increase in the volume of orders naturally involved corresponding increases in merchandise inventories and in customers' notes and accounts receivable.

After deducting reserves which are regarded as ample the merchandise in factories, district warehouses and elsewhere is shown at a net book value of \$81,851,310, an increase of \$30,690,671 for the year.

Customers' notes and accounts receivable, after deducting adequate reserves, are carried at a net book value of \$38,406,993, which is \$11,590,695 more than the balance outstanding at the close of 1916.

The additional capital absorbed in plant extensions, inventories and customers' accounts amounted to \$77,602,262, in order to provide for which in part the company issued short-term notes during the year, the balance outstanding at Dec. 31 being: Issue of July 2, 1917, three-year 6 per cent notes, \$15,000,000; issue of Dec. 1, 1917, two-year 6 per cent notes, \$10,000,000; temporary notes, maturing in February and May, 1918, \$2,757,721; total, \$27,757,721.

It is expected that with the return of normal business conditions sufficient cash will be released by a reduction in inventories and customers' notes and accounts to provide for the two note issues aggregating \$25,000,000.

The federal taxes for 1917, including the income tax at 6 per cent, \$1,789,508, which was absorbed in cost of sales, and the estimated excess profits tax of \$5,500,000, will amount to \$7,289,508.

On May 8, 1917, Anson W. Burchard, vice-president, was elected a director of the company.

The board of directors desires once more to testify to its deep appreciation of the admirable response of the employees in all departments to the demands made by the difficult and pressing problems of the past year.

Mr. Coffin then takes up the increase in capital stock. None had been made since 1912, and in the meanwhile the growth of the business had been:

	1917	1912
Orders received	\$246,778,491	\$102,934,788
Sales billed.....	196,926,318	89,182,185
Net income (after all taxes) applicable to interest and dividends.....	28,016,830	13,110,823
Total surplus (after payment of interest and dividends), represented by investments in manufacturing facilities, working capital and other assets.....	49,898,699	12,031,145

On Jan. 3, 1918, stockholders voted to increase the authorized stock from \$105,000,000 to \$125,000,000, and they have since been given the right to subscribe at par for one share for each ten shares held. On Nov. 24, 1917, directors declared a semi-annual dividend of 2 per cent, payable in stock.

"This action was taken," says Mr. Coffin, "in view of the large surplus from accumulated earnings covering a period of years, invested in manufacturing facilities, working capital and other assets, against which no stock had been issued. Your directors preferred, rather than to increase the rate of cash dividends, to adopt the policy of paying semi-annual stock dividends at the rate of 4 per cent per annum, payable in January and July, in addition to the regular 8 per cent cash dividends."

Total factory floor space in 1917 was 17,573,000 sq. ft., as compared with 15,300,000 sq. ft. in 1916.

Book value of the manufacturing plants on Jan. 31, 1893, was \$3,958,528. In the twenty-four years ended Dec. 31, 1916, additional expenditures of \$88,634,909

were made, and in 1917 \$22,320,895 was added, making an aggregate of \$114,914,332. During the twenty-five years there was written off or carried to "general plant reserve" \$75,975,922, leaving the book value of all plants as of Dec. 31, 1917, at \$38,938,410.

In addition to the \$22,320,895 expended last year it has been necessary to authorize \$13,000,000 for further plant extensions, which will be completed during 1918.

The balance sheet as of Dec. 31, 1917, sets forth manufacturing plant, including land, buildings and machinery, at \$77,028,908, which, less the general plant reserve of \$38,090,498, leaves net \$38,938,410. Real estate, buildings, warehouses, etc., other than manufacturing plants, stood at \$794,210. Stocks, bonds and other securities were listed at \$37,348,608. Cash on hand was \$21,190,675. Current liabilities were \$18,450,025.

Speaking further of the balance-sheet changes, Mr. Coffin says:

For a number of years it has been the practice of the directors to provide against contingencies by setting aside substantial reserves. An examination of these reserves makes it clear that a proportion of them is unlikely to be used for the purpose originally intended, and such proportion, estimated at about \$12,000,000, has therefore been set apart and shown as a general reserve against all assets of the company other than its plant investment.

In past years it has been the company's practice to state its patent account at \$1, but a record has been maintained showing the serial number, date and cost of these patents. That proportion of the cost which represents the unexpired life of the patents, viz., \$3,097,444, is carried as an investment on the company's books, being offset by a reserve of like amount, and both accounts are now shown in full.

Details of the changes in the plant account were:

	Gross Book Value	General Plant Reserve	Net Book Value
Real estate and buildings.....	\$40,533,721	\$15,061,826	\$25,471,895
Machinery	31,274,744	17,808,232	13,466,512
Patents	1,991,110	1,991,109	1
Furniture and fixtures.....	3,229,331	3,229,330	1
Total.....	\$77,028,908	\$38,090,498	\$38,938,410

Give Liberty to the World

LIGHTING QUESTION FROM THE USER'S POINT OF VIEW

Electrical Engineer for Marshall Field & Company, Chicago, Tells of Effect of Light on Volume of Sales of Merchandise and on Factory Production

Frederick J. Pearson, electrical and mechanical engineer for Marshall Field & Company, Chicago, speaking before the Illuminating Engineering Society, Chicago Section, presented facts and conclusions regarding the use of light in the company's retail, wholesale and manufacturing establishments. Light intensity, he said, has a decided bearing on the rapidity with which retail merchandise moves. If time were available, actual data could be prepared from the records of the store to show that increasing the intensity of light beyond what is ordinarily considered a normal value increases the sale of goods in certain departments. The more intense light reacts on customers and salespeople alike. It intensifies the customer's desire to buy and increases the enthusiasm of the sales person. This does not hold true in all departments, however. It would obviously be foolish to try such a plan in the

Oriental goods department. There is, of course, a limit to the intensity that can be used with profit, but this intensity, the speaker thought, will approach daylight intensities more closely as the quality of the light is improved. The better quality of the gas-filled lamps in some measure helps to make possible the present high intensities used in the store. There is much less complaint now from lighting with 7 ft.-candles, 8 ft.-candles and 9 ft.-candles than there was with intensities 50 per cent as great before the advent of gas-filled lamps. Mr. Pearson expressed a firm belief that lighting should be designed for sales efficiency or production efficiency rather than lighting efficiency. He urged a thorough study of the conditions and a design based on the conditions rather than a study of installations already made and a copy of them.

Speaking of factory production in its relation to lighting, Mr. Pearson stated that he had been able to increase factory output as much as 10 per cent by the application of adequate lighting. The intensities used in the factories, of course, depend on the work. The average intensity for general lighting in Marshall Field's plants is from 6 ft.-candles to 7 ft.-candles, with special localized lighting as high as 15 ft.-candles.

The speaker's comment on lighting equipment, given altogether from the viewpoint of the user, was not altogether flattering. He dwelt at considerable length on the inadequacy of showcase lamps and lighting equipment, but stated that it is impossible to do without showcase lighting. He declined to comment on a trial installation which he had made to test many forms of daylight equipment. He expressed the general view that adequate lighting could most easily be secured by a scheme of general illumination supplemented by localized lighting.

How Hydroelectric Energy Saves Coal



Here is a 55,000-kw., 110,000/13,200-volt and 55,000/13,000-volt substation which materially reduces the amount of coal that must be hauled long distances into the great producing centers of the Northwest. It is "Terminal A" of the Minneapolis General Electric Company, which receives at Minneapolis hydroelectric energy from Taylor Falls, 40 miles distant, and from Wisconsin, 90 miles distant. Working at 50 per cent load factor, it will relieve Minneapolis industries from burning 360,000 tons of coal per year.

For a Free World—Buy Bonds

Our Boys Go—Shall Money Fail?

STUDY OF ECONOMY FOR THE PUBLIC UTILITIES

Addis Whitney of Boston Appointed by Commercial Economy Board of the Council of National Defense

The commercial economy board of the Council of National Defense has arranged with Addis Whitney of Boston to go to Washington in the near future to make a study and a report on opportunities in conservation among the public utilities of the country as a war measure. The board, of which A. W. Shaw of Chicago is chairman, has been instrumental in bringing about various economies in different industries, notably among department stores and laundries, eliminating overlapping deliveries, returning goods sent on approval and in similar ways.

Mr. Whitney has made a preliminary visit to Washington for conferences with officials. It is expected that two or three weeks will be required for his study, which, Mr. Shaw states, will take in possibilities of conservation in the use of capital and material.

He Also Fights Who Buys

DELAY IN WAR FINANCING AFFECTS PUBLIC UTILITIES

Washington Authorities Hear That Need of Prompt Action Is Urgent, but Liberty Loan Campaign Causes Delay

The delay in the organization of the War Finance Corporation, the enabling act for which was recently signed by President Wilson, is, according to reports reaching Washington, seriously affecting a number of large public utilities which have to finance maturities on the first of May. Public utilities in various sections of the country whose officials had looked forward to an early organization of the corporation and had expected that relief in finance would be afforded before this may not be able to obtain the necessary result under the act of Congress until after the present Liberty loan campaign is ended on May 6, when the Secretary of the Treasury will have returned to Washington and be able to take up with the President the subject of organization and appointing directors.

Reports reaching Washington show that between \$15,000,000 and \$20,000,000 in public utility securities will in all likelihood go by default on May 1, when they mature, unless, in the absence of the Secretary of the Treasury, there is assistance from unexpected governmental sources. Newspaper dispatches show that in at least one city, Pittsburgh, a receivership has been applied for, and there are reports in Washington of other possible difficulties.

The conditions, it is stated in Washington, point to the urgent necessity of the speedy organization of the War Finance Corporation, so that the investing public as well as the public utility management may feel that governmental machinery able and willing under proper conditions to come to the relief of the public utility industries has been set up.

There are no indications in Washington yet as to who will be appointed directors in the War Finance Corporation. It is believed that the matter will not be taken up at the White House until the return of Secretary McAdoo from his Liberty loan tour.

Will You Lend for Human Freedom?

WAR SERVICE OF THE WIRE AND CABLE MAKERS

Le Roy Clark Will Act Hereafter as a Government Representative Instead of as Representative of the Manufacturers

At a dinner-meeting of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies at the Yale Club, New York, on the evening of April 18, the conditions under which co-operation is being developed with the government on war orders were reviewed carefully.

Since the original formation of the wire and cable committee to give the fullest measure of service to the government, several changes have been made, which



LE ROY CLARK

were really in the nature of evolution to meet the necessities of the different government departments as they enlarged from time to time. Thus, the committee became a committee of the General War Service Committee of the Electrical Manufacturing Industry, and as such it represents all of the wire and cable manufacturers, without regard to whether they are or are not association members.

The latest change arises from the fact that Le Roy Clark, president Safety Insulated Wire & Cable Company, who has been the chairman of the wire and cable committee from its inception, has been made a member of the War Industries Board, serving as chief of the wire and cable section of the finished products division.

It was explained at the meeting on April 18 that Mr. Clark, as a result of this appointment, resigns as chairman and as a member of the committee. He, however, will continue to do exactly the same work of allocating government orders, though he will do so now as a government representative instead of as a representative of the manufacturers.

To take the place of Mr. Clark as a member of the

committee, George B. North, Hazard Manufacturing Company, was elected. The committee will elect a chairman later. The organization of the committee will be fully maintained, and it will be used to strengthen the co-operation between the government and the manufacturers.

Everett Morss, president Simplex Wire & Cable Company, a member of the priorities committee of the Council of National Defense, spoke at the meeting of the reorganization of the War Industries Board and emphasized how necessary it is that every manufacturer shall make all of the government work that he can handle in order to meet war necessities as promptly as possible.

A. W. Berresford, Cutler-Hammer Manufacturing Company, recently elected president of the Associated Manufacturers of Electrical Supplies, spoke of the effective work of the Wire and Cable Section for the government.

An interesting report was made by the freight committee.

In connection with the meeting the members of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies elected officers as follows: chairman, Le Roy Clark; secretary, J. Nelson Shreve, Electric Cable Company; treasurer, Edward Sawyer, Atlantic Insulated Wire & Cable Company.

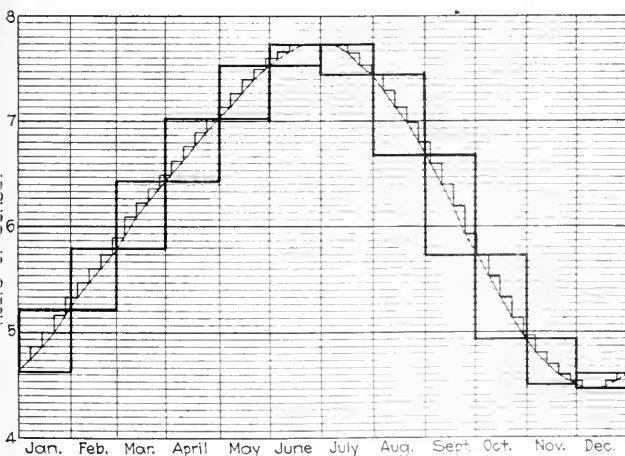
Back the Bayonets with Bonds

EFFECT OF THE CHANGE TO DAYLIGHT SAVING

William H. Winslow Shows Results of New Plan in Superior, Wis.—Regular Progression of Hour of Sunset

William H. Winslow, vice president and general manager Superior (Wis.) Water, Light & Power Company, has made diagrams showing the results of daylight saving which are reproduced herewith.

One chart shows a comparison of the total station load of that company between 6 and 11 p. m., standard

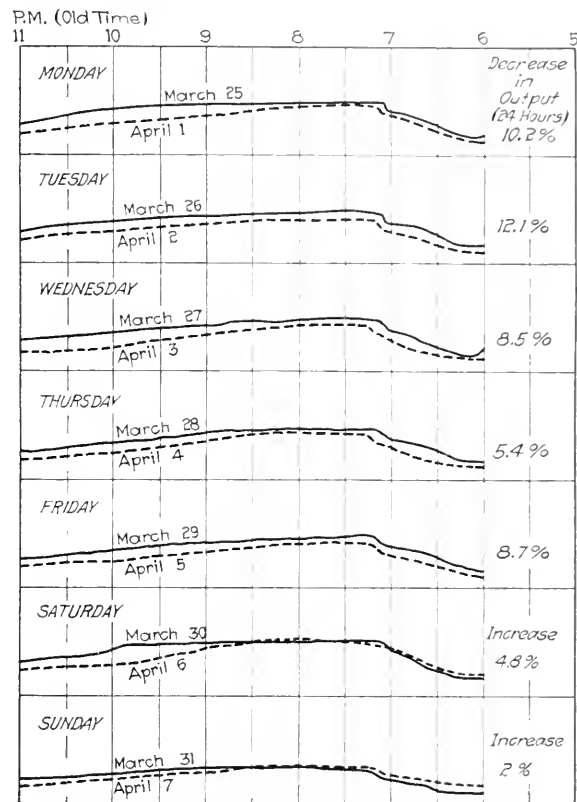


PROGRESSION AND RETROGRESSION OF SUNSET HOUR

time, or 7 to 12 p. m. as the clocks are now set, for the first week in April, compared with the same days of the week seven days earlier.

It will be noticed that all of the curves except those for Saturday and Sunday show a decrease throughout which is comparatively slight to about 8.30 (9.30 new

time), when it increases quite rapidly. The business of the company is very largely residential, such sales being almost equal to the commercial sales for lighting, and Mr. Winslow attributes the falling off in the load between 6 and 8.30 (old time) to the fact that there is now practically no duplication such as existed prior to April 1, when living-room lights would be turned on



BEFORE AND AFTER DAYLIGHT SAVING

before those in dining rooms, whereas now there is no light required until after the usual hour for the evening meal.

"The reason why the curves for Saturday and Sunday show no falling off until late in the evening and why the total outputs show an increase is that on these days in April we had a severe storm," Mr. Winslow says, "so that it was dark much earlier than usual. Of course, the first Sunday shown on the chart was supposed to be the beginning of the daylight-saving period, but it did not seem to be fully observed, so that I have used it in preference to going back another week."

The other chart brings out the fact, not perhaps generally appreciated, that during the first half of the year the progression of the hour of sunset is much more regular than is its retrogression during the second half of the year. The vertical height of each of the parallelograms shows the difference between the hour of sunset at the beginning and close of the month. It will be noted that the three months of August, September and October show a greater shortening of the days than the lengthening during the four months of February, March, April and May. The hours of sunset used are those given for this altitude in the World Almanac.

"I made this chart in connection with a study of the probable effect of daylight saving," adds Mr. Winslow, "but it is also useful in explaining to customers the rapid increase in their lighting bills during the fall months."

Buy for Liberty—Invest in Bonds

CONFERENCE ON WAR PROBLEMS BY SOUTHWESTERN ASSOCIATION

Rates and Labor Shortage, with High Cost of Operation, Discussed at Meeting at Dallas, Tex. —

W. A. Sullivan Elected President

War conditions were largely responsible for a falling off in attendance at the fourteenth annual convention of the Southwestern Electrical and Gas Association, which closed its session at Galveston, Tex., on April 17. The following officers were elected:

W. A. Sullivan, vice-president and general manager Shreveport Railway Company, president; Burr Martin, general manager Texas Electric Railway, Dallas, first vice-president; E. S. Fletcher, general superintendent Texas Power & Light Company, Dallas, second vice-president; A. Hardgrave, chief operating engineer Southwestern Utilities Company, Dallas, third vice-president, and J. B. Walker, treasurer. H. S. Cooper was elected executive secretary by the newly elected executive committee, making the seventh consecutive time for him to be chosen for this office.

The convention was opened on April 15 with President H. C. Morris, Dallas, presiding. The welcoming address was delivered by Mayor I. H. Kempner and the response by W. B. Head, vice-president Texas Power & Light Company.

Edward F. Harris of Galveston delivered a patriotic address on "War Savings, a Solution of Our National Problem."

Lynton T. Block, president Employers' Indemnity Insurance Association of St. Louis, spoke on "Jovian Insurance."

ADDRESS OF PRESIDENT MORRIS

"Since our last convention so many changes have occurred affecting the public utilities of various kinds comprised within this association that I found it difficult to decide where to begin," said President Morris in his annual address. He continued:

The first and most vital matter is the ratio between operating expenses and gross income, because that ratio must be in favor of the gross earnings to an extent to provide a reasonable return on our investment in our properties or we are potentially bankrupt, for the reason that one of our liabilities is the necessity of continually giving our customers a 100 per cent local service, and we are compelled to cut our service in either quantity or quality.

The most surprising condition which has come upon many of us within the last year is that while our gross receipts have largely increased, our operating expenses have increased in so much greater proportion that in almost every case our profits have decreased. As a matter of law we are compelled to take on under prescribed conditions any new business offered us in normal times, but the times are so abnormal that we are often compelled to protect customers by refusing new business which causes any expenditure for extensions, enlargements or increases.

One of the benefits of this condition is that it has compelled us, and still is compelling us, to investigate thoroughly our ability to saturate more completely the territory covered by our lines.

The ability of the private concerns to raise the prices of their products or services in proportion to the rise in the price of labor and materials used in manufacturing gave them an elasticity in financing which was denied the public utility, whose prices for its product or service were fixed

and which had not the power or the ability to increase them as its operating expenses increased.

The public has never been so educated that it has actually realized that the local utility, with few exceptions, is fully as dependent on ordinary business and commercial laws as is the local flour mill, cotton gin, furniture factory or any other local manufacturing or distributing business.

While present conditions have increased our operation expenses in almost every line and in every department of our business, the two most important things that we have to consider at this moment are labor and fuel. I have put labor first because all the rest of our business is dependent on it. Labor is the personal, human element which, when everything is fully reckoned up, makes us or mars us. We can accumulate a surplus of fuel, we can use a less economical or less efficient fuel, but we can do neither without labor. Under the peculiar conditions now confronting us, the "labor market" is so depleted that we cannot get the desired number of laborers. We not only have to make the best of what we have, but the prospects are that even this "best" may be further depleted in the near future. We have the experience of England and France to guide us, and this experience of theirs has shown only two methods of meeting the emergency. One of these is using a different character or class of labor from any ever used before. The other is making the present labor more efficient by supplementing it with labor-saving machinery. It is probable that we may have to do both.

With the proper and increasing objection to child labor, there is left as the single alternative the use of woman labor. England and France are not alone in the use of woman labor. Our own East and Middle West are employing women in work which twelve months ago would have been given to men only. We of the South and Southwest have certain traditions with respect to the employment of women in positions necessitating hard manual labor of great publicity which will make it difficult immediately to follow the example set in other portions of the country; but we may soon be compelled to follow their example.

We of the utility business are behind other manufacturing and distributing plants in the use of labor-saving machinery. With the sole exception of firing our boilers we have been plodding along with the same proportion of labor to our output as we have for years past. It is true that we have greatly increased the size of our generating, transmitting and distributing units, and have thus indirectly decreased the proportion of labor to output. That has been in most cases a resultant not fully considered in the investment, because the reason has been to obtain greater efficiency and economy in our apparatus. If by the expenditure of \$500 we make a net saving of only 10 cents per day in labor we have made an annual saving of \$36.50 per year, which is over 7¼ per cent on the investment. This is almost as good as a Liberty bond and nearly as patriotic, for we have released nearly \$40 worth of actually useless labor, and as badly as the government needs labor at this time every cent's worth wasted is a crime.

The question of fuel in Texas is a complicated matter, because we have four fuels locally available, coal, lignite, natural gas and oil. The distances in the State are so great that freight and pipe lines costs are a large factor. The necessities of the national government are such at this time that not only have the mine prices been raised on coal but freight rates in some cases have also been advanced. It seems probable that the use of oil as fuel may be still further restricted in the future to an extent which will make it too costly or too uncertain for the use of public utilities.

There has come at least one bright spot in the gloom surrounding the public utilities at this time, and that is the recognition which they have received at the hands of the government. No one can read the letters of our President and our Secretary of the Treasury or the reports of the Comptroller of the Currency and feel that our efforts have not been fully appreciated.

At the second day's session reports were made by H. S. Cooper, secretary of the executive committee.

Discussions on "What Are Many of Us Going to Be Compelled to Do on the Fuel Question?" and "A Safe

Method of Public Procedure When Increasing Operating Expense Necessitates Increase of Rates" filled the morning session on April 16. These were followed by a discussion on the possibility of using lignite for fuel. Fuel questions were brought up again at the afternoon session.

STUDY OF LIGNITE PROPOSED

Secretary Cooper displayed a geological map of Texas, in which locations of lignite beds were shown. These were found to be near the largest public utility plants. Mr. Cooper said that the deposits would be useless unless steps were taken to make the fuel easier to handle. He said that North Dakota has spent considerable money in looking into the possibilities of its lignite operations and that lignite is being stored in that State.

It was decided to consider sending two young men to the University of Texas to take a special course in geology for the purpose of endeavoring to find a solution for the fuel problem through lignite beds. H. C. Morris, Dallas, said that students of the University of Michigan and Cornell University are now studying the lignite problem with the hope that they may find a way in which the product may be used for fuel. These students are receiving geological instruction at the expense of public utility concerns.

The question of increasing rates was discussed by nearly every one in attendance. The prevailing opinion was that eventually rates must be raised because of the increased costs of labor and fuel. J. C. Kennedy of Brenham reported that some concerns have increased their rates without receiving complaints from the public.

Others maintained that in nearly every instance the public probably would complain if rates are increased, but that the public must be educated to the fact that it may be necessary to increase the rates on account of conditions being abnormal. Several expressed confidence that the public would not complain if reasonable increases in rates are made, and all delegates declared that no excessive profits should be made during the war. Every delegate declared that his company is endeavoring to give the best service possible and that consumers in general are pleased with the service.

A. Hardgrave, Dallas, said that no company should expect to increase rates except in cases of necessity. Several said that the companies should take up the matter of increasing rates with the city officials before making increases. Fred P. Brien, Amarillo, said that each company should have its employees become familiar with conditions and that by working out this plan the employees would tell the public of the conditions.

Secretary Cooper said that in any event the rates should be made equitable. "It may not be so much a matter of increasing rates as it may be of revising rates," he declared.

The question of obtaining sufficient labor during the war also was discussed. Delegates said that they were making the best of conditions under the circumstances, but all of the companies have lost considerable numbers of capable employees on account of the draft. Some companies are training men who are not subject to draft.

R. W. Van Valkenburgh, Dallas, general manager of

the Texas Western Electric Company of Texas, read a paper on "Suggestions for Conservation in Purchasing from the Seller's Standpoint." The paper contained numerous suggestions that might be used by the sellers and pointed out the necessity of conservation. The paper was followed by discussions on the subject.

Build for the Future—Buy Bonds

COMMISSIONS SHOULD HAVE POWER TO INCREASE RATES

Commissioner Whitney of New York Says that
Policy Must Assure Development and
Improvement at All Times

Commissioner Travis H. Whitney of the New York Public Service Commission, First District, describes the attitude of the commission as a recognition of the need for a close continuous scrutiny of the public utility corporations and for a rate that will "yield operating expenses, depreciation and obsolescence and a moderate return on the actual value of the property." This appears in a statement prepared by Mr. Whitney concerning the commission's administrative, judicial and legislative functions.

It is stated that when operating expenses are lowered through a decline in wages, costs or otherwise there is reason for reducing the rates charged the public, but when the reverse condition prevails the commission should have the power to increase rates.

Commissioner Whitney says further:

The commission must see that the public gets what it pays for. That task requires the constant supervision of all phases of public utility service. The basis of the right of a public utility to charge a reasonable rate and earn a reasonable return is the furnishing of adequate service, and the duty of the commission is to determine what service shall be rendered and the rate to be paid for that service.

The commission must see to it that the public pays for what it gets. The commission ought to be at all times in a position to see to it that the rates are such as to represent payment by the public for what it gets, no less and no more. If the company is to be at all times denied the right to earn more than a fair return when operating costs are falling, it cannot be left to earn less when costs are mounting.

The commission must see to it that the policy pursued by it and by other public authorities is such as to assure at all times the development and improvement of public utility enterprises. It must also see that the conditions surrounding public utilities are such as to encourage new utilities where and when needed, and generally to attract the necessary capital to enable the upkeep of the properties and service at suitable efficiency.

Capital can be drawn to public utilities from private enterprises only by establishing an attractive relationship between the certainty of return and the percentage of return the utility is allowed to earn upon the money of investors.

It is also shown by Mr. Whitney that if capital is deterred from embarking in public utility enterprises the public suffers.

The Legislature will be asked to amend the public service commissions law so that the commissions will have authority to raise rates as well as to reduce them.

End the Spy System—Buy Bonds

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Synchronous Club of Los Angeles.—The annual banquet of this club was held in Los Angeles on April 18.

A. S. M. E., Providence Section.—The power division of the Providence Section of the American Society of Mechanical Engineers will hold a discussion on "Thermal-Insulation Covering" on May 9.

A. I. E. E., Madison Section.—On April 16 G. E. Wagner talked on "Three-Phase, Four-Wire Distribution" before the Madison (Wis.) Section of the American Institute of Electrical Engineers.

A. S. M. E., Los Angeles Section.—"Power Sources and Distribution in California" will be discussed at the meeting of the Los Angeles Section of the American Society of Mechanical Engineers in May.

New York Electrical Credit Association.—On Tuesday evening, April 30, the New York Electrical Credit Association will hold its regular annual meeting at the Building Trades Club, 30 West Thirty-third Street, New York.

A. I. E. E., Cleveland Section.—"Storage Batteries in War" was the subject of a talk delivered by M. R. Berry, president Electric Products Company, before the Cleveland Section of the American Institute of Electrical Engineers on April 22.

Electrical League of Cleveland.—Major Ross C. Cockburn of Toronto, Canada, a veteran of Canada's Expeditionary Forces, gave an interesting address entitled "The First Canadian Contingent" before the Electrical League of Cleveland on April 18.

A. I. E. E., Seattle Section.—F. Lindsay presented a paper on "Recent Additions to the Generating Equipment of the Puget Sound Traction, Light & Power Company" on April 16 before the Seattle Section of the American Institute of Electrical Engineers.

A. I. and S. E. E. Inter-Section Meeting.—The Pittsburgh and Cleveland Sections of the Association of Iron and Steel Electrical Engineers will hold a joint session at Youngstown, Ohio, on May 18. A special trip will be made to the McDonald and Ohio works of the Carnegie Steel Company.

A. I. and S. E. E., Philadelphia Section.—On May 4 the Philadelphia Section of the Association of Iron and Steel Electrical Engineers will hold a meeting at the Majestic Hotel, at which H. A. Lewis and W. H. Burr will present a paper on "Electrically Operated Door Hoists for Open Hearths and Furnaces." Major William A. Garret will address the meeting on "Some of My Observations in France."

Western Society of Engineers.—"Storage of Bituminous Coal" was the topic of a paper read by H. H. Stoeck, professor of mining engineering, University of Illinois, before the Western Society of Engineers at Chicago, April 15.

A. I. and S. E. E. Section Meeting.—T. F. Bailly, president of the Electric Furnace Company, is to read a paper on "Electric Soaking Pits, Annealing and Heat-Treating Furnaces and Furnaces for Melting Non-Ferrous Metals" before the Cleveland Section of the Association of Iron and Steel Electrical Engineers on April 27.

A. S. M. E., New York Section.—"Labor Turnover" will be the subject of a discussion at the May 21 meeting of the New York Section of the American Society of Mechanical Engineers. The subject will be presented by Captain Boyd Fisher of the War Industries Board at Washington and G. R. Woods of the Allied Machinery Company.

Electric Club-Jovian League.—The Electric Club-Jovian League of Chicago has recently listened to two war addresses. Rufus C. Dawes gave some amazing figures on the cost of the war and on the sums of money expended by the United States. Alexander Reichmann spoke on April 18 on "Reflections on the War, Its Consequences and Problems."

A. I. E. E., Schenectady Section.—"Modern Transformers" was the subject of an illustrated address delivered by J. J. Franks of the engineering department of the General Electric Company before the Schenectady Section of the American Institute of Electrical Engineers on April 19. The design of both large and small transformers was discussed.

Jovian League, Atlanta, Ga.—A chapter of the Jovian League has been formed in Atlanta that will include Jovian and non-Jovian members. It will be made up strictly of those in the electrical industry. The membership will be limited to fifty during the first six or eight months, and the object will be of a promotional character both for electrical and civil purposes. C. D. Cabiness, Western Electric Company, has been chosen as the first president, and C. A. Collier, Georgia Railway & Power Company, secretary-treasurer.

Ohio Electric Light Association, New-Business Meeting.—The industrial power and heating section of the new-business committee of the Ohio Electric Light Association will hold a meeting at the Electrical League club-rooms, Statler Hotel, Cleveland, on May 8. Papers to be presented are: "Present Status of the Electric Brass Furnace," by H. M. St. John, research engineer, Commonwealth Edison Company, with discussion by E. F. Collins, Schenectady, N. Y., and T. F. Bailey, Electric Furnace Company, Alliance, Ohio; "Silent Chain Drives Used in the Application of Electric Motors," by Paul V. Wheeler, Cleveland; "War-Time Economies," by W. A. Wolls, Columbus Railway, Light & Power Company, Columbus, Ohio.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Liability for Injury on Private Premises.—Where plaintiff's injuries resulted from electric wires of defendant city left lying on private premises, the city's liability depends on whether plaintiff was a trespasser or had a legal right to be on the premises, according to the Court of Appeals of Kentucky (200 S. W. 931).

Condemnation Denied Where Acquisition Will Not Accomplish Object.—Where another company has condemned part of land intended by a water company to be a part of its project, proceedings by the latter to condemn the remaining part will be dismissed where the acquisition of such lands could not accomplish its object, as shown by its filed maps and plans, the Supreme Court of New York held in Ramapo Mountains Water Power & Service Company vs. Seidler (168 N. Y. S. 737).

Contract to Furnish Energy.—Where complainant had paid for electric light to be furnished for three years pursuant to a contract an injunction will issue to prevent cutting off the light or to compel a public utility company which had turned the current off to turn it on again, the Supreme Court of Arkansas held (200 S. W. 799). A contract by an electric company to furnish a consumer free energy for three years upon being released from a previous contract to furnish energy for a share of the consumer's earnings was held not invalid because discriminatory in a case where the franchise from the city did not appear to prohibit such contracts.

Franchises Free from State Control.—While the state may authorize municipalities to grant a franchise to a public service corporation free from the exercise of the state's power of regulation, such franchises are never construed to have that effect unless the state's grant of authority and the municipality's grant in the franchise are clear and positive, according to the Supreme Court of Indiana (118 N. E. 531). A state may ratify a franchise granted by a municipality which excepts the grantee of the franchise from the exercise of the state's power of regulation, even though the municipality had no authority so to exempt at the time of granting the franchise. The act of 1867, as amended in 1891, giving the common council of a city exclusive power over the streets, highways, alleys and bridges within the city did not authorize the city to grant a franchise to a public service corporation free from the state's police power to regulate.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Fuel Administration and Utility Ownership Problems.—A letter from Dr. H. A. Garfield, the federal Fuel Administrator, has been made public by representatives of the United Improvement Association of Los Angeles, Cal. That association sent recently to the federal Fuel Administration a copy of a letter in which the association urged the city council of Los Angeles to take action to conserve the city's power rights. "You may rest assured," says Administrator Garfield, "that the Fuel Administration will do nothing under the guise of conservation that would cause injustice to the people of Los Angeles, and that the State of California must determine for itself whether municipal ownership or private control shall be the future policy in its regulation of public utilities."

Electric Storage Battery Earnings.—The annual statement of the Electric Storage Battery Company, Philadelphia, for the year ended Dec. 31, 1917, shows gross sales, less cost of manufacture and purchases and all expenses incident thereto, amounting to \$3,140,560. Operating expenses, including salaries, commissions, engineering, selling and traveling expenses and rent of branch offices, were \$919,947. Net earnings from sales were \$2,220,613. Other income amounted to \$257,269, making total net earnings of \$2,477,882. There was reserved for 1917 federal taxes \$450,000, leaving a balance for surplus account of \$2,027,882. The balance of Dec. 31, 1916, amounted to \$2,318,686. Dividends paid during 1917 aggregated \$649,967, and "sundry adjustments of accounts and all items not incident to the current year" aggregated \$102,009. The net surplus was \$3,594,592.

School for Women Substation Operators.—Because of the existing and constantly increasing shortage of male labor due to war conditions, the generating department of the Edison Electric Illuminating Company of Boston has started a school for women substation operators. The school opened March 25 with fifteen members at the service buildings, and is being conducted by the laboratory, under the direction of P. J. Kent, system operator of the generating department. The school for women operators has been started as an experiment, to determine whether it is practicable, as a war measure, to substitute them for men in some substations. The women are receiving the same pay at this school that the men are receiving at the L Street school. Married men and men over the draft age will not be displaced by women, but only young single men of small experience.

Effect of Closing Window-Glass Factories.—With the first operating period allowed manufacturers of window glass by the United States Fuel Administration at an end, and the closing of approximately forty-five such plants, largely distributed through Pennsylvania, Ohio and West Virginia, a statement made public by John R. Johnston, secretary of the National Association of Window Glass Manufacturers, shows that the early closing order has resulted in a great saving of fuel, labor and freight capacity. The curtailment of output in the window-glass trade, according to the statement of Secretary Johnston, will save 450,000 tons of coal and 18,000 freight cars and release 5500 workmen for other labor. The direct loss to glass blowers, the statement says, will approximate \$3,000,000, although this will be reduced by earnings in other industries. The resulting shortage in window glass is estimated at 5,500,000 boxes, or about half the yearly output of 11,000,000 boxes.

Opportunities in the Ordnance Department.—Two statistical engineers are needed by the Control Bureau, Ordnance Department, Washington. Each position calls for a man who is keen, an analyst, with vision, accomplished in the compilation of reports and statistics, and able to put himself in the reader's place. He should be a college or technical graduate and from thirty-five to fifty years of age. There is also an opportunity for two men along the same line but with less experience and younger. Four men are also wanted experienced in cost keeping and bookkeeping who have skill and initiative. They must be over the draft age. There is an opportunity here for men with and without college degrees. Women college graduates with mathematical ability and actual practical experience in such work as bookkeeping and statistics and able to make charts of various kinds are also desired. Address Chief of Personnel of Control Bureau, Chief of Ordnance Department, Washington, D. C.

Stevens Institute for Steam Engineering Training School.—The Navy Department, after consultation with President Humphreys, has designated the Stevens Institute of Technology, Hoboken, N. J., as the headquarters for the new United States Naval Steam Engineering School for the training of engineer officers for the United States Naval Auxiliary Reserve. This school is the only one devoted to training engineer officers for steam-engine service and is a branch of the large training school at Pelham Bay Park, New York. There is at Pelham, in addition to the school for general training of enlisted men, an officers' material school, Naval Auxiliary Reserve. Both the school at Pelham and the engineer officer school at Stevens are under the supervision of the supervisor of the Naval Auxiliary Reserve. The education of the engineer officers at Stevens is directed by Prof. F. L. Pryor of that college, who has been appointed by the Navy Department, with the approval of President Humphreys, civilian director.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Contracts in Illinois.—In an issue affecting the Normandie Hotel Company and the Commonwealth Edison Company, Chicago, the Illinois Public Utilities Commission says in part: "It appears that the consumer in signing a contract in August, 1916, signed it with a different name from that signed to the original contract. Knowledge that the café and hotel were operated under one management could only have been obtained through an inquiry into the business affairs of the consumer. Such an inquiry could hardly have been expected of the Commonwealth Edison Company and might have proved a source of embarrassment to the consumer. In case the company, acting in good faith, accepts a signature to an application for service, the commission believes that a practice requiring inquiry into the ownership of the business would result in imposing unwarranted expense upon the company and would further result in just complaint and criticism on the part of the consumer. The commission therefore finds that under conditions existing at the time of signing the contract, in August, 1916, the company was under no obligation to inquire into the ownership and management of these premises. A further question exists as to whether the company, after determining that an error has been made in signing the contract as hereinabove set forth, should be ordered to refund to the consumer the difference of bills which has resulted from this error. To impose this obligation upon the company would result in opening innumerable contentions for refunds, many of which might have a semblance of justice and many of which would be unjust, but all of which would involve an adjudication of issues which had arisen during times long since past. The adjudication of these issues, if conducted properly, would involve a large amount of investigation and expense. The liability of the company for the errors which it has committed, due to wrongful meter readings or discrepancies in billing, cannot be denied, but to extend this liability to cases which involve errors on the part of the consumer would offer problems of an entirely different character. Quite aside from any legal obligation and liability which the company may have in this or similar cases, and upon which the commission is not passing, to hold in this case that the reasonable practices of the utility warrant a refund of the overcharges would be in effect holding that the company is liable not only for its own errors but for the errors of its consumers. The commission believes that this would be unreasonable."

Charles H. Session has been appointed a member of the Kansas Public Utilities Commission.

R. T. Carruthers has been appointed district agent for the Southern California Edison Company in the Visalia district.

R. H. Ballard, second vice-president and assistant general manager of the Southern California Edison Company, in the rearrangement of titles becomes first vice-president.

Charles Strong has resigned as engineer for the Galva (Ill.) Electric Light Company to become connected with the Galesburg & Kewanee (Ill.) Electric Railway Company.

O. E. Hines, formerly new-business manager of the Washington (Ohio) Gas & Electric Company, will succeed C. B. Owens as manager of the Boonville (Mo.) Light, Heat & Power Company.

Harry Strapp, a load dispatcher for the Edison Electric Illuminating Company of Boston, Mass., has resigned to become superintendent of the Towns Electric Light Company, Harbor Grace, Newfoundland.

Jerome L. Cheney of Syracuse, N. Y., has been appointed a member of the Public Service Commission for the Second District of New York State, to fill the vacancy caused by the death of William Temple Emmet.

C. W. Beck, formerly superintendent of the Valparaiso (Ind.) Lighting Company, has been appointed manager of the Albion (Mich.) Lighting Company. Mr. Beck was graduated from the University of Nebraska in 1914.

Albert M. Grall, Webb City (Mo.) representative of the new-business department of the Empire District Electric Company, has been made new-business manager of the Ashland (Ohio) Gas & Electric Company.

George H. S. Mart, for the last seven years superintendent and commercial manager of the Knoxville (Tenn.) Railway & Light Company, has opened an office as a consulting and efficiency engineer in the Holston National Bank Building, Knoxville.

H. A. P. Langstaff, for the past two years associated with Willis L. Adams as electrical engineer, has resigned to become field electrical engineer for the J. G. White Engineering Corporation at Muscogee Shoals, Ala., on the United States government nitrate plant No. 2.

Harry L. Thomson has been promoted from assistant superintendent of lighting of the Hartford (Conn.) Electric Company to superintendent of lighting, succeeding F. W. Prince. Mr. Thomson, who is a graduate of the Rensselaer Polytechnic Institute, has been connected with the Hartford company since 1910.

Arthur L. Mullergren, secretary-treasurer of the Benham Engineering Company, consulting engineers, Oklahoma City, Okla., has been commissioned a first lieutenant in the Quartermaster's Corps of the National Army and assigned for duty as officer in charge of light, power and ice, camp utilities division, Camp Funston, Kan.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

J. R. Newell, formerly in charge of electrical construction, has been appointed superintendent of electrical operation for the British Columbia Electric Company, succeeding W. H. Fraser.

W. H. Fraser, superintendent of electrical operation for the British Columbia Company of Vancouver, B. C., has resigned that position to undertake similar work for the Mexican Light & Power Company at the city of Mexico.

Arthur Preger has been promoted by the Federal Light & Traction Company from the assistant treasurership of the Springfield (Mo.) Railway & Light Company and the Springfield Traction Company to be manager of the Albuquerque (N. M.) Electric Light & Power Company, succeeding W. P. Southard.

George Steinwedell, a former member of the new-business department of the Denver Gas & Electric Company, has been made manager of the Binghamton (N. Y.) Gas & Electric Company. On leaving Denver Mr. Steinwedell became advertising manager for the St. Paul Gas & Electric Company and then went East.

P. M. Downing, chief engineer of the electric department of the Pacific Gas & Electric Company, San Francisco, Cal., has been placed in charge of the combined operating plants of the Pacific Gas & Electric Company, Great Western Power Company and Sierra & San Francisco Power Company, which have pooled their activities as a means of aiding in the general conservation of fuel oil.

Prof. Philip B. Woodworth, dean of electrical engineering of Lewis Institute, Chicago, has entered the government service as a major in the aviation section of the Signal Corps. Professor Woodworth in 1910 became associated with the patent law firm of Rummler & Rummler, Chicago, where he gave his attention to applications for patents on electrical products and patent suits involving electrical points.

F. T. Morrissey, who has been associated with the Southern Illinois Light & Power Company and its subsidiary, the Saline Electric Company, for several years past as manager of its Duquoin (Ill.) properties and is at present district manager of its Eldorado group of properties, has resigned to become associated with the Indiana Railways & Light Company at Kokomo, Ind. Mr. Morrissey was previously connected with the Illinois Northern Utilities Company, the Kansas City Electric Light Company and the Eastern Michigan Edison Company.

C. B. Owens has resigned as manager of the Boonville (Mo.) Light, Heat & Power Company to enlist in the Thirty-seventh Engineers.

C. W. Squier has resigned as assistant electrical engineer of the Public Service Commission for the First District of New York to become a member of the editorial staff of the *Electric Railway Journal*.

Charles Philip Coleman has advanced in position from vice-president to president of the Worthington Pump & Machinery Corporation. Prior to becoming vice-president of the corporation, in May, 1916, he was receiver of the International Steam Pump Company, an associate company. Mr. Coleman, who is a graduate mechanical engineer of Lehigh University, has had considerable experience in industrial and railroad corporations. He joined the International Steam Pump Company in 1913 as vice-president, and upon the outbreak of the war in 1914 was made one of the co-receivers of the company, becoming sole receiver in 1915.

W. B. Voth has resigned as manager of the Ogdensburg (N. Y.) Street Railway, the Ogdensburg Power & Light Company and the Ogdensburg Gas Company to become manager of the properties at Eau Claire, Wis., operated by the Wisconsin-Minnesota Light & Power Company. Mr. Voth is a native of Milwaukee. He was graduated from the University of Wisconsin in 1897. After designing, constructing and operating several small hydroelectric plants in his native State, he was appointed resident engineer at Sheboygan in 1904 during the building of a steam station and the reconstruction of the local commercial and street-lighting system. After finishing the construction work, Mr. Voth remained to operate the plant as general superintendent. At the same time he acted as consulting engineer for the Greensboro (N. C.) company, controlled by the same interests. He resigned from these companies in 1914 to enter the service of the Empire United Railways.

C. R. Dooley, manager of the educational department of the Westinghouse Electric & Manufacturing Company, has been granted a leave of absence to enable him to accept an appointment by the government as director of the vocational educational project for army needs, now being developed by the War Department committee on educational and special training. He will be in the War Department at Washington. With the assembling of the first drafted men at Camp Sherman, Mr. Dooley was given the task of instituting and putting into operation a system of classification by which it is possible in a few minutes to select from the men in the cantonment the one best fitted for any particular class of service. The efficient manner in which this system was installed is largely responsible for Mr. Dooley's second call from the government. During Mr. Dooley's absence from the Westinghouse company his duties there will be assumed by C. S. Coler, who has been appointed acting manager of the educational department.

Louis H. Mather has been appointed superintendent of distribution for the gas and electrical department of the city of Norwich, Conn.

F. A. C. Tocque, formerly new-business manager of the Fort Smith (Ark.) Light & Traction Company, has passed the necessary examinations for entrance into the Canadian officers' training camp and will sail for England.

Fred M. Reast has resigned from the engineering inspection branch of the Western Electric Company to become second lieutenant in the Quartermaster's Corps of the National Army and is now stationed at Camp Holabird, Baltimore, Md.

Ainslie A. Gray of the firm of Gray & Benjamin, advertising specialists, Chicago, has been commissioned major in the Ordnance Reserve Corps and will have charge of a new publicity bureau that will endeavor to co-ordinate the activities of the Ordnance Department and the industries through the medium of the technical and trade press. Formerly he was vice-president and general manager of the Electrical Review Publishing Company. He joined the staff of the *Electrical Review* in 1902, becoming managing editor in 1905. When the Electrical Review Publishing Company purchased the *Western Electrician* he became managing editor of the consolidated paper. In 1909 he also became general manager of the company and in 1914 was elected vice-president. He was made vice-president of the Chicago Trade Press Association in 1913 and the following year became its president. In 1915 he was elected president of the Federation of Trade Press Associations. In 1916 this body was reorganized as the Associated Business Papers, Inc., and Major Gray continued as its president until last year.

J. W. Welsh, electrical engineer and traffic agent of the Pittsburgh (Pa.) Railways, has been called to Washington, D. C., by A. Merritt Taylor, manager of passenger transportation of the Emergency Fleet Corporation of the United States Shipping Board. Mr. Welsh, who will serve on Mr. Taylor's staff, will assist in providing transportation facilities and remedying deficiencies, where such exist, in the shipyards on the Atlantic and Pacific coasts. Mr. Welsh became associated with the Pittsburgh Railways in 1906 as assistant electrician. In 1910 he was made electrical engineer and in 1913 took charge of the traffic department. Prior to this time he was employed as an electrical engineer by the National Tube Company, Wheeling, W. Va., and also by the Westinghouse Electric & Manufacturing Company at East Pittsburgh. He was graduated from Wittenberg College in 1900, Harvard University in 1901 and the Massachusetts Institute of Technology in 1903. He is a fellow in the American Institute of Electrical Engineers and several years ago served as chairman of the Pittsburgh Section of this organization. Since 1914 he has been chairman of the power generation committee of the American Electric Railway Association.

J. S. Wharton, formerly manager of the Southern Gas & Improvement Company at Henderson, N. C., and having charge of the gas plants at Elizabeth City, N. C., and Rock Hill, S. C., has been appointed manager of the Helena (Ark.) Gas & Electric Company.

William H. Merrill, president of the Underwriters' Laboratories, Chicago, has been appointed section committee chairman of the newly organized fire prevention section of the War Industries Board of the Council of National Defense. Mr. Merrill is now in Washington to assume the duties of the new position for the period of the war. He brings to the fire prevention section experience in fire prevention engineering gained during a period of twenty-five years of active participation in nation-wide fire-prevention work. Four years after his graduation from the Massachusetts Institute of Technology, in 1889, he went to Chicago as elec-



W. H. MERRILL

trician with the Chicago Underwriters' Association, and in the following year, upon association with the Western Insurance Union, organized the Underwriters' Bureau of Fire Protection Engineering. Mr. Merrill assisted in the organization of the electrical committee of the old Underwriters' National Electric Association, and participated in the conferences which resulted in the National Electrical Code. He was secretary-treasurer of the National Fire Protection Association and president two years, besides being for a long time a member of its executive committee and other important committees interested in the maintenance of electrical standards.

Obituary

James A. Scrymser, president of the Central and South American Cable Company and the Mexican Telegraph Company, died at his home in New York City on April 21, in his seventy-ninth year. Mr. Scrymser was a pioneer in the establishment of wire communication between the United States and Latin America, and in 1917 succeeded in establishing the first American-owned line direct between the United States and Brazil.

Charles H. Merritt, general manager of the Danbury (Conn.) & Bethel Gas & Electric Light Company, died April 3 in his seventy-fifth year. Mr. Merritt went to Danbury in 1868 and entered the shoe business, in which he continued until 1880, when he became interested in the hat trade, in which he remained until his retirement in 1907. Before 1880, however, Mr. Merritt had become a public utility figure in Danbury, he having been connected with the old gas company and later with the electric company, becoming president and general manager while still in the hat business. When the Doherty interests took over the Danbury company in 1912 Mr. Merritt headed it, and he has remained in that position ever since. Mr. Merritt's local activities extended far beyond business, however, and he was very active in charitable and social work.

Dr. Ferdinand Braun, who in 1910 shared with William Marconi the Nobel prize for physics awarded for services to humanity through the invention of improved methods in wireless telegraphy, died in New York City on April 20 in his sixty-ninth year. Dr. Braun was born at Fulda on June 6, 1850, and received his education at the universities of Marburg and Berlin, graduating from the latter in 1872. In 1895 he was appointed director of physics at the University of Strassburg. He came to this country in 1915 as a witness in the litigation between the Marconi company and the German company which operated the wireless plant at Sayville, Long Island, and Tuckerton, N. J. His early studies were devoted largely to mechanical oscillations, but later he devoted his attention chiefly to research on electrical problems, and more particularly to radio-telegraphy.

James P. Merrihew, one of the oldest of the telegraph and telephone engineers, has recently died at the age of eighty. He started his career as a messenger boy with the Western Union and at the age of sixteen was manager of a telegraph office in a small New Jersey town. About 1877 Mr. Merrihew and the late W. T. Westbrook, Sr., secured a license from the American Speaking Telephone Company and established exchanges at Wilmington, Chester and Trenton, under the firm name of J. P. Merrihew & Company. On July 18, 1882, the Delaware & Atlantic Telephone & Telegraph Company was organized by Mr. Merrihew at New York, and a few months later a similarly named company was incorporated under the laws of the State of Pennsylvania. He was the first president and also a member of the board of directors and remained at the head of these conferences until July, 1897. For a number of years he was president of the Bell Telephone Company of Philadelphia. In the early seventies he was manager of the Western Union force in Philadelphia and later became superintendent of the sixth district. About the year 1880 he became the general superintendent of the Western Union company.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

DEMAND FOR TRANSFORMERS HAS DROPPED CONSIDERABLY

Shipments Can Now Be Made Under Six Months on
All Sizes and Types—Stock on Smaller Sizes Is
Being Accumulated

Since early last fall transformer business has dropped from the high level occasioned by the entry of the United States into the war. Present-day demand is probably in the neighborhood of 70 per cent of what it was ten months to a year ago. During the past few weeks the demand has been noticed to rise somewhat, and indications are for a continuance of the present volume of business.

While it is true that the manufacturers have by no means entirely caught up with old business, deliveries are now much closer to normal. In some sizes and types stocks are beginning to accumulate. Present manufacturing capacity is now in excess of current demand.

Shipments on all sizes, even for special construction, are now being made well under six months. Under 50 kva. shipment in four weeks is being promised, and in many cases orders are being filled from stock. Longer time is required for larger sizes, but only recently some very large transformers were ready for shipment in four months.

There does not seem to be any tendency toward lower prices, while there is some talk by manufacturers of higher prices if raw materials continue to advance. Present contracts, of course, will not be affected, but new contracts may be made on a different schedule or price basis. Boiler plate and cotton thread are at present the most alarming of the raw materials. Transformer oil deliveries are now in better condition, and the supply of oil drums is freer.

Obeys That Impulse—Buy a Bond

RETURN-GOODS NUISANCE SUPPRESSED BY JOBBERS

Dealers or Contractors Must Obtain Permission
Before Credit Is Allowed—Rigorous Rule
to Bring This About Is Applied

Returning merchandise to the jobber, distributor or manufacturer by the dealer or contractor, at their own discretion, and demanding credit allowance in addition, without first obtaining permission, has been greatly abused. In fact, to accept the statement of a number of jobbing houses, the practice had actually become a menace, so widely was the custom followed. Other lines of business have been victimized in the same way by unscrupulous buyers, so much so that organized efforts to lessen the evil, if not wholly suppress it, have received special attention at the hands of trade associations. It is generally admitted, however, that keen competition for orders is alone responsible for these and similar loose business methods. Conditions since the advent of the war have changed radically.

Jobbers may differ in their ways of handling the return-goods problem, but after inquiry it is ascertained that concerns of standing have a rule in connection therewith which they enforce. The following, appearing in a recent price list of a prominent jobber, is a fair sample of them all:

"No goods can be returned for credit without our permission, first obtaining our return-goods tag, to be attached to goods returned. All goods returned for credit must be in salable condition, and all charges must be prepaid. A

minimum service charge of 20 per cent will be made on all standard apparatus returned for credit. No permission will be given to return apparatus of any special finish, design or capacity. No permission will be given to return apparatus that has been shipped over sixty days."

Every Bond Brings Victory Nearer

TEMPERAMENTAL WORKMEN AT WIRE PLANTS TROUBLESOME

Skilled Operatives Have Peculiarities as Specialists
and Have a Tendency to Be Shifting
All the Time

Besides the difficulty of obtaining early or prompt delivery of copper to the wire drawers and manufacturers, labor at these plants is not only short but at times creates embarrassing conditions. One large wire producer said the major part of the labor force were foreigners—Poles in many instances. They are skilled men, excellent artisans, but inclined to be "temperamental." The practice at this and other plants is to use the working operatives to the best advantage.

Occasionally the supply of bare copper wire runs low, and replenishment cannot always be accomplished now readily and promptly. At such periods the management shifts these men to other departments and on different tasks. This is resented. The workers prefer to follow one particular line in which they are proficient and skilled. Consequently when a shift is made to conserve time and material these workmen not infrequently "throw up" their jobs and leave for other wire plants where perhaps their specialty may be followed. The absence is usually brief, for the same procedure brings the easily ruffled workman back to his original place of employment and temporary contentment. It is said that there is continually a round of changes on this account. While this break in the plant's working personnel is a source of annoyance, the frequent holidays—mostly of a religious character—also upset the smooth running of the factory and cut down the output. One day is not sufficient to attend to these duties, but two are usually the rule and not the exception.

Let Your Gold Eagles Rout the Hun

FAN PRODUCTION MAY FALL SHORT OF REQUIREMENTS

Government Needs, Running Into Great Quantities,
Largely Overlooked—Difficulty Met in
Obtaining Transportation

An investigation seems to prove conclusively that electric fans will be in none too plentiful supply by the time the retail selling season arrives. Several manufacturers admit the possibility of a shortage at the present time. Inquiries for additional stocks are already coming in. No one, it is averred, foresaw the enormous governmental requirements for military and naval needs at the camps, aboard ships, at hospital bases, and for various other purposes. The departments in Washington are also reported to be short of an adequate supply, so much so that with the arrival of the recent warm spell the local trade at the capital had its entire stocks absorbed.

One jobber from there came to New York and placed an order for 1500 fans with a leading manufacturer for early shipment. This could not be complied with, but an effort was made to obtain as many as possible from the company's distributors, the remainder of the specifications to be made up and delivery promised in six weeks to two months.

In accordance with the statement of a leading manufacturer, whose output is an important factor, it will be impossible to get the material to keep the production of fans up to the demands of a normal season. It was made clear that last year, which recorded an unprecedented sale, every nook and corner of factories, warehouses, stores and even cellars was ransacked for fans in any condition that could be made salable. The result is that the market is bare. With this knowledge before them, distributors, territorial agents and jobbers in many instances doubled their orders for 1918.

Where a good stock of raw material is assured, more or less difficulty is being encountered in the retention of skilled workmen. Prices are now quoted f. o. b. local stocks for factory, and a change in price on new business may come along without previous notice. One manufacturer is known to have stocks exceeding last year's supply by 100 per cent in Eastern warehouses. Trouble is being found in obtaining priority shipping orders. A Philadelphia distributor requested an order for sixteen cars from a Middle West factory and was "turned down." A requisition for two cars by a New York house resulted in having an order for one granted and subsequently an order for the other. One manufacturer of prominence is not accepting any more business.

A Father's Mite—A Bond

METAL MARKET SITUATION

Supply of Copper Liberal—Wire Base Price Nominal—Tin Reaching High Figures

No uneasiness is expressed regarding the quantity of copper accessible and available for all purposes. So much is this the case that the arguments for a higher government price than 23.50 cents fell flat. One large producer in a report to his company last week said that the cost of mining and refining was 11 cents a pound. Wire base is quoted at 27 cents to 30 cents, which is nominal, actual sales for wire products being a case of negotiation. An authority states that "bare copper wire for electrical purposes, carloads and mill shipments, is quoted at 26 cents per pound base."

Tin, as far as spot may be quoted, is now over 90 cents per pound. A few lots of Chinese tin were sold last week at 91 cents, with 84 cents for April shipment. The market is unstable. Commandeering of all platinum by the government for the manufacture of electrical instruments and other war purposes is threatened. The War Industries Board has warned holders of the metal that not more than \$100 an ounce will be paid for commandeered platinum.

NEW YORK METAL MARKET PRICES

	April 15	April 22
	£ s d	£ s d
Copper:		
London, standard spot....	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25 to 26.75	26.25 to 26.75
Lead, trust price	7.00	7.00
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter....	Govt. price 15.00	Govt. price 15.00
Spelter, spot	6.92½ to 7.02½	6.83 to 6.87
Tin, Straits	85.00	92.00
Aluminum, 98 to 99 per cent.	Govt. price 32.10	Govt. price 32.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire.....	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 14.00	13.50 to 13.75
Brass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	5.75 to 6.00	5.75 to 6.00
Zinc, old scrap	5.50 to 5.62½	5.50 to 5.62½

THE WEEK IN TRADE

WITH a very fair volume of commercial business recorded in all parts of the country, government orders continue to dominate all lines in the electrical field. Deliveries have slightly improved, but the ever-present embargoes interfere greatly with the calculations of jobbers and dealers in keeping their stocks of staples and leading specialties in a normal condition. Delays in transportation are particularly acute in the Far West. Building operations are confined to necessities and those localities where war industries require unusual housing accommodations.

Sales are strong, in many instances heavy, on armored cable, conduit and large-size lamps, with enlarged transactions in renewable fuses, rubber-covered wire, sewing and washing machines. The fan situation is attracting attention, and a shortage is freely and frankly discussed as a possibility. A scarcity in certain staples is also evident. The curtailment of labor is causing concern, jobbers and dealers on the Pacific Coast stating that it is impossible to obtain and hold competent assistance.

Collections are encouraging, and credits are being limited and shortened to keep business in a liquid condition.

NEW YORK

In a general way business in the sale and distribution of electrical goods is very satisfactory. Manufacturing plants are running to capacity, some of them reducing accumulated contracts as the progressive transportation improvement, in the aggregate, makes freer deliveries of raw material and products possible. However, there is yet an inadequate supply of cars for both inbound and outbound tonnage. The factories, with scarcely a single exception, remain handicapped by the scarcity of experienced workmen, and the steadily increasing costs of production, through rising wages and other causes, apparently render further upward price revisions in some lines inevitable. Within the last month prices have been remarkably even.

Reports that the financing of the third Liberty loan was interfering with collections seem to be without substantial foundation. Credits, nevertheless, are firmly held up to the line of safety.

PORTABLE LAMPS.—Floor and table lamps are mentioned as fast sellers. Fine finishes and beauty of design prove attractive to jobber, dealer and ultimate consumer. Prices vary in accordance with these features.

COLLECTIONS AND CREDITS.—If collections have fallen off on account of investments in the drive to make the third Liberty loan an overwhelming success, it is not conceded in the electrical field.

HOUSEHOLD SPECIALTIES.—Warm weather lines are moving rapidly. A special effort on electrically equipped ironers and scrubbers of an improved type is bringing in satisfactory returns. The sale on toasters, grills, flatirons, sewing and washing machines and vacuum cleaners is far ahead of last year's record. Stocks are strong notwithstanding transportation difficulties.

FANS.—With the advent of a few warm days and others to follow in due course, the retail fan season has opened up with an unexpected showing of strength. Some manufacturers state that jobbers and dealers who have not "signed up" may be treated to a surprise in a raise of prices, as a shortage is generally conceded to be in sight.

LAMPS.—Supplies in all sizes are not so good as they should be, to repeat the statement of the largest jobbers. A shortage is still reported.

CONDUIT.—The larger sizes are particularly scarce. The smaller are in better supply, but not a great deal better.

DRY BATTERIES.—Stocks are reported to be in excellent shape. Deliveries are being made from factories in about ten days..

SMALL MOTORS.—Government demands for small direct-current motors, for use in the trenches abroad in connection with signaling devices, have nearly cleaned up the market, to quote one of the largest manufacturers. It is not easy, therefore, to deliver motors of 10 hp. under 60 to 120 days, which also applies to those of 2 hp. and below. On larger sizes of motors, from 25 hp. to 50 hp., where the frames are coming through or in stock, deliveries are better.

GLASS INSULATORS.—On April 1 glass insulators were advanced 10 per cent. The market is close and deliveries out of stock, but not guaranteed.

LOCUST PINS.—Conditions are very unsettled, changes in price occurring frequently owing to specifications for definite delivery dates. Quotations are \$2 to \$3 per 1000 higher, f.o.b. mill, with indications of a still further increase.

CHICAGO

Government business is coming to Chicago in larger volume. Apparently this is due to two things—first, the decentralized control of purchasing for the Ordnance Department; second, the lack of power facilities among the central stations in the East. An army officer at one of the ordnance depots in Chicago is responsible for the statement that the department here is doing a business of \$1,000,000 a day now, whereas only a little more than a year ago that business was about \$1,000,000 a year. Practically all of the officers in the Ordnance Department seem to recognize that the shortage of power exists in the East and that more business must be pushed into the Middle West. Vast quantities of warehouse space have recently been secured in Chicago through the aid of the Chamber of Commerce. It is expected that more will be needed, as the plan apparently is to continue production at top speed regardless of shipping, so that when the ships are available there will be no delay in sending the materials abroad. Even organized labor in Chicago seems to have awakened to the situation, as all of the building trade unions, including the electrical workers, have now signed a no-strike agreement for the duration of the war. Payments on government contracts are being speeded up, and this, it is expected, will have a good effect on the general collection situation. Jobbing business remains about the same, a spotty condition prevailing.

PINS AND BRACKETS.—Locust pins and brackets have taken another increase in price, amounting to from 10 to 20 per cent. Locust is very difficult to get, large quantities of it going into the war activities. Jobbers are being asked to push rock-elm pins and brackets.

CONDUIT.—Jobbers' stocks of conduit are still low. It is possible, however, to get good deliveries in some instances by carefully searching through the trade.

PORCELAIN.—Jobbers report that it is necessary to order about six months in advance and that manufacturers are not taking orders at stipulated prices, but are quoting only "price as of date of shipment."

SECOND-HAND MACHINERY.—Business for the last week has been rather slack, but indications are that it will take a sharp upturn, as inquiries during the latter part of this week have been very many. The repair shops of second-hand machinery places are exceptionally busy. It is predicted with considerable confidence that higher rates for repair of electrical machinery will shortly go into effect.

SMALL MOTORS.—Single phase, three-phase and direct-current motors of small sizes are moving in good volume. This includes motors up to 5 hp.

LIGHTING FIXTURES.—Business in lighting fixtures is decidedly off in volume. Some of the Chicago factories are bidding on such government business as trench mirrors and other small metal articles in order to occupy their factories.

BOSTON

The electrical trade is getting more and more "into phase" with the "win the war" movement each week. Although jobbers report a moderate recession in the volume of business, underlying conditions are held to be sound. Fairly good collections indicate this. Credits are closely watched, but a large amount of money is in circulation and a goodly share is flowing into the coffers of the electrical industry. Jobbers are getting ready to handle the immense amount of detail orders which will be required by the quartermaster's terminal now under construction at Boston. Preliminary wiring of field structures has begun and the rush of orders will soon be on. The shipyards are buying substantially, motors and wiring supplies being in great demand.

Stocks are generally in good shape and deliveries are improving, with the marked exceptions of conduit and porcelain.

FIXTURES.—Inquiries from summer home owners are coming in faster than was anticipated considering the quiet state of trade heretofore. A drive is also under way to capture the business of the summer hotel in connection with remodeling of old establishments. Prices show little change beyond an occasional shading to stimulate buying in the off-season period. Stocks are large and well adapted to varied requirements.

STORAGE BATTERIES.—A heavy demand for batteries is now being maintained by the automobile trade. The accumulation of stocks is very difficult as to local agencies. In some quarters an advance in the price of lead batteries would not be a surprise, in view of the increased prices lately put into effect by competing makes, but nothing definite is as yet given out on this. Government business holds up well.

MOTORS.—Deliveries are improving, one dealer stating that in a general way quotations have been reduced from a matter of months to a matter of weeks on shipments. Up to 50 hp. deliveries of from four to six weeks are not uncommon. Now and then motors slip into factory stock, but their tenure of residence is apt to be short. Unless advances in steel and copper occur before July well-informed opinion holds that motor prices will hold firm for the present. Shipyards are buying motors for both steel and woodworking tool service, air compressors, etc.

CONDUIT.—The situation continues discouraging. A recent inquiry for 3/4-in. pipe brought out the fact that the mill in question cannot start rolling this size until the last of May, making a three months' gap in this output from shipment to rolling. Long delays are prevalent in delivery of orders placed some time ago.

FANS.—Fans are going out to the retailer now in good volume. The jobbers continue to report receipts from the factories in carload lots.

POLE-LINE MATERIAL.—Very little buying is noted by central stations in comparison with peace times. Some orders are being handled in connection with energy supply to war service plants. Municipal purchases for fire-alarm work, etc., hold up well, but are, of course, small in volume compared with the normal absorption of the central stations.

ATLANTA

The large expenditures along governmental lines in the South during 1918 will create a greater market for electrical goods of all descriptions. That this condition will exist is borne out by the fact that somewhere in the neighborhood of \$275,000,000 has been appropriated for nitrate plants, shipbuilding yards and enlargements to military establishments, together with the development of those minerals which are vital to the winning of the war. Kingsport, Tenn., is proving to be a big center of activity in the munitions line, and a nitrate plant, with an accompanying industrial city, costing \$10,000,000, is now contemplated for this point, in addition to the manufacture of acetone and other by-products now under way. The War Department has also decided upon an outlay of \$20,000,000 for building piers and warehouses at Charleston, S. C. As the war has

greatly stimulated the demand for denatured alcohol from sawmill waste, a number of these plants in the lumber belt are being equipped.

The Lamb-Fish Lumber Company, Charleston, Miss., has let contracts for construction this week. Wilmington, N. C., has secured a million-dollar plant for concrete ship construction. Reports received from Washington indicate that it has been definitely decided to enlarge Camp Gordon to take care of 60,000 men, which will entail an expenditure of \$4,000,000. Other construction contemplated for Atlanta includes \$1,500,000 for additional hospital buildings at Fort McPherson and a reclamation plant employing 2500 men. Details for this plant are not available at this time.

ARMORED CABLE.—A big business has been recorded this week, and a number of the well-distributed stocks of the past few weeks have almost been cleaned out. Large quantities of this material have been shipped to Columbia, S. C., Jacksonville, Fla., and other cantonment centers. Inquiries reveal the fact, however, that the demand is from commercial sources, and there is no indication that any is being purchased for government account. Manufacturers report a scarcity of raw materials, at least temporarily, with an advance of 5 per cent in price. Two-wire, No. 14, is very scarce.

INCLOSED SAFETY SWITCHES.—Jobbers' representatives state that business in these shows a strong tendency. The demand has been accelerated by the activity of the inspection departments of a number of Southeastern cities, which have passed ordinances of a nature that facilitates sales. Shipments are reported as being very good.

RENEWABLE FUSES.—All the dealers and jobbers are securing some good orders and business seems to be increasing daily. Deliveries are excellent.

SEWING-MACHINE MOTORS.—Every one dealing in this appliance appears to be doing a very substantial business. The volume of sales is well ahead of the same period last year. One large jobber reports large sales on the complete outfits, which include sewing machine and motor. Deliveries are fair.

VACUUM CLEANERS.—The industry has experienced a larger trade in cleaners this spring than ever in the past.

SEATTLE

Prosperous activity is general among retail trade, with a gratifying reflex upon wholesalers. Specifically, in the past week the volume of sales was as satisfactory as during several weeks past. Sales to shipyards, as in the past, constituted the bulk of business transacted, although allied industrial plants did considerable buying. Orders for lumber mills show a slight increase. Government buying shows a decrease over last month.

Portland territory during the past week reports a large order for a complete electrical equipment for grain elevators, also the receipt of numerous inquiries for other elevators in contemplation in the Spokane territory. It also reports sales of electrical equipment complete for elevators in the Inland Empire. Portland jobbers report heavy sales of electrical machinery equipment and supplies to shipyards in Portland, Vancouver, Wash., and Astoria. Yards in Vancouver especially have been buying heavily lately.

The largest jobbing houses in the Northwest agree that the labor situation has never been equalled. The shortage of men, particularly of the draft age, is almost unbelievable. Jobbers report that warehousemen and clerks are impossible to obtain and hold. Retailers in many cases are resorting to female help. The electrical industry in all its various branches is seriously threatened. In Seattle particularly the shortage is most acute. The local traction company cannot secure men to operate the street cars and service is disorganized. The telephone company is hampered by a scarcity of outside men as well as of clerical force.

Difficulty in securing shipments of badly needed materials is causing anxiety. In several cases shipments have been en route for two months. L. C. L. shipments are particularly affected. Extreme shortages exist in rubber-covered wire, conduit and larger-sized lamps, and present indica-

tions are far from promising. The Seattle territory especially reports continued heavy sales of sewing machines and washing machines. Other domestic appliances are moving satisfactorily. Retailers report an increasing volume in the sale of house-wiring materials and fixtures, including chandeliers and shades. Electrical novelties are moving well. A slight increase in weatherproof wire is noted, the first increase mentioned for the past month.

The Northwest lumbermen feel that the curtailment of the government's wooden shipbuilding activities, tentatively announced recently, will not affect the fir lumber industry of the Northwest adversely.

SAN FRANCISCO

Business is very good and factory deliveries are better, save on conduit. A fair has been held at Davis, where farm plants and 32-volt appliances were featured. It was well attended and is expected to accomplish educational work. We are now in the year's first hot spell, which, coming as it does after a late rainfall, will hasten needed crops.

CONDUIT.—Conduit sales are slightly less than those of last year, but this is due to the difficulty of deliveries and the fact that many dealers were given an opportunity to stock on the old price basis. This is especially true of at least one of the largest shipbuilding plants, whose past purchases will carry it well on into 1918.

RUBBER-COVERED WIRE.—Jobbers report increased sales of rubber-covered wire, in some cases as high as 25 per cent over last year's showing.

FANS.—Dealers are found to be very cautious in estimating their requirements for the 1918 season, complaining in general that they carried over unusually large surpluses from last year's stock and do not anticipate a normal demand this year; but those whose position enables them to survey the entire field are positive that this will be a good fan year, principally because of the widely scattered industrial plants (especially canneries in the central valleys) that have been hastily constructed with practically no provisions for ventilation.

INSULATING MATERIAL.—The United States government is requiring plenty of fiber, and the shortage of large motors, which makes much rewinding imperative, causes it to requisition much cotton tape and insulating compound. Deliveries are now very good, even of cotton tape, which has been practically an unknown quantity for months past. The market on silk tape is upset, owing to unexpected survivals of stock purchased at former prices, which were very small in proportion to those now effective.

HEATING DEVICES.—Present demands are rather poor and surplus stocks are on hand. Flatirons are selling at a little less than the normal rate, but devices such as toasters and percoiators are barely moving. It is evident that more intensive effort must be made before the real buying public is reached. One of the best selling heating devices is the heating pad, on account of a considerable amount of prevalent sickness. The unusually warm and dry winter spoiled the radiator season.

WASHING MACHINES.—The demand for washing machines is better than ever and is to be further stimulated by billboard displays. Prices have just advanced so that washers for the average household now list at \$115 in place of \$105, and washers for small families have jumped from \$80 to \$90 each. In spite of this fact the demand is good.

DRY BATTERIES.—Dry-battery sales are running about 20 per cent above those of last year, owing to the increasing number of electric trucks, long haul requirements, and, of course, the ever-increasing number of automobiles in service. The United States government, for instance, hauls a large portion of its requirements by its own fleet of motor trucks from San Francisco.

FLASHLAMPS.—Flashlamp sales are excellent. Deliveries are very good on account of the Pacific Coast factories for the manufacture of renewals. The presence of thousands of soldiers, many of whom have been generously remembered by gifts of flashlamps, augments the steady battery demand.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

Less than coil.....	List to \$61.00
Coil to 1000 ft.....	10% to 57.25
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	10% to 66.75

Twin-Conductor

Less than coil.....	List to \$104.00
Coil to 1000 ft.....	\$97.75 to 10%
Less than coil.....	List to \$135
Coil to 1000 ft.....	10% to \$126.80

DISCOUNT—CHICAGO

Single-Conductor

Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%

Twin-Conductor

Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std pkg.....	10% to \$24.00
1/5 to std. pkg.....	20% to 19.80
Std. pkg.....	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+20% to 12%
1/5 to std. pkg.....	20% to List
Std. pkg.....	28% to 44%

BATTERIES, DRY NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175-.3195	.3275-.3295
Barrel lots.....	.2875-.2895	.2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 100 FT.—NEW YORK

Less Than Coll Coil to 1000 Ft.	
3/8-in. s. stp...Net to \$75.00	—15% to \$69.75
3/8-in. d. stp...+10% to 75.00	List to 72.00
1/2-in. s. stp...List to 100.00	—15% to 93.00
1/2-in. d. stp...+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coll to 1000 Ft.	
3/8-in. single strip....	\$75.00 \$63.75
3/8-in. double strip....	78.25-78.75 71.25-71.75
1/2-in. single strip....	100.00 85.00
1/2-in. double strip....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$24.45 \$20.00-\$21.50
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00 \$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.00-\$55.00	\$25.00 \$22.50
1/4-in.—	\$40.00-\$60.00	\$27.00 \$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37 1/2
2 1/2.....	.58 1/2
3.....	.76 1/2

Couplings, List Elbows, List

1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb...4% to 12%	7% to 15%
2500 to 5000 lb...6% to 14%	9% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb...5.3% to 8.9%	8.3% to 11.9%
2500-5000 lb...7.3% to 10.9%	10.3% to 13.9%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	30%

CHICAGO

List.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50
	600-Volt		
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	20% to 30%
1/5 to std. pkg.....	38% to 40%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28% to 30%
1/5 to std. pkg.....	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Less than 1/5 std. pkg.	Per 100 Net
5 to std. pkg.	\$5.00
Standard packages, 500. List, each	\$0.07.

CHICAGO

Less than 1/5 std. pkg.	Per 100 Net
5 to std. pkg.	\$6.25
Standard packages, 500. List, each	\$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List.	Each
10 to 40-watt-B	100	\$0.30	
60-watt-B	100	.35	
100-watt-B	24	.70	
75-watt-C	50	.70	
100-watt-C	24	1.10	
200-watt-C	24	2.20	
300-watt-C	24	3.25	
Round bulbs, 3 1/4 in., frosted:			
15-watt-G 25	50	.53	
25-watt-G 25	50	.55	
40-watt-G 25	50	.55	
Round bulbs, 3 3/4 in., frosted:			
60-watt-G 30	24	.77	
Round bulbs, 4 3/4 in., frosted:			
100-watt-G 35	24	1.10	

DISCOUNT—NEW YORK

Less than std. pkg.	Net
1. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
1. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

Less than coil (250 ft.)	Per 1000 Ft. Net
11 to 1000 ft.	\$31.00 to \$34.90
	26.20 to 27.90

CHICAGO

Less than coil (250 ft.)	Per 1000 Ft. Net
11 to 1000 ft.	\$29.00 to \$30.00
	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Std. per 100	\$24.00
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CHICAGO

Std. per 100	\$21.75 to \$25.75
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OUTLET BOXES

	List.
1-A, A1 1/2, 4 S.C., 6200, 320	per 100 \$30.00
2-B.A., 6200, S.E., 300, A.X., 1 1/2	30.00
3-C.A., 9, 4 R, B 1 1/2	25.00
6-F.A., 7, C.S., 1 1/2, 3 R.	20.00

DISCOUNT—NEW YORK

Less than \$10.00 list	Black Galvanized
0.00 to \$50.00 list	25% 20%
	42% 37%

DISCOUNT—CHICAGO

Less than \$10.00 list	Black Galvanized
0.00 to \$50.00 list	40% 35%
	50% 45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
5 to std. pkg.	20%
1. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
5 to std. pkg.	20%
1. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

Less than 1/5 std. pkg.	Per 1000 Net
1/5 to std. pkg.	\$20.00 to \$38.00
Standard package, 2200. List per 1000,	19.00 to 20.00
	\$20.

CHICAGO

Less than 1/5 std. pkg.	Per 1000 Net
1/5 to std. pkg.	\$15.80
Standard package, 2200. List per 1000,	14.80
	\$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000	
5 1/2 N.C.—Solid Nail-it—N.C.	

Less than 1/5 std. pkg.	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000	
5 1/2 N.C.—Solid Nail-it—N.C.	

Less than 1/5 std. pkg.	\$11.85	\$30.75
1/5 to std. pkg.	11.10 to \$11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets.	500	\$0.33
1/2-in. cap keyless socket.	500	.30
1/2-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to \$23.00
1/5 to std. pkg.	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	24% to 25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	\$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than \$10 list	High Grade List to +5%
\$10 to \$25 list	11%
\$25 to \$50 net	14% to 15%
Less than \$10 list	Low Grade 5% to 10%
\$10 to \$25 list	16%
\$25 to \$50 list	24% to 25%

DISCOUNT—CHICAGO

Less than \$10 list	High Grade +5%
\$10 to \$25 list	10% to 11%
\$25 to \$50 list	14%
Less than \$10 list	Low Grade 5%
\$10 to \$25 list	16%
\$25 to \$50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	\$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	\$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

	List
Union and Similar—	Each
No. 155	\$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list	List 40%	Net to 30%
\$2.00 to \$10.00 list	10% to 50%	5% to 40%
\$10.00 to \$50.00 list	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list	25%	20%
\$2.00 to \$10.00 list	25%	20%
\$10.00 to \$50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	\$6.00
Discount	30%

CHICAGO

List price	\$4.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	\$0.41 1/4 - \$0.44 1/4
No. 18, full spools	0.36 1/4 - 0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	\$0.57 1/4 to \$0.65
No. 18, full spools	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net
Less than 500 to 1000 to	
No. 500 Ft. 1000 Ft. 5000 Ft.	
11.. \$15.00-\$18.00	\$12.50-\$13.00
12.. 23-25-25.40	21.30-21.80
15.. 32-40-35.20	29.70-30.20
18.. 45.70-49.15	41.90-42.10
6.. 72.40-77.85	66.35-66.75
	48.95-60.30

CHICAGO

	Price per 1000 Ft. Net
Less than 500 to 2500 to	
No. 500 Ft. 2500 Ft. 5000 Ft.	
14.. \$18.00	\$13.00
12.. 25.33-\$26.28	22.02-\$25.33
10.. 30.49-36.54	27.94-31.26
8.. 42.54-51.57	38.99-44.13
6.. 66.46-88.38	56.15-75.61
	50.53-70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	\$33.25 to \$35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	\$35.42 to \$40.35
25 to 50 lb.	34.42 to 39.35
50 to 100 lb.	33.42 to 38.35

NEW APPARATUS & APPLIANCES

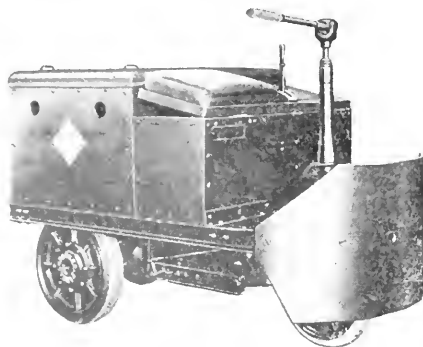
A Record of Latest Developments and Improvements
in Manufacturers' Products Used in
the Electrical Field

Coal Conveyor That Requires Only One Man to Operate

A mechanical conveyor that will load and unload auto-trucks and wagons very quickly is being manufactured by John F. Godfrey of Elkhart, Ind. A single-rope overhead cable is employed to support the bucket. The conveyor can be operated by one man, who loads the bucket directly from the truck, hoists it to another truck or to the storage pile. The conveyor bucket runs along the cable until it reaches a movable trip and there empties its load upon the pile. It is claimed that in a hundred feet of cable length, 1000 tons of coal can be stored by this device.

Medium-Service Electric Truck

A three-wheel tractor designed for service of a character between that accomplished by the carrier truck and the heavy-duty tractor is being manufactured by the Elwood-Parker Electric Company of Cleveland, Ohio. The most distinctive feature of this tractor is the single front wheel, which is steered by a hand-wheel or hinged lever on the body of the tractor. When the wheel steer is used the control lever is placed on the left of the column, but when the lever steer is installed the control lever is provided at the side of the operator's seat as shown in the accompanying illustration. The tractor cannot be started from the floor because the seat operates a circuit breaker which closes when the operator's weight presses on the seat. The battery is



OUTSIDE TURNING RADIUS LESS THAN THE
LENGTH OF THE TRACTOR

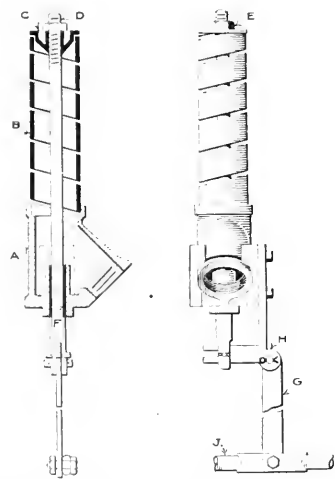
arranged so that the weight is over the drivers.

Solid wheels as well as solid rubber tires are provided, and the tractor has a normal drawbar pull of 300 lb. (136 kg.) and maximum pull of 850 lb. (385 kg.) The speed at no load is

625 ft. (190 m.) per minute. Its length is 40 in. (101.6 cm.) and its width 41 in. (104.1 cm.). The outside turning radius is less than the length of the tractor.

Adjustable Spray-Head for Cooling Tanks

A spray-head equipped with convenient adjusting gear that can be actuated from the shore is being manufactured by the Yarnall-Waring Company, Chestnut Hill, Philadelphia. Referring to the diagram produced herewith, *A* indicates the cast-iron body of the device to which a 3.25-in. (8.2-cm.) bronze tube, *B*, is secured. A helical opening of coarse pitch is cut in the tube through which the sprayed water leaves the nozzle at



SPRAY-HEAD WITH ADJUSTABLE WATER
APERTURE

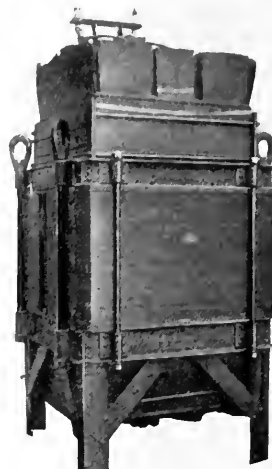
an angle of 60 deg. to the axis of the tube. By moving the bar *J* to the left the cap *C* is pressed against the helically slotted tube, thus reducing the slot opening through which the water issues.

The manufacturer claims that the maximum cooling effect is obtained under all conditions of temperature and humidity, that the minimum loss of water by driftage due to wind results, and that a high efficiency is obtained at fractional loads by the use of this spray-head.

14,000-Kva. Single-Phase Transformer

The accompanying illustration shows the framework and bracing arrangement of a large single-phase transformer recently manufactured by the Westinghouse Electric & Manufactur-

ing Company of East Pittsburgh, Pa. The transformer is rated at 14,000 kva., 60 cycles and 150,000 volts. The transformer, which is of the shell type, has



LARGE SINGLE-PHASE TRANSFORMER DE-
SIGNER FOR 150,000-VOLT SERVICE

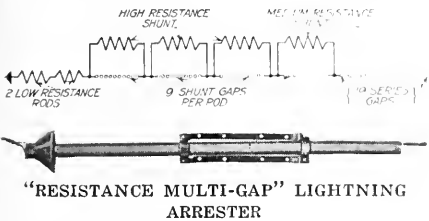
a 25 per cent overload rating, which gives a maximum rating of practically 17,500 kva. The top and bottom ends of the coil are held against distortion by two heavy steel plates reinforced by four lengths of angle iron riveted to them. These angle-iron plates are held together by four heavy tie-rods. The transformer tanks are made of heavy boiler plate, all seams being oxy-acetylene-welded. The tank is supported by a structural-steel base equipped with wheels. The high-tension terminals are of the condenser type protected by means of a number of porcelain rain shields to adapt them to outdoor service. The transformer is 23 ft. 6 in. (7.2 m.) over all in height, and weighs, complete with oil and fittings, about 110,000 lb. (49,895 kg.).

Sensitive Lightning Arrester for Pole Transformers

A multi-gap shunt-resistance lightning arrester in which the gaps shunt the resistance has been developed by the General Electric Company, Schenectady, N. Y. The arrester is of the compression-chamber type and is adapted for the protection of distribution transformers. By mounting the combination of gaps and shunt-resistance rods in porcelain tubes a high degree of sensitiveness to lightning disturbances is obtained. It is claimed that the arrester will discharge with small increases in potential, will divert lightning disturbances having a wide range of frequency and will quickly cut off

the dynamic power supply after the transient disturbance has passed. It also prevents grounds and "shorts" on the transformer.

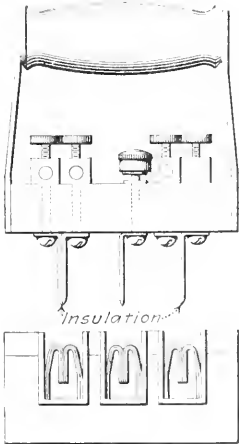
Numerous paths are offered for the discharge of lightning through the arrester by the four units of shunting resistance used. As the resistance rod shunted across the series gaps is grounded through the other resistances, the initial discharge is minimized. The path which the discharge travels after passing through the series



gaps depends on the frequency and power back of the discharge. Very high frequency will cause a discharge straight across all the gaps, whereas discharges of lower frequency will take place through one of the shunt paths. The generator current which tends to follow the lightning discharge will be diverted through the resistance rods and thereby limited to a value that can be readily extinguished by the gaps.

Testing Blocks That Assure Accurate Results

A terminal block for use in testing electrical machinery which, it is claimed, will assure accurate results has been developed by the Metropolitan Engineering Company, 35 Vestry Street, New York City. The device consists of phosphor-bronze clips mounted on a porcelain block in such a manner that opposite sides of the clips are connected



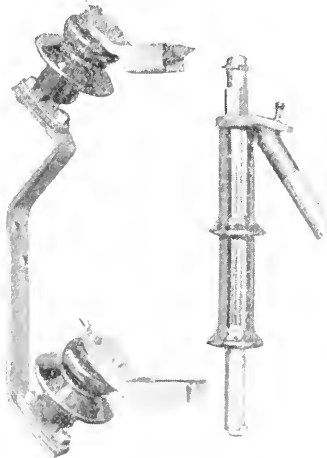
BLOCK PERMITS CONNECTION OF METERS WITHOUT INTERRUPTING SERVICE

to the corresponding incoming and outgoing circuits. The outline diagram presented herewith shows the portion of the testing block which is permanently installed in the circuit, and above it the portable portion to which the testing meters are connected.

The current-tapping blades on the portable portion consist of phosphor-bronze strips separated by a thin layer of micarta insulation. The meters are connected across the bronze strips so that when the blades are inserted in the clips on the testing block the meters are connected in series with the circuit. The middle terminal of the three-phase portable block shown is a potential tap and also consists of a strip of bronze. By using this block for testing the necessity of making temporary connections with wire jumpers is avoided, fire hazard is reduced, and the necessity of stopping a machine to insert meters is eliminated.

Outdoor Fuse and Disconnecting Switch

A combined fuse and disconnecting switch for use with transformers where no primary switches are used is being manufactured by the General Electric Company, Schenectady, N. Y. The fuse is suitable for interrupting the exciting current of transformer banks rated at



EXPLOSION WHEN FUSE BLOWS AND EXTINGUISHES ARC

not more than 300 kva. To open the circuit the holder is lifted completely out of the contacts by the fuse hook handled from the ground. The upper end of the fuse holder can be hung from the cap which partly surrounds the lower contact clips when the switch is open. To close the circuit the upper contact of the holder is inserted in the upper clips first and the lower contact is then pressed into the lower clips by the hook.

The fuse holder has petticoats spaced so as to provide ample creepage surface. The brass contact parts at the ends of the fuse holder engage with the stationary contacts on the supporting insulators when the holder is in normal operating or closed position.

The contacts are protected against the effects of ice, sleet and snow by the hood attached to the top of each supporting insulator and by the relative position of the parts. The fuse element passes through the center of a fiber tube within the porcelain fuse holder and is attached to the upper closed end of the fuse holder by means

of an adjustable clamp and to the lower open end by a circular ring. When the ring is tightened it holds the fuse firmly in place and prevents it from shearing off when the element blows. The expansion of the gases formed, occurring after the fuse has ruptured, effectively expels the arc through the open end of the holder in a downward direction, thereby opening the circuit. New fuses may be readily inserted.

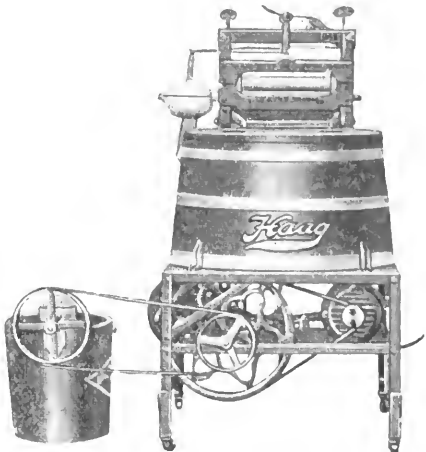
The device is listed as the type TD-127 and is made in single-pole units for vertical mounting on flat surfaces. It can be obtained for use on 15,000, 22,000, 35,000 and 45,000-volt circuits with a maximum current rating of 50 amp. No special arrangements are needed for mounting. The supporting bracket is bolted to the cross-arm of the supporting structure.

Lightning Protector for Substation Telephone Circuits

A self-cleaning saw-tooth lightning arrester is being manufactured by the Reliable Electric Company, 411 South Sangamon Street, Chicago. The protectors, which have been approved by the National Board of Fire Underwriters, consist of copper blocks entirely inclosed by covers that surround the fuses as well as the rest of the lightning arrester. The fuse cases are made of tubular fiber, tubular magnesia, tubular wood, flat wood, folded mica or folded fiber. They can be easily re-wired.

Motor-Driven Washing Machine

A motor-driven washing machine which is equipped with an extra pulley that can be used to drive water pumps, turn ice-cream freezers and other small



WASHING MACHINE HAS EXTRA PULLEY FOR DRIVING OTHER MACHINERY

machinery has been brought out by the Haag Brothers Company of Peoria, Ill. The washing machine, known as the "Nuway," is of the dolly type and is equipped with a varnished wood tub finished in natural color. The supporting platform is made of steel.

Trade Notes

Bryant Electric Company's Sales Department Personnel

The Bryant Electric Company of Bridgeport Conn., has announced the personnel of its sales department as follows:

JOHN R. TOTTING, connected with the Chicago office for more than twenty years, is continued as assistant manager.

FRANK V. BURTON has been appointed general sales manager, a post just established. His connection with the company covers sixteen years, he having been Eastern sales manager for the last eleven years.

HAROLD E. SANDERSON, Pacific Coast manager at San Francisco, Cal., for the last eight years, continues in that capacity, but this office will now report direct to the general sales manager instead of being a subsidiary of Chicago.

ROBERT M. EAMES is appointed export manager, with headquarters at Bridgeport. He has been with the company for twelve years and for more than a year past has been devoting most of his attention to this department of the company's business.

WILLIAM A. STACEY, field representative of the company in the Middle West for the last ten years, becomes Western manager, succeeding to the vacancy caused by the death of Edward K. Patton, mention of which was made in the ELECTRICAL WORLD of March 30.

THE SUNDH ELECTRIC COMPANY, manufacturer of controlling devices, of New York City, announces a change of address from New York to Newark, N. J., the Newark address being Avenue C and Parkhurst Street, and the New York office 51 East Forty-second Street.

THE SHAWINIGAN ELECTRO-METALS COMPANY of Montreal, Can., maker of magnesium, has established a sales office in Cleveland, Ohio, with Detroit, Chicago, Buffalo, Pittsburgh and other points as tributary territory. D. P. Falconer, sales agent, has his office at 932 Leader-News Building.

THE NATIONAL BANK OF COMMERCE of New York City is distributing a new book entitled "Export Trade Associations." The publication contains the complete text of the Webb act, approved April 11, and an official summary of the report of the Federal Trade Commission on the development of foreign markets. Copies may be had on application.

THE WILLIAM F. WOLFF COMPANY of New York City has appointed the S. W. Electrical Company, 144 East Thirty-fourth Street, sole distributor of the "Anywhere" lamp brackets, under the management of William F. Wolff, effective May 1. The S. W. company intends appointing sales agents in the principal cities to handle wholesale and retail business.

THE GENERAL DEVICES & FITTINGS COMPANY has moved its office from 817 West Washington Street to the Mid-City Bank Building, Halsted and Madison Streets, Chicago. The factory will remain at the old location and will be enlarged to take in the space formerly occupied by the offices. This change was necessitated owing to the large increase in business.

THE BOSCH MAGNETO COMPANY of Plainfield, N. J., and Springfield, Mass., has been taken over by the government. A. Mitchell Palmer, alien property custodian, will name a new board of directors. It is officially announced that an investigation showed that the company was owned entirely in Germany. The real valuation of the property is said to be about \$7,000,000, although it was capitalized at only \$75,000.

HERBERT A. JACKSON has been elected president of the Chicago Pneumatic Tool Company of Chicago, to succeed W. O. Duntley, resigned. Mr. Jackson has for some time been connected with the Bethlehem Steel Corporation and was more recently head of its Boston office. He has had charge of the sales in that territory, and it is considered probable at Chicago that he will readjust the sales methods of the Chicago company.

THOMAS M. CLULEY, who has been associated with George W. Provost, president of the Union Electric Company, for the last twenty-two years, resigned his position on April 1 and joined the forces of the W. A. McCombs Company, Pittsburgh, Pa. The W. A. McCombs Company manufactures "Maco" safety switches. It is territorial representative of the following manufacturers: American Brass Company,

American Circular Loom Company, Atlantic Insulated Wire & Cable Company, Delta-Star Electric Company and Page & Hill Company.

FRANK E. WATTS has gone into business for himself as manufacturer's agent at 30 Church Street, New York City. He will continue to represent the Hart Manufacturing Company, for which he has been New York district manager since the beginning of 1915, and in addition has taken on the lines of the following companies: Electric Fuseguard Company, Wadsworth Electric Manufacturing Company and Worth Manufacturing Company. His territory will cover Virginia, District of Columbia, eastern Maryland, Delaware, eastern Pennsylvania, New Jersey and New York State.

THE PHOENIX ELECTRIC COMPANY, Mansfield, Ohio, now occupies a new modern two-story brick building, fully equipped. A. C. Linzee, proprietor, secured possession of the plant about two years ago, going from Akron, Ohio, and having been designing engineer for the General Electric Company. He has developed a line of alternating-current motors, which will be manufactured on a large scale at the new plant. The increased business of the company made it necessary to secure new quarters and the new building is the result. The plant is fully equipped for the expansion of the business, which has had steady growth and during the past two years has nearly doubled.

Trade Publications

LAMPS.—A circular being distributed by the Waterbury-Wallace Company, Inc., describes the "Wallace" portable lamp.

STOKERS.—Laclede-Christy, Railway Exchange Building, St. Louis, has issued a new catalog describing and illustrating its chain-grate stokers.

ATTACHMENT PLUG.—The Mueller Electric Company of Cleveland, Ohio, is distributing a circular describing its "At-tacho" plug for electric appliances.

LAMPS.—"A Light Which Beats Daylight" is the title of a paper by E. L. Elliott which is being distributed by the Cooper Hewitt Electric Company, Eighth and Grand Streets, Hoboken, N. J.

BALL BEARINGS.—The Norma Company of America, 1790 Broadway, New York, has issued a circular describing its ball bearing for fractional horsepower motors. The various features of the ball bearing are given.

FUSES.—A. F. Daum of Pittsburgh, Pa., is distributing a circular describing and illustrating the Daum refillable cartridge fuse for electric light and power installation. The method of reloading the fuses is illustrated in the folder.

ELECTRIC HOUSE PUMPS.—The "Buckeye" electric house pump for cisterns and shallow wells is described in a bulletin distributed by Mast, Foos & Company of Pittsfield, Ohio. Illustrations of the pump are given and the construction features recounted.

BRASS FITTINGS.—The Ohio Brass Company of Mansfield, Ohio, has issued supplement No. 1 of its general catalog No. 16, describing and illustrating its brass fittings for electric railway and mine haulage construction. High-tension porcelain insulators are also described in the bulletin.

MECHANICAL RECTIFIERS.—The Breco Electric Company of Toledo, Ohio, is distributing a bulletin describing the Breco converter for rectifying alternating current. Converters for furnishing direct current to operate electric tools, etc., and for service stations and garages where large capacities are required are illustrated and described in the booklet.

FIBER AND PAPER INSULATION.—The National Fibre & Insulation Company, Yorklyn, Del., has issued a bulletin entitled "Vulcanized Fiber and Insulation Paper" that describes the "Old Hickory" fiber and "Peerless" insulation. The bulletin is illustrated with photographs showing the bushing, gear and gear blank and other products of the company. In the back of the booklet tables of useful formulas are presented.

BOWLS, GLOBES AND REFLECTORS.—The Ivanhoe-Regent Works of the General Electric Company, Cleveland, are distributing catalog No. 257, descriptive of the "Regent" bowls, globes and reflectors for commercial and ornamental illumination. Semi-indirect illumination for offices, schoolrooms and drafting rooms is discussed and general engineering data, including photometric curves and detailed illumination curves for various lamps and

reflectors, are given. Illustrations of the "Regent" shades and holders are included.

ELECTRICAL EQUIPMENT FOR CEMENT MILLS.—This is the title of a publication issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The pamphlet illustrates the interior of a motor-driven cement mill. Numerous photographic reproductions are given that show the application of motors to various types of machinery employed in cement mills. Advantages of motor drive for this class of service and characteristics required by motors to be specially successful are briefly discussed in the bulletin.

New Incorporations

THE ILLINOIS SOUTHERN POWER COMPANY of Chicago, Ill., has been incorporated with a capital stock of \$2,500 by Henry M. Brooks, Mack E. Gillis and P. L. Miller.

THE FRANCONIA ELECTRIC LIGHT & POWER COMPANY of Souderton, Pa., has been granted a charter with a capital stock of \$5,000. S. F. Muzzy is interested in the company.

THE NEW ENGLAND ELECTRIC LAMP COMPANY of Danvers, Mass., has been chartered with a capital stock of \$25,000. O. R. Bodwell is president and William A. Webb is treasurer.

THE OSKALOOSA (IOWA) POWER COMPANY has been incorporated with a capital stock of \$5,000. The officers are: C. B. Vermillion, president, and Code M. Vermillion, secretary and treasurer.

THE SOUTHERN CITIES POWER COMPANY of Chattanooga, Tenn., has been incorporated by George B. Adams, G. W. Irwin, J. C. Stickney, J. H. Roymer and John R. Evans. The company is capitalized at \$50,000.

THE ATTICA (IND.) ELECTRIC & SUPPLY COMPANY has been incorporated by J. W. Harrison, Charles W. Zeigler, John T. Nixon and Floyd E. Poston. The company is capitalized at \$50,000 and proposes to generate and distribute electricity.

THE LEGAL LEVEL LIGHT COMPANY of Rochester, N. Y., has been chartered by D. T. Roach, I. Smith and T. B. Shanahan of Rochester, N. Y. The company is capitalized at \$20,000 and proposes to manufacture automobile headlights, etc.

THE KANAWHA CENTRAL POWER & SUPPLY COMPANY of Olcott, W. Va., has been chartered with a capital stock of \$100,000 to generate and distribute power. The incorporators are: S. B. Avis, Ivory C. Jordan, N. F. Young, John A. Thayer and F. A. Avis of Charleston.

THE AUTO ELECTRIC SERVICE COMPANY of Toronto, Ont., has been incorporated by George J. Beattie, 72 Victoria Street; Ivan R. Church, Rudolph P. Caulford and others. The company is capitalized at \$40,000 and proposes to manufacture electrical apparatus, machinery, etc.

THE DOMINION LAND COMPANY of Montreal, Que., Canada, has been incorporated with a capital stock of \$100,000 to manufacture electrical supplies, lamps, motors, engines, etc. The incorporators are: Philip H. Klein of Westmount, Que.; Henry B. Irving, Edson G. Place and others.

THE COMMONWEALTH PUBLIC SERVICE COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$500,000 to generate and distribute electricity. The incorporators are: M. M. Clancy, C. L. Rimlinger and F. A. Armstrong of Wilmington, Del.

THE UNILECTRIC COMPANY OF CANADA, LTD., of Edmonton, Alta., Canada, has been incorporated with a capital stock of \$25,000 to manufacture electrical supplies, equipment, motors, etc. The incorporators are: Chester McMann, Joseph R. Ulery of Edmonton, Godfrey H. Beaudry of Wainwright, and others.

THE INTERURBAN ENGINEERING COMPANY of Toronto, Ont., has been incorporated by Edwin Smiley, 17 Thornburn Avenue, Toronto; Bruce Williams, Bank of Hamilton Building; Wesley Rhodes and others. The company is capitalized at \$35,000 and proposes to manufacture machinery, motors, electrical apparatus, etc.

THE GREAT WEST ELECTRIC COMPANY of Winnipeg, Man., has been incorporated with a capital stock of \$300,000 by Sidney T. Smith, William R. Ingram, James N. Hutchison and others. The company proposes to generate and distribute electricity for lamps, heaters and motors; also to manufacture electrical equipment.

New England States

BATH, ME.—The Central Maine Power Company is extending its feed wires from a plant near the Chops to the pumping station at Nequasset, which is to be equipped for electrical operation soon.

CAVENDISH, VT.—Negotiations have been completed between the Colonial Power & Light Company of Claremont, N. H., and the Cavendish Electric Power Company whereby the former will supply electricity (100 kw.) to the latter. Plans have been prepared for the construction of a new substation.

HARTFORD, VT.—Preliminary plans have been prepared by the New England Telephone & Telegraph Company, 50 Oliver Street, Boston, Mass., for the construction of a new telephone exchange building at Gates and Currier Streets, in the White Junction district of Hartford.

BROCKTON, MASS.—Work will soon begin on the installation of the ornamental lighting system on Main Street, in the business center, School and Centre Streets, and City Hall Square. Orders have been placed for the material for the proposed work.

FALL RIVER, MASS.—The Fall River Electric Light Company has petitioned the Massachusetts Board of Gas and Electric Light Commissioners for permission to issue \$700,000 in capital stock, the proceeds to be used for erecting an electric transmission line to connect the company's plant at Fall River with the wires of the New England Power Company and for enlarging the Hathaway Street plant.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company is installing a 300-kw. generator at the station of the Worcester Suburban Electric Company for the purpose of supplying electricity to its line between Uxbridge and Milford.

NEWBURYPORT, MASS.—Plans are being considered for the construction of an addition to the new electric plant of the Newburyport Gas & Electric Company on the former Fiberloid wharf, to provide space for the installation of a 2000-kw. electric generating unit, with a condenser pump, boilers and other apparatus.

NEW BEDFORD, MASS.—The City Council is considering some changes in the ornamental lighting system on Purchase Street. It is proposed to erect the type of lamp used on Washington Street south to School Street and north of Maxfield Street, calling for the installation of 23 additional lamps. Nothing will be done until the end of the war. William P. Briggs, superintendent of street lights, was instructed by the Council to prepare and submit a sketch for a lighting scheme for Acushnet Avenue from Ball's Corner to Belleville Road.

TAUNTON, MASS.—The special committee appointed to look into the needs of the municipal electric-light plant has engaged C. W. Whiting of Boston, consulting engineer, to advise the City Council and the management as to the condition of the plant and what is needed to put it in a position to meet the demands of increasing business.

HARTFORD, CONN.—A permit has been granted to the Arrow Electric Company for the construction of a factory, 55 ft. by 135 ft., three stories high, on Hawthorn Street, to cost \$55,000. W. J. Sexton has the contract for building. Ford, Buck & Sheldon are architects.

NEW HAVEN, CONN.—The United Illuminating Company has been granted a permit for the construction of an addition to its plant on Grand Avenue, to cost about \$6,000.

NORWALK, CONN.—The ornamental lighting system on South Main Street will be extended as far as Monroe Street soon.

STAMFORD, CONN.—Plans have been prepared by the Stamford Electric & Manufacturing Company for further extensions to its plant. The company manufactures electric motors and has recently completed the erection of a large two-story factory. It is proposed to build another similar building and to make extensions to the present building.

Middle Atlantic States

BUFFALO, N. Y.—The Transmission Ball Bearing Company, 1050 Military Road, Buffalo, is considering the erection of an addition, 175 ft. by 350 ft., to its plant, to cost about \$150,000.

DUNKIRK, N. Y.—The Council has appropriated \$7,000 for the purchase of ornamental street lamp fixtures, the cost of the installation and maintenance to be met by the water board. The type of lamp has not yet been decided upon.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ELMIRA, N. Y.—The Public Service Commission has directed the Elmira Water, Light & Power Company to erect an electric transmission line to Moutour Falls and to supply electricity to residents in that village.

GLENS FALLS, N. Y.—The Adirondack Electric Power Corporation is planning to construct a power house at Glens Falls, to cost about \$100,000. The company is also contemplating the construction of a power station in the vicinity of Schoharie later on.

GROTON, N. Y.—The Groton Electric Power Company has petitioned the Public Service Commission for permission to construct an electric-light plant in Groton and for an approval of franchise granted by the village.

LONG ISLAND CITY, N. Y.—A. J. Buschmann Company, 461 Eighth Avenue, New York, has been awarded contract for all electrical work in connection with the new addition to the plant of the Welin Marine Equipment Company, 312 Vernon Street, now under construction. The cost of the building is estimated at \$25,000.

NEW YORK, N. Y.—The capital stock of the A. L. Shemel Company, 60 East 116th Street, has been increased from \$30,000 to \$75,000. The company manufactures electrical supplies.

ROCHESTER, N. Y.—Contract has been awarded to A. Frederick & Sons Company, 710 Lake Avenue, Rochester, by the Board of Contract and Supply for the construction of a new power plant.

ROCHESTER, N. Y.—Preparations are being made by the Mayer Coating Machine Company of Rochester for the erection of a factory, 2 miles outside of the city limits. The company, it is reported, is in the market for equipment for an automatic steam engine plant. The company manufactures paper-coating machinery.

GLOUCESTER CITY, N. J.—Plans are being considered by the Public Service Electric Company for the installation of a new conduit system, for electric wires, in Market Street, beginning at its local power house and extending to King Street. The City Council has granted the company permission to install the system.

MORRISTOWN, N. J.—The installation of new motor equipment in the local schools for operating the ventilating system is under consideration by the board of education.

NEWARK, N. J.—Plans have been prepared by the Natural Carbonic Gas Company, McClellan Street, for the construction of a boiler plant, to cost about \$10,000.

NEWARK, N. J.—Bids will be received by the Board of Freeholders for the installation of a new water tube boiler at the Essex County Hospital at Overbrook. Thomas W. Smith is chairman of the committee on public buildings.

NEWARK, N. J.—The Northern Leather Works & Produce Company, 377 Broadway, New York City, has awarded contract to H. W. Franklin, 110 Fort Greene Place, Brooklyn, N. Y., for the construction of a new power house at its local plant on Backus Street.

RAHWAY, N. J.—The National Pneumatic Company, 50 Church Street, New York City, is contemplating the construction of a new building, 200 ft. by 300 ft., on New Brunswick Avenue. Rahway, which will be equipped as a machine shop and for general manufacturing purposes.

WEEHAWKEN, N. J.—Plans are being considered by the Weehawken Tungsten Lamp Company, 550 Gregory Avenue, for the reconstruction of its brick and iron lamp manufacturing plant, recently destroyed by fire, causing a loss of about \$25,000.

ALTOONA, PA.—The Penn Central Light & Power Company has filed notice with the Public Service Commission of an issue of \$75,000 in bonds, the proceeds to be used for extensions and improvements to its plant and system.

GREENVILLE, PA.—Notice has been filed with the Public Service Commission by the Mercer County Light, Heat & Power Company of an issue of bonds to the amount of \$100,000, the proceeds to be used for extensions, improvements, etc.

HAZLETON, PA.—Plans have been completed for equipping the Oneida slope of the Lehigh Valley Coal Company of Hazle-

ton for electrical operation. Energy to operate the mine will be supplied by the Harwood Electric Company of Hazleton.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia & Reading Railroad Company for the construction of a new power house, 45 ft. by 75 ft., at Tulip and Somerset Streets.

PHILADELPHIA, PA.—Plans are being prepared by the Bell Telephone Company for additions and improvements to its telephone building in Germantown. John T. Windrim, Commonwealth Building, is architect.

WILLIAMSBURG, PA.—Notice has been filed with the Public Service Commission by the Penn Central Power & Transmission Company of an issue of \$50,000 in bonds, the proceeds to be used for extensions and improvements to its system.

WILMINGTON, DEL.—The turbine room at the plant of the Wilmington Gas Company, foot of Madison Street, was recently destroyed by fire, causing a loss of about \$25,000.

WILMINGTON, DEL.—Notice has been filed with the Public Service Commission by the National Electric Service of a change in its name to the Brokaw-Eden Manufacturing Company, and an increase in capital stock from \$500,000 to \$1,000,000.

FREDERICK, MD.—The Hagerstown & Frederick Railway Company has submitted a plan to the Mayor and Aldermen for lighting the streets of Frederick. Two proposals were submitted, the city to have the option of taking either, under a contract for one, two or three years, or practically any time it sees fit, the contract to be terminated upon a notice of a certain length of time. The first is to light the city at a cost not to exceed \$7,200 per year, exclusive of the College Park, and not to exceed \$7,500 per annum, including College Park. The other is for the city to learn the cost of operating the municipal plant from April 1, 1917, to April 1, 1918, and no matter what this amount might be the company would guarantee to furnish the service for the same figures, less \$2,000. It is not proposed to dismantle the municipal plant. The plans provide for the installation of a motor in the city plant and to utilize energy from the plant at Security and water power at Dam No. 5.

PARKERSBURG, W. VA.—The Parkersburg Iron & Steel Company has begun work on the construction of an addition to its power plant, 30 ft. by 45 ft., to cost about \$12,000.

WILCOE, W. VA.—The Norfolk & Western Railroad Company is planning to rebuild its machine shop in Wilcoe, recently destroyed by fire.

NORFOLK, VA.—Plans have been filed and contract awarded to Nicholas & Linderman, Seaboard Bank Building, Norfolk, for alterations and improvements to its electric substation, to cost about \$11,000.

RICHMOND, VA.—The capital stock of the Williams Power Company has been increased from \$50,000 to \$150,000, the proceeds to be used for extensions and improvements.

RICHMOND, VA.—Hackley Morrison, Moore Building, 16 North Ninth Street, Richmond, Va., it is reported, would like to receive prices (dealers') on a 75-kw., 125-volt direct-current generator, directly connected to generator; could use a turbo-generator of same rating.

WASHINGTON, D. C.—The United States Shipping Board, 1319 F Street, N. W., is planning to erect a five-story building, to have 500,000 sq. ft. of floor space, for which \$5,000,000 has been appropriated.

WASHINGTON, D. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for construction of substation and frequency-changer house to the Dawson Construction Company, May Building, Pittsburgh, Pa., at \$52,520.

WASHINGTON, D. C.—Contract has been awarded by the Chesapeake & Potomac Telephone Company, Thirteenth and G Streets, N. W., to Andrew Murray, 729 Twelfth Street, N. W., Washington, for remodeling its exchange buildings at 1420 Columbia Road and at 629 B Street, to cost \$60,000 and \$15,000 respectively; and also for a third exchange building at another location.

WASHINGTON, D. C.—The contract for construction of the building for the Washington Athletic Club is reported to have been awarded to the Longacre Construction Company, Widener Building, Philadelphia, Pa. The building will be 138 ft. by 150 ft., 12 stories high, and will cost about \$650,000. Milburn, Heister & Company, Union Savings Bank Building, Washington, are architects.

North Central States

DETROIT, MICH.—The Detroit United Railway Company is planning to build an extension to the Ford plant on the River Road.

GRAND RAPIDS, MICH.—The Lewis Electric Company of Grand Rapids has been awarded a contract for the installation of lamps and motors in the new Haskell plant near Euler Station. The contract calls for wiring and the installation of 3.0 nitrogen lamps of 3.0 cp. each and 3.5 Wagner motors.

RYAN, OHIO.—Improvements are contemplated to the municipal electric-light plant and water-works system, involving an expenditure of about \$10,000.

CLEVELAND, OHIO.—The capital stock of the North Electric Company has been increased from \$135,210 to \$210,000.

COVINGTON, OHIO.—The capital stock of the Buckeye Light & Power Company has been increased from \$10,000 to \$60,000.

DAYTON, OHIO.—Resolutions have been adopted by the City Council providing for the installation of an ornamental lighting system on East Second Street between Jefferson and St. Clair Streets.

FRONTON, OHIO.—The Fronton Incandescent Light & Supply Company is contemplating building an addition to its plant at First and Chestnut Streets.

LORAIN, OHIO.—The American Ship Building Company is erecting a large power house in connection with extensions to its plant, which include a new boiler shop, machine shop and other new departments. The cost of the power house is estimated at \$200,000.

MANSFIELD, OHIO.—The capital stock of the Richland Public Service Company has been increased from \$10,000 to \$3,200,000.

NELSONVILLE, OHIO.—The Hocking-Sunday Creek Traction Company is planning to build a new substation. A new rotary converter, it is reported, has been purchased by the company.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Company has entered into a contract with the Erie Window Glass Company for an initial installation of electrical power, which will ultimately lead to larger demand for electricity.

SHELBYVILLE, KY.—Surveys are being made by the Frankfort & Shelbyville Traction Company for the construction of its proposed electric railway between Frankfort and Shelbyville, a distance of about 20 miles. Pending the construction of its own power plant the company will purchase energy to operate the system from a nearby central station. L. G. Smith of Shelbyville is president.

EVANSVILLE, IND.—The capital stock of the Schroeder Headlight & Generator Company has been increased from \$150,000 to \$250,000. The company has taken over the plant of the L. B. Jones Company of Kansas City, Mo., manufacturers of farm electric plants.

INDIANAPOLIS, IND.—The Ross Power Equipment Company, Merchants' Bank Building, Indianapolis, it is reported, would like to receive prices (dealers') on a 250-kva., 240/440-volt, 60-cycle, three-phase engine type generating unit, for 125-150 lb. steam, 3 to 5 lb. back pressure; also one 400-kva. generating unit, same as above; one 150-kw., 250-volt compound generating unit, directly connected; one 250-kw. and one 500-kw., either simple or tandem, compound engine.

CHICAGO, ILL.—The plans are being prepared by the International Harvester Company, South Michigan Avenue, for the construction of a series of foundry buildings on Rockwell Street, to cost about \$500,000.

GILLESPIE, ILL.—The Illinois Traction System has secured contract to supply electricity to operate the machinery in the new coal mine being developed in Gillespie. The company will also transport coal mined from the new shaft.

SPRINGFIELD, ILL.—The Springfield Light, Heat & Power Company has applied to the State Utility Commission for permission to issue \$100,000 in bonds, the proceeds to be used for extension to mains and service and the purchase of boilers and mechanical equipment.

TUSCALOOSA, ILL.—The board of education is considering the construction of a heating plant in connection with the high school building.

BRODHEAD, WIS.—Bids will be received by the Electric Light and Water Commission, Brodhead, until April 30, for improvements to the municipal hydroelectric plant, including the installation of a new water power unit, with all appurtenances, to cost about \$35,000.

FAIRWATER, WIS.—The Joint District No. 1, Metomen, Fond du Lac County, has voted to build a new high school, with a manual training department, the cost not to exceed \$3,000, in the village of Fairwater. B. E. Mohner of Fond du Lac is architect.

MILWAUKEE, WIS.—The Austed Leather Company, 560 Commerce Street, is contemplating the installation of an additional steam-driven electric generating unit of 150 capacity and 16 electric motors aggregating 165 hp. The cost is estimated at \$10,000.

MILWAUKEE, WIS.—Plans have been completed by the Milwaukee Paper Box Company, 400 Florida Street, for the construction of a manufacturing plant, 120 ft. by 145 ft. The cost, including machinery, motor and other equipment, is estimated at \$200,000. William C. Carlson is president and treasurer. Schenectzky & Son, 712 Germania Building, architects, are taking bids for the above works.

OREGON, WIS.—Bids are being asked by C. A. Hagan, village clerk, for a 175-gal. centrifugal pump and an auxiliary suction pump with a 220-volt motor, starter, etc.

IVANHOE, MINN.—Bids will be received by Karl A. Hansen, county auditor, court house, Ivanhoe, until May 6, for the construction of the Lincoln County court house at Ivanhoe, separate bids to be submitted on general construction, heating and ventilation, plumbing and electric work. Plans and specifications may be obtained at the above office or at the office of James A. Burner Company, architects, 554 McKnight Building, Minneapolis, Minn.

STILLWATER, MINN.—The Northern States Power Company (Stillwater division) is erecting an electric transmission line to furnish electricity to the plant of the Twin City Forge & Foundry Company in Stillwater. The Twin City company is building docks at its plant here.

HUMBOLDT, IOWA.—Bids will be received by the board of directors of the Independent School District of Humboldt until May 3 for construction of high and grade school building. Separate bids to be submitted on general construction, heating and ventilating, plumbing electrical work, seating and equipment. Plans may be obtained at the office of G. L. Lockhart, Endicott Building, St. Paul, Minn., and Youngerman Building, Des Moines, Iowa, upon deposit of \$5.

RED OAK, IOWA.—The Red Oak Electric Company has applied to the Board of County Supervisors for a franchise to erect and operate electric transmission lines on certain roads in Pleasant Township for a period of 20 years.

KANSAS CITY, MO.—The Kansas City Railways Company, it is reported, has purchased 20 underfeed stokers, two boiler feed pumps, one locomotive crane and one feed water heater.

KANSAS CITY, MO.—The Kewanee Boiler Company, 1420 McGee Street, is contemplating the purchase of a hand-power or electrically-operated traveling crane on track similar to locomotive type with a capacity of 20,000 lb.

ST. LOUIS, MO.—Three warehouse units will be erected by the United States War Department, Second and Arsenal Streets, instead of one as originally planned. The buildings will be 600 ft. by 100 ft., six stories high, and will cost about \$1,200,000. Further information may be obtained from Major James R. Fordyce of the St. Louis quartermaster's department.

BRADLEY, S. D.—The Dakota Northern Power Company is contemplating the erection of a new power plant and the installation of a 300-kw. reciprocating unit, the equipment to be purchased within 30 days. E. H. Lewis is secretary.

VERMILION, S. D.—The proposal to issue \$20,000 in bonds for the construction of a city building, in which to house the equipment of the municipal lighting plant, provide offices for the city officials and quarters for the volunteer fire department, will soon be submitted to the voters.

CARROLL, NEB.—At an election held recently the proposal to issue \$9,500 in bonds for the installation of an electric-lighting system in Carroll was carried.

FIRTH, NEB.—Bids, it is understood, are being asked for extensions to the electric-lighting system. For further information address J. S. Kallemyr.

HEARTWELL, NEB.—Bonds to the amount of \$2,700 have been voted for the installation of an electric-lighting system in Heartwell.

EDGERTON, KAN.—The installation of an electric-lighting system in Edgerton is reported under consideration. Energy to operate the proposed system may be se-

cured from the Wellsville-Gardner electric transmission line.

LEONARDVILLE, KAN.—The Riverside Light & Power Company of Abilene is contemplating extending its service to Leonardville. A street-lighting system, consisting of 20 lamps, will be installed, which will probably be followed by ornamental lamps.

PERU, KAN.—The installation of an electric-lighting system in Peru is reported to be under consideration.

WICHITA, KAN.—The construction of an electric interurban railway from Wichita to Arkansas City, via DeWey, Mulvane, Belleplaine and Winfield, is under consideration. John Madden and W. J. Funk are reported interested in the project.

WINCHESTER, KAN.—The Automatic Electric Light Company is contemplating the construction of an electric-light and power plant near Winchester.

Southern States

CHAPEL HILL, N. C.—Bids will be received by Edward K. Graham, president of the University of North Carolina, until May 7, for the construction of the Physics-Engineering Building. Plans and specifications may be obtained at the office of Charles C. Hook, architect, Charlotte, upon deposit of \$15.

GREENSBORO, N. C.—Contract has been awarded to J. T. Salmon of Durham for the erection of the east wing of the McIver Building for academic building, 65 ft. by 110 ft., at \$68,546; steam heat from central plant, \$8,000; conduit lighting system, \$1,450; also for construction of dormitory, 49 ft. by 158 ft., at \$84,500; steam heat from central plant, \$13,000; conduit lighting system (exclusive of fixtures), \$2,200. Harry Barton of Greensboro is architect. For further information address Dr. J. I. Foust, president of the college.

ROCK HILL, S. C.—Plans have been prepared by Edwards & Sayward of Atlanta, Ga., for the construction of a students' social and activity building and a dormitory, to cost \$125,000 and \$100,000 respectively. Bids will be asked for construction of buildings in from 60 to 90 days.

ATLANTA, GA.—The election which was to have been held on March 25 has been postponed by the City Council until May 26, when the proposal to issue the following bonds will be submitted to the voters: For electric generating plant, \$75,000; water-works pumping station, \$300,000; cyclorama building, \$100,000, and fire department, \$175,000.

REIDSVILLE, GA.—The proposal to issue \$10,000 for the installation of an electric-lighting system in Reidsville is under consideration.

SAVANNAH, GA.—The Chatham County Traction Company has recently been granted a charter to build an electric railway from a connection with the street railway system of the Savannah Electric Company in Savannah to Port Wentworth. The company is capitalized at \$150,000. H. C. Foss, manager of the Savannah Electric Company, is interested in the company.

JACKSONVILLE, FLA.—Plans are being prepared to establish a plant in the Jacksonville ship-outfitting yard of the California Brick Company to install machinery in ship hulls. The plans provide for the erection of machine, blacksmith, coppersmith, paint and electrical shop, garage, storerooms, 11-room office, etc., to cost about \$50,000, also installation of 50-ton and 10-ton traveling cranes. Machinery for the proposed plant, it is understood, has been purchased. The work will be done by the company's own force. It has a contract to furnish and install mechanical equipment in twenty 3500-ton wooden vessels of the Emergency Fleet Corporation owned by the United States government. John Clarence Temple of Jacksonville is general manager.

ST. PETERSBURG, FLA.—The St. Petersburg Lighting Company is contemplating extensions to its power plant, including the installation of a 300-hp. incense water tube boiler and turbine-driven feed pump. This equipment, it is understood, has been purchased.

ENSLEY, ALA.—The Southern Bell Telephone Company is contemplating building an addition to its telephone exchange on Nineteenth Street, between F and G Streets, to cost about \$17,500.

HUNTSVILLE, ALA.—Plans are being considered by Miller Brothers for the reconstruction of its cotton gin, recently destroyed by fire. The gin will be operated by electricity.

LITTLE ROCK, ARK.—The Mutual Power Company is contemplating the installation of a complete shop, new equipment including a lathe with 8-in. to 12-in. boring, 20-in. back-gear drill press, electrical equipment, air compressor, portable engine, small tools, etc.

RECTOR, ARK.—Plans are being prepared by Luther King for the construction of a new power house to operate a new gin house and cotton house now being built.

NEW ORLEANS, LA.—The construction of an electric railway between New Orleans and Mobile, Ala., is reported under consideration.

NEW ORLEANS, LA.—Preparations are being made to establish a vocational school shipbuilding, repairing, etc., in New Orleans, involving an expenditure of from \$2,000 to \$317,000 for buildings and equipment, which will include the construction of four buildings, consisting of administration and auditorium with 6000 sq. ft. provision will be made for training in foundry and machine work, electrical construction, carpentry, etc. J. A. Pratt, president.

NOTES, OKLA.—The City Council is planning to rebuild the municipal electric plant recently destroyed by fire.

SAVANNA, OKLA.—The Savanna Light & Milling Company, recently incorporated with a capital stock of \$2,000, it is reported, is contemplating the installation of a lighting plant in Savanna.

STONEWALL, OKLA.—The Oklahoma Power & Transmission Company is contemplating extending its electric transmission lines to Stonewall to supply electrical power here.

BEAUMONT, TEX.—Bids will be received by J. G. Sutton, city secretary, until May 7 (extension of date) for general construction, heating, plumbing and wiring additions to Ogden Fletcher and Magalia schools. The total cost is estimated at \$100,000. Plans and specifications are on file at the office of Sanguinet, Staats & Little, architects, at Fort Worth and Houston.

CARTHAGE, TEX.—Plans are being prepared by F. T. Rembert and K. S. Melton Longview for the installation of an electric-light plant and ice factory in connection with the Carthage Cotton Oil Company's plant.

CLYDE, TEX.—The installation of an electric-light and power plant in Clyde is under consideration. Robert Cook is reported interested in the project.

NIXON, TEX.—The Nixon Electric Light & Power Company, recently incorporated with a capital stock of \$12,000, is contemplating the construction of an electric-light and power plant in Nixon.

RIO GRANDE, TEX.—The capital stock of the Rio Grande Ice, Water & Light Company has been increased from \$24,000 to \$30,000.

ROUND ROCK, TEX.—Preparations are being made by S. E. Bergstrom of Kerens for the installation of an electric-light plant in Round Rock. Machinery, it is understood, has been purchased.

Pacific and Mountain States

COLVILLE, WASH.—The Stevens County Power & Light Company of Colville has petitioned the Commissioners of Stevens County for a franchise to erect an electric transmission line over the public roads in Stevens County.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company is contemplating improvements to its power house at 6600 Fourteenth Avenue South, including the installation of a coal conveyor, concrete tunnels and hopper.

TACOMA, WASH.—At an election held April 16 the proposal to issue \$4,000,000 in bonds for the construction of the proposed additional power plant was defeated.

COLUSA, CAL.—The Colusa Land & Water Company, it is reported, is contemplating the development of electricity for agricultural purposes. The proposed work will include a main canal, 8.7 miles long, a pumping plant, equipped with one 42-in. pump having a capacity of 100 sec.-ft., driven by a 400-hp. motor, and two 26-in. pumps with a capacity of 50 sec.-ft. each, driven by a 200-hp. motor. The cost of the project is estimated at \$219,890.

LOS ANGELES, CAL.—A resolution has been introduced in the City Council providing for the use of electricity from the municipal electric plant for the new Broadway lighting system.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has been instructed by the Board of Public Utilities to double-track its car line between Wilmington and Long Beach immediately.

LOS ANGELES, CAL.—The Public Service Commission has awarded the contract for laying of the submarine cable across the channel in the harbor to serve the substation to be erected at Fish Harbor, which will furnish electrical service to the proposed plant of the Southwestern Shipbuilding Company.

LOS ANGELES, CAL.—Plans are being considered by the power bureau for the installation of two submarine cables across the main harbor channel from the foot of Fifth Street in the San Pedro district to serve the city power substation, to be erected near Fish Harbor, which is to furnish energy to the shipbuilding plant.

MONTEREY, CAL.—The City Council has authorized the city engineer to prepare plans for extending the electrolier street-lighting system on Main Street from Scott Street north toward Decatur Street.

ONTARIO, CAL.—The San Antonio Water Company of Ontario is contemplating the construction of a new electric power house in San Antonio Canyon. Glenn D. Smith is manager.

RICHMOND, CAL.—The City Council has voted \$12,000 for electrical equipment for the municipal wharf, now under construction. Contracts have been awarded for two electric trucks, at a cost of \$4,383, to the United Vehicle company and for a 5-ton electric crane to the Cyclops Iron Company, at \$7,500.

ROUND MOUNTAIN, CAL.—The development of a hydroelectric power plant at a

drop near Round Mountain is reported to be under consideration by Wilbur O. Lusk of Los Angeles. The plans provide for the construction of a ditch and pipe line, 6.2 miles long. It is estimated that 7500 kw. can be developed.

SAN FRANCISCO, CAL.—The contract for electrical work in connection with the yard work at the southeast wing of the San Francisco Hospital has been awarded to J. Burtchall, 357 Ellis Street, at \$4,975.

PUEBLO, COL.—The Arkansas Valley Railway, Light & Power Company has recently completed an extension of its transmission lines to the Outland Ranch, and has accepted a contract to extend its lines to other ranches in that vicinity.

Canada

NEW WESTMINSTER, B. C.—The Campbell River Lumber Company has recently installed a step-down transformer station to convert the high-tension current of 12,000 to 2200 volts. The amount of energy used in the mill is about 950 hp.

HAMILTON, ONT.—Plans are being prepared by the Stone & Webster Engineering Corporation, 147 Milk Street, Boston, Mass., for the construction of a new plant at Old River at its junction with the Baltimore & Ohio Railroad for the Hamilton & Rossville Hydraulic Company on land which has been given the company in exchange for its present quarters. The company has been obliged to change its location owing to the flood prevention work by the Miami Conservancy District. The plans provide for the installation of three generating units of 800 kw. each.

SUDBURY, ONT.—Bids will soon be asked by W. J. Ross, clerk, for one electrically-driven pump of 12,000 gal. capacity, and one 175-lb., two-phase, 220-volt alternating-current induction motor.

MONTREAL, QUE.—The Ferro Alloy Company, it is reported, is planning to build a plant on the St. Maurice River in the Province of Quebec to secure the advantages of the cheap water power there.

SHAWINIGAN FALLS, QUE.—Plans are under consideration, it is reported, for the installation of three additional units of 20,000 hp. each in plant of the Laurentide Power Company, increasing the output to 180,000 hp. J. E. Aldred, 24 Exchange Place, New York, N. Y., is president of the company.

Miscellaneous

HAVANA, CUBA.—Contracts have been placed by the Havana Electric Railway, Light & Power Company for equipment for railway substations, consisting of two 2000-kw. rotary converters, six-phase, 60 cycles, 450 r.p.m.; six 750-kva., single-phase, oil-insulated, self-cooled transformers, 13,200 volts to rotary voltage; also switch and control equipment, to the Westinghouse Electric & Manufacturing Company.

(Issued April 9, 1918.)

261,771. MOTOR-CONTROLLED BRAKE; John S. Coldwell, Milwaukee, Wis. App. filed March 19, 1917. Improvements.

261,772. SYSTEM FOR SIGNALS AND MOTOR CONTROL FOR ELECTRIC ROADS; Roy V. Collins, New York, N. Y. App. filed May 13, 1913. Improvements.

261,777. OVERLOAD SWITCH; James K. Delano, Jr., Louisville, Ky. App. filed March 8, 1915. For use on low-voltage work.

261,790. CIRCUIT - CONNECTOR SWITCH; Harry A. Douglas, Bronson, Mich. App. filed Aug. 23, 1917. Improvements.

261,817. ELECTRICAL SYSTEM AND APPARATUS THEREFOR; John W. Jepson, New York, N. Y. App. filed Oct. 2, 1908. For voltage regulation.

261,856. SUPPORTING MECHANISM; Thomas B. Rule, Arklow, Ireland. App. filed Aug. 17, 1916. Supports an electric lamp.

261,870. ELECTRIC TRANSMITTING SYSTEM; Olof A. A. Tenow and Erik G. Ahnstrom, Stockholm, Sweden. App. filed Dec. 29, 1916. Remote control.

261,874. ELECTRIC FITTING; Samuel B. Van Ranst, Syracuse, N. Y. App. filed Feb. 11, 1910. Conduit fitting for use as a receptacle for snap switch.

261,884. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; Lionel M. Wolffsohn, Hoboken, N. J. App. filed March 18, 1916. Improvements.

Record of Electrical Patents

Notes on United States Patents

1,261,891. ARC-LIGHT CARBON; Hertha Ayrton, Hyde Park, London, England. App. filed Sept. 28, 1914. Improvements.

1,261,906. ELECTROMAGNETIC REGULATOR; John A. Coleman, Cleveland, Ohio. App. filed April 8, 1916. For operating valves and dampers.

1,261,928. ELECTRIC-LAMP INSTALLATION; Monroe Guett, Hartford, Conn. App. filed April 5, 1917. Lamp socket connected into the electrical circuit is inaccessible for the purpose of the insertion or removal of a lamp.

1,261,943. PLATE-WELDING PROCESS AND ARTICLE; Walter B. Lasher, Bridgeport, Conn. App. filed May 31, 1917. Welds thin plates.

1,261,968. MAIL - DISTRIBUTING SYSTEM; Simon B. Storer, Syracuse, N. Y. App. filed Dec. 11, 1914. Improvements.

1,261,971. ELECTRIC RIVETING MACHINE; Albert C. Taylor, Warren, Ohio. App. filed Sept. 19, 1916. Improvements.

1,261,975. HALL-BUTTON CUT-OUT SWITCH; Clarence W. Wheeler, Chicago, Ill. App. filed May 21, 1915. For automatic electric elevators.

1,261,999. DYNAMO-ELECTRIC MACHINE; Ernest J. Andrews, Chicago, Ill. App. filed June 11, 1912. For starting internal-combustion engines.

1,262,000. BATTERY METER; William Anthony, Clyde, Ohio. App. filed June 4, 1917. For measuring the energy or electromotive force of batteries.

1,262,019. VOLTAIC CELL; Miller E. Conrad, Atlantic, Iowa. App. filed Feb. 7, 1917. Improved depolarizing cell.

1,262,020. VOLTAIC CELL; Miller E. Conrad, Atlantic, Iowa. App. filed Feb. 7, 1917. Improved depolarizing cell.

1,262,037. TROLLEY RETRIEVER; Charles E. Gierding, Mansfield, Ohio. App. filed March 19, 1911. Improvements.

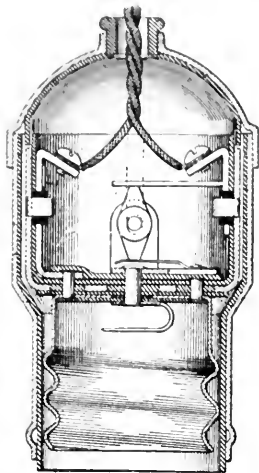
1,262,045. ELECTROLYTIC ALUMINUM; J. J. B. Herrshoff, Jr., Richmond Hill, N. Y. App. filed Dec. 4, 1915. For use in refining.

1,262,072. ELECTRICAL APPARATUS FOR HEATING STILL, BOILERS AND THE LIKE;

Charles O. Lorenz, Fort Arthur, Tex. App. filed May 8, 1917. Heating element not affected by repeated changes in temperature.

1,262,080. ELECTRIC STARTER; Albert H. Midgley, Acton Vale, England. App. filed July 10, 1915. For internal-combustion engines.

1,262,088. SPARK-PLUG TESTER; Alonson D. Perkins, New York, N. Y. App. filed May 10, 1916. For determining if the electric circuit of a spark plug has been accidentally broken without requiring the plug to be removed from the engine.



1,262,237—Incandescent-Lamp-Bulb Socket

1,262,103. APPARATUS FOR TESTING CABLES; Edmund O. Schweitzer, Chicago, Ill. App. filed Feb. 1, 1912. For fault or ground.

1,262,112. TELEPHONE SYSTEM; Frank M. Slough, Elyria, Ohio. App. filed May 15, 1915. Improvements.

1,262,113. TELEPHONE SYSTEM; Frank M. Slough, Elyria, Ohio. App. filed July 26, 1915. Improvements.

1,262,128. TROLLEY RETRIEVER; William C. Starkey, Mansfield, Ohio. App. filed Nov. 21, 1914. Improvements.

1,262,141. ELECTRIC INCANDESCENT LAMP; Edward Terry, Brixton, London, England. App. filed Oct. 2, 1915. Filament renewable.

1,262,148. ELECTRIC TOOL; Alex Wendelburg, New York, N. Y. App. filed Sept. 4, 1913. Operating means for the tool-driving motor.

1,262,149. CONTROLLER FOR ELECTRIC HAMMERS; Alex Wendelburg, New York, N. Y. App. filed Aug. 26, 1914. Means for delivering current to the operating coils of the hammer at predetermined time intervals.

1,262,150. METHOD OF AND APPARATUS FOR CONTROLLING A CIRCUIT; Paul R. Werner, Philadelphia, Pa. App. filed Oct. 13, 1915. Saturated magnetic field is fully developed before the movement of the armature takes place.

1,262,155. TERMINAL CONNECTOR FOR ELECTRICAL CONDUCTORS; Otto Zimmerman, New York, N. Y. App. filed July 15, 1916. Double-eyelet type for flexible electric conductors.

1,262,173. APPARATUS FOR NEUTRALIZING STATIC ELECTRICITY; William H. Chapman, Portland, Me. App. filed April 21, 1917. Removal of static electricity from paper, fabrics and other material in process of manufacture.

1,262,187. CONTROLLING SWITCH FOR SYNCHRONOUS MOTORS, ROTARY CONVERTERS AND SYNCHRONOUS RECTIFIERS; James K. Elderkin, Jr. App. filed July 30, 1914. Starts motors so as always to synchronize with the fields excited at the same polarity.

1,262,198. MAGNETO-GENERATOR; Edward B. Jacobson, Springfield, Mass. App. filed March 13, 1915. Operating parts effectively housed from dust and dirt.

1,262,228. STORAGE - BATTERY SEPARATOR; William Morrison, Chicago, Ill. App. filed Feb. 20, 1918. Sheet of wood impregnated with barium sulphate.

1,262,233. ELECTROMAGNETICALLY OPERATED DEVICE; Ethelbert T. R. Murray, Radlett, and George F. Shutter, Streatham, London, England. App. filed March 23, 1916. Relay in which the current necessary to

operate the device can be varied by changing the length of the air gap.

1,262,234. CIRCUIT BREAKER; Ethelbert T. R. Murray, Radlett, and George Frederick Shutter, Streatham, London, England. App. filed March 21, 1916. Improvements.

1,262,237. INCANDESCENT - LAMP - BULB SOCKET; Charles A. Nelson, Chicago, Ill. App. filed May 22, 1914. The use of blocks or masses of porcelain, hard rubber, etc., is eliminated.

1,262,248. APPARATUS FOR THE ELECTROLYTIC PRODUCTION OF COPPER AND OTHER METALS; Marcel Pelter-Lloyd, Boulogne-sur-Seine, France. Improvements.

1,262,257. MOTOR CONTROLLER; Harrison P. Reed and Walter C. Kennedy, Milwaukee, Wis. App. filed March 1, 1915. Field-controlling means for motors having shunt-field windings.

1,262,264. ELECTRODYNAMIC MACHINE; Amato N. Sammarone, Akron, Ohio. App. filed Aug. 16, 1916. Improvement in the commutator support.

1,262,266. MOTOR MECHANISM FOR VIOLIN PLAYERS; Henry K. Sandell, Chicago, Ill. App. filed Dec. 19, 1914. Improvements.

1,262,270. POCKET LAMP FOR FIREARMS; Paul Schmidt and Carl Dobslaw, Berlin, Germany. App. filed April 23, 1914. Improvements.

1,262,276. MOLD; Walter E. Skidmore, East Liverpool, Ohio. App. filed Aug. 8, 1917. Molded product is automatically released without breaking.

1,262,290. REGULATOR FOR ELECTRIC MOTORS; George H. Whittingham and William T. Holmes, Baltimore, Md. App. filed May 1, 1917. Electric motors used for driving individual machines.

1,262,307. PORTABLE ELECTRIC FUSE LIGHTER; Albert S. Cole, Livermore, Cal. App. filed May 23, 1916. Improvements.

1,262,315. TELEPHONE-EXCHANGE SYSTEM; Bert G. Dunham, Hawthorne, N. J. App. filed Oct. 5, 1915. For telephone-exchange systems utilizing automatic switches.

1,262,320. PORCELAIN PULL SOCKET; Edgar H. Freeman, Trenton, N. J. App. filed Nov. 8, 1915. No exterior metal parts.

1,262,323. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Oct. 29, 1917. Automatic line finders.

1,262,326. AUTOMATIC INTERRUPTER FOR ELECTROMAGNETICALLY OPERATED PAWL-AND-RATCHET MECHANISM; Georg Grabe, Berlin, Germany. App. filed Feb. 15, 1916. Improvements.

1,262,330. ELECTRIC SWITCH; Monroe Guett, Hartford, Conn. App. filed Nov. 21, 1913. Improvements.

1,262,331. ELECTRIC SNAP SWITCH; Monroe Guett, Hartford, Conn. App. filed Nov. 20, 1916. Improvements.

1,262,333. INDICATING DEVICE; John A. Hall, East Orange, N. J. App. filed Oct. 20, 1916. For use in telephone systems.

1,262,352. CALLING DEVICE; William Kaising, Chicago, Ill. App. filed Nov. 19, 1915. Used in telephone substations for controlling automatic switches.

1,262,359. IMPULSE-TRANSMITTING DEVICE; John A. Kropp, Oak Park, Ill. App. filed Oct. 11, 1916. Relates to senders employed in automatic and semi-automatic telephone exchanges.

1,262,360. SIGN; Frank O. Ladwig, Chicago, Ill. App. filed Feb. 10, 1917. Motor-operated changeable sign.

1,262,365. AUTOMOBILE SIGNAL; James P. McDermott, New Haven, Conn. App. filed May 4, 1917. Improvement.

1,262,378. LOCKING DEVICE FOR COIL BOXES AND SWITCHES; Harry W. Neal, Indianapolis, Ind. App. filed Dec. 21, 1916. To control the electric circuits in automobiles.

1,262,382. MAIL BOX; Roy J. Oliver, Prescott, Ariz. App. filed Nov. 29, 1916. Signal given when mail has been deposited within the box.

1,262,391. ELECTRIC RAIN ALARM; George A. Sabol, Clairton, Pa. App. filed Aug. 10, 1917. Improvements.

1,262,396. ARC WELDING; John A. Seede, Niskayuna, N. Y. App. filed Jan. 9, 1914. Limits the current supplied to the work to a low value at striking.

1,262,411. CAR-LIGHTING SYSTEM; John F. Trittle, Schenectady, N. Y. App. filed Dec. 18, 1913. Improvements.

1,262,424. ELECTRICAL SWITCH; Albert C. Wynne, Birmingham, England. App. filed April 17, 1916. Key-operated oscillating-arm switch.

1,262,435. ELECTRICALLY CONTROLLED LOCK; Gordon G. Berg, Chicago, Ill. App. filed

April 6, 1916. Door lock may be positively latched to prevent its manual operation.

1,262,453. PROCESS FOR VOLATILIZING ORES; Selden I. Clawson, Salt Lake City, Utah. App. filed Aug. 11, 1909. Apparatus in which the chlorine gas may be reclaimed from the volatile chlorides and reused in the volatilization of the ores.

1,262,463. FUSE PLUG; C. L. Dickson, Chattanooga, Tenn. App. filed July 8, 1916. Fuse-lock attachment which is to prevent the theft of energy.

1,262,487. MECHANICAL LOCKING DEVICE FOR PRESS CONTROLLERS; George W. Harrold, Philadelphia, Pa. App. filed Jan. 27, 1916. Improvements.

1,262,490. METHOD OF APPARATUS FOR TRANSLATING ELECTRICAL VARIATIONS; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed March 30, 1907. Flow of electric current through a gas or vapor utilization.

1,262,491. METHOD OF AND APPARATUS FOR TRANSLATING ELECTRICAL VARIATIONS; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed March 30, 1907. Improvements.

1,262,492. APPARATUS FOR AND METHOD OF TRANSLATING ELECTRICAL VARIATIONS; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed March 30, 1907. Electrodes used in operative relation to a gas or vapor-carrying current.

1,262,496. TELEPHONE-EXCHANGE SYSTEM; Edward E. Hinrichsen, East Orange, N. J. App. filed Aug. 2, 1916. Improvements.

1,262,497. ELECTRICAL SYSTEM OF SHIP PROPULSION; Henry M. Hobart, Schenectady, N. Y. App. filed Sept. 1, 1915. Improvements.

1,262,531. IGNITION SYSTEM FOR EXPLOSION ENGINES; Henry A. Lyon, Solomon, Kan. App. filed Aug. 22, 1916. Improvements.

1,262,534. IGNITION MECHANISM FOR INTERNAL-COMBUSTION ENGINES; Samuel C. McKeown, Newark, N. J. App. filed June 21, 1916. Improvements.

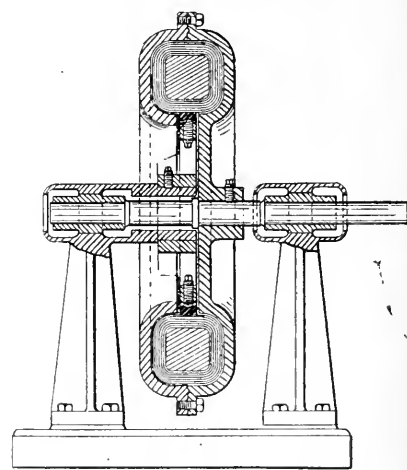
1,262,544. IGNITION DEVICE; William B. Moses, Brookline, Mass. App. filed March 10, 1916. Improvements.

1,262,558. ELECTRICAL MEASURING INSTRUMENT; Willard E. Porter, Lynn, Mass. App. filed March 18, 1915. Improved adjusting means for the control spring.

1,262,581. BATTERY CONSTRUCTION; William Gardiner, Chicago, Ill. App. filed Feb. 7, 1916. Improved separator.

1,262,582. PROTECTIVE DEVICE; John F. Graybill, York, Pa. App. filed Oct. 5, 1914. For secondary circuits of electric distribution system.

1,262,585. ELECTRIC MOTOR; Edgar L. Hollingshead, Minneapolis, Minn. App. filed



1,262,585—Electric Motor

March 30, 1916. Rotor is free from winding, insulated bars or electrical fittings of any kind.

1,262,587. DYNAMO - ELECTRIC MACHINE; John W. Jepson, Depew, N. Y. App. filed May 8, 1913. For charging storage batteries and supplying lights on motor vehicles driven by gas engines.

1,262,599. ELECTRIC MOTOR; Thomas J. Murphy, Rochester, N. Y. App. filed Oct. 29, 1915. Used to produce a steady arc light of high candlepower for moving pictures.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

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Number 18

America's Belated Recognition of Oliver Heaviside

WE PUBLISH in another column an announcement that the board of directors of the American Institute of Electrical Engineers has elected Oliver Heaviside an honorary member. Thus another great name is added to the small list of honorary members of the Institute, which comprises André Blondel, S. Z. de Ferranti, C. E. L. Brown and Guglielmo Marconi. It is, indeed, a belated tribute which America thus pays to the powerful English mathematical physicist, whose brilliant work on electromagnetic theory laid the foundation upon which the great superstructure of long-distance telephony has since been reared. When this generation bears in mind that as early as 1887 Oliver Heaviside demonstrated theoretically, and then urged practically, the advantage of inductance in telephone circuits; when it has further considered that the British Post Office Department, then under Sir William Preece, failed completely to understand his theories, so much so that Sir William Preece suggested for a transatlantic telephone cable a cable in which the electrostatic capacity was increased, it is little wonder that it has taken some time to bring about a clear recognition of Heaviside's fundamental principles underlying the propagation of electric impulses along wires and cables.

Unceasingly, in the teeth of a gale of "scienticulist" ignorance and prejudice, this great mathematician developed his theories and urged experimental work along the lines laid down by him, aiming at an increase of the inductance per unit length of the cable or conductor. In a series of brilliant articles published in 1893 in the London *Electrician* he suggested having "large distributed inductance together with inductance in isolated lumps. This means the insertion of inductance coils at intervals in the main circuit. . . . The electrical difficulty here is that inductance coils have resistance as well, and if this be too great, the remedy is worse than the disease. . . . This means using coils of low resistance and the largest possible time constants."

Twenty-five years have passed. Under the direction of Col. J. J. Carty, telephone engineers of this country have demonstrated the truth and the applicability of Oliver Heaviside's scientific reasoning. Great is truth, though it may be slow in prevailing!

Not alone, however great this work has been, can it be viewed as Heaviside's life work. Besides numerous contributions to the science of mathematics of utmost and revolutionary importance, there are the Heaviside units, called the "rational" units; there is the "rational" current element used throughout his work by Sir

Joseph John Thomson; there are the fundamental equations of the motion of an electrically charged body, with all the ramifications of mathematical and scientific work, which has culminated in the theory of the electron, and inseparably connected with Heaviside's name is the "distortionless circuit" and its beautiful theory. A busy age may plead preoccupation in extenuation of its failure to give earlier official recognition. So many are the subjects touched upon in Heaviside's writings, so absorbing and stimulative are these contributions to electrical science, that they have been an inexhaustible source from which lesser men have drawn material for interesting and instructive papers. The theory of the distortionless circuit, the building up of the steady state from a conception of direct and reflected waves, the use of operators—all these are but a few of the contributions made more than a quarter of a century ago, and they are cited at random from the wealth of Heaviside's papers. May this recognition of one of the greatest mathematical physicists the world has ever known convey to Great Britain and her men of science another message from America that in realization of each other's strength must lie the basis of their enduring greatness and invincibility.

Protect the Credit of the Utilities

IT WAS not necessary under normal conditions to give serious concern to the subject of credit of well-managed electric utilities. They had good credit. It is highly necessary to give most careful attention to this vital question under the war conditions of to-day. Herbert A. Wagner, in the suggestive article published in this issue, discusses critically the vital problem of maintenance of sound credit. It cannot safely be ignored or left to haphazard decision. This is a matter which is intimately connected with the operation of war industries at war-time speed and with satisfactory service to the general public. It is not the part of wisdom to let these properties be subject to the economic burdens of war and at the same time to withhold relief from them through larger revenue where higher rates are required.

Recognizing that the paramount obligation of the utility is to the public which it serves, Mr. Wagner discusses various other considerations which should be kept in mind. These are, first, the positive obligation to bondholders, who may throw the property into confusion, endangering the equity of shareholders, if their interest is not met; second, the obligation to shareholders, which is only slightly less than the obliga-

tion to bondholders, for the public utility stock certificate with state rigid regulation represents investment and limited return, not speculation and a fair chance of big profits; and, third, most important of all to the large body of consumers, the urgent importance of meeting the need for ever-increasing service in a growing community. To comply with the demand for service, which is a very real and crying demand in these times, you have to provide plant. To buy plant takes money. And one cannot get investment money at low rates from the bankers unless credit is good, unless earnings show ability to pay, unless the record of the past is unequivocal payment of obligations and sustained earning power.

Only the keen appreciation of the crisis which lies just on the border line of sustained credit or damaged credit justifies the utilities in bringing their problems to public attention when the nation is at war. Ordinary trials they would face without complaint. But they cannot afford now to lose the ability to cope uncrippled with whatever the future holds. They cannot dissipate strength in struggle when it is imperatively needed for efficient operation. They can weather a storm if clear, smooth seas lie ahead. It is plainly the hour when the utilities have the right to insist that all of the obligation is not resting upon them. Some of it belongs to the other side. Maintained credit will keep them in the best condition to give the service which will help to win the war. The utilities ask in confidence that their business be set and kept on a self-sustaining basis, so that irrespective of government aid in financing they may make a good showing and have a reasonable surplus.

Seriousness of the Coal Situation

THE only certain feature about the coal situation is its seriousness. This unfortunately does not appear to grow less with time. Indications are that fuel will be as hard to get as ever and with the coal zoning system many utilities will have in addition to content themselves with inferior coal. Prudent managers, therefore, will lay in as large a supply of fuel as they can obtain before railroad service becomes any worse, and operators will adapt their furnaces to the grade of coal allotted them. This is sensible as well as patriotic. So far as public utilities are concerned the Fuel Administration is doing its utmost to provide for their wants, but the best laid plans often go awry owing to circumstances beyond the control of the planner. The Fuel Administration is not the Railroad Administration, and thereon hangs a tale. Just as long as co-operation between administrations and co-ordination of various governmental activities are lacking, to that extent there will be confusion and inefficiency. Coal at the mines is of no service to a utility. It can only be used when in the bunkers of power houses, and to put it there cars are necessary. If the Railroad Administration does not provide the cars, the Fuel Administration is helpless. The zoning system of the Fuel Administration was devised primarily to help the Railroad Administration, but no one-sided co-operation is ever very effective. The railroads, of course, are deluged with freight, and some day there may be a freer movement of low-grade freight, which includes

coal. Until that day arrives, however, the coal situation will continue to be serious. The safest way to provide against freight contingencies is to get all the coal obtainable and store the surplus. In such a plan the co-operation of the Fuel Administration is assured.

Additions to the Commonwealth Edison Plant

NO BETTER evidence of the difficulty of keeping pace with the demand of a great and rapidly growing city can be found than in the description of some of the new work at the Northwest station of the Commonwealth Edison Company which we publish this week. The first plant contained two 20,000-kw. units, to which have now been added three 30,000-kw. turbo-generators and one of 35,000 kw., the last-named for 25-cycle operation like the original plant. When in full operation the station will be able to furnish 85,000 kw. at 25 cycles and 80,000 kw. at 60 cycles. To provide for this immense output corresponding changes have been necessary in the boiler room. Each of the first two machines of 20,000 kw. was fitted with ten boilers per unit. The last generators, in spite of their greatly increased rating, have only five double boilers each.

This change is an impressive demonstration of the tendency toward getting boiler units somewhere nearly commensurate with the generator capacity. Whether the time will ever come when it will be the practice to install one boiler unit per generator is another matter. Probably not, since boilers require overhauling on account of the nature of their service, and it is desirable to have the boiler capacity sufficiently subdivided to permit one section to be taken out of service without too great inconvenience.

The additions to the plant have also involved a general change from steam to electric drive for all the auxiliaries, a change thoroughly in keeping with the general trend of practice for obtaining higher efficiency and greater convenience. All the new units are equipped with direct-connected exciters, and the circuits are so connected that each unit can be fully controlled from its own particular panel. They are all, too, equipped with control relays which are somewhat unusual in the thoroughness of the operations conducted by them. When tripped they act in succession to open the main generator switches, the generator field switch, the generator neutral switch, and the ventilating-fan switch in the case of the machines which have artificial ventilation.

Exploring coils installed in the generators are connected to temperature indicators in the operating gallery, and similar coils in the air intakes of the machines give continuous indications of the temperatures reached in operation. The whole switching equipment of the new plant is installed in the more recent portion of the switch house, which contains a basement for cables, high-tension buses on the first floor, oil and disconnecting switches on the second floor and the oil-switch mechanism on the third floor. Interesting details regarding the arrangement of the switchboard connections and apparatus in the plant are included. Our readers will find in the diagrams a wealth of information regarding the complete equipment of this very modern and highly organized plant.

Taking Proper Care of Reactors

ALTERNATING-CURRENT stations grow bigger and bigger, and the importance of reactors to serve as protection against short circuits becomes greater and greater. In the earlier days of alternating-current service every effort was made to improve generators in the direction of lowered reactance, so as to obtain good inherent regulation to facilitate the keeping up of uniform voltage. The first alternators were extremely unsatisfactory in this respect, but as bigger machines came into use it was found that a moderately high reactance was very desirable to avert trouble from short circuits, particularly where machines were operated in parallel. Later it was found advisable to put this reactance in part at least outside the machine, chiefly for mechanical reasons. The average engineer has a very meager idea of the tremendous forces exerted by reactors when big currents arising from a short circuit occur. The installation of reactors transfers the major part of the troubles from the generator to the reactor, hence in the design and installation of these much care has proved to be necessary.

M. E. Skinner's paper on this subject throws a vivid light on the electrodynamic problems of reactor installation. The reactors in practical use are always without iron cores. They are akin to the primary circuit of a coreless transformer adapted to carry very great currents, and usually take the form of coils of bare wire with the turns supported on fireproof and non-magnetic material. They are too big to immerse conveniently in oil tanks, so reliance is placed on air as a dielectric. The temperatures reached under short-circuit condition may be very high. Ordinary insulating materials would be of little service even if one attempted to employ them.

Owing to the fact that the reactor coil is without a core and its magnetic field very widely distributed, particular pains must be taken to keep it away from closed metallic circuits of every kind to prevent loss of energy and even possible overheating. It is found in practice, for example, that beams, pipes and even expanded metal may be very considerably heated by acting as secondaries to the reactor coils, so that in installing reactors it is necessary to pay close attention to the surroundings. Finally, the magnetic stresses may result in drawing loose magnetic bodies into the coils and short-circuiting or injuring some of the turns. For the same reason the forces between two adjacent reactors may become high enough to cause mechanical trouble to supports in case of short circuit unless fairly liberal spacing is adopted.

Overcoming the Difficulties of Long-Span Construction

IT IS to the great transmission networks of the Pacific Coast that engineers continually look for important suggestions in power transmission. The art began there, and the Coast has continually been in the front line of progress. In particular the Pacific plants have had to deal with topographical conditions which have made their pole lines of very diversified and interesting character, especially since long spans have been used far more freely than in most other parts of the country. Not only have there been various sensational feats in spanning navigable waters but there has been a free use of uncommonly long spans in the more ordinary classes of pole construction. The difficulties which have been encountered in such work are of a rather special character, since the length of the span increases the possibility of conductors swinging into contact, a contingency quite negligible under ordinary circumstances. The stresses on the insulators and their supporting structures are increased too, and there is of course the usual rise in the stress of the conductors.

To meet these requirements it is usual to space the conductors more widely than has been the practice elsewhere, to use relatively heavy conductors, and sometimes to provide intermediate spacing devices. Just which one of these devices is most effective has to be determined in accordance with the local conditions. In some of the longer spans stranded-steel cable has been used successfully, in others composite wire, and sometimes even copper carried on a messenger cable.

For protection against the strains produced by changes of temperature at least one very interesting development has been made. The strain insulator group is attached at the tower side, not directly, but to a cable passing over pulleys, and thence to heavy concrete weights inside the tower, so that the connection is a flexible one ready to yield to the necessary degree when extra strains are imposed on the cable, and so to keep the tensions uniform. Considerable progress has been made, too, by dividing the strain of long spans between groups of insulators installed in parallel, with equalizing yokes when of the disk type.

When one realizes that in these Coast systems spans from 1000 ft. to 2500 ft. (304.8 m. to 762 m.) in length are fairly common the necessity of special engineering becomes altogether obvious. For this class of work stranded steel is being freely used regardless of voltage. A study of the suggestions contained in this particular article ought to result in considerable saving for many Eastern lines.

DECREASED net profits due to the rapidly mounting cost of operation have forced central stations to look more than ever to methods of improving economy. Among articles which will be published from time to time to show how the situation can be faced one will be presented soon giving the capitalized value of the yearly saving which can be realized from higher steam pressures. Various loads, coal prices and rates of capitalization are taken into consideration. Features of additions to the Northwest station which are touched on in this week's issue will be further noticed next week, special attention being

The Coming Issues

given to the control of auxiliary motors in the plant. A precision method of measuring alternating currents which requires relatively simple apparatus and by which all disturbing factors are eliminated or minimized so that they can be disregarded will be explained, and results of tests to show the accuracy of the method will be given. Value of flywheels for woodworking machines and methods of economizing in copper for transmission and distribution will also be discussed. The effects of daylight saving on central-station load curves and income will also be treated in articles from time to time.

The Credit of Public Utilities

Commission Regulation with Limited Rate of Return Should Be Counterbalanced by Elimination of Risk to Investors—Additional Capital in Large Amounts Must Be Attracted

BY HERBERT A. WAGNER

President Consolidated Gas, Electric Light & Power Company, Baltimore

IN THESE times, when the energy of the entire nation is being mobilized with the one object in view of winning the war, the financial resources of the country are being taxed to the utmost. Our public utilities are being called upon for more service than ever before, while at the same time their operating expenses are being greatly increased and their means of obtaining the additional capital required are being restricted in every way. It is most essential, from the standpoint of national efficiency, that these corporations should be permitted to make such additions to their charges for service as will enable them to maintain their credit.

The credit of a public utility, like that of any corporation or individual, depends upon its ability to meet its obligations. The obligations of a public utility are threefold and of equal importance to its credit—first, its obligation to the public; second, its obligation to its bondholders, noteholders and other creditors; third, its obligation to its shareholders.

OBLIGATIONS OF THE PUBLIC UTILITY

Its obligation to the public includes good service, adequate service and prompt provisions for additional facilities to furnish increased service as demanded. Its obligation to its bondholders and noteholders includes, not only the payment of interest but the maintenance of the value of its property and a reasonable equity in value above the bond and note issues. The strongest evidence of the maintenance of the required equity is in the maintenance of a fair margin in earnings above its interest obligations, and the best proof of the maintenance of such margin in earnings is the actual payment of dividends on the capital stock. On the other hand, a failure to maintain the usual dividend rate would be a direct admission of inability to maintain a normal margin.

The utility corporation's obligation to its shareholders includes not only the maintenance of the confidence of existing shareholders but also the maintenance of the confidence of the investing public, to whom the utility must apply time and again and with increasing frequency for a substantial part of the money required for expanding business and in ever-increasing amounts. No corporation can do business entirely upon borrowed capital. A substantial part of its capital must be furnished by its stockholders, and the ratio between borrowed capital and stock issued must be maintained as greater amounts of capital are required for the growth of the business.

The laws in most states prohibit the issue of public utility stock at less than par. Many issues have been put out at par or over, under the regulations and approval of public service commissions.

It is evident that, as future stock issues are an absolutely necessary part of future financing, it will be

impossible to put out additional shares at par if the market price of outstanding shares is not maintained at par or over. Manifestly the only practical course for public service commissions to pursue is to do all within their power, under the law, through the adjustment of rates for service, to maintain, in so far as may be possible, by the payment of dividends, the market value of shares issued under their approval, at prices not less than the price of original issue.

THE UTILITY CANNOT STAND STILL

The public utility is in an altogether different position from all other industrial and commercial undertakings. It cannot stand still and mark time at its will nor merely maintain its existing business. It is forced continually to expand its facilities at the demand of the public, and at an enormous rate of growth, particularly in present times. The annual new capital requirements are many times the total net income of such concerns and, by law, the earnings cannot be used to finance the growth, nor can money be diverted for this purpose from the payment of dividends.

The element of risk in the investment in public utility shares should be practically eliminated. Ordinary business enterprises succeed or fail according to their character and the demands for their products, and wise investors continue to invest only in those which appear to offer the best prospects of success. The public utility, on the other hand, cannot be permitted to rise or fall with fluctuations or changes in the opinion of the investing public in regard to its chances of success or the risk involved. Public utilities must continue in business and must continue to expand, and consequently must readily secure additional money. This involves the absolute necessity for financial success and substantial profits.

There is nothing of greater practical importance in assuring good and adequate service to the public than the maintenance of regularity in the dividend rate paid by a utility to its shareholders. In the past it has been a practice to regard shareholders as standing in substantially the relationship of partners in a business. They were supposed to be familiar with the status and fluctuations of the business and were expected to share in its ups and downs. But the corporation which has shareholders who are not active in the business or familiar with it is in a different situation, and this applies with particular force to the great public utility corporations that number their shareholders in the thousands and tens of thousands.

The great majority of the shareholders in such corporations have only the barest information as to the manner in which the business is handled and as to the results that are being achieved, and are not sufficiently familiar with the business or sufficiently interested in it to absorb more detailed information even if it were

given to them. They regard their ownership of public utility stock purely as an investment of capital that will bring them an income. They buy such stock with much the same purpose as they would have in buying a real estate mortgage, the only purpose being that of securing a dependable income with a chance of profit. The object that is actually in their minds in making the purchase is not a partnership interest in a going enterprise but the acquisition of certain certificates of stock which at regular intervals will bring them dividend checks.

To shareholders of this type regularity in their dividend returns is of the greatest importance. They count upon these returns as a fixed portion of their income. Indeed, in thousands of instances the living expenses of dependents are provided out of these dividends. In this present war time these dividends are being already substantially reduced by federal income taxes and made to bear their part of the burden imposed by the war. Further than this, the purchasing power of all money has greatly decreased under existing conditions, which in itself is equivalent to a decrease in dividend rate.

The desirability of maintaining regularity of dividend rates rests not merely upon the duty of the corporation to its shareholders but also upon a substantial advantage for the corporation itself, by reason of the fact that shares which yield regular dividends are in far greater demand by owners of capital who are not engaged in active business or who are investing their hard-won savings than those shares which are paying irregular dividends, however large these latter may sometimes be.

Out of two stock issues, otherwise equivalent, one of which is paying a permanent dividend rate year after year, and the other of which is paying dividends irregularly but averaging at least as high as the regular payer, the former issue will always sell at a substantially higher price. For this reason the corporation which has succeeded over a period of years in maintaining a record of dividend stability, and which has not changed and is not likely to change its dividend, except to raise it to a permanently higher level, enjoys the benefit of a credit and of a consequent demand for its securities which is worth an enormous amount to the corporation and to the public which it serves.

By commission regulation public utilities have been deprived of the possibility enjoyed by all other industries of taking advantage of the law of supply and demand for fixing prices and maintaining profits. Their ability to maintain profits is no longer dependent primarily upon the skill and foresight of the management, but is limited to what may be laid down from time to time as a fair rate of return on the capital invested, nor is this rate of return even assured by more than implication and the moral responsibility and self-interest of the community. The ultimate responsi-

bility lies with the public service commission, and it has been confidently expected that limitation in the amount of profits which may be earned on the investment of public utilities by such regulation would be offset and counterbalanced by the practical elimination of risk to investors and shareholders in such corporations.

By this it is not to be understood that such regulation should or could eliminate the risk incident to inefficient management (although this, to a large extent, is also under the control of the commission), nor the risk incident to depressed or subnormal general business conditions. The risk that can and should be eliminated, however, is that due to insufficient rates for service to provide for operating expenses, fixed charges and dividends; or, in other words, for the maintenance of the normally prosperous financial condition of the corporation in times of normal or expanding business. When operating expenses increase, owing to increasing cost of materials and wages, the rates for service should increase in commensurate degree.



HERBERT A. WAGNER

IS IT TO BE A GAMBLE?

If the purchase of public utility stock is to become a gamble on the part of investors, then the chance of obtaining adequate service must become a gamble on the part of the consumers.

In just so far as the risk of loss in income to the investor is minimized will the risk of inadequate service to the consumer be minimized. Additional capital in large amounts must be attracted to the utility each year to meet the growing demands of the consumer, and in order to attract the capital of the investor a record must be established and maintained for regularity and sufficiency in income-producing dividends which will not only hold the investor but will induce him, under money market conditions existing at the time, to buy more stock when it is offered.

Credit and borrowing power are not necessarily equivalent terms. While it is necessary to have good credit in order to negotiate loans satisfactorily, there are times when it is difficult or next to impossible to borrow money even with good credit. When money is plentiful almost any concern with ordinarily good credit can obtain it. When, however, there is an unusual demand for money, and for more money than there is available, then only extraordinarily good credit will command it.

At the present time the demand of the United States government for money has strained all our resources, and only those public service corporations which can show a far better credit than would be considered necessary in normal times can hope to obtain money, even at the prevailing higher rates of interest. Rates of interest are far higher than in normal times, and those undertakings which need money must not only prove their ability to pay the higher rates of interest demanded but must also show an earning capacity to

provide a higher margin above their fixed interest obligations than in usual times.

DANGERS OF DECLINE IN EARNING POWER

In these times any corporation which must admit its inability to pay its usual rate of dividends will get small consideration in the money market. The banks and trust companies throughout the country must, directly or indirectly, supply such money as the public service companies are able to obtain, and these same financial institutions are interested in one way or another in the shares of such companies, and consequently in the dividends paid. Even where banks or trust companies may not have invested directly in such shares, they are quite generally carrying loans which have been made by borrowers with such shares as collateral. Shrinkage in the value of such securities, particularly when it becomes general, creates a financial situation which not only embarrasses the investing public but the banks themselves. It is no doubt for this reason that John Skelton Williams, Comptroller of the Currency, in his last annual report to Congress, took occasion to call attention to the danger of the situation being brought about by the decline of the earning capacity of public utilities in the following words:

National and state banks and many thousands of small and large investors have suffered seriously from the decline of the earning capacity of public utility corporations and the consequent shrinkage in the value of their securities, representing investments of many hundred millions of dollars. These losses naturally diminish the power and disposition of the public to respond to the calls of the government for money for war. This danger should arouse, I venture to suggest, the anxiety and stimulate the efforts of the Congress and of every patriotic citizen. A more urgent and pressing peril is forced upon our attention by the obvious fact that we are dependent so largely on the efficiency and strength of these corporations and on our railroads for speed and success in preparing for and prosecuting the war. . . . If they are allowed to sink into inefficiency, much of the important war work will be crippled or paralyzed.

The work of war has thrown upon many of these corporations strains which they are unable to endure without prompt help. The costs of their labor and of all material for operation, betterment and upkeep have increased heavily and suddenly. They are required to increase radically and quickly their service and facilities. Industries manufacturing war munitions and materials demand of the public utilities corporations constantly greater supplies of power and light. At the industrial centers car lines are being rushed and overburdened by new armies of workers. The gas companies are called upon for gas for cooking and heating in quantities beyond all normal calculations and far beyond their present capacities. . . .

The continued and increasing efficiency of these corporations is important for the successful conduct of the war. This efficiency is not possible with present conditions. Corporations proved by their own figures to be approaching bankruptcy cannot obtain money for improvements or maintenance. On the other hand, banks and citizens suffering severe losses from investments in the securities of these entirely legitimate and once promising enterprises will be discouraged from lending money to the government or deprived of the means to lend.

The first and most direct relief to the public utilities corporations can be given by the state public utilities commissions and municipal and local authorities, with the broad-minded co-operation of the people generally, understanding the necessities of war and realizing that the more promptly its burdens are accepted the sooner they will be lifted. It is essential that forbearance and consideration be exercised by the state commissions and municipal authorities, and that the corporations also be permitted to make such additions to their charges for service as will keep in them the breath

of solvency, protect their owners against unjust loss and give them a basis of credit on which they may obtain the funds with which to meet the strain put on them by the government's needs. The breaking down of these corporations would be a national calamity.

The public utility corporations in the United States have an aggregate capitalization of more than \$10,000,000,000. Their annual operating revenues, combined, amount to more than \$500,000,000. The combined funded obligations of these utilities maturing in 1918 approximate \$225,000,000. It is estimated that they are carrying, in addition, about \$300,000,000 of short-term notes which must be refunded within from one to four years hence. These obligations cannot be met with impaired credit.

NEW JERSEY'S COMMISSION POINTS THE WAY

The attitude taken by the Board of Public Utility Commissioners of New Jersey in granting an increase in gas and electric rates upon the petition of the Public Service Corporation of New Jersey shows a broad and enlightened grasp of the financial situation and of the need of maintaining public confidence and stable security market conditions. This board has clearly pointed the way which all commissions should promptly follow to avert the national danger of which the Comptroller of the Currency has warned the country. In its opinion this board says:

Although not specifically stated therein, the petition is in effect a prayer for emergency relief on account of the extraordinary increases in the cost of labor and materials entering into the production and distribution of the company's power, arising out of the war. . . .

The board has dealt with this application as one growing out of extraordinary war conditions resulting in abnormally high costs. We have not dealt with this proceeding as we would, under normal conditions, deal with an application to increase rates. . . .

It is a matter of common knowledge that wages and the cost of fuel which make up a large part of the production expense of electric light and power companies have greatly increased, and, in fact, that all labor and supplies which must be used in the process of operating such properties and maintaining them in repair have risen greatly in price since the normal pre-war times—in some instances, in the case of supplies, the rise being more than 100 per cent. These added costs must be met. The question now presented, therefore, is whether they may with fairness be met by an increase in rates. . . .

We have not dealt with the value of the property in this proceeding. In the existing emergency the determining consideration must be to keep the property in uninterrupted and effective operation. This involves the payment of fixed rentals and charges, without regard to the value of the property, since failure to satisfy such contracted rents and charges would jeopardize uninterrupted operation.

If the revenues are not increased to meet these added costs, the moneys available for dividends will be substantially diminished. In the present financial situation the public has a vital interest in maintaining the fund available for dividends on the stock of the company. Without assurance of sufficient earnings at the present time, the company will be unable to attract new capital to finance the extensions that are required to meet war needs. A material decrease in dividends would not only result in preventing the free flow of new capital but would materially depreciate the market value of outstanding securities.

This possible shrinkage in the value and marketability of such securities would tend to undermine confidence and render unstable security markets. Such a condition would have direct influence upon the securing of money by the national government for war purposes. The required funds for these purposes must be yielded by operating revenues. In the broad view the public interest requires it.

Special Transmission-Line Problems

How Some Difficulties Peculiar to Supporting Long Spans Have Been Overcome on the Pacific Coast—Use Made of Novel Methods—Details of the Structures That Have Been Employed

METHODS of preventing the ordinary troubles which are liable to arise in connection with moderate-span transmission lines have been discussed quite fully in various articles printed in the ELECTRICAL WORLD. In this article it is the intention to consider some of the more special problems, especially those encountered in supporting long spans, and to point out how they may be solved. Practice on the Pacific Coast is cited in most instances because topographical conditions there require the use of long spans to a greater extent, perhaps, than anywhere else in this country.

In some places where long spans are required—for instance, over rocky country or places cut by deep ravines—it is possible to place the supporting structures in elevated places, so relatively short poles can be used. In other places, however, where large bodies of water must be crossed or where long stretches of ground are level but of such a nature that it is difficult to set poles satisfactorily, additional problems are imposed inasmuch as tall towers may be required.

PROBLEMS PECULIAR TO LONG-SPAN CONSTRUCTION

Regardless of whether tall or short supports have to be used, special problems are encountered which might be only incidental with moderate-length spans. For instance, with long spans there is more of a tendency for the conductors to swing into metallic contact with each other, larger stresses have to be transmitted through the insulators to the supporting structures, excessive strains have to be avoided in the conductors and other similar conditions arise. Provision must also be made to withstand the whipping action of the conductors when they are subjected to gusts of winds and also to prevent failure of the towers in case the long spans break.

The possibility of the conductors swinging together can be avoided or minimized in several ways—by spacing the conductors liberally, by using conductors which are relatively heavy compared with the area exposed to wind pressure, by using intermediate spacing structures, by minimizing the sag, and by artificially weighting the conductors. The first three methods are used most extensively, both singly and collectively.

The sag can be minimized, of course, by employing extra high strength conductors, but this method increases the strain on the towers and makes them more expensive. Providing liberal spacing at the supporting structures also makes the latter more expensive, since longer cross-arms have to be used. Only detailed analysis of each case will determine which method is most economical. Even where suspension insulators could be used, as may be practicable where the adjacent spans are sufficiently long to balance each other, it may be advisable to use pin or strain insulators to prevent conductor deflection, which can occur if suspension insulators are used.

The clearances ordinarily required over rights-of-way

do not usually impose so great a problem as those over navigable streams. Where the structures at each end of the long span can be erected on elevated ground the expense and engineering problem of designing and providing mechanically satisfactory towers are considerably reduced, as they can be made relatively short. This cannot be done in many cases, however, and therefore tall towers have to be employed or conductors with very high tensile strength have to be used to permit reducing the sag, or both.

In one case in the Northwest the expense of tall steel structures was avoided by splicing wood poles together

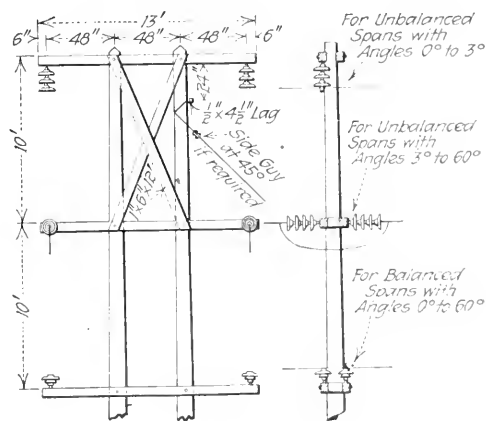


FIG. 1—TYPES OF CONSTRUCTION USED ON 45,000-VOLT LINES FOR THREE DIFFERENT CONDITIONS AND 600-FT. TO 1500-FT. SPANS (GREAT WESTERN POWER COMPANY)

and making H-frame towers which were cross-braced and guyed at numerous points. In another case the conductors were supported on a saddle carried by several pin insulators and the ends dead-ended at a special structure near the ground, thus avoiding the excessive bending moment which would have been exerted on the tower if strain insulators were used. This construction was not used so much for this reason, however, as to avoid depending on the tensile strength of disk insulators.

Various methods of preventing excessive stresses in the conductors have been employed. Sometimes the conductors are supported at such an elevation that large sags can be permitted. In other cases stranded steel wire of extra-high tensile strength or composite wire such as copper-clad steel, steel-core aluminum and stranded cable with a steel core has been used. Even high-strength steel messenger wire supporting a copper conductor has been employed.

NOVEL METHOD OF SECURING UNIFORM TENSION

Allowance for expansion and contraction of the conductor due to temperature changes is especially necessary on long spans as the wires may be worked nearer the safe margin of their tensile strength than on moderate-span lines. In one case compensation for this change in conductor length is provided for to insure

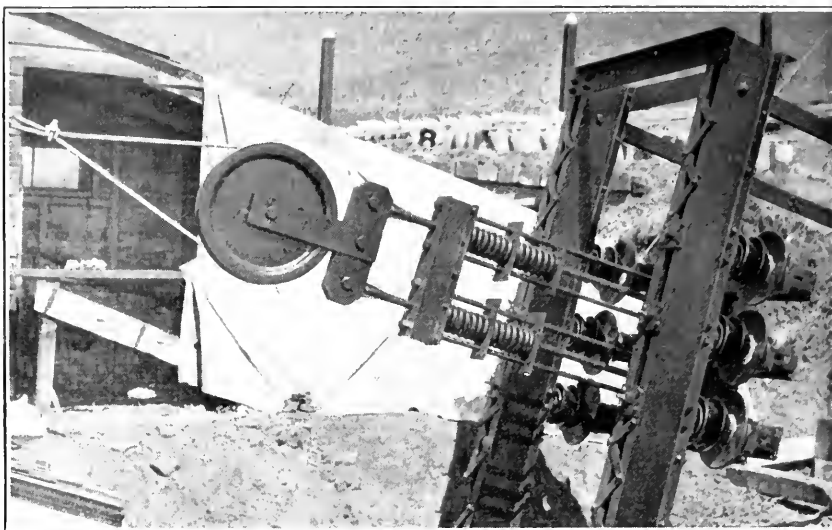
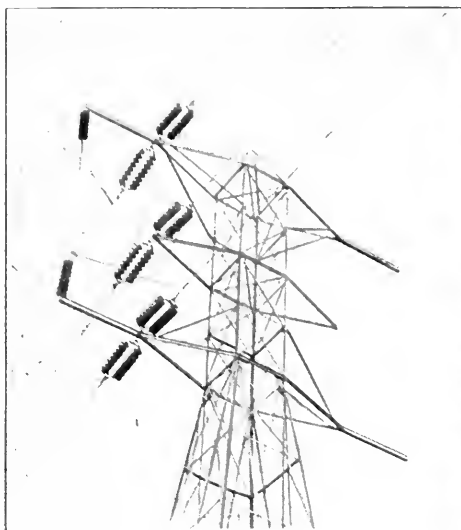
uniform tensile strength at all times by attaching the tower side of the strain insulators to cables running over pulleys, thence down to large concrete weights inside the tower near the ground. The weights are provided on only one end of the span. Incidentally the construction relieves the insulators from sudden strains due to whipping of the conductors and reduces the bending moment on the tower on which they are installed.

Transmission of the conductor stresses to the supporting structures is a problem of no little importance on long spans. If pin-type insulators are used, it is necessary to support the conductors on them in such a way that no bending moment is exerted on the pins, and furthermore if several pin insulators are required to carry each conductor, as may be the case with exceedingly long spans, the stress must be evenly distributed over them. If disk-type insulators are used,

two-horse vehicle so that the strings of insulators can be placed in one plane. Other yokes are constructed on the same principle, but the equalizing bars are arranged so that the insulators can be placed in two parallel planes as shown in the illustrations. In attaching the conductors to the insulators care must be taken not to bend the wire in too sharp a radius and not to injure the skin with clamps. In some cases the wires are bent around small pulleys attached to the insulators. When aluminum wire is used aluminum sleeves are advisable to protect the wire from the clamps.

SURFACE LEAKAGE

Surface leakage has caused more trouble than actual failure of insulators on the lines of the Southern Sierras Power Company, Riverside, Cal. In the dry climate of that section practically all the moisture in the poles



FIGS. 2 AND 3—TRANSPPOSITION ON 100,000-VOLT LINE (GREAT WESTERN POWER COMPANY); LONG-SPAN ANCHORAGE WHICH IS HOUSED FOR SAFETY AND TO PROTECT INSULATORS (PACIFIC GAS & ELECTRIC COMPANY)

it is not safe to depend on one string of insulators for transmitting the stress, at least for spans more than 1500 ft. (457 m.) in length. The real decision should be based, of course, on the tensile strength of the disks used and the margin of safety considered necessary.

TRANSMISSION OF STRESSES TO SUPPORTS

One case in which pin insulators are used very successfully for supporting an exceedingly long span is at Carquinez Straits, this construction being referred to before. A saddle is provided over the insulators (several are used to support each conductor) to distribute the stress and also allow the conductor to slide and thus prevent lateral stresses in the insulators. Each conductor is dead-ended by being served around a pulley and clamped, the pulley in turn being connected to a yoke pressing against multiple pin insulators. Springs are connected between the pulley and yoke to relieve suddenly applied stresses.

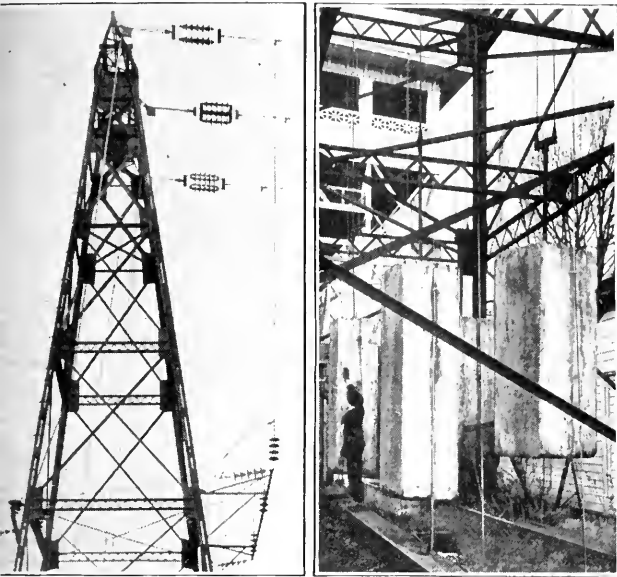
Where disk insulators are used for transmitting the conductor stresses to the supporting structure they are usually connected in parallel for spans above 1500 ft. (457 m.) in length. There is not much difficulty in dividing the stress between two parallel strings, but with more than two there may be some unless properly designed equalizing yokes are employed. Some yokes for this purpose are arranged like the whiffletree on a

and cross-arms evaporates so that the leakage from the iron pins chars and even burns the wood. To remedy this trouble the pins are metallicly connected by means of No. 9 galvanized iron wire stapled to the cross-arm and pole. The connection to the pins is made by wrapping the wire around the pin bolts under the washer and clamping it in place by screwing up the nuts.

At such places as river crossings and over rough country subject to slides and indented by deep ravines the Puget Sound Traction, Light & Power Company, Washington, employs spans of two to three times normal length supporting the conductors on A-frame towers made of two poles set 12 ft. (3.6 m.) apart at the base and bolted together at the top. No. 4 hard-drawn solid copper and No. 4/0 and No. 2/0 seven-stranded aluminum conductors are used on the long spans. The wires are supported in triangular formation 7 ft. by 9 ft. (2.1 m. by 2.7 m.) apart. No difficulty has been experienced from the wires swinging together.

Wherever possible the wires are strung so that the tensions on each side of the supports are equal. Where this is impossible the conductors are dead-ended by strain insulators fastened to the cross-arms by eyebolts, and the towers are back-guyed. The aluminum wires, where dead-ended, are protected from damage by the clamps by aluminum sleeves 1/16 in. (0.15 cm.) thick. Long spans are computed for a stress in the con-

ductor up to the elastic limit at 0 deg. Fahr., a wind pressure of 50 miles (80.4 km.) per hour and a $\frac{1}{2}$ -in. (1.3-cm.) coating of ice. Wherever the ground clear-



FIGS. 4 AND 5—UNIFORM WIRE TENSION MAINTAINED BY COUNTERWEIGHTS

Tower-ends of insulators attached to cables leading over pulleys and running down to concrete counterweights weighing 10,800 lb. each. The span is 1792 ft. long, the conductors are made of $\frac{3}{8}$ -in. galvanized crucible-steel track cable, and four strings of five insulators are connected in multiple. (Portland Railway, Light & Power Company.)

ence in the center of the span will permit, 10 per cent more sag is allowed than is usual.

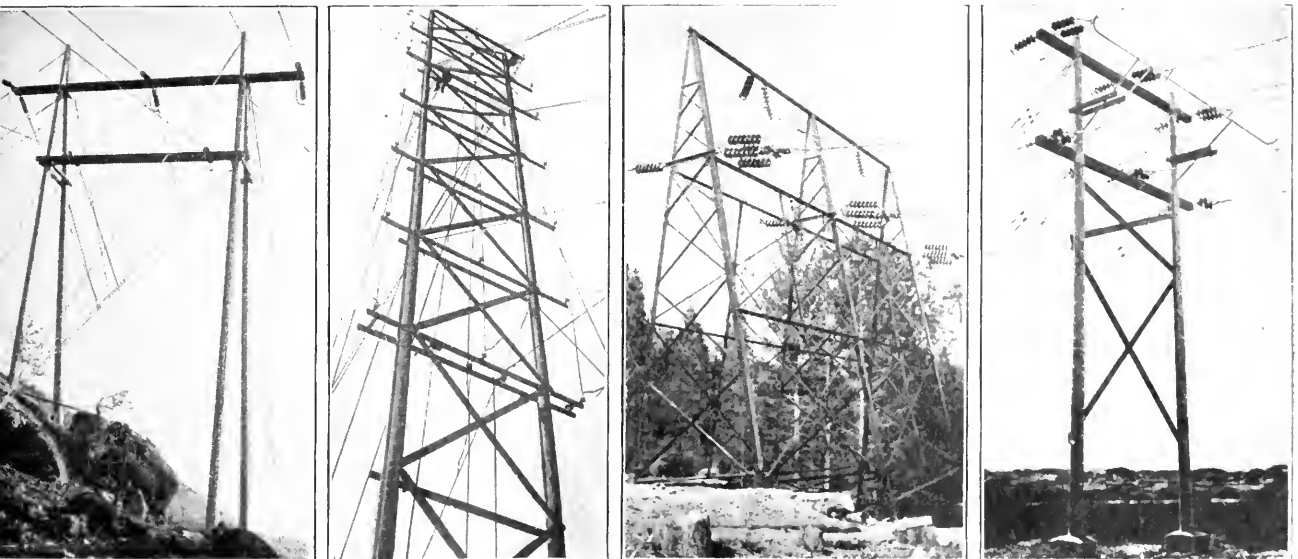
On the Drum-Cordelia line of the Pacific Gas & Electric Company are two long spans, 4534 ft. (1382 m.) and 4033 ft. (1229 m.) in length respectively. The con-

The anchorage at the terminal towers consists of four strings of eight Ohio Brass Keokuk type insulators assembled in such a way that the total tension is evenly distributed between them. As originally equipped, seven sets of insulator disks were used, but the number has been increased to eight to provide a larger insulating safety factor. Both spans are subjected to severe stresses at times owing to snow and sleet, but have given satisfactory service since 1913.

DETAILS OF SOME STRUCTURES EMPLOYED

Long spans are ordinarily divided into three classes by the San Diego Gas & Electric Company, viz., spans of from 1000 ft. to 1500 ft. (305 m. to 457 m.), of 1500 ft. to 2500 ft. (457 m. to 762 m.) and of 2500 ft. (762 m.) up. Two-pole structures without cross-bracing, known as type T, are used on spans of 1000 ft. to 1500 ft. Two-pole structures with cross-bracing, called type U, are employed for spans of 1500 ft. to 2500 ft. where the adjacent spans are less than 1500 ft. Two pole structures with cross-bracing, distinguished as type V, are used for spans of 1500 ft. to 2500 ft. where adjacent spans likewise exceed 1500 ft., and three-pole structures, known as type S, are used for spans exceeding 2500 ft.

Conductors.—Regardless of the voltage, the conductors are of seven-strand extra-galvanized steel in one of three grades—high strength, extra high strength, or a quality which falls between the two, manufactured especially for telephone messenger cables. For spans of from 1000 ft. to 2500 ft. considerable $\frac{3}{8}$ -in. (9.5-mm.) high-strength (11,500-lb.) steel has been installed. A large quantity of 7/16-in. (11.1-mm.) special high-strength (18,000 lb.) steel has also been used on spans of 1000 ft. to 3000 ft. On one span of 3069 ft. (936 m.)



FIGS. 6, 7, 8 AND 9—SOME LONG-SPAN STRUCTURES

The spans adjacent to the structure shown in Fig. 6 are 1175 ft. and 1325 ft. No. 1/0 A. W. G. seven-strand medium hard-drawn copper is used. Fig. 7 indicates a 135-ft. wood structure made of laced poles supporting a 1611-ft. span. (Pacific Power & Light Company.) On the structure shown in Fig. 8 the anchorages con-

sist of four strings of eight strain insulators in multiple. (Pacific Gas & Electric Company.) Fig. 9 represents a type U tower with 66-kv. line above and 11-kv. line below. This tower is set in concrete because of marshy soil. (San Diego Consolidated Gas & Electric Company.)

ductors consist of $\frac{3}{4}$ -in. (1.9-cm.) nineteen-strand copper-clad steel and are placed 20 ft. (6.1 m.) apart. To prevent their swinging a spacing tower is erected in mid-span at a lower grade than the terminal towers; thus it has to support only a fraction of the weight.

the company employs 7 16-in. (11.1-mm.) extra high-strength (22,500-lb.) steel.

At the point of attachment to the towers the conductors are usually bent around a cast-iron pulley wheel and are held by three or more three-bolt guy

clamps. All long spans are sagged with a dynamometer, and a record is kept of the tension and stringing temperature of each span. No sleet is allowed for in the design, as none occurs in this territory.

Insulators. Only one type of insulator is used independent of voltage. This is Locke No. 3538, having an average ultimate strength of 12,500 lb. (880 kg. per sq. cm.). On type T towers they are used in single strings; on type U and V structures in parallel strings, balanced by means of steel yokes, purchased from Pierson, Roeding & Company and especially manufactured for this company. On type S towers four parallel strings are used, spaced and balanced with double sets of interconnected strain yokes. For voltages of less than 11 kv. single insulators are used; for 11-kv. lines two insulators are used in each string, and for 66-kv. lines five per string.

Poles.—Class A, Western red cedar poles especially selected with large tops, are used when available; the butts being open-tank-treated. Type U structures have been constructed of a variety of sizes of poles from 40 ft. to 75 ft. (12.2 m. to 22.9 m.), depending on the clearance required. Some structures built on hillsides require poles of two different heights. Type S towers are ordinarily constructed of two 45 ft. (13.7-m) pole and one 60-ft. (18.3-m.) pole.

Where poles are erected in marshy ground or sandy soil they are set in concrete to obtain a greater bearing area and for protection against deterioration.

The guys are ordinarily made of the same material as the line conductor. Each pole is usually held by three guys. In addition to the main back guy, side guys

kg.). Two three-bolt guy clamps are used at each point of attachment, the strain insulators being similarly equipped with three-bolt guy clamps rather than wrapped splices. Galvanized-steel anchor rods $\frac{3}{4}$ in. (1.9 cm.) by 8 ft. (2.4 m.) long are used.

On type T towers the conductors are supported in a horizontal plane, each outside wire being separated from the middle one by a distance of 6.5 ft. (2 m.) On type U and V towers single cross-arms are used, the conduc-

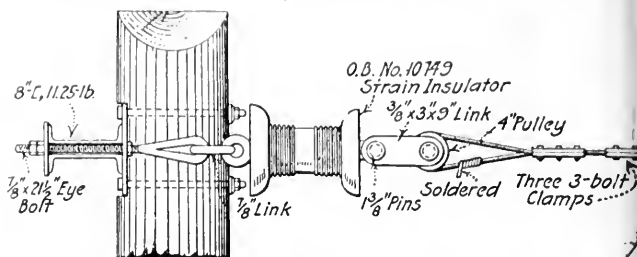


FIG. 12—METHOD OF DEAD-ENDING 5/16-IN. STEEL STRAND SUPPORTED FROM TOWER SHOWN IN FIG. 7

tor separation being 11 ft. (3.4 m.). On type S towers no cross-arms are used as each conductor is attached directly to the pole. The conductors are arranged in a triangular formation with 20-ft. (6.1-m.) separation.

Most of the information on which this article is based was contributed by the following: E. W. Beardsley, general superintendent of the Great Western Power Company; R. H. Halpenny, electrical engineer of the Southern Sierras Power Company; W. C. Heston, acting superintendent department of wires and conduit, Portland Railway, Light & Power Company; H. H.

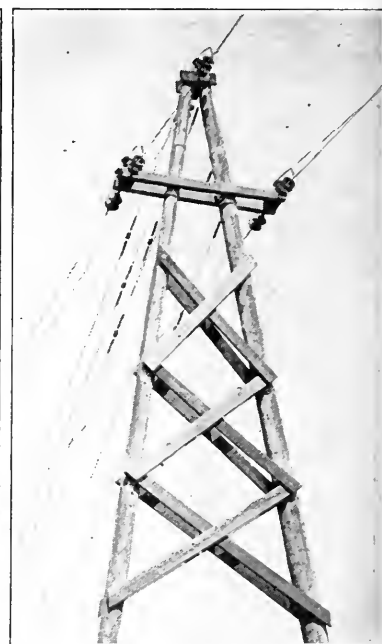
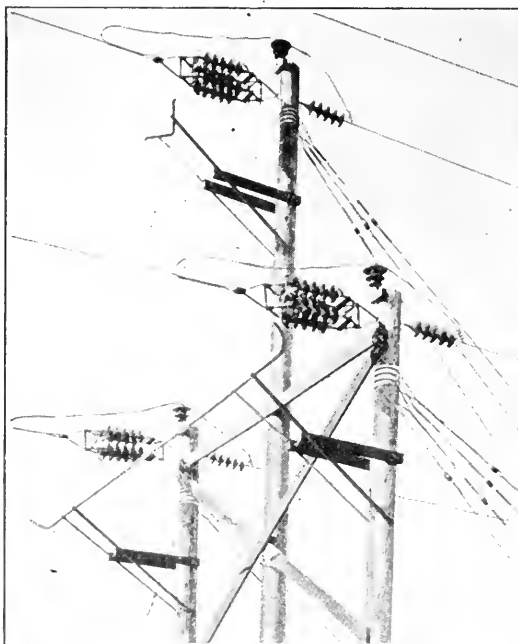
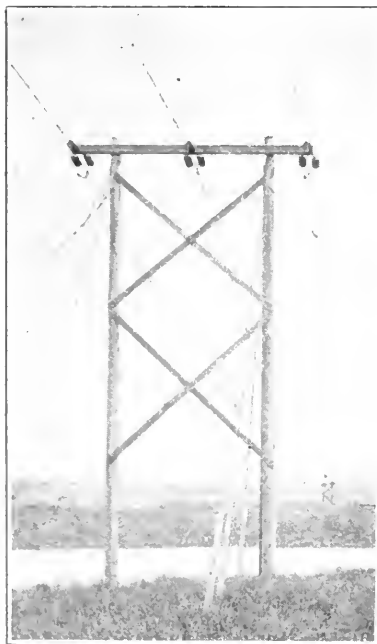


FIG. 10—TYPE U STRUCTURE USED ON 66-KV. LINE WITH 2195-FT. SPAN. FIG. 11—LINES DEAD-ENDED DIRECTLY ON POLES; THIS CONSTRUCTION IS SUITABLE FOR SPANS OF 2000 FT. FIG. 12—A-FRAME WOOD TOWER SUITABLE FOR SPANS UP TO 2000 FT. (SAN DIEGO CONSOLIDATED GAS & ELECTRIC COMPANY)

and front guys are provided, the latter serving primarily to prevent the tower from whipping if a conductor should break. They are also useful during the erection of the line. In accordance with the state law, strain insulators are put in all guys, regardless of voltage. These are White No. 506 brown-porcelain strain insulators, having a rated ultimate strength of 20,000 lb. (1550

Schoolfield, chief engineer of the Pacific Power & Light Company; M. T. Crawford, superintendent of transmission and distribution, Puget Sound Traction, Light & Power Company; P. M. Downing, chief engineer of the electrical department, Pacific Gas & Electric Company, and L. M. Klauber, superintendent of the electrical department, San Diego Gas & Electric Company.

PRESENTING A CASE BEFORE PUBLIC UTILITY COMMISSION

Advice Concerning What to Do and What Not to
Do in Order to Expedite the Handling of an
Appeal for a Rate Revision

BY HAROLD L. GEISSE*

Secretary Railroad Commission of Wisconsin

THE utility desiring to obtain an increase of rates or the public desiring to contest an increase or to secure a reduction of rates usually confidently seeks the assistance of a lawyer, with a sublime trust in the ability of the legal profession to know what to do before any public body or on any public occasion. The lawyer, however, even though most skillful in the trial of cases before a court or jury, is very often as much at sea as his client on what to prepare for the hearing and how to present it. The result is that the commission is obliged to resort to an inquiry into the books and accounts of the company and to a statistical analysis of the operating performance of the plant for some years back or to extended service investigations in order to obtain facts upon which to determine whether or not the relief sought is justified, and in a fair percentage of the cases the record of the hearing is encumbered with a mass of irrelevant testimony, inexpert opinions and even vituperation, to which the commission has been obliged patiently to sit and listen.

One of the recurring incidents in the taking of hearings is the attempt to influence the judgment of the commission by the introduction of prejudicial matter. This is a method to be deplored, totally ineffective and unworthy of notice by opposing counsel.

THE PROPER SCOPE OF THE COMMISSION

The commission is not a court of law. Its business is to fix rates, to pass upon the character and quality of service, to pass upon rules and regulations under which service is given, to inquire into the methods of keeping accounts and the business management, to prevent the interference of one utility's lines and facilities with those of another, and to approve methods of construction. In performing these functions it is interested solely in finding out the facts. It is concerned in accounts, in operating statistics, in unit costs, in prices of materials and supplies, in coal costs, in values of property, in measurements and surveys, in traffic counts and in the opinions of experts.

One cannot attempt to outline a procedure for each character of case that may come before the commission. A service case will differ much in its method of presentation from a rate case, but, to illustrate how plain and matter-of-fact a case may be made, one can follow through in its simplest form a typical case in which rates are involved.

The elemental question in which the commission is concerned in a rate case is the determination of the value of the property used and useful in the service of the public. It is upon this fair value that the lump sum to be allowed as return is based. The lower the value found, the lower will be the rate schedule. In determining the ultimate fair value, the physical value of the tangible property, the amount of going value and the necessary working capital to be allowed must all be

considered. The opportunity to affect the judgment of the commission commences with the engineering appraisal of the physical value of the property. The engineers of the commission have returned their report upon the physical value, and copies of the report have been submitted to both sides in the case. It is possible that in making the appraisal the engineers have overlooked some element of the property, have failed to allow for mishaps in building the plant which increased the money expenditure necessary to its construction, or to make allowances for other elements. On any of these points the commission would be glad to have enlightening testimony.

THE DIFFICULT QUESTION OF "GOING VALUE"

Having concluded the testimony on the physical valuation, the amount of going value and of working capital to be allowed are considered. The various theories of computing going value as discussed in textbooks, prior decisions and monographs of experts furnish a fertile field of inquiry for persons preparing to present a case before a commission, and the amount of working capital necessary to conduct any particular business is sufficiently vague and uncertain to afford the litigants opportunity to present very helpful testimony.

Completing the inquiry into the value of the property, an analysis of the expenses becomes necessary to determine that no improper charges are being included and whether or not the property is being fairly economically managed. If the case under consideration arises through a public attack on the rates charged, it is probable that the representatives of the public will be able to present little testimony of any considerable assistance. Frequently testimony is introduced showing that the rates charged by the company under attack are in excess of those charged by other plants similarly situated in communities of approximately the same size. Such testimony is usually of little significance because of the factors that make the amount of the investment and the operating costs vary in different communities.

If, on the other hand, the case arises through an application of a company for authority to increase rates, the company should be able to present a thorough analysis of its operating costs and earnings, together, if possible, with graphic charts showing tendencies over a long period. Prepared with sufficient care, such a statement can be of material assistance to the commission. Data relative to the degree of saturation attained in the community, presenting a statement of the kilowatt-hour sales per capita and the gross earnings on the per capita basis, can frequently be shown with considerable effect.

In placing these data in evidence an officer of the company should be prepared to explain them in detail, answering any questions relating thereto that may be propounded either by the commission or by representatives of the public. Similarly, carefully prepared data should be provided for presentation in any service case, the object being constantly in mind to cut down the extent of inquiry that the commission must make independently after the hearing before decision can be rendered. With the figures carefully compiled, introduced and explained at the hearing, only such investigations would be required as would satisfy the commission of the fairness with which they have been com-

*Excerpts from a paper read before the Wisconsin Electrical Association.

piled, their completeness and the safety with which conclusions may be drawn from them.

It is true that the commission has a more or less complete mechanism for the ascertainment of the facts in any inquiry it may be called upon to make. This is necessary in order that the evidence introduced in a case before it may be tested by subsequent independent investigation and that accounting and engineering assistance may be rendered to utilities and municipalities operating utilities. It is taking an advantage of the commission, however, for a utility to presume that the possession of a staff of engineers, accountants and investigators renders it an available agency for the investigation of the utility's affairs when the utility feels itself in need of aid in the way of higher rates or relief from service requirements. The utility, having full

access to its own books, records and accounts, should, before seeking relief, prepare itself to draw its own conclusions as to its needs and the reasons therefor and should be in a position to convince the commission of the fairness of its cause.

A somewhat different situation exists where the public invokes the jurisdiction of the commission in securing relief from high rates or inadequate service. There the complainant has not the machinery at hand to conduct its own inquiry, but is obliged to depend to a greater or less degree on the inquiries made by the commission. Even here, however, the person in charge of the case, be he city attorney or private counselor, should have a sufficiently well prepared outline to present clearly the issues he wishes to draw and the grounds for the public belief that relief is justifiable.

Installation and Care of Reactors

Some of the Factors Which Are of Vital Moment in Their Operation but Which Are Usually Not Within the Control of the Designers Are Emphasized in This Article

BY M. E. SKINNER

Transformer Engineer, Westinghouse Electric & Manufacturing Company

CURRENT-LIMITING reactors are rapidly becoming indispensable adjuncts to electrical power-plant equipment, especially where a large source of power is concentrated in one plant—a marked characteristic of modern central station development. During the early days of the electrical industry the apparatus was of such small size and voltage that mechanical problems were not developed. With the increase in the size and concentration of generating equipment, however, the mechanical forces increased until weaknesses made themselves apparent, and to-day the electrical engineer's problems are probably as much mechanical as they are electrical.

WHERE WEAKNESSES FIRST APPEAR

Among the places where mechanical weakness first became evident may be mentioned the end windings of generators. Investigation disclosed that a majority of the early high-speed generators of large capacity would not stand a dead short circuit without considerable distortion of the end windings. There were two principal reasons for this weakness—first, the low inherent reactance of the early machines, which were built primarily for the close regulation demanded by a lighting load; second, a lack of appreciation on the part of designing engineers of the tremendous forces which could be developed. To protect such generators it was necessary to supply external reactors to limit the current under short circuit, as it was usually impossible to brace the windings more thoroughly without rewinding the machine. Modern machines combine high reactance with more thorough bracing in order to withstand the stresses due to dead short circuit.

The solution of the generator problems did not clear the situation, however, but simply removed the limitation from the generators to the next weakest link in the system. Whether this involves the circuit breakers, bus

structure, transformers and other apparatus or not, the point is that as the available power back of a short circuit increases and the system becomes more nearly able to maintain its full voltage it becomes necessary to limit in some way the current which can be fed into the fault. Reactors have met this requirement quite satisfactorily.

The questions of how much reactance is required and where it should be placed in order to give the maximum protection have been the subject of numerous articles in the trade and technical papers¹ and they will not be discussed here. However, there are some factors which are vital to the successful operation of reactors that will be discussed as they are usually not under the control of designing engineers.

AIR-CORE REACTORS TO LIMIT CURRENT

Air-core reactors are invariably used for current-limiting purposes. Since this type of reactor is surrounded by a widespread magnetic field, it is impossible to immerse them in iron oil tanks without developing a very large stray loss. On account of the high temperatures caused by short-circuit currents, it is also impossible to use inflammable material for insulation. The common form of air-core reactor is a cylindrical coil with the turns supported at suitable intervals by a fireproof and non-magnetic structure. The conductor is bare and adjacent turns are insulated from each other by the air or by the supporting structure. The reactor problems which the central-station man is likely to encounter may be traced either to the limitations of

¹"Protection Against Short Circuits," *Electric Journal*, Vol. X, p. 1217; "Protective Reactances for Large Power Systems," *Proceedings A. I. E. E.*, February, 1914, Vol. 33, p. 141; "Protective Reactors for Feeder Circuits of Large City Power Systems," *Proceedings A. I. E. E.*, October, 1914, Vol. 33, p. 1663; "Current-Limiting Reactances on Large Power Systems," *London Electrician*, Vol. 72, p. 1046; "Selection of Power-Limiting Reactances," *General Electric Review*, Vol. 17, p. 604; "The Application of Current-Limiting Reactors," *Electric Journal*, Vol. 13, p. 280.

air insulation or to those imposed by the widespread magnetic field.

The voltage across a current-limiting reactor, when carrying normal current, is seldom much more than 5 per cent of the voltage of one leg of the system. With the large number of turns which is usually required in a reactor, the voltage between adjacent turns under these conditions is below the value necessary to maintain an arc in air. However, under short circuit the voltage across the coil rises directly with the current, and it is under these conditions that there is danger of breaking down the air which constitutes the insulation. If the coils are installed on an ungrounded system, there is an additional element of danger introduced in the form of possible high transient voltages due to arcing grounds.

AIR A DEPENDABLE DIELECTRIC

Air itself is the most dependable dielectric which we have at our disposal. The difficulty lies, not with the dielectric, but rather in the ease with which it may be contaminated. Moisture, either rain or steam, metallic vapors or dust will lower the strength to a greater or less extent, depending upon the amount of the foreign substance present. Reactors are, therefore, fundamentally indoor apparatus. They should be housed so as to preclude the possibility of inclement weather affecting their insulation strength. They should not be installed where they will be exposed to steam, as even an amount so small that it would not weaken the air might condense on the surface of the structure supporting the turns and cause a breakdown at this point. Metallic vapors or dust have about the same effect. In no plant is it possible to eliminate dust completely, and for this reason a periodic inspection and cleaning of reactors is recommended. Providing a smooth surface on the reactor structure between turns will do a great deal toward minimizing the accumulation of dirt.

On account of the very high temperatures which may be attained under short circuit, inflammable material should not be used around reactors. The reason for the high temperature is that the heat-storing capac-

The short circuit conditions to which a coil will be subjected rather than the current which it is to carry normally should fix the rated temperature rise. The ultimate temperature which a coil will attain under short circuit depends upon the temperature just prior to the disturbance and the amount of copper in the coil. It is given approximately by the following relation:

$$T = \frac{(1 + cT_0) e^{R_0 I^2 ct / 180 W}}{c} - 1$$

Where T = final temperature in degrees C.

T_0 = temperature of the copper just prior to the short circuit in degrees C.

t = duration of short circuit in seconds.

R_0 = resistance of copper at temperature T_0 in ohms.

W = weight of copper in pounds.

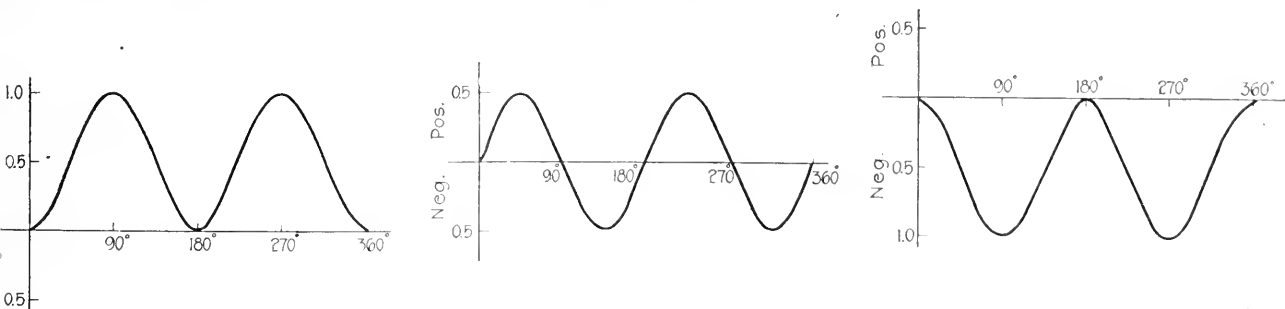
I = short-circuit current in amperes.

c = coefficient of resistance per degree C.; = 0.00427 for copper.

e = base of Napierian logarithms.

Applying this formula to the case of 2 per cent and 5 per cent coils of the same current-carrying capacity having the same cross-section of copper we find that, though they operate at the same temperature when carrying full-load current, the 2 per cent coil will reach approximately 1150 deg. C. after a dead short circuit lasting two seconds, as compared with only 200 deg. C. in the case of the 5 per cent coil. From this example it is evident that the lower the percentage of reactance for a given current-carrying capacity the greater should be the cross-section area of the copper and, therefore, the lower the temperature rise under normal full-load current.

The amount of heat generated within the reactor can be controlled more or less largely in the design. Such provisions as the use of stranded conductors and the equalization of the impedance of parallel circuits, with consequent reduction in circulating currents, will do much to prevent excessive heating within the coil. To avoid a large expenditure for protection, it is common practice to design reactors so that a short circuit last-



FIGS. 1, 2 AND 3—VARIATION IN FORCE EXERTED BY REACTORS ON EXTERNAL MAGNETIC OBJECTS UNDER DIFFERENT CONDITIONS

If both currents are in phase, the force is unidirectional and insulating, as shown in Fig. 1. The effect of a phase displacement between the currents is to shift the curve toward negative values. As the angular displacement increases, the positive and negative peaks become more nearly equal, until when the currents are in

quadrature the force alternates between equal positive and negative values, as shown in Fig. 2. If the displacement between the currents is still further increased, the shifting continues until, with currents completely out of phase, the conditions shown in Fig. 3 exist.

weight of the parts of a reactor exclusive of those carrying current is negligible. Unlike a generator, a reactor has no heavy iron core and frame, nor is it immersed in oil like a transformer, either one of which will absorb the extra heat generated on short circuit so rapidly that the duration of the high temperature in the copper is generally not sufficient to injure the insulation.

ing approximately two seconds will not cause the temperature to reach dangerous values. This corresponds to automatic operation of the circuit breakers, with the maximum relay setting that is now considered good practice. In the case of bus-tie reactors the design should be more liberal. The designer should be informed of any special conditions, such as hand opera-

tion of circuit breakers, which might increase the length of time the reactors will be required to carry short circuit currents.

EXTERNAL CONDITIONS AFFECT HEATING OF REACTORS

Unfortunately, the heating caused by a reactor is not all within the coil. The heat developed outside a reactor is due to the widespread magnetic field which surrounds the coil. It is of two kinds—first, electrical heating caused by the circulation of currents by transformer action in neighboring closed metallic circuits; second, magnetic heating caused by the alternat-

of concrete floors and walls, where the temperature rise of the steel work must be kept low to avoid cracking the concrete.

To demonstrate the relatively great distances through which the magnetic field of a reactor is exerted, it is only necessary to walk past one when it is under load with a bunch of keys or other magnetic material in one's pocket. The attraction is quite considerable even some distance from the coil. Instances have been known where the number of ampere turns concentrated in a single air-core reactor has been as high as 135,000 under normal rated load, increasing to

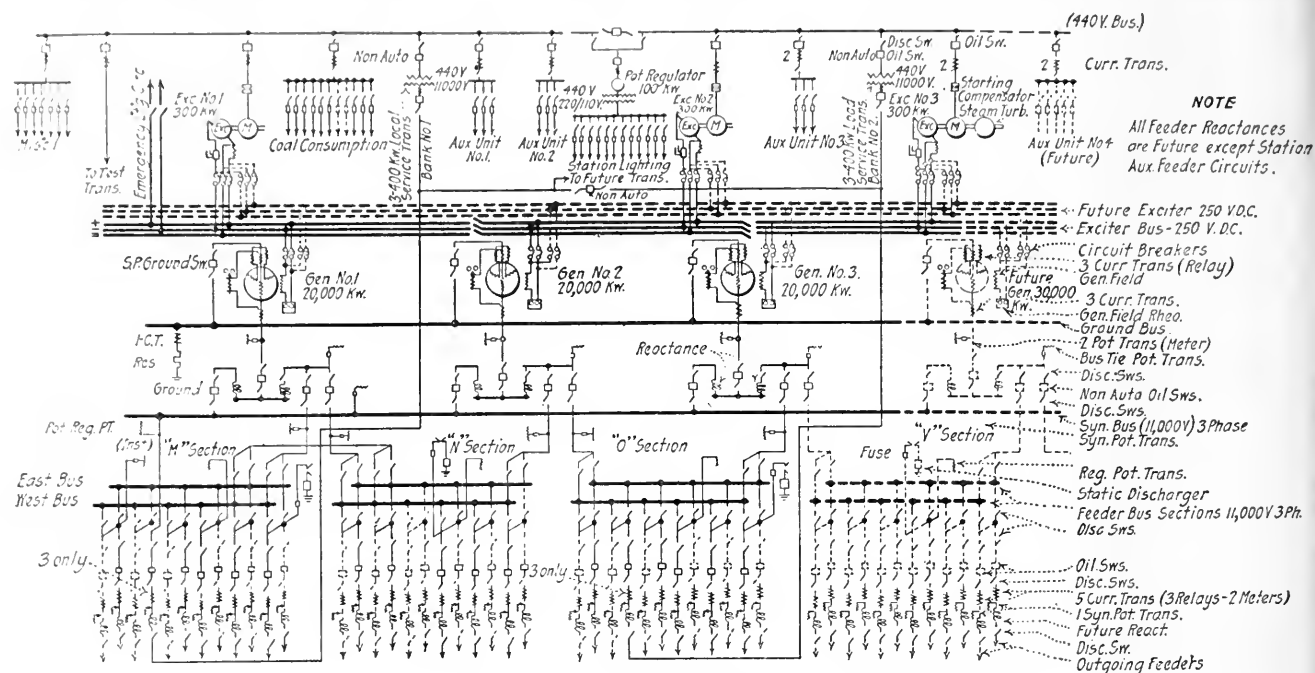


FIG. 4—AN INSTALLATION IN WHICH REACTORS ARE USED EXTENSIVELY

ing field in adjacent iron structures. A reactor may be considered as the primary of an air-core transformer to which any conducting circuit in the vicinity becomes a secondary. The current which will circulate in any secondary depends upon the closeness with which the primary and secondary are linked together, and upon the impedance of the secondary circuit.

The most common sources of trouble on this account are formed by the structural steel work of floors and ceilings, pipe railings or angle-iron frames supporting screens. To avoid trouble, either the coupling of the circuits must be made very loose or the impedance of the secondary must be made large. The former may be accomplished by arranging the reactors so that they are not coaxial with the meshes in the steel work and by using insulating joints in the pipe or angle frames and railings. Where it is impossible to avoid placing a reactor directly over or under such a closed circuit in the steel work the amount of circulating current can be minimized by increasing the distance between the coil and the steel work as much as possible.

In addition to the loss just described there will be a certain amount of heating in any magnetic material adjacent to a reactor due to hysteresis and eddy currents. The loss from this source depends upon the frequency and upon the flux density and can be limited only by keeping the material far enough away to limit the density. One of the most common places where this trouble is encountered is in the reinforcing

the enormous value of 1,700,000 ampere turns under short-circuit conditions. However, as the latter condition is only momentary, it need not be considered with regard to its influence on the heating in surrounding objects. The sphere of influence of a reactor not only depends on the number of ampere turns in the coil, but also, to a very large extent, upon the dimensions and the proportions of the coil. In general, the greater the diameter and the less the axial length the greater will be the area through which the field is exerted.

The temperature rise of magnetic material in the vicinity of a reactor is very much affected by the conditions of ventilation. Some results which were derived from tests are given in the table on the following page. Although the results thus attained cannot be applied directly to another installation, they indicate in a general way what may be expected and show the effects of the location and character of the material upon the temperature rise. The dimensions of the coil used for this test were as follows: Diameter over outside turn, 51¼ in. (130 cm.); diameter of inside turn, 37¾ in. (95 cm.); axial length, 73 in. (185 cm.); turns, 54; current, 1600 amp. at 25 cycles.

FORCE EXERTED ON EXTERNAL OBJECTS

Force is an instantaneous quantity, and the capacity which it has for doing damage is dependent upon its maximum value as contrasted with the temperature rises, which depend upon the average value of the

heating. Force coming from the interaction of alternating currents is always pulsating, being unidirectional at times and alternating at others (see Figs. 1, 2 and 3).

The peak value of the force is twice as great when the currents are in phase or completely out of phase as it is when they are in quadrature. The force may be considerably increased during the first instant of a short circuit owing to the unsymmetrical nature of the currents during this interval.

GENERAL LAW GOVERNING INTERACTION OF CURRENTS

The general law which governs forces coming from the interaction of electric currents is that the force is always in such a direction that the movement produced

RESULTS OF TESTS ON THE TEMPERATURE RISE OF MAGNETIC MATERIAL IN THE VICINITY OF A REACTOR

	Distance (In.) from Outer-most Conductor of Coil for Rise in Material of		
	15 Deg. C.	20 Deg. C.	25 Deg. C.
(1) ½-in. boiler plate, 36 in. by 60 in., located centrally above the reactor coil and in a plane perpendicular to the axis of the coil.....	36	30	25
(2) ¼-in. boiler plate, 50 in. by 60 in., located as in (1).....	44	38	34
(3) 8-in. standard I-beam, 20 ¼ lb. per foot, located directly above reactor and perpendicular to the axis*.....	52	44	40
(4) Same as (3) above, except that it is located below the reactor*.....	29½	25½	23
(5) Screen of expanded metal 0.0938-in. iron, ¾-in. diamond mesh, 24 in. by 30 in., located above reactor and in a plane perpendicular to the axis of the coil.....	13½	11	10
(6) ½-in. boiler plate, 36 in. by 60 in., located at the side of the coil in a plane parallel to the axis.....	41½	34	29
(7) 5-in. standard iron pipe located as in (6).....	31	26	22½
(8) 6-in. standard iron pipe located as in (6).....	37½	29	25½

*Tests (3) and (4) show the effect of the heat carried to the magnetic material from the coil by convection.

will increase the total amount of flux and the back emf. of the system. Applying this law to the case of an air-core reactor, four distinct kinds of stress may be produced:

(1) A stress between adjacent turns which tends to compress the current-carrying parts into a minimum cross-section at their electrical center. This crushing force tends to shorten the length of the restricted flux path and thereby to increase the flux.

(2) A stress on the whole coil, tending to increase the diameter and in that way decrease the reluctance and increase the flux.

(3) An attraction between the coil and any magnetic material in the vicinity. The greater the proportion of the total flux path which lies through magnetic material the lower will be the reluctance of the circuit. The force, therefore, tends to pull the magnetic material closer to the coil in an effort to decrease the reluctance.

(4) Mutual stress between adjacent reactors, which may be attraction or repulsion, depending upon the phase relation of the currents, but which always acts in a direction to increase the flux.

The first two stresses mentioned above are entirely within the coil and cannot be influenced by the method of installation. The third type of stress has been proved by experience to be small enough to be neglected in most cases. If both reactor and metal work are securely fastened down, it will usually be found that the steel work will heat up unduly before the attraction becomes large enough to cause trouble. However, care must be exercised to make sure that there are no small magnetic bodies loose in the vicinity of the reactor which may be pulled into the coil, resulting in a short circuit between some of the turns. This is a danger which is often not fully appreciated. As pointed out previously, the number of ampere turns which are active at times of short circuit is often very large. At such times a reactor will attract loose magnetic material of considerable size. Bolts, nuts, screws and small tools, such as pliers and monkey wrenches, are among the things which should be particularly kept away from reactors. The writer knows of one reactor failure which was directly traced to trouble of this description.

The fourth type of stress—namely, the mutual force between adjacent reactors—depends upon the spacing of the reactors and upon the relative phase relations of the currents flowing through them. Methods have been developed for calculating these stresses to a very fair degree of accuracy. These methods all depend upon the principle that the force between two coils is proportional to the space rate of change of the mutual inductance between them. For the case of two coaxial coils, one above the other,² the methods are quite accurate. The case of two coils side by side on the same level, the axes being parallel,³ is more difficult and the results will probably be more approximate. In general, formulas involving mutual inductance are rather tedious to work with, so that a rough and ready rule is perhaps of more value to the central-station man than the actual method of computing the stress. At least such a rule will serve to indicate when the more complicated computation should be carried out.

It has been found that when the adjacent reactors are separated by one-third of their diameter when side by side and one-half of their diameter when coaxial the mutual forces due to short circuits are within safe limits and external bracing between reactors will generally not be required. This rule applies only to three reactors on a three-phase circuit and is in terms of diameter over copper and separation from copper to copper. The arrangement which should especially be avoided is that where adjacent reactors may simultaneously carry short-circuit currents in phase with each other. This condition is likely to arise when two adjacent feeders enter the same substation or are carried in the same cable duct. A short circuit on the substation busbars, or a short circuit in one cable, which is severe enough to communicate itself to other cables in the same duct would then cause both of the adjacent coils to carry very heavy currents. Since the force is proportional to the product of the currents and turns and the currents are likely to be in phase, this condition will result in very high stresses.

²See "Calculation of Alternating-Current Problems," by L. J. Cohen, p. 51; also "Repulsion and Mutual Inductance of Rectangular Coils with the Same Axis," by H. B. Dwight, *Electric Journal*, May, 1918.

³See *ELECTRICAL WORLD*, June, 1916, Vol. 69, p. 1148.

Six-Unit Station Will Develop 165,000 Kw.

Some Features of the Latest Additions to the Northwest Generating Station of the Commonwealth Edison Company, Where Some 30,000-Kw. and 35,000-Kw. Units Are at Present Being Installed

SINCE the last article* on the Northwest generating station of the Commonwealth Edison Company appeared in the *ELECTRICAL WORLD* a considerable addition to the plant rating has been made and the design which was originally followed has been improved. To the original installation of two 20,000-kw., 4500-volt, 25-cycle machines have been added one 30,000-kw. and one 35,000-kw., 25-cycle, 9000-volt machine and two 30,000 kw., 60-cycle, 12,000-volt machines. One of the latter is still under erection and is expected to go into service within a short time. One of the original 20,000-kw., 25-cycle, 4500-volt machines (unit No. 1) has been temporarily equipped with a 60-cycle, 12,000-volt armature. As the station stands, therefore, it will be able to produce, when completed, 85,000 kw. of 9000-volt, 25 cycle energy and 80,000 kw. of 60-cycle, 12,000-volt energy. It will be among the largest stations in the world in point of total rating and for some years will probably be the only station able to produce 165,000 kw. from as few as six machines.

The coal-handling system, the water system and the general building plans have been completed as origi-

the first two units under the boiler-room floor instead of above. This change was made to secure greater flexibility.

The big changes were made in the turbine room. The features of the recent design here are in the large machines themselves, in the change from steam to electric drive for auxiliaries, in the excitation system, in the installation of a 440-volt power system for the principal auxiliaries, and in the relay and protective equipment.

The horizontal machines were installed on a level nearly 11 ft. (3.4 m.) higher than the vertical machines to give room for large condensing equipment and auxiliaries. The arrangement and numbering of the units is shown in Fig. 2. This layout was selected because it permitted the 25-cycle and 60-cycle switching equipment to be kept separate and at the same time eliminated any necessity of crossing the generator cables on their routes to the switch house.

Unit No. 6 is a compound reaction turbine driving a 60-cycle, 12,000-volt, three-phase star-connected generator rated at 30,000 kw. at 85 per cent power factor,

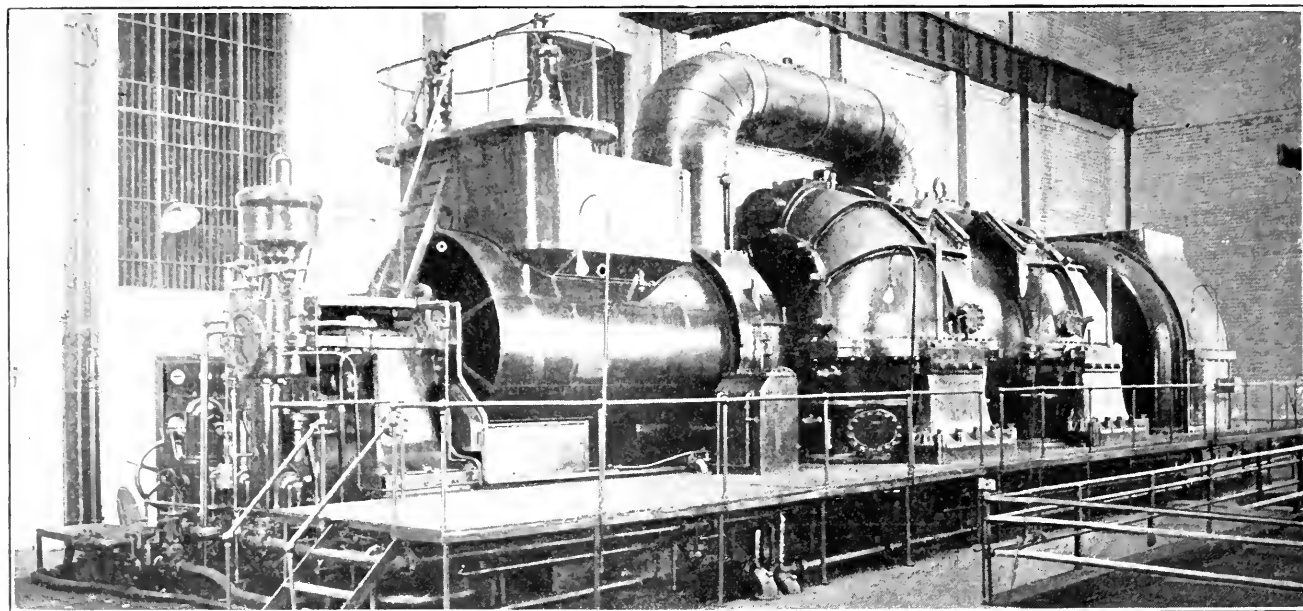


FIG. 1—ONE OF THE NEW TURBINE-GENERATORS RATED AT 35,300 KVA., 60 CYCLES AND 12,000 VOLTS

nally contemplated. In the boiler room a few changes were made. Ten boilers per unit without economizers were installed for the first 20,000-kw. machines. Five double boilers for the first 30,000-kw. unit were installed without economizers, on account of building limitations. For each of the last three horizontal units the steaming equipment consists of five double boilers with economizers. Another change in the boiler room consisted of installing the stoker drive for all except

or 35,300 kva. The turbine is of the tandem compound type, the two elements being connected by a solid flange coupling. The generator is connected to the turbine through a flexible coupling so that the three rotors turn as a unit. The turbine is served by two condensers. This machine, unlike unit No. 4, has no built-in fan for cooling the generator windings but is equipped with an external motor-driven blower. The 60-cycle unit, No. 5, now being erected is a duplicate of unit No. 6.

All of the horizontal units are equipped with direct-connected 230-volt exciters. The 125-volt excitation for the two 20,000-kw. vertical machines is supplied by a

*Other articles in the *ELECTRICAL WORLD* dealing with the Northwest station of the Commonwealth Edison Company were published in the issues of March 17, 1910; June 1, 1911; Oct. 5, 1912; Jan. 11, 1913, and May 31, 1913.

300-kw. steam-driven and a 200-kw. motor-driven exciter. The motor-driven exciter has a sufficient range of voltage to permit it to be used for charging the control batteries. A system of connections has been installed by means of which this machine may be used as a reserve source of excitation for the horizontal units. Control of the field of each horizontal unit is accom-

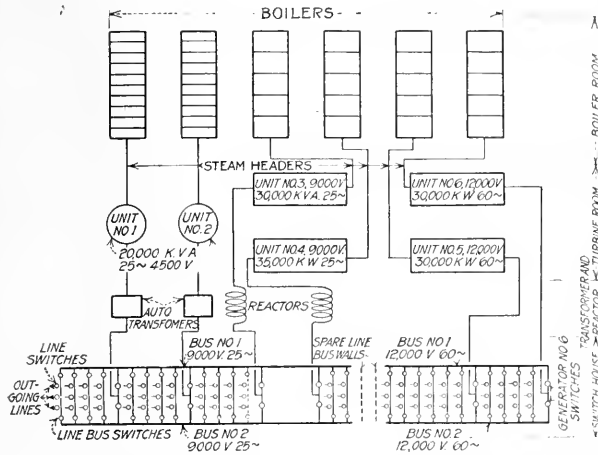


FIG. 2—ARRANGEMENT OF UNITS THAT PERMITS KEEPING 25-CYCLE AND 60-CYCLE EQUIPMENT SEPARATE

plished by manipulation of the exciter field rheostat, which is remotely controlled from the bench board in the operating gallery. A double-throw selector switch is provided so that the field rheostat of the reserve exciter can be controlled by the normal field-control switches when desired (Fig. 3).

The advantages of this scheme of connections are that it permits control of a unit from its own control panel, and after a change-over from normal to reserve excitation has been made the method of operation is not changed. The selector switches and solenoid-operated generator field switches, as well as the field rheostats for each direct-connected exciter, are grouped in sheet-iron cabinets on the turbine-room floor adjacent to the base of the unit they serve, except in the case of unit No. 4, where a special panel has been installed near the unit. Here they are readily accessible for inspection or emergency operation.

The previously mentioned selector switch is of the double-blade type to permit the selection of the normal or the reserve source of excitation without interruption of generator load. Both the double-pole, solenoid-operated generator field switch and the ammeter shunt are connected in the leads to the generator field so that the same equipment serves in both normal and emergency operation. The field switch is also under the control of protective relays on the generator, as is explained later in connection with protection. Sectionalization of the reserve excitation supply cable at several points was also resorted to for confining trouble on these circuits. As a further precautionary measure spare armatures for all direct-connected exciters are carried in stock.

RELAYS AND OTHER GENERATOR PROTECTIVE DEVICES

All generators are equipped with balanced relays of the modified Merz-Price type. The system of connections used is shown in Fig. 4. The relays are placed in the switch-house basement on concrete piers so constructed as to preclude any possibility of the relays

being operated by vibration. In addition to this the relays are inclosed in locked cabinets. The engineers of the company have recognized that, while the relays are very desirable equipment, they are delicate and must be treated accordingly. The operation of the relays is somewhat unusual in that they not only "clear" the machine from the system but also cut off excitation, and in the cases of units No. 5 and No. 6, which have external fans, also cut off the ventilation.

When the relays are tripped they perform the following functions in the order mentioned: First, open main generator oil switches; second, open generator field switch and generator neutral switch, the time element being obtained by auxiliary control contacts on the generator oil switches; and third (in the case of units No. 5 and No. 6), cut off energy supply to the motors driving ventilating fans. This sequence of operations was selected to minimize the rush of current into the generator which would occur if the field switch were to open at the same time as the first oil switch. It was thought advisable to provide for stopping the ventilation in order to reduce damage from fire.

Among the other interesting devices installed on the generators are exploring coils connected to pyrometers in the operating gallery. Temperature coils which operate on the same principle as the exploring coils are also installed in the air intakes of the machines. By means of these coils the temperature of air entering the machines can also be read in the operating gallery. These coils are of value in checking the operation of the air washers, of which enough are now installed at the plant to supply about 500,000 cu. ft. (14,000 cu. m.) of pure air per minute.

In the air ducts of units No. 5 and No. 6 an additional precaution against operating without ventilation has been taken. It consists of a small pivoted vane hung in the air duct. As long as air is being forced through the duct the vane is held in an approximately horizontal position. Should the air supply fail, the vane drops to a vertical position and gives an audible alarm in the operating gallery and a visible signal in the turbine room.

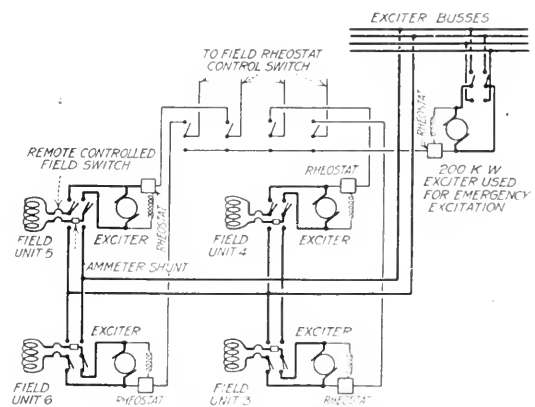


FIG. 3—DOUBLE-THROW SWITCHES PERMIT CONTROL OF RESERVE EXCITER FROM NORMAL FIELD-CONTROL SWITCHES

Plans have been made for a future installation of a three pole oil switch in the neutral leads of each generator. Under present conditions these leads are tied together and joined with a single-pole oil switch. A three-pole switch installed in this connection would assist considerably in speedily clearing trouble which may occur on any one or several phases of the generator.

The switching equipment for these generators and transmission lines is installed in the portion of the switch house which was built later than the original section. This portion differs from the original layout only in that it provides a basement for cables. The first floor contains high-tension buses and bus compartments. The second floor houses the oil switches and "disconnects" and the third floor the oil-switch mechanisms. Since the company's rules require that the transmission lines shall be grounded through oil switches, a special device has been worked out for this

purpose. It consists of a copper rod screwed to the work of the oil switch and connected at its upper end to a ground bus through a flexible conductor. Other features of the switch house are the testing cabinets installed on the second floor for each unit and the signal-lamp system energized by potential transformers on each transmission line to show operators which lines are alive.

This article will be concluded in a later issue.

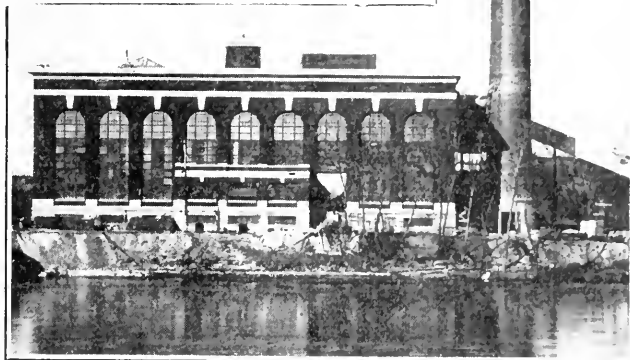
WATER-POWER PROGRESS IN NEW ENGLAND STATES

The Relation Between Steam Relay Plant and Hydroelectric Development Is Analyzed by President of Turners Falls Company

An interesting analysis of the relation between steam relay plant capacity and hydroelectric development was recently presented before the Massachusetts Gas and Electric Light Commission by Philip Cabot of Boston, president of the Turners Falls Power & Electric Company. In connection with the issue of additional securities since authorized by the commission, Mr. Cabot was asked to explain some of the broader economic considerations bearing upon the construction of the new Hampden steam plant of the Turners Falls company and incidentally to set forth the underlying conditions governing the development of the Connecticut River. Closely related to the company's program of plant construction is the problem of supplying power to the Springfield Street Railway.

The Hampden steam station at Chicopee, Mass., at the junction of the Chicopee and Connecticut Rivers, is now rapidly approaching completion for its initial service. The first unit, of 15,000 kw. rating, is due for delivery in May, 1918, and a second unit of the same size is due for delivery at the end of this year. The estimated cost of the station with one 15,000-kw. unit installed, as at first contemplated, was about \$1,500,000. With two units installed the estimated cost is \$2,250,000. The ultimate capacity is 60,000 kw. and as much of the work has been done for the

Turners Falls is 60,000 hp. and that a reasonable part, say one-fourth, of the possible storage on the Connecticut River is provided in some way, Mr. Cabot said that roughly 40,000 hp. of relay would have to be maintained against that water power. The water power will provide 75 or 80 per cent of the annual kilowatt-hours taken out of the development, the steam plant being about two-thirds the size of the hydroelectric plant and providing not more than one-fifth of the kilowatt-hours. Mr. Cabot said that because of the increased price of coal it is probable that the development at Turners Falls can be made somewhat larger than was originally planned. Regarding stream conservation, he said that exhaustive study of the possibilities indicates that it is very difficult, perhaps impossible, and in his judgment unwise, for conservation



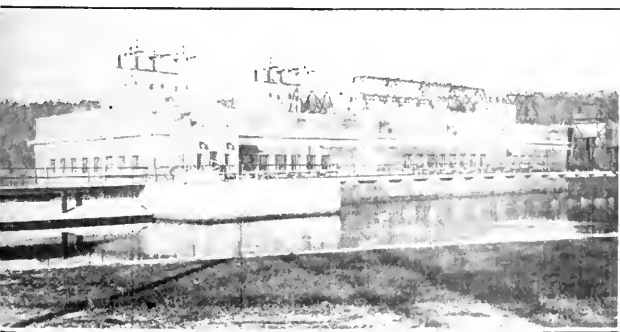
HAMPDEN STEAM PLANT AT TURNERS FALLS

on a large scale to be undertaken by private interests.

Mr. Cabot said that there is no possibility of providing in the watershed of the Connecticut River enough storage to make the flow of the stream permanent. Some relay would be necessary even if the power existed to-day and the money were at hand to store all the water which can be stored in the watershed.

The Turners Falls company spent about three years in negotiating with the Springfield Street Railway for the power contract now in vogue. As the negotiations proceeded it became clear that if the railway company was to make a contract it would have to be made for the entire supply of energy and that the investment of the railway in its generating station would have to be eliminated in some way. The Margaret Street station in Springfield is a direct-current steam plant of about 12,000 hp. rating and has little value for operating purposes in connection with a hydroelectric system like that of the Turners Falls company. It is expected that the Market Street and Westfield plants will be dismantled as the Turners Falls company takes on the railroad load. These plants have been purchased by the Turners Falls company.

The Springfield Street Railway has signed a twenty-year power contract with the Turners Falls company, and at present three 1500 kw. motor-generator sets are providing the local service required from Margaret Street as a distributing center, the incoming line pressure being 66,000 volts at the outdoor substation adjoining the motor-generator and operating room.

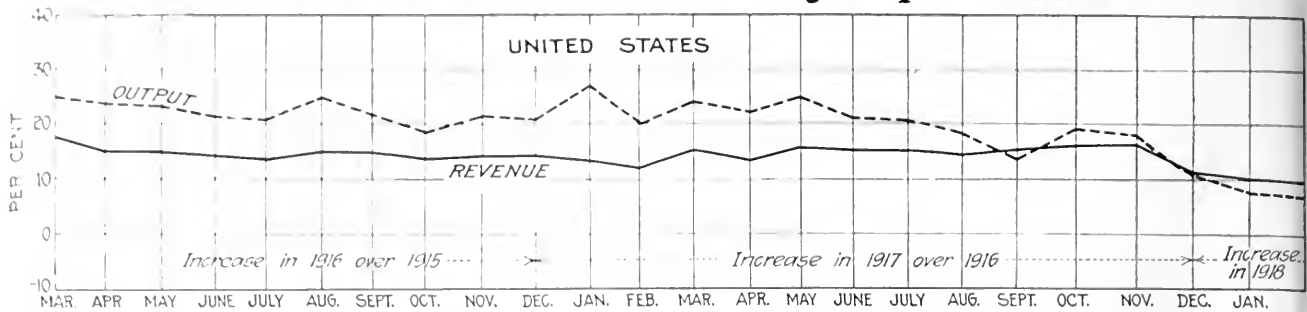


HYDROELECTRIC PLANT OF TURNERS FALLS COMPANY

nal development, including intake and headworks, much of the foundations and a great part of the underground work and coal handling system, the unit cost of plant for the first two machines is considerably higher than the probable unit cost of the whole station.

Assuming that the hydroelectric development at

Central-Station February Operations



CENTRAL-STATION INCOME AND OUTPUT GAIN IN PER CENT BY MONTHS FOR NATION

STATISTICS of revenue and output in February show that the central stations experienced in that month about the same retarding influences which they felt in January. Companies reporting to the ELECTRICAL WORLD, representing 52 per cent of the industry, had an increase of 9.6 per cent in the revenue from sales and of 7.1 per cent in kilowatt-hour output as compared with February, 1917.

In other words, the rate of increase in energy produced and in the revenue therefrom continued at a lower level during the second month of the year. It is encouraging that increase was maintained notwithstanding the various factors which operated to reduce production at that time.

Some of these factors were temporary, others must be accepted so long as the war lasts. Changes in requirements of customers, according as they are engaged in essential or "less essential" production, will have to be anticipated. Coal shortage must be reckoned with. The industry-closing order of Fuel Administrator Garfield is not generally accepted as a precedent to be repeated, but while the nation is at war any remote contingency may become a fact without warning.

It is interesting to see that in February as in January the rate of increase in revenue was maintained better than the rate of increase in output, showing that the

curtailment in consumption was mostly from the heavy power users. While the underlying conditions are unusually complex, it is probable that rate increases entered into the ultimate result of larger gain in revenue than in output.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	REVENUE FROM THE SALE OF ENERGY		Per Cent Increase	Kw.-Hr. OUTPUT		
		1917	1916		1917	1916	Per Cent Increase
March.....	64	23,919,070	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April.....	63	22,927,030	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May.....	62	23,339,070	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June.....	63	23,279,070	20,168,000	15.6	1,497,869,000	1,165,629,000	28.8
July.....	63	22,768,070	19,680,000	15.8	1,397,482,000	1,159,410,000	20.5
August.....	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.....	63	23,861,030	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
Oct.....	62	25,745,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.0
Nov.....	62	26,665,030	23,183,000	17.0	1,485,370,000	1,292,113,000	15.1
Dec.....	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.3
Jan.....	61	27,085,000	24,538,000	10.3	1,749,971,000	1,624,432,000	7.7
Feb.....	52	21,583,000	19,691,000	9.6	1,117,326,000	1,043,291,000	7.1

For the entire industry the ELECTRICAL WORLD calculates, from the returns for 52 per cent of the industry, that the February figures were: Revenue, \$41,506,000; output sold, 2,148,000,000 kw.-hr.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States		
		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase
REVENUE																
March.....	64	\$2,861,000	\$2,547,000	12.3	65	\$10,203,000	\$8,902,000	14.7	56	\$6,692,000	\$5,754,000	16.5	86	\$4,193,000	\$3,780,000	11.0
April.....	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	17.0	86	4,282,000	3,821,000	12.1
May.....	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
June.....	64	2,641,000	2,290,000	15.1	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
July.....	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
August.....	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	21.9
Sept.....	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
Oct.....	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
Nov.....	61	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
Dec.....	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6
Jan.....	62	3,393,000	2,990,000	13.8	63	9,590,000	9,440,000	1.5	51	8,513,000	7,327,000	16.1	84	5,049,000	4,781,000	5.6
Feb.....	62	2,976,000	2,760,000	7.8	52	8,438,000	7,813,000	8.0	44	6,107,000	5,323,000	14.7	78	4,062,000	3,795,000	7.0
KW.-HR. OUTPUT																
March.....	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
April.....	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
May.....	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
June.....	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
July.....	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
August.....	64	105,848,000	85,113,000	24.5	65	514,251,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
Sept.....	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
Oct.....	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
Nov.....	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
Dec.....	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
Jan.....	62	125,212,000	111,339,000	12.4	63	474,647,000	463,763,000	2.3	51	604,247,000	552,960,000	9.2	84	545,865,000	496,370,000	10.9
Feb.....	62	109,487,000	102,263,000	7.6	52	391,526,000	362,625,000	5.3	44	291,850,000	277,850,000	5.0	78	324,463,000	360,548,000	7.9

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

ASCERTAINING BOILER-ROOM INSTRUMENT PRACTICE

Central-Station Company Contemplating the Purchase of Measuring Equipment Needed to Effect Economies Distributes Questionnaires

Contemplating the purchase of a complete quota of boiler-room instruments and the establishment of a bonus system for firemen, one Middle Western operating company mailed questionnaires to nearby plants of similar size with the idea of finding out what its neighbors were doing. Of the eight companies reporting seven have boiler-flow meters and seven have CO₂ apparatus. These companies produce 10,000,000 kw.-hr. to 67,000,000 kw.-hr. annually. Five of the seven recognize that the installation of these instruments has permitted them to effect economies. All eight companies have draft gages, six of the eight have water meters, and seven have recording thermometers on the feed water. Three use coal scales of some sort, and a like number depend on the mine weights or number of car loads for records.

Some sort of bonus system for boiler-room employees is used by only three out of the eight. One of these was certain that the bonus system effected economies in operation. From the information contained in this questionnaire and from a study of its own conditions the company decided to install a more adequate complement of boiler-room instruments.

IDLE GENERATOR IS USED TO IMPROVE POWER FACTOR

Connected with Load End of Transmission Line by Parallel Reserve Circuit and Operated as Synchronous Condenser

It is not unusual to connect a synchronous machine to some part of a circuit to improve the power factor, but a company in New England has found a method of doing this which utilizes any generators which may be idle. This is made possible by the fact that it has duplicate transmission lines running from its main generating station, only one of which is ordinarily required to carry the load. The other circuit is provided for emergency use and also to take care of future increases in load. When the power factor gets low the duplicate lines are paralleled at their distant ends, and any generator that may not be carrying load is connected to the reserve line. It is then allowed to run as a synchronous motor, being excited enough to compensate for the low power factor at the delivery end of the line.

A slight load can be put on the generator if necessary to secure the desired wattless current by allowing some water to flow through the waterwheel.

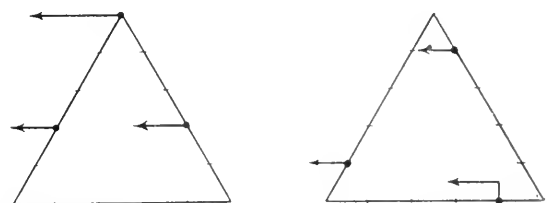
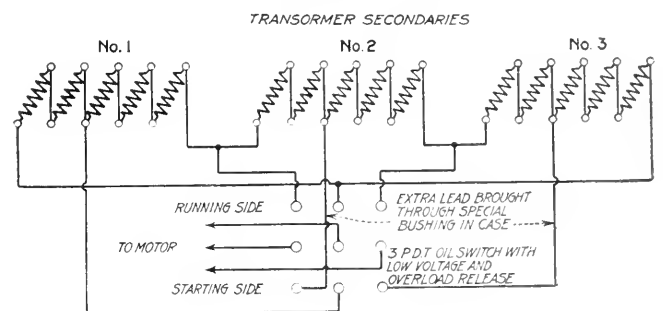
This arrangement, besides utilizing equipment that

would otherwise be idle, improves the power factor in both the line and the generators carrying load, whereas if it was merely floated on the bus as a synchronous condenser it would not benefit the line. By so doing it is also possible during a sleet storm to circulate enough current through the reserve line to melt any sleet which may adhere to the conductors.

TRANSFORMER CONNECTIONS ELIMINATING AUTO-STARTERS

Can Be Easily Arranged to Give 53, 60 or 72 per Cent Normal Voltage, Depending on Starting Torque Necessary

Where transformers arranged for three-wire secondaries are connected in delta for service to three-phase motors the neutral points may be connected to one side of a double-throw switch to provide half voltage for starting. This scheme is one which has been



CONNECTIONS FOR OBTAINING DIFFERENT STARTING VOLTAGES WITH VECTOR RELATIONS

much used in the past and should never be overlooked in emergency cases.

A modification of this system may be readily applied where transformers having 2300/460-volt secondaries are in use to furnish low voltage for starting 2300-volt motors. In such transformers only two secondary leads are available, and it is necessary to run an extra lead out of the case. If connections are made as shown in the upper part of the accompanying illustration, 53 per cent of full voltage can be procured for starting. This will ordinarily afford good starting torque without an excessive rush of current.

This connection was recently used successfully in operating a 350-hp. motor from three 100-kva. transformers after the auto-starter had burned out. The

double-throw oil switch was equipped with low-voltage and overload release. If this voltage is insufficient, 60 per cent or 72 per cent normal voltage may be obtained by tapping, as shown by the vector diagrams at the bottom of the illustration.

CONSOLIDATION OF TWO CENTRAL-STATION SYSTEMS

Conditions in Memphis Were Unfavorable for Unification, but It Was Accomplished with the Apparatus at Hand Without Interrupting Service

When the Merchants' Power Company and the Consolidated Memphis Gas & Electric Company of Memphis, Tenn., were taken under one management the engineering department was confronted with the problem of connecting two dissimilar systems in the most effective manner. The first-mentioned company furnished most of the energy to the underground business district, and the latter supplied the remainder and the overhead residence section. The Merchants' plant was equipped with 4000-volt generators that were connected directly to the business district by means of seven four-wire overhead cables. The Consolidated plant supplied 2300-volt electric service to the transformer primaries in the business district through fourteen single-phase, two-conductor feeders in separate ducts.

When the cut-over was made the Merchants' plant was shut down and its service was supplied from the 2300-4000-volt transformers at the Consolidated power house. The fourteen two-conductor cables were reconnected to serve as six four-wire feeders for the 4000-volt system. The cables were originally designed fifteen years ago for 4000 volts, but had been used at only 2300 volts up to the time of the change-over.

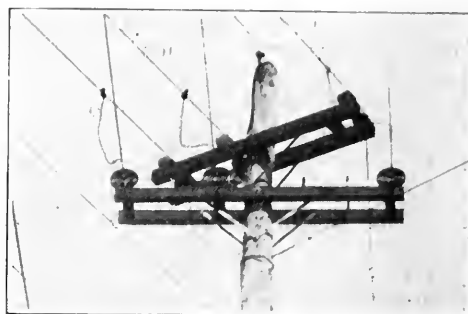
As the cables became heavily loaded during the peak hours, additional feeder capacity was necessary for emergency purposes. Fortunately a municipal electrical pumping station supplied by two 6600-volt cables was situated near the old Merchants' plant though fed from the Consolidated plant. In it were three 667-kva., 4000-6600-volt transformers through which energy could be supplied from the Merchants' plant in case of accident to the Consolidated station. An auxiliary line was therefore run from the 6600-volt cable to the Merchants' plant, where arrangements were made to step down the potential to 4000 volts and to feed back to the business district by means of the old 4000-volt feeders from the Merchants' plant.

This method of unification permitted the cut-over to be made without the purchase of new equipment, permitted the two dissimilar generating systems to feed the same cut-overs without changing the secondaries and provided workable emergency operating conditions. The coal consumption per kilowatt-hour of the Merchants' plant was about twice that of the Consolidated, and therefore considerable economy was effected when the latter assumed the load. The main difficulty in unification was the changing from two-wire to four-wire circuits. It was found that a four-wire system in two cables had doubled the reactance of a single four-wire feeder in one duct. Under the conditions existing at the time—high price of equipment, poor deliveries, etc.—however, this trouble had to be overlooked.

SPECIAL CLAMPS PERMIT THE SECTIONALIZATION OF LINE

With Tools Adapted Particularly to This Purpose the Clamps Can Be Connected or Disconnected While the Line Is Energized

By dead-ending its lines at points where it may be desirable to sectionalize them in case of trouble and by connecting these sections with jumpers and special conductor clamps, a Southern electric-service company has made it easy to isolate the sections at any time. These clamps, which are of the Johnson type, are constructed so that they may be connected or disconnected safely (see ELECTRICAL WORLD, Vol. 57, page 1346)



CONDUCTOR CLAMPS CAN BE REMOVED TO SECTIONALIZE LINE

while the line is energized with the use of a simple device on the end of a switch hook. Thus the expense of higher-priced disconnecting devices is avoided. The installation illustrated is on a 13,200-volt line.

NAMING PACKAGE QUANTITIES IN ORDERING COPPER WIRE

Class of Service for Which the Wire Is to Be Used Should Determine Whether It Shall Be Ordered in Reels or Coils

In placing orders for overhead copper conductors it is necessary to determine whether shipment should be made in coils or reels. This is especially true on large orders or where a specific character of construction is in view. Manufacturers' standard package quantities differ considerably, and often reductions may be made in construction costs by specifying packages suitable for the work in hand.

For large jobs reels are to be preferred. The greater length of the pieces minimizes splicing and permits pulling longer sections at a time. Furthermore, the wire can be easily run off the reels clean and is free from kinks. Large crews are usually available on such work, so no difficulty should be experienced in handling the heavy reels. The reels may be mounted on cable-reel jacks, on reel wagons or on trucks specially equipped for wire pulling.

On the other hand, wire which is to be used on a multitude of small installations should be ordered in coils to expedite the issuance of supplies and handling by small crews in the field.

One company having these requirements in view specifies packages as follows:

No. 8 weatherproof, 75 per cent in 50-lb. coils, 25 per cent in 100-lb. coils.

No. 6 weatherproof, 50 per cent in 125-lb. coils, 50 per cent in 250-lb. coils.

No. 4 weatherproof, 250-lb. to 300-lb. coils.

No. 2 weatherproof, 600-lb. to 800-lb. reels.

Nos. 1 and 1/0 weatherproof, 1000-lb. to 1200-lb. reels.

Nos. 2/0 and 4/0 weatherproof, 1500-lb. to 1800-lb. reels.

Nos. 6 to 2 bare, 1000-lb. reels.

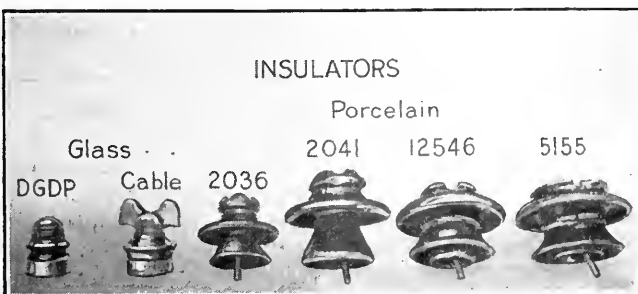
Nos. 1 to 2/0 bare, 1500-lb. reels.

No. 8 weatherproof wire, being used exclusively for services, is ordered in small packages so that it may be issued directly to service wagons without cutting or re-reeling. No. 6 weatherproof conductor is used for short secondary extensions, series circuits and other light work and is therefore ordered in small and medium coils suitable for such work. No. 4 is also used in moderate lengths, but the lighter coils are found unnecessary. The larger sizes are generally employed only on more extensive jobs and are therefore ordered exclusively on reels. The same is true of bare wire in all sizes. This, being used only on high-voltage distribution systems or transmission lines, is invariably ordered on large reels.

USING MATERIAL CATALOGS FOR INVENTORY PURPOSES

Assist Inspectors Who Are Not Familiar with Equipment and Are Also Useful for Other Purposes

In making inventories of overhead distribution systems difficulties are experienced in securing inspectors sufficiently familiar with line construction materials to list them correctly in detail. One company recently engaged in making a complete inventory for use in a rate hearing before a state public service commission provided its inspectors with illustrated catalogs showing in detail line hardware and appliances with ap-



PHOTOGRAPHS OF EQUIPMENT AID INSPECTORS MAKING INVENTORIES

propriate names and style numbers. A group cut from one of these catalogs is reproduced. A number of such sheets were provided, showing respectively cross-arms, bolts and braces, clamps, pins, brackets, anchors, strain insulators, grounding devices, cut-outs, lightning arresters, pin-type insulators, disconnecting switches, mast arms, lamp reels and hangers, time switches and dead-ends. The smaller devices were shown grouped in single photographs; the larger ones required separate sheets for each style.

It was found that photographs were cheaper to prepare than diagrammatic sketches, besides which they were more easily identified in the field. After the inventory was completed the booklets were found of service to inspectors checking completed work and to

line foremen ordering material from the storeroom. Such a catalog will in fact be found useful for any central-station employee engaged in the purchase, handling or utilization of line materials.

HIGH-GRADE COAL FIRED DURING PERIOD OF PEAK

Emergency Measure Is Also Utilized to Good Advantage During Plant Construction When Boiler Deliveries Are Slow

Influx of war industries coupled with slow deliveries of equipment made the problem of carrying last winter's peak a difficult one for the Moline plant of the Moline-Rock Island Manufacturing Company, which supplies electric service to the "Tri-Cities," Davenport, Rock Island and Moline. Boiler capacity appeared to be the limiting factor. In order, therefore, to obtain the maximum rating out of the existing equipment only high-grade coal was burned during peak hours. Under ordinary conditions Iowa coal was burned.

Getting the high-grade fuel on the fires at the critical time was the chief problem. The difficulty was surmounted by constructing auxiliary bunkers for the high-grade southern Illinois coal. They were constructed of wood and were set almost against the fronts of the 500-hp. boilers in an elevated position so that they could be emptied into the stoker hoppers during peak loads by operating a metal-bound wooden gate. The clearance between these bunkers and the boiler fronts was just sufficient to afford ventilation and to give space for operating levers. The auxiliary bunker in front of each 500-hp. boiler holds 3 tons of coal. Coal was delivered to these auxiliary hoppers by the same machinery that conveyed coal to the overhead bunker that holds the supply of ordinary coal. When the high-grade coal had to be distributed chutes were arranged under the conveyor so that the coal would be dumped into the auxiliary bunkers instead of the main bunker. With underfeed stokers it was possible to get as much as 300 per cent of rating out of the boilers with this arrangement, but with the chain-grate stokers 175 per cent of boiler rating was about the limit that could be obtained.

At the Fort Dodge (Iowa) Gas & Electric Company, which is under the same management as the Davenport company, the same idea was utilized in a different way and for a different purpose. In constructing the plant permanent arrangements were made to fire two kinds of coal in order to reduce the investment which would otherwise be necessary for additional steaming equipment. The boiler plant at Fort Dodge consists of 500-hp. boilers with a sectionalized 17-ton bunker divided into two equal parts. One part is for Iowa coal and one is for southern Illinois coal. Duplicate spouts are provided to each stoker hopper. During the peak, or at times when transmission line failure places extra load on the plant, it is possible to get at least 20 per cent increase in rating over the best that can be obtained with Iowa coal. It may be possible to get even better performance. The great saving in this instance comes, however, from the saving of investment in one entire boiler equipment, which would amount to around \$22,000.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

INNOVATION IN ADVERTISING ON CUSTOMERS' STATEMENTS

Washington Company Gives Discount Coupon Besides a Different Cooking Recipe Each Month to Be Pasted in a Scrapbook

An interesting innovation has been introduced by the Potomac Electric & Power Company of Washington, D. C., by the addition of a special advertising and discount coupon to its monthly service bills. The Potomac company's bill is printed in four sections, the bill proper carrying the amount and detail of the charge with a cashier's "tear-off" coupon at the right which is to be returned with the check. At the left of the bill, however, is a special advertising panel featuring at the top an attractive picture lithographed in many colors and illustrating a nursery rhyme which appears beneath it. Below this is an advertisement of some appliance which is being advocated particularly that month; at the bottom of the coupon is a notice to the effect that the holder of this coupon is entitled to a special 10 per cent discount on all cash purchases of appliances made during that month, while on the reverse of this coupon is printed a cooking recipe. At the left of this advertising panel is a "tear-off" for the collector which is sent to the collection department when the bill is rendered, in case the account stands in arrears.

This bill, which is reproduced here, is exceedingly attractive in appearance. The entire form is lithographed, and the advertising panel, being in bright

recipes which will have a value for the housewife and a little file of illustrated nursery rhymes which will appeal to the children, but also a little file of pictures and descriptions of electrical household appliances which will have an advertising influence of some permanence.

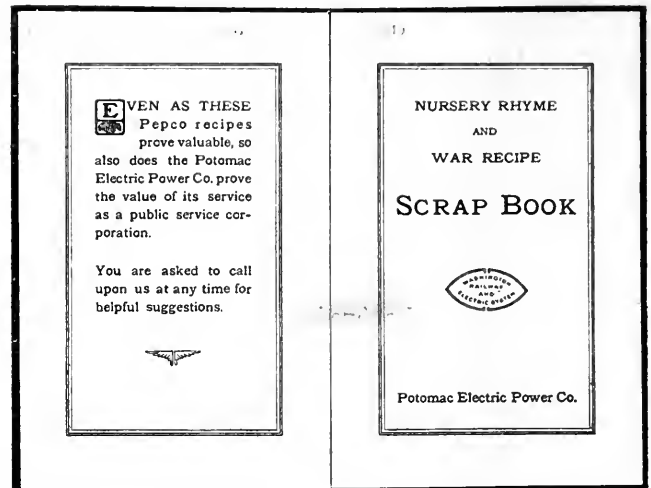


FIG. 2—SCRAPBOOK GIVEN TO CUSTOMERS

The offer of the 10 per cent discount to the holder of the coupon is expected to bring a large number of people into the company's salesroom to purchase appliances. This will give an opportunity to present the scrapbook

MAY 10, 1918		THIS BILL IS RENDERED NET AND SHOULD BE PAID ON OR BEFORE MAY 10, 1918. IF NOT PAID BY SAID DATE AN ADDITIONAL CHARGE OF 10 PER CENT OF THE AMOUNT OF THE BILL WILL BE ADDED.	
DEPOSIT		OFFICE HOURS: 8:30 A. M. TO 5:00 P. M. SATURDAYS, 8:30 A. M. TO 1:00 P. M. On Request from the Consumer the Readings of the Meter will be Made on the Bills.	
AMOUNT		TO POTOMAC ELECTRIC POWER CO., DR. OFFICE, FOURTEENTH AND C STREETS N. W. TEL. MAIN 7260 FOR ELECTRIC CURRENT	
SUPPLIES		SERVICE CHARGE \$ FROM MCH TO APRIL 1918 K. W. HRS. @ 10 CTS. PER K. W. -HR. K. W. HRS. @ 5 CTS. PER K. W. -HR. K. W. HRS. @ 10 CTS. PER K. W. -HR. K. W. HRS. @ 5 CTS. PER K. W. -HR. TOTAL K. W. HRS. AMOUNT \$	
 ANNOUNCEMENT NEAT SCRAP BOOK		AMOUNT \$ BILL RENDERED LAMPS APPLIANCES CONDUIT TOTAL NAME ADDRESS ACCOUNT NO. FOLIO BOOK NO.	
THIS COUPON GOOD FOR 10% DISCOUNT This coupon is good for 10% discount on all cash purchases of P. E. P. CO. appliances shown on the list of appliances on page 10 of this bill.		CUSTOMER'S RECORD PAID BY Check No. Date Dtd RECEIVED FOR PAYMENT STAMP FINAL BILL AT AMOUNT \$ LAMPS APPLIANCES CONDUIT TOTAL BILL	
		IF RECEIPT IS DESIRED PLEASE SEND ENTIRE BILL AND REQUEST WITH YOUR REMITTANCE. IF YOU DO NOT DESIRE A RECEIPT SEND COUPON ONLY WITH YOUR CHECK, AS AN ENDORSED CHECK IS EVIDENCE OF PAYMENT. RECEIPTING SLIP WILL BE MAILED ON CHECK PAYMENTS ONLY WHEN REQUESTED. THIS BILL SHOULD BE PAID ON OR BEFORE MAY 10, 1918 POTOMAC ELECTRIC POWER CO.	

FIG. 1—SERVICE BILL OF WASHINGTON (D. C.) COMPANY, SHOWING COUPONS

colors, is assured of a reading. The plan goes further, however, as is announced on this particular bill. The company has prepared a "Nursery Rhyme and War Recipe" scrapbook which will be given to any customer for the purpose of pasting up and saving these rhymes and recipes. The result will be not only a little file of

and paste in the first rhyme and recipe, which will insure the distribution of a very large number of books.

J. C. McLaughlin, commercial manager of the company, says: "We figure that the additional cost of adding this advertising panel to our bills is exceedingly profitable when we realize that for \$1,800 more it will

distribute during the year over 500,000 advertisements, each one a direct appeal for business with an appealing, human-interest feature. More than \$64,000 worth of appliances were sold out of the company's display room last year, and we are confident that this new system will greatly increase our sales through 1918. Our appliances all carry a 50 per cent profit. This allows us ample margin for the 10 per cent discount offered to the coupon holders, which of course covers cash purchases only. This particular bill, being the first of the series and announcing the plan, does not exactly follow out the form of display which will be standardized hereafter, the 'ad' being on the back."

Another interesting feature of this bill form is a list on the back of thirty-seven banks and trust companies to which the bill may be paid by arrangement with the power company if such payment is more convenient for the consumer.

REDUCING THE DELINQUENT ACCOUNT BY 80 PER CENT

Central Station Obtains Excellent Results in Twelve-Month Period by Building Up Collection Organization

In one year the Muncie (Ind.) Electric Light Company reduced its delinquency account from \$12,591.98 to \$2,225.51, or more than 80 per cent. This was done, says C. L. Walling in the *Bulletin* of the American Gas & Electric Company, the parent organization, first, by creating the office of manager of collections; second, by insisting upon a deposit with each contract; third, by never closing the books on a bad account, and, fourth, by keeping continually after the old offenders and educating them to pay their bills promptly. The

Name _____	Folio _____
Address _____	
Amount _____	
Business _____	J. E. No. _____ Date _____
Remarks _____	

FIG. 1—FRONT OF CARD FOR DELINQUENT FILE

following figures serve to show how well this plan worked out:

	1917	1916
January	\$11,008.94	\$7,444.22
February	10,348.00	9,064.80
March	6,839.73	9,672.39
April	6,703.13	9,461.24
May	5,513.07	10,302.97
June	5,140.99	11,038.65
July	5,123.06	12,278.54
August	5,144.66	10,441.52
September	5,017.13	10,393.71
October	4,510.52	12,350.35
November	4,913.11	15,597.56
December	2,225.51	12,591.98

A file of 3-in. by 5-in. (7.6-cm. by 12.7-cm.) alphabet cards (as shown) is kept of accounts charged off as

uncollectible, which furnishes quickly the following information: Name, address, amount, ledger folio, business, journal entry number, remarks. The reverse side is ruled so that an itemized account can be quickly entered.

During the year 1917 the company received many payments which are attributed to this card system. At the last of the month the new-business Ford is bor-

	LIGHT	POWER	MDSE.	CASH
Jan.				
Feb.				
Mar.				
Apr.				
May				
June				
July				
Aug.				
Sept.				
Oct.				
Nov.				
Dec.				
Total				

FIG. 2—BACK OF CARD FOR DELINQUENT FILE

rowed for a few days and a big drive on delinquents is made by the collection department.

Delinquent letters are sent out as soon after the tenth as possible to every delinquent account, and the delinquent list is kept up to the minute.

HANDLING MOTOR AND WIRING ORDER CREDITS

Short Sketch of Office Routine by Large Middle Western Lighting Utility in Matters of This Nature

In taking care of credit matters on orders for motors or for wiring the practice of one of the large central stations of the Middle West is as follows:

If applicant for motor or wiring is a consumer, both his service and mercantile accounts are scanned and if habit of pay is good the order is approved. If payment is slow or the customer's account would not justify the amount or terms of the order, the customer is so notified and payment in full or in part, as the case may be, is requested in advance.

Should the applicant not be a consumer, his rating, if any, is looked up, his references are investigated, and if found satisfactory the order is passed. If investigation proves otherwise, applicant is notified and advance requested, and a copy of such notice is filed seven days ahead, which, if not acted on, is removed from the file and a second or follow-up letter is written, a copy of which is also held seven days, at which time the con-

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Windings for Polyphase Motors.—T. SCHUTTER.—Rules for making half-coil and whole-coil windings are given and slot spacing and winding details are embodied in this article, which is illustrated by several drawings.—*New York Electrical Engineering*, April, 1918.

Winding Troubles of Direct-Current Machines.—GORDON FOX.—Methods of locating and temporarily repairing faults of armature and field coil windings are described.—*Railway Electrical Engineer*, April, 1918.

Elementary Principles of Continuous-Current Armature Winding.—F. M. DENTON.—Armature windings are classified as closed-coil and open-coil windings and further subdivided into ring, drum, lap, wave and series parallel windings, single and double re-entrant duplex and multiplex ring windings, and simplex and multiplex wave windings. The different types of windings are illustrated.—*London Electrician*, March 29, 1918.

Economy of Electric Drive in Cane Sugar Mills.—C. A. KELSEY.—Economic advantages that result from adopting electric drive are discussed with respect to labor, supplies, repairs, production, water supply, illumination and traction. The general as well as the specific advantages of electric drive are analyzed, particular attention being given to the direct-current motor-driven centrifugal pumps.—*General Electric Review*, April, 1918.

Essentials of Transformer Practice, Section 11.—E. T. REED.—The author points out that the amount of insulation to be used in a given space often depends upon its mechanical properties and the stresses which it must withstand in winding as well as on other electrical properties involved. Among other subjects discussed are the dielectric characteristics of transformer insulation, curves being presented to show temperature effect, etc.—*Electric Journal*, April, 1918.

Mechanical Design and Specification of Turbo-Alternator Rotors.—S. F. BARCLAY.—Methods of providing for adequate ventilation, the design of end-bells, the relative merits of solid and laminated types of rotor, the maximum diameter permissible, factors that should determine the steel used, the design of the shaft and the effect of alternating stresses are among the subjects discussed in this, the last of the author's articles on this subject.—*London Electrician*, March 29, 1918.

Lamps and Lighting

Importance of Correct Lighting in the Shop.—A. L. POWELL.—The factors that influence the amount of light and the equipment necessary to fulfill certain requirements are discussed in this article.—*Railway Electrical Engineer*, April, 1918.

Report on Automobile Headlamps.—Road illumination, the intensity, distribution and direction of light required, the optical principles of headlighting features required in a practical headlamp, safety limitations and

the minimum illumination and minimum spread permissible are among the subjects discussed in this report, which includes data and charts.—*Report of Committee on Automobile Headlights*, I. E. S. Council.

Generation, Transmission and Distribution

Russian Water-Power Legislation.—Statistics show that the water-power reserve in Russia is approximately 30,000,000 hp., of which only about 1,000,000 hp. has been utilized. Turbine installations utilize about one-quarter of this amount. Lack of special legislation and the existence of stringent rulings are given as the reasons for this lack of development.—Abstracted from a Petrograd journal by the *London Electrical Review*, Feb. 22, 1918.

Recent Advances in Transmission Construction.—L. M. KLAUBER.—The article deals with improved methods of installing transformers, conductors, splices, spans, poles, cross-arms, braces, insulators, ground guards and dead-end clamps and refers to the latest tendencies as to wire arrangement, clearances and grounding. Embodied in the article is a sag table suitable for stringing conductors. The article is illustrated by several instructive diagrams.—*Journal of Electricity*, March 15, 1918.

Relief of Fuel Consumption.—J. M. ROBERTSON.—The complete and efficient utilization of Canadian resources, including transportation and fuel, as well as the reduction of fuel consumption, by the increased use of hydroelectric energy, are discussed.—*Canadian Engineer*, March 28, 1918.

Power-Plant Losses.—R. J. C. WOOD.—The interconnection of power lines has resulted in economies being effected. A detailed survey of the saving possible in the power plant itself, as well as an analysis of the larger problems, is given in the article.—*Journal of Electricity*, April 1, 1918.

Transmission and Distribution Losses.—R. E. CUNNINGHAM.—War conditions necessitate that electric service be stimulated rather than diminished. The elimination of losses along economic lines is of paramount importance and is dealt with in this article.—*Journal of Electricity*, April 1, 1918.

Power Resources in Southern California.—H. A. BARRE.—The increase of war demand for economical output was met by the power companies of southern California by the interconnection of the hydraulic resources.—*Journal of Electricity*, April 1, 1918.

Installations, Systems and Appliances

Canadian Pumping Stations.—G. KUHN.—Description of a number of interesting pumping stations installed in Canadian cities. Three of the installations are electric (Port Arthur, Kitchener and Deseronto). The author explains how the problems of speed regulation and water regulation for ordinary and emergency

demands are solved to the satisfaction of these cities.
Schweizerische Bauzeitung, Feb. 9, 1918.

Power-Factor Improvement in a Large Central Station.—F. SCOUMANNE.—An extended study of the actual application of methods of improving power factor previously outlined by the author to the networks of the company at Baku of which he is director. The main divisions of the subject cover the character of the installations and choice of the system; the consequence of raising the power factor and how far it is advantageous; data on interest charges, amortization, price per kilowatt-hour, value of existing installations, and the optimum charge of aerial lines; choice of the centers of production of reactive current, and an elaborate valuation of the economy effected thereby in operating turbo-generators, substations, aerial lines, network, transformers, etc. The determination of the reactive current necessary, the employment of synchronous motors and the use of static condensers are also discussed. The conclusions arrived at are: (1) The improvement of the power factor in the case under study afforded a considerable advantage; (2) on the bases accepted for price, rate of amortization, cost of repairs and production of energy by existing equipment, the static condenser is superior to the synchronous condenser; (3) the optimum value of the power factor is approximately $\cos \Phi = 0.90$, whatever type of condenser is employed. It is better to keep slightly within this value than to go beyond it.—*Revue Générale de l'Electricité*, Feb. 23, 1918.

Tres Sargentos Electric Substation, Buenos Aires.—An unusual feature in this substation is the replacement of reserve batteries by a Diesel-engine-driven generator plant. The article describes the substation in detail.—*London Engineering*, March 22, 1918.

Tendency Toward Outdoor Switching Apparatus.—H. G. MACDONALD.—It is pointed out that only recently has it been possible to make large power transformers with all their controlling and protected apparatus so that they can be installed outdoors without protection from the weather. Pressures set up within oil-switch housings by automatic operation under severe overloads must have means of relief, and provision must be made for the escape of gas volatilized from the oil during the summer. If the apparatus is used in cold climates, the oil must be prevented from solidifying. Adequate provision must also be made to protect the mechanism from accumulations of snow and ice. The apparatus must have more mechanical strength than indoor apparatus because severe internal pressures have to be withstood. The insulation of exposed parts must be protected against collection of dirt and moisture and snow. Methods of supporting the switches, providing for inspection, protecting the bushings and operating mechanism are also described.—*Electric Journal*, April, 1918.

Wires, Wiring and Conduits

Iron and Steel Conductors.—R. C. POWELL.—The scarcity of copper owing to war conditions has led to the use of iron and steel wherever the substitution is possible. The application of these metals as conductors has created a new situation and problems for the power expert to solve. The situation is analyzed in this article.—*Journal of Electricity*, April 1, 1918.

Electrophysics and Magnetism

Some Applications of Electromagnetic Theory of Matter.—ALBERT C. CREHORE.—The theory of radiation and the atomic structure was principally interpreted from the Rutherford-Bohr theory of the atom. The fundamental hypothesis of atomic structures as composed of electrons, positive and negative, may be considered to be correct. Planck's quantum theory of radiation, the Rutherford-Bohr theory, the electromagnetic theory, rings of electrons, electrons ejected from atoms with high velocity, X-ray spectra, ionizing voltages, theory of crystal structure, atoms at a great distance, the number of electrons per atom, the order of magnitude of the orbits of the electrons in the atoms and several other interesting phases of the subject are set forth in this article.—*Proceedings A. I. E. E.*, April, 1918.

Improvement of Power Factor.—W. C. RECHNIEWSKI.—Different methods employed to raise the power factor are discussed. The chief of these are: (1) The employment of high-tension or low-tension static condensers. These have not given practical results because of their fragility, difficulty of regulation, high price, etc. (2) The employment of phase advancers. (3) The employment of over-excited synchronous motors placed in the installations or at particular points of the network to furnish current to the surrounding motors—a plan widely adopted and facilitated by specially constructed motors. The author considers over-excited synchronous motors in two aspects—as producers of wattless current and as producers of motive power. In the first aspect he holds that in the great majority of cases they will pay for themselves in two or three years by the economies realized; from the second point of view they afford the maximum of economy wherever they can be employed. A practical example is worked out to support these conclusions.—*Revue Générale de l'Electricité*, March 9, 1918.

Electrochemistry and Batteries

Methods and Plant for Battery Charging.—F. AYTON.—Different methods of charging lead-plate and nickel-iron alkaline batteries are described and the advantages and disadvantages of a reducing booster plant are discussed. The author concludes by saying that in spite of the higher efficiency and lower cost of the reducing booster it will generally be found, where pressure reduction is required on a scale which justifies the employment of a rotary transforming machine, that the motor-generator is the most satisfactory type to use.—*Electric Vehicle*, March, 1918.

Battery-Charging Equipment of Southern Pacific.—Economies were effected by using a motor-generator set to reduce the generated voltage to a value suitable for charging storage batteries and by employing resistors only to make small adjustments in the voltage. The method of doing this is described and illustrated.—*Railway Electrical Engineer*, April, 1918.

Units, Measurements and Instruments

Experimental Study of Periodical Movements.—A. POUCHOLLE.—Description of an interesting apparatus due to the ingenuity of M. Gueugnon and consisting of an Atwood machine modified for the production and recording of periodical movements, the graphical records lending themselves to precise quantitative measurement.

It will facilitate the comprehension of alternating currents in less advanced schools where the lack of mathematical knowledge makes it necessary to proceed experimentally.—*Revue Générale de l'Electricité*, March 16, 1918.

Chart for Calculating the Resistance of Parallel Conductors.—A. CASTEX.—The chart, based on the method of M. d'Ocagne, provides a convenient means to the end mentioned.—*Revue Générale de l'Electricité*, March 23, 1918.

Telegraphy, Telephony and Signals

Limitations of a Telephone Receiver.—The telephone receiver as a detector for very feeble alternating currents in both wireless telegraphy and wireless telephony is discussed.—*Telegraph Engineer*, April, 1918.

Postal Company's Generator Wiring Arrangement.—A method is illustrated and described for wiring three motor-generators to operate duplexes and quadruplexes.—*Telegraph and Telephone Age*, April 1, 1918.

Simultaneous Telegraph and Telephone Communications.—WILLIAM MAVER, JR.—This article relates to the use of the Van Rysselberthe method of transmitting telegraph messages over metallic telephone circuits without impairing the telephone service. Several wiring diagrams are shown indicating the key system and use of gradulators. By this system the emission and extinction of the telegraphic current is rendered gradual, thereby permitting the transmission of telegraphic and telephonic messages over the same line or lines simultaneously by means of a combination of electromagnets and condensers from the gradulators by the inventor.—*Telegraph and Telephone Age*, April 16, 1918.

Technical Problems of Radio-Communication.—LÉON SOUTHILLON.—A paper on the application of the Austin-Cohen formula to the determination of the characteristics of sending and receiving radio stations in the calculation of rating, desirable wave length and sending distance. The author arrives at a formula which affords a simple solution of these problems.—*Revue Générale de l'Electricité*, March 23, 1918.

Miscellaneous

Bonus for Power-Plant Employees.—WARREN B. LEWIS.—The author outlines a basis for a bonus system, discussing stand-by losses.—*Power*, March 26, 1918.

Automobile Electric Kitchen.—ANSON S. RICE.—A mobile and entirely self-contained electric kitchen is described. The capabilities of the outfit are demonstrated by results of tests made at the direction of government officials.—*General Electric Review*, April, 1918.

Combustion Characteristics of Coals.—JOSEPH G. VORKER.—Four factors determine the selection of stoker equipment—load conditions, available coal, draft conditions and application conditions. The nature of the load and the amount of coal to be burned by the apparatus are the most important. This is true because different types of stokers can burn the same kind of coal, but each type is limited in the overload rating that can be successfully maintained. The performance data of various stokers burning buckwheat and anthracite coal, Eastern bituminous coal, Pittsburgh coal, low-grade Illinois coal, Illinois and Carterville mixed, lig-

nite, etc., are given. The effect of mixing various percentages of anthracite coal with the ordinary coal used is given in dollars and cents.—*Electric Journal*, April, 1918.

Low-Temperature Industrial Heating.—DWIGHT D. MILLER.—The relative advantages of different types of electric furnaces, their operation and control and the advantages that accrue by the use of electrical energy for production of high temperatures are discussed in this article, which is concluded from the March issue.—*Ohio Electric Light Association Monthly*, April, 1918.

Substitute for Cedar Poles.—L. M. KLAUBER.—War demands on lumber have caused a scarcity of cedar poles. As a result substitutes have been resorted to, the best available substitute on the Pacific coast being Douglas fir, usually termed Oregon pine. Availability, cost, strength and durability are factors to be considered in selecting substitutes, the author points out. A treating plant for fir poles is described.—*Journal of Electricity*, April 15, 1918.

Report of Sub-Committee on Insulation Deterioration.—J. A. KOONTZ.—It is pointed out that the best method of bringing out defects in cap and stud insulators is to subject them to several temperature cycles and test them at suitable intervals for failure due to the formation of cracks in the caps by spark-over voltage. The article includes two tables embodying insulator test data.—*Journal of Electricity*, April 15, 1918.

Possibilities of Reducing Fuel Consumption by the Adoption of Electrical Heating.—P. H. MITCHELL.—The author points out the relative amounts of heat which can be produced for one cent with various fuels and electricity at different prices as follows:

	B.t.u.
Anthracite at \$8 per ton.....	18,000
Anthracite at \$10 per ton.....	14,300
Bituminous coal at \$3.50 per ton.....	48,000
Bituminous coal at \$7 per ton.....	24,000
Peat at \$4 per ton.....	21,000
Fuel oil at 0.07 cent per gal.....	15,500
Fuel oil at 0.14 cent per gal.....	7,750
Electricity at 0.01 cent per kw.-hr.....	3,413
Electricity at 0.008 cent per kw.-hr.....	4,240

From this he concludes that electric heating is feasible at \$12 per horsepower, but that it is not yet an economic possibility, due to high cost and lack of available power. Electric power rates would have to be one-quarter of the present rates for electric heating to compete with heating by anthracite coal. Many millions of horsepower would be required to meet even present requirements. For example, 2,000,000 hp. would have to be available to heat Toronto's dwellings and other buildings, or 4 hp. per capita. When millions of horsepower in Canada are developed and power at \$12 is available, a large electric heating load may be established. This, of course, does not mean that every portion of the country could be served, but the great bulk of the population would be within zones of distribution and it might thus be in large degree substituted for coal and other fuels. It may be that the economic use of fuel and water-power resources will demand that fuels shall be reserved for heating purposes and that the hydroelectric power available will be substituted to the maximum for all mechanical, railroad and metallurgical operations. By arranging to maintain a continuous heating load electric heating may be given a positively economic status.—*Canadian Electrical News*, April 15, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

ELECTROCHEMISTS INSPECT PLANTS IN THE SOUTH

Members and Guests of the American Electrochemical Society Are Making Extensive Tour—
F. J. Tone Elected President

One hundred and twenty-five members and guests of the American Electrochemical Society left Washington on Sunday evening, April 28, for a week's trip through the Appalachians south to inspect the electrochemical and metallurgical industries of that region, as well as to study its mineral resources and possibilities of hydroelectric development. The society is traveling by special train chartered with the approval of Director-General McAdoo.

The first stop was at Johnson City, Tenn., on Monday, as breakfast guests of the Chamber of Commerce. Later in the day, at Kingsport, the varied industries of that city were opened to the visitors, who saw the manufacture of cement dyes, explosives, alcohol, paper pulp and tanning extract. The local committee entertained the party at luncheon at Rotherwood Farm. A complimentary banquet in the evening was followed by the annual business meeting, at which the election of officers for the ensuing year was announced as follows:

President, F. J. Tone of the Carborundum Company of Niagara Falls; vice-presidents, Acheson Smith, H. W. Gillett and R. Turnbull; managers, C. F. Burgess, E. L. Crosby and C. G. Schluederberg; treasurer, H. G. Salom; secretary, J. W. Richards.

Tuesday, April 30, was spent in the Knoxville district, with the first stop at Mascot to visit the ore concentration and flotation plant of the American Zinc Company. Later the Knoxville Board of Commerce provided a special train to take the party to the new hydroelectric development of the Aluminum Company of America at Cheoah and Alcoa. At each of these points a 200-ft. (60.9-m.) dam and power house are under construction as the first two units of a complete development of about 400,000 hp. A brief technical session was held in the afternoon at the University of Tennessee.

In the evening a banquet was tendered the visitors, after which President Fink made his presidential address on electrochemistry and national economy. Mr. Schluederberg spoke on the part the United States industries must play to enable the Allies to win the war. Prof. J. A. Switzer of the University of Tennessee gave a report of a preliminary survey of possible water powers in eastern Tennessee. He showed a total possible development of 750,000 hp. at twenty-one sites.

Wednesday, May 1, was spent at Chattanooga and vicinity, visiting plants of the Southern Ferro Alloys Company and the Chattanooga Gas & Coal Products Company. A special trip was made by boat to the Tennessee Power Company's development at Hales Bar. In the evening the society was tendered a dinner at

Signalman Inn, which was followed by a short technical session. The rest of the week will be devoted to districts in the vicinity of Muscle Shoals, Birmingham and Anniston, Ala.

SPRING MEETING OF THE CONFERENCE CLUB

National Labor Policy, Government Attitude Toward
Contractors and Functional Reorganization of
the Industry Discussed at Asheville

The spring meeting of the Conference Club, at Asheville, N. C., on April 25, 26 and 27, was of particular importance for two reasons: Sullivan W. Jones, secretary of the Conference Club, and its representative in Washington, was appointed to represent the National Association of Electrical Contractors and Dealers for the purpose of placing before the government the right claimed by the electrical contracting industry to serve the government in connection with its war construction work. A Conference Club plan for the functional reorganization of the electrical industry was announced.

The regular sessions of the Conference Club were preceded by a meeting of the advisory board of the National Association of Electrical Contractors and Dealers. All of the members of the advisory board are also members of the Conference Club. L. K. Comstock, chairman of the Conference Club, is also chairman of the advisory board. William Creighton Peet, chairman of the national association, outlined the intended function of the advisory board. Mr. Peet's statement was followed by a general discussion of the Washington situation as it relates to government construction work and the employment of the electrical contractor, and also a discussion of the labor problem.

The chairman was authorized to discuss with Mr. McNulty, grand president of the International Brotherhood of Electrical Workers, the possibility of formulating a national labor policy. Back of this authorization was the view, expressed by many of those present, that the labor problem was of the utmost importance to the industry; that the mistake had been made in the past of regarding it as local and intermittent instead of nation-wide and continuous. Organized labor had come to stay, and the time had likewise come to think of the labor question in terms of the future, to look at it down a vista of years, and to formulate a constructive policy acceptable to both employer and employed. It was felt that such a policy need not necessarily be the answer to the sporadic issues arising, but one which would ultimately so alter conditions of employment and relations between the employer and his employees as to provide for the future industrial peace and the maximum of benefits to both.

With respect to the situation on government con-

struction, the discussion developed the consensus of opinion that the electrical contracting industry was at present in a critical position, largely brought about by the government's failure to require general contractors to follow their normal practice of sub-contracting the mechanical and specialized trades. The government's failure in this connection had a very important bearing upon the future of the electrical contracting industry. If the government continued to permit general contractors to create and educate, at the government's expense, branches of their organizations to execute these trades, the electrical contractor might, after the war, find it necessary to go into general contracting to secure his legitimate work. The conclusion was that the work of the secretary in Washington was vital and must be continued. It was pointed out, however, that while he was directing his efforts toward the employment by the government of the whole electrical contracting industry, he represented only the Conference Club. It was decided that in carrying on his work the secretary ought to represent the entire electrical contracting industry.

At the first session of the Conference Club a resolution was introduced and unanimously carried authorizing the advisory board to offer to the national association the services of Mr. Jones as its Washington representative. The offer was accepted by Mr. Peet under authority already vested in him.

The proposed functional reorganization of the electrical industry was presented in a paper in the preparation of which a number of Conference Club members collaborated. After reviewing the defects in the present system for distributing the manufacturers' products and the conflicts between the engineering functions performed by the manufacturer, the contractor and the consulting electrical engineer, the paper proposed a readjustment providing for an orderly sequence of mutually complementary engineering functions in connection with the production, distribution and utilization of the industry products. The proposed plan was summarized as follows:

1. That the manufacturer change and ultimately abandon his practice of selling direct to the ultimate consumer, and abandon also his policy of making such sales on the basis of expert engineering advice given by his representative.

2. That the consulting engineer organize to increase the scope of his practice to include rendering expert services to those large consumers of electrical products who heretofore have been thus served by the manufacturer; that he establish with all manufacturers such relations that he may familiarize himself with their products and standards, advise with them on the improvement of their product, and function as the coordinator of their several departments, and that he cease to function as his client's agent in the purchase of apparatus and supplies.

3. That the electrical contractor reorganize, and annex to his organization engineering talent of a high order, so that he may become a constructing engineer with sufficient capital to act as his own jobber; that he assume much of the consulting engineer's detail work, abandon very largely his independence as a purchaser of the manufacturer's product, and effect with the manufacturer some sort of close working contact based upon a liberal policy providing for reciprocal benefits.

OLIVER HEAVISIDE MADE

A. I. E. E. HONORARY MEMBER

Board of Directors Votes to Confer Honor Upon English Mathematician and Physicist for Eminent Services to Science

At a recent meeting of the board of directors of the American Institute of Electrical Engineers in New York Oliver Heaviside, mathematician and physicist, fellow of the Royal Society of London, was elected an honorary member. The vote was unanimous.

This action accorded with the procedure prescribed in the constitution to govern the election of honorary members. It followed the presentation to the board of a proposal in writing, signed by ten prominent members.

In recognition of the eminent services rendered by Heaviside to the scientific world the directors adopted the following resolution:

Whereas, Oliver Heaviside has rendered service of the highest value in the advancement of electrical science, leading to practical results of a far-reaching order, and notably in the development of electromagnetic theory; and

Whereas, The constitution of the American Institute of Electrical Engineers provides that by unanimous vote of all the members of the board of directors honorary members may be chosen from among those who have rendered acknowledged eminent services to electrical engineering or to its allied sciences; it is

Resolved, That Oliver Heaviside, Fellow Royal Society, London, England, be elected, in recognition of his contributions to electrical science and engineering, to honorary membership in the American Institute of Electrical Engineers.

Oliver Heaviside, now made an honorary member of the A. I. E. E., is, as stated, a fellow of the Royal Society of London. He is an honorary member of the Literary and Philosophical Society of Manchester, a member of the American Academy of Arts and Sciences and an honorary member of the Institution of Electrical Engineers. The University of Göttingen, Germany, conferred the honorary degree of Doctor of Philosophy upon him. The home of Mr. Heaviside is at Homefield, Lower Warberry, Torquay, England.

SHORTAGE OF COAL IS

THREATENED NEXT WINTER

National Coal Association Issues Public Statement that Unless Railroad Traffic Is Readjusted Soon Serious Conditions Will Arise

Another coal shortage, more serious than that of last winter, and almost certain interference with the war program are inevitable throughout the East, in the opinion of bituminous coal operators in the chief producing sections of the country, unless there is a readjustment soon of traffic over Eastern railroads. This is stated in a statement made by the National Coal Association. The enormous demands of other war industries are crowding coal off the rails, and the resultant continued shortage of cars at the mines has cut production to the danger point.

WILLIAM D. WEAVER TO BE HONORED BY A. I. E. E. TABLET

Directors of American Institute of Electrical Engineers Accept Petition of Group of Members to Record Appreciation of His Services

A bronze tablet in honor of William D. Weaver of Charlottesville, Va., former editor of the *ELECTRICAL WORLD*, is to be placed in the room of the board of directors of the American Institute of Electrical Engineers.

A communication to the president and directors of the Institute, presented at the meeting of the board on April 12, follows:

The undersigned members and fellows respectfully submit to the president and the board of directors of the American Institute of Electrical Engineers a petition asking for the acceptance of a permanent record in the form of a bronze tablet, to be placed in the room of the board of directors, in honor of Lieut. William Dixon Weaver, volunteer chief engineer, United States Navy.

The signatories have selected this year since it is twenty years ago that Mr. Weaver, laying aside his work and private duties, re-entered, as volunteer chief engineer, the United States Navy at a moment of the nation's need.

The contemporaries of Mr. Weaver need no explanation of the reason why the signatories desire to do him honor and why they deem the rooms of the Institute the proper place for such record. We have, however, to remember the younger generation.

He was born at Greensburg, Pa., Aug. 30, 1857. He was graduated in 1880 from the United States Naval Academy at Annapolis, studying at the Sorbonne and in London. In 1883 he went on the first Greely relief expedition. He founded the *American Electrician*, and he was editor of the *ELECTRICAL WORLD* from 1893 to 1912. He re-entered the United States Navy as volunteer chief engineer in 1898. In 1900 he was appointed by the United States government as the official delegate to the International Electrical Congress at Paris, but, upon his suggestion, the appointment was transferred to Dr. Kennelly, who had taken a more active part in the congress work. In 1904 he was treasurer and business manager of the International Electrical Congress at St. Louis.

He was twice a director of the Institute, and from 1901 to 1906 chairman of its library committee. In 1915 he was selected by the board of directors as one of the Institute's representatives on the Naval Consulting Board, but he declined on account of his health.

The Engineering Societies Building owes its existence to the munificence of Mr. Carnegie. At the Institute library dinner in 1903, which Mr. Carnegie attended as guest of honor, Dr. Billings, then perhaps the greatest authority of the world on library administration and organization; Theodore De Vinne, our greatest printer, and R. R. Bowker, who had the leading part in introducing the card catalog, were the principal speakers. In their remarks they referred to the desirability of proper quarters for the great collection of books gathered by the American Institute of Electrical Engineers. Mr. Weaver prepared and submitted to Mr. Carnegie a proposition under which Mr. Carnegie was to donate an amount for the purpose of "housing" the library. Mr. Weaver wished to make this library a great library of reference on electrical, physical, engineering and technical subjects generally, having complete files of important publications, notably the proceedings of the French Academy (donated by C. O. Mailloux) and the proceedings of the Royal Society (donated by E. D. Adams). The library is Mr. Weaver's silent monument.

"But for his extremely retiring disposition," said the *ELECTRICAL WORLD* of May 4, 1912, "he would long since have been clothed with the highest honors which it is within the power of the profession as a whole to bestow. . . . The career of Mr. Weaver is notable . . . also by reason of many other highly important results attained in his characteristic manner, without widespread public knowledge of his work therefor, but always with the assurance on his

part that no credit was withheld from all others assisting in the work."

The signatories recognize in him the highest type of an American, engineer, scholar, journalist and patriot, and they desire to dedicate to this Institute, in recognition, always so modestly veiled by him, of his services in the promotion of the welfare of the Institute and the engineering profession; of his untiring assistance and aid to men he deemed able and promising; of the creation of a journalistic forum in which independent opinions could be voiced by all; in rendering those columns familiar to great English, French and other European writers; in having been instrumental, jointly with others, in securing a permanent home for the engineering societies, and in building up the Institute's library and rendering it serviceable to the membership; in organizing and carrying to a successful conclusion the work of the International Electrical Congress at St. Louis and the Commission on Resuscitation from Electric Shock.

We conclude this brief memoir by citing the words of our honorary secretary, Ralph W. Pope:

"The most prominent feature, and which is a matter of record, is his building up of our great engineering library, which was practically accomplished by his exertions, guided by a most remarkable knowledge of engineering literature and his devotion to the highest ideals in the ever-growing field of electrical science."

COMFORT A. ADAMS,
EDWARD D. ADAMS,
BERNARD A. BEHREND,
LOUIS BELL,
ANDRÉ BLONDEL,
EDWARD CALDWELL,
JOHN J. CARTY,
GANO DUNN,
THOMAS A. EDISON,
WILLIAM L. EMMET,
CARL HERING,

F. L. HUTCHINSON,
ARTHUR E. KENNELLY,
C. O. MAILLOUX,
ADDAMS S. MCALLISTER,
RALPH D. MERSHON,
WILLIAM H. ONKEN, JR.,
MICHAEL I. PUPIN,
SAMUEL REBER,
HARRIS J. RYAN,
CHARLES P. STEINMETZ,
NIKOLA TESLA.

In response to this petition the board of directors unanimously adopted the following resolution:

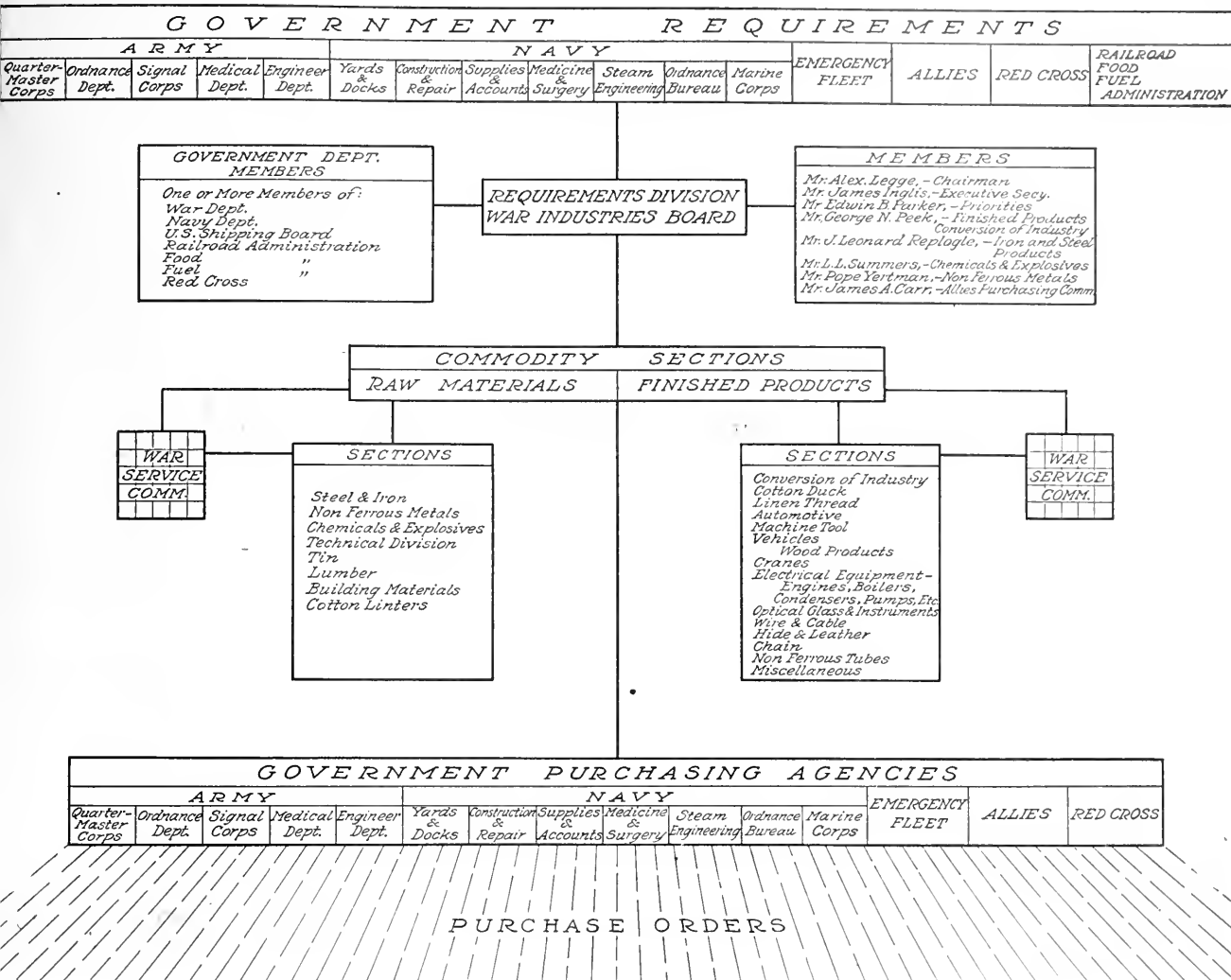
Whereas, A group of members of the Institute has presented a petition to this board offering to donate to the Institute a bronze tablet for the purpose of recording appreciation of the services rendered to the Institute and the electrical engineering profession by William D. Weaver; and

Whereas, Mr. Weaver has been an active member of the Institute for over thirty years and has ably served the Institute in various capacities, including several years as chairman of the library committee and six years as a member of the board of directors; be it

Resolved, That the American Institute of Electrical Engineers hereby accepts the offer referred to above, and that the president be authorized to appoint a committee of three to confer with representatives of the petitioners, this committee to have power to complete the arrangements to carry out the intent of this resolution.

Red Cross Mission Includes Engineers

The American National Red Cross announces that a commission of about sixty, including a number of engineers from the United States, will study existing conditions in Palestine. The commission, with the exception of a few members, is believed to have arrived in Palestine. The following electrical engineers are in the party: Arthur A. Bacon, Hobart College, Geneva, N. Y., and Julius A. Brown, Fayerweather Hall, Columbia University, New York.



In order to acquire a knowledge of the government's requirements as far in advance as possible this division has been formed, and the various departments of the government and the Allies' Purchasing Commission bring their requirements to it as soon as they are known. These re-

quirements are passed from the requirements division directly to the commodity sections interested in the particular requirements. The diagram was exhibited by George N. Peek at the recent Chicago meeting of the United States Chamber of Commerce.

ENGINEERING COUNCIL ACTS ON INDUSTRIAL EFFICIENCY

Special Committee on Industrial Affairs Drafts Resolution to Urge Retention of Bonus Method of Stimulating Production

The Engineering Council has appointed a special committee on industrial affairs as follows: Prof. George C. Swain, Massachusetts Institute of Technology, chairman; E. W. Rice, Jr., president General Electric Company; Charles T. Main, president American Society of Mechanical Engineers; Alexander C. Humphreys, president Stevens Institute of Technology and Buffalo Gas Company, and Benjamin B. Thayer, vice-president Anaconda Copper Mining Company. The committee has drafted a resolution which was adopted at once by special action of the Engineering Council.

In the preamble of the resolution it is stated that Congress has under consideration in the navy and army appropriation bills proposals to prohibit, diminish and condemn the payment to public employees or to employees of private establishments under government

control of any cash reward, premium or bonus for superior service. In the opinion of the Engineering Council these methods, if applied with due regard to wages, surroundings, health and safety of the employee, will increase efficiency and production, help win the war and preserve our institutions. It is vital to the winning of the war, the Engineering Council holds, that no legislation or other measure should be adopted which may interfere with highest efficiency and maximum production; on the contrary, every proper means should be taken to increase efficiency and production.

Upon the subject matter of the resolutions presented on April 18 by F. P. Fish, chairman of the National Industrial Conference Board, the special committee is now concentrating its attention and making a careful investigation. This board has requested the engineering societies of the United States "to investigate and to publicly express themselves as to whether or not we are losing or gaining in industrial efficiency, and to state what causes, if any, in their opinion are influencing the condition, and in what manner broadly they believe our industrial efficiency can be stimulated."

The A. I. E. E. Members in Service



A framed poster hanging on the wall of the offices of the American Institute of Electrical Engineers, New York, tells the present total.

EDISON MEDAL AWARDED

TO COL. JOHN J. CARTY

Presentation of Eighth Edison Medal for Colonel Carty's Work in Science and Art of Telephone Engineering to Be on May 17

The eighth Edison medal has been awarded by the Edison medal committee of the American Institute of Electrical Engineers to Col. John Joseph Carty for his work in the science and art of telephone engineering.

The medal will be presented to Colonel Carty at the annual meeting of the Institute to be held in the auditorium of the Engineering Societies Building, New York, Friday, May 17, at 8.30 p. m. President E. W. Rice, Jr., will preside and the program will be as follows: Address by A. E. Kennelly outlining the origin and purpose of the Edison medal; address by Michael I. Pupin giving history of Colonel Carty's work in regard to telephone engineering; presentation of medal to Colonel Carty by President E. W. Rice, Jr.; acceptance of the medal by Colonel Carty.

As is generally known, the Edison medal was established upon the initiative of a group of friends and associates of Thomas A. Edison for the purpose of recounting and celebrating the achievements of a quarter of a century in the art of electric lighting with which the name of Edison is imperishably identified. It was decided that the most effective means of accomplishing this object would be by the establishment of a gold medal which should, during the centuries to come, serve as an honorable incentive to scientists, engineers

and artisans to maintain by their works a high standard of accomplishment.

Therefore the Edison medal was established and endowed with a trust fund, under an indenture dated Feb. 11, 1904, whereby the American Institute of Electrical Engineers agreed to award the medal annually. The medal is awarded each year, by a committee consisting of twenty-four members of the Institute, to a resident of the United States of America and its dependencies or of the Dominion of Canada, "for meritorious achievement in electrical science or electrical engineering or the electrical arts."

POWER CONTRACT TERMS

MADE IN PASADENA, CAL.

Agreement, Subject to Approval of State Railroad Commission, Arranged Between City and Southern California Edison Company

After lengthy negotiations between the Southern California Edison Company and the city of Pasadena, an agreement has finally been reached which is satisfactory to both, and essentially along the lines of elimination of duplicate investment and conservation of fuel resources. The agreement is subject to the approval of the Railroad Commission of California, and a joint application was made to the commission by the city and the Edison company at a hearing held in Los Angeles on April 25. The following are the principal points covered by the agreement:

The city of Pasadena agrees to lease the electric distributing system of the Edison company in Pasadena, the stipulated value of which is \$513,102.11, for a period of two years, the city to pay a rental for said property equal to 8 per cent per annum and also to pay rental for the use of every extension made to the company's distributing system in Pasadena at the same rate. In addition, the city agrees to pay to the company an amount equal to 3.36 per cent of the value of the company's distributing system on account of depreciation, the money so paid to go into a depreciation reserve fund, which will be handled according to a special provision in the agreement.

The city is to have an option to purchase the company's distributing system in Pasadena at the price stipulated plus cost of additions thereto at the end of the two-year period. If the war still continues at the end of two years, then the lease may be extended under the same terms and conditions until the end of the war and for four months thereafter.

The city agrees to purchase from the company at all times during the term of the lease such electrical energy as it may require, and at the termination of the lease, provided that the city acquires the company's distributing system, to continue purchasing all its electrical energy from the company until April 15, 1933.

The schedule for energy supplied by the company to the city is to be: For the first 250,000 kw.-hr. furnished during each month, 0.95 cent per kilowatt-hour; for the next 500,000 kw.-hr. furnished during each month, 0.90 cent per kilowatt-hour; for all over 750,000 kw.-hr. furnished during each month, 0.75 cent per kilowatt-hour.

The city is to have the right, upon giving thirty days' notice, to take service upon an annual load-factor basis;

the load factor being figured upon an average of the three highest peaks in a year, no two peaks being in any one month. The load-factor schedule is:

	Cents per Kw.-hr.
less than 44 per cent load factor.....	0.875
less than 46 per cent but not less than 44 per cent.	0.85
less than 48 per cent but not less than 46 per cent.	0.84
less than 50 per cent but not less than 48 per cent.	0.82
less than 52 per cent but not less than 50 per cent.	0.79
less than 54 per cent but not less than 52 per cent.	0.77
fifty-four per cent and over.....	0.75

The steam plant of the city, with a rating of 6000 h.p., which now supplies electrical energy to the city's distributing system, shall be maintained by the city and kept in condition for operation, but shall be operated only upon the order of the company or when and during the time the service of the company to the city shall be interrupted and the operation of the plant reasonably necessary. Whenever the plant shall be operated the company is to pay all costs incident to putting in operation and maintaining it during the period required, including interest and depreciation at the rate of 12 per cent per annum for said period on the depreciated value of the plant as carried upon the books of the city.

During the period of the lease the provisions of the agreement will be carried out under the supervision of "operating board," to consist of the manager of the city's electric department and a representative of the company.

The city agrees to lease and sell to the Edison company certain distribution lines belonging to the city outside the limits of Pasadena under the same terms and conditions as the Edison company's lines in Pasadena shall be leased or sold to the city, and further agrees to confine its electric distributing business in future to the territory within the corporate limits of Pasadena, to certain specified existing consumers outside the city accepted.

During the term of the lease all additions and new business secured by the city shall be attached to and become a part of the respective systems of the city and the company in such manner and quantity that the new business and extensions measured in income shall be distributed that the present proportion of business between the company and the city shall be at all times substantially maintained. The distribution of such extensions and new business shall be subject to the operating board. The present proportion between the city's business and the company's business is determined 56 to 44.

The testimony submitted at the hearing before the commission indicated that Pasadena could make great economies in operation by the consolidation of the Edison company's Pasadena business with that of the city. No rate reductions were promised by the city in the near future. The Edison company will be a gainer by the agreement in that it will earn 8 per cent on its capital investment instead of less than 5 per cent under existing conditions, and that it will supply a total of over 12,000,000 kw.-hr. annually to the territory within the city, instead of approximately 5,000,000 kw.-hr. at present.

Since December, 1917, the city of Los Angeles has been supplying Pasadena with some electrical energy, this being surplus energy from the aqueduct plant over and above that required by Los Angeles under its con-

tract with the Edison company. At the hearing before the Railroad Commission in reference to the joint application of the city of Pasadena and the Edison company, the city attorney of Los Angeles entered a protest against the discontinuance of power service to Pasadena by Los Angeles which would follow the approval of the joint application made by Pasadena and the Southern California Edison Company. The existing contract between Los Angeles and Pasadena for surplus electrical energy contains a provision that it may be abrogated upon thirty days' notice by either. According to the attorney for Los Angeles, the protest was made along the lines of patriotic conservation. He stated that Los Angeles did not desire to embarrass Pasadena in the matter of its agreement with the Edison company, but that if the power service of Los Angeles city to Pasadena were discontinued, the Edison company would have to supply an equal amount of energy generated by steam. This statement was not allowed to go unchallenged by representatives of the Edison company.

PROBLEMS OF WAR BEFORE OKLAHOMA ASSOCIATION

Meeting of 200 at Oklahoma City Marked by Seriousness and Patriotic Consideration of War-Time Questions

The seventh annual convention of the Oklahoma Gas, Electric and Street Railway Association was held in Oklahoma City on April 22, 23 and 24. About 200 utility representatives were in attendance. The convention was marked by an attitude of seriousness not noted in previous conventions. The utility members seemed to feel that the present conditions called for co-operative work, for patriotic willingness to share their portion of the war burdens and for an entire revision of the past methods in dealing with the public. The association at this convention accomplished more in the way of reaching a solution of the larger utility questions than at any convention in the previous history of the association.

The first session met on Monday afternoon. Mayor Overholser of Oklahoma City made an address of welcome, and F. D. Shaffer, manager of the Chickasha Gas & Electric Company, gave his presidential address, the keynote of which was co-operation on the part of the utilities of the State to relieve the present financial stringency and effectually prosecute the war.

C. W. Shannon read a paper on "The Reliability of the Oklahoma Oil and Gas Fields." Mr. Shannon predicted that in the near future it would be possible to predetermine the life of Oklahoma oil and gas wells. The convention then adjourned to inspect the new waterworks project built for the supply of Oklahoma City at a cost of \$1,500,000.

At the Tuesday morning session L. E. Mohrhardt read a paper on the use of electricity in the oil and gas fields of the State. Discussion brought out the point that the load obtainable in the oil and gas fields would be advantageous to central-station men from every standpoint, but that there had been no attempt to get this load. One of the difficulties is the necessity for costly equipment and high-tension lines. Mr. Barnes of the Westinghouse Electric & Manufacturing

Marching for the Third Liberty Loan in New York City



Executives and employees of the New York Edison Company, the United Electric Light & Power Company and

affiliated companies turned out for the Liberty Day parade, April 26, swelling the numbers and adding to the enthusiasm.

Company said that the oil-well supply firms have volunteered to carry a stock of electrical apparatus, thereby lowering the capital investment of the central stations.

After hearing the papers of Guy B. Treat, chief engineer of the Oklahoma Railways Company, and Prof. L. W. W. Morrow of the University of Oklahoma, the convention went on record in support of the National Committee on Public Utility Conditions appointed by the National Electric Light Association, the American Gas Institute, the National Commercial Gas Association and the American Electric Railway Association. It passed a resolution to the effect that the Oklahoma sub-committee of the national committee be empowered to engage a high-grade man to handle the work of the associations in Oklahoma in connection with the granting of rate increases, the obtaining of financial aid from the War Finance Corporation and the obtaining of proper publicity for the utilities in the State, and in other ways to advance the interests and promote the welfare of the individual members of the association.

In discussing the papers, the consensus of opinion was that a rate increase was the only solution of present financial problems, and that such an increase ought to be granted upon proper presentation of facts with a minimum delay.

At the afternoon session C. S. Thompson and J. W. Shartel discussed the advisability of concentrated production, transmission and distribution of electricity in Oklahoma through the use of a few large stations.

The discussion of the paper by L. A. White, entitled "Gas-Fired Boilers," dwelt on the fact that a large combustion chamber was the essential prerequisite for the efficient use of gas under boilers. Mr. Kretz of Okmulgee went so far as to advocate the Dutch oven method of combustion. Mr. Molinard of the Oklahoma Gas & Electric Company said that his company was now trying out the effect of large and small combustion

chambers on oil-fired boilers. The opinion prevailed that the use of gas for power production was a thing of the past and that every plant must necessarily be equipped with oil or coal for emergency conditions when the gas supply was low or completely failed.

At the Wednesday morning session the discussion following Charles Hoopes' talk was to the effect that the licensing of stationary engineers was advisable in Oklahoma, and a resolution favoring a law to this effect was passed.

In discussing Prof. F. F. Blachly's paper on "Utility Taxation" there was no agreement as to a proper method of taxation, but there was an entire agreement as to the advisability of an intensive study of the subject with a view to working out an equitable basis for Oklahoma.

At the afternoon session there was a thorough discussion on the relations of the utilities and the consumer. The idea advanced by A. L. Mitchell was that every utility should be represented in an association and at its meetings, and that the meetings of such an association afforded the only place for the utilities and the corporation commission to discuss informally the many utility problems. The opinion of the members was that commission regulation had come to stay and that so long as the standard of the Oklahoma commission membership was maintained there could be no more advisable method. J. C. Resler, city manager at Weatherford, advocated the placing of municipal plants under the jurisdiction of the corporation commission in order to enforce proper accounting methods.

J. F. Owens, vice president and general manager Oklahoma Gas & Electric Company, was elected president; C. S. Thompson, general manager Shawnee Gas & Electric Company, first vice-president; J. W. Shartel, vice-president and general manager Oklahoma Railways, vice-president, and L. W. W. Morrow, University of Oklahoma, secretary-treasurer.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 963 of this number.

Duluth Engineers' Joint Meeting.—There will be a joint meeting of all the engineering societies in Duluth on May 6. General subjects will be discussed.

Institute of Radio Engineers.—"The Feasibility of Low Antennas in Radio Telegraphy" was the title of a paper presented by Prof. Edward Bennett of the University of Wisconsin before the Institute of Radio Engineers on May 1.

A. I. E. E., Panama Section.—On April 1, the Panama Section of the American Institute of Electrical Engineers held a meeting at Balboa Heights. E. A. Graham, electrical engineer, presented some general notes on methods used in public utility examinations.

National Fire Protection Association.—On May 7, 8 and 9 the National Fire Protection Association will hold its twenty-second annual meeting at Chicago in the auditorium of the Insurance Exchange Building. The report of the electrical committee will be given during the Tuesday morning session, which opens at 10 o'clock.

N. E. L. A., Southeastern Section.—The Southeastern Section of the National Electric Light Association will hold its annual convention on June 19 and 20 in Atlanta, Ga. The meeting will be a strictly war-time meeting and no provision will be made for entertainments. The titles of the papers and other details will be given later.

Syracuse Technology Club.—Prof. A. J. Acheson, consulting engineer of the Bureau of Gas and Electricity, presented some thoughts regarding street lighting in Syracuse, N. Y., before the Technology Club on April 22. He discussed several methods for lighting the town-districts in the town, methods for assessment for the special lighting and a new method of lighting residential districts.

A. S. C. E., San Francisco Section.—"What water-power development is to be fostered was the prediction of F. H. Fowler, United States Forestry Engineer, before the San Francisco Section of the American Society of Civil Engineers on April 16. "Demand for power in California has been increasing at a steady rate of about 30,000 kw. mean load annually," said Mr. Fowler, "and this means that there should be an annual installation of from 40,000 kw. to 50,000 kw. to carry the peak loads." He also stated that there was a shortage in development which could be attributed to two causes, first, the uncertainty concerning federal legislation, and second, the failure of rate-fixing bodies throughout the country to allow increases in rates as rapidly as the cost of production increased.

A. I. E. E., Spokane Section.—"Hydraulic Turbines—Their Design, Manufacture, Efficiency and Testing," was the subject of a paper by J. W. Hungeate, electrical superintendent Inland Empire Railway Company, C. F. Udhen, chief engineer Washington Water Power Company, and R. F. Daniels, engineer Washington Water Power Company, presented before the Spokane Section of the American Institute of Electrical Engineers on April 19.

A. E. R. A. Annual Convention.—The annual convention of the American Electric Railway Association and affiliated associations will be held at Atlantic City, N. J., this year during the second week in October. According to the tentative program so far prepared, the American association meeting will open on Tuesday afternoon, Oct. 8, and close on Wednesday afternoon. The affiliated associations will meet on Wednesday and Thursday mornings.

Boston Engineers.—The ninth annual dinner of the Boston Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers was held at the Boston City Club on April 30. W. H. Flood, Jr., of the American International Shipbuilding Corporation spoke on "The Greatest Shipyard in the World." Alfred D. Flynn, secretary of the Engineering Council, talked about the progress and changes of that body.

American Gear Manufacturers' Association.—The second annual meeting of the American Gear Manufacturers' Association was held April 18 to 20 at White Sulphur Springs, West Va. F. N. Sheppard of the United States Chamber of Commerce spoke at the opening session on "How We Can Get Behind the Government and Help Win the War." F. W. Sinram was elected president, and Frank D. Hamlin was chosen for secretary and treasurer. The next meeting of the association will be held in September, the time and place to be determined later.

Pacific Coast Joint Electrical Meeting.—The meeting of all of the electrical interests on the Pacific Coast will be held in Del Monte, Cal., as previously announced in the ELECTRICAL WORLD. The National Electric Supply Jobbers of the Pacific Coast will meet on Monday, May 6, the California Association of Electrical Contractors and Dealers will convene on Tuesday, and the delegates of the National Electric Light Association will arrive on Thursday. Some of the important papers to be presented are: "Possible Water-Power Development in California," by F. H. Fowler; "Joint Operation of Power Companies," by J. P. Jollyman; "Power-Plant Losses," by R. J. C. Wood; "Transmission and Distribution Losses," by R. E. Cunningham; "Iron and Steel Conductors," by R. C. Powell; "Standardization of Pin-Type Insulators," by L. M. Klauber and R. E. Cunningham; "Substitute for Cedar Poles," by L. M. Klauber, and "Insulator Deterioration," by J. A. Koontz. There will also be papers on commercial, accounting and contractors' problems.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Pole Maintenance.—Where the employee of a telephone company, in order to make certain repairs, climbed a telephone pole and sustained injuries as a result of the breaking of the pole beneath the surface of the ground on account of its decayed condition, which condition was not obvious or known to him, it being shown that it was not the duty of the employee under his contract of employment to make an independent inspection of the pole for the purpose of discovering hidden defects, the failure of the telephone company to use due care to maintain such pole in a reasonably safe condition for the purpose of such employment constitutes actionable negligence, the Supreme Court of Idaho held (170 P. 88).

Liability of Water-Power Company for Damages Caused by Dam on Navigable River.—The erection of a dam in the Tennessee River, backing water over lands adjacent to those occupied by plaintiff as tenant at will, was an appropriation for flowage purposes, all resulting damages from which were compensated by an award to the owner, plaintiff's landlord, the Supreme Court of Tennessee held in Chattanooga & Tennessee River Power Company vs. Lawson (201 S. W. 165). A private contractor building a dam to be deeded to the United States in a navigable stream under direction and according to specification of the United States is liable only to the same extent as the government, which is not liable for the consequential damages to a tenant at will of one who has been compensated for land taken by alternate overflow and recession of water, causing stagnation and breeding mosquitoes which infected plaintiff and his family with malaria. Such contractor, being liable only to the same extent as the government, it is not liable for the tort of failing to remove obstructions and rubbish after each overflow, since the United States is not liable for torts. Where a dam was erected for the United States in a navigable stream and alternate overflow and recession caused a stagnant pool on land of a private owner, the United States was not liable for failure to drain the pool, since it had no right to go upon private lands for such purpose. That a private contractor building a dam to be deeded to the United States in a navigable stream under direction and according to specifications of the United States retained an interest in the surplus water for power production did not render the contractor liable for merely consequential damages to residents of the vicinity by reason of creation of unhealthful conditions.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Government Wants Men for Export-Trade Offices.—The government is looking for men capable of taking charge of branch offices of the Bureau of Foreign and Domestic Commerce, Department of Commerce; also men to act as assistants in such offices. These branch offices are established in the principal commercial cities, the salaries ranging from \$1,800 to \$3,000 for managers and from \$1,200 to \$1,800 for assistants. Applicants should write at once to the Bureau of Foreign and Domestic Commerce at Washington, as a non-competitive examination will be held on May 16 in various parts of the country.

University of Pittsburgh Gives Radio Engineering Course.—A course in radio engineering for technical graduates will be given at the University of Pittsburgh, starting May 20 and lasting for eight weeks. This course will be open only to graduates in electrical or mechanical engineering who are recorded in class 1 of the National Army draft. Men enrolling in it will be placed by the government in class 5 until completion of the course, when they will be inducted into the Signal Corps and sent to an army school for further training. The need for men familiar with the technique of radio communication is great, and the chances for obtaining a commission ultimately are good. There will be no charge for tuition, but students must provide their own living and traveling expenses. As the number of men is limited, application should be made at once to Prof. H. E. Dyche, department of electrical engineering, University of Pittsburgh, Pittsburgh, Pa.

National War Labor Board.—The National War Labor Board, the outgrowth of the Commission of Employers and Workers, has mapped out a plan of organization. Frank P. Walsh of Kansas City and William H. Taft, who had been designated by the President as chairmen of the board, will preside alternately at all sessions. The board, as finally appointed by the President, consists of the same persons who formulated the national war labor program, but pending the return of William H. Johnson, president International Association of Machinists, now abroad upon a special mission, his place will be taken by T. J. Savage. The other members are: Loyall A. Osborne, vice-president Westinghouse Electric & Manufacturing Company; B. L. Worden, vice-president and general manager Submarine Boat Corporation; W. H. Van Dervoort, vice-president Root & Van Dervoort Engineering Company; L. F. Loree, president Delaware & Hudson Company, and C. E. Michael, president Virginia

Bridge & Iron Company, representatives of employers, and Frank J. Hayes, president United Mine Workers of America; William L. Hutcheson, president United Brotherhood of Carpenters and Joiners of America; Victor Olander, secretary Illinois State Federation of Labor, and T. A. Rickert, president United Garment Workers of America, representatives of employees.

Employment Management.—The first course of intensive training in employment management under government supervision has been opened at the University of Rochester. Twenty prospective employment managers, sent by manufacturers having war contracts, including especially shipbuilding plants and several departments at Washington, have begun six weeks' intensive training in the practice and theory of employment management. The course is given at the request and under the supervision of the industrial service sections of several departments at Washington. It will later be repeated in Boston, New York and elsewhere.

Dividends in Scrip.—American Public Utilities Company directors declared the regular quarterly preferred dividend due on April 1 in scrip, payable on or before April 1, 1923, with 6 per cent interest, payable semi-annually. The directors deemed it prudent to conserve the cash resources of the company and its subsidiaries. While not authorizing any unusual construction expenditures by subsidiary companies, at the same time the directors felt that they must provide for the constant demands for added service at existing plants, and as there is no certainty that funds for these unavoidable expenditures can be obtained through the sale of securities in the usual way, they must be taken from earnings ordinarily devoted to dividends.

Vail Expects Justice for Telephone Company.—In a statement at the annual meeting of shareholders of the American Telephone & Telegraph Company, Theodore N. Vail, the president, said: "The system must be increased as fast as demands of a growing country call for service and as fast as new services are discovered and introduced. Whenever our earnings are in excess of requirements, if they are not absorbed by improvements in service, they are invested in plant, which is not burdened with capital charges and which thus forms a safeguard against possible obsolescence on a large scale. These commitments make necessary readjustments in charges, and while we have had many reductions, we have been obliged to ask many rate increases. After a thorough presentation of our case, we have never been refused relief, with the possible exception of some negligible cases. We have been allowed many increases in rates in many cases the last year, and there are several very important cases closing in which we have had most favorable consideration and in which material increases are conceded. We feel confident that we shall continue to get ample justice and full consideration."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Electric Extensions During the War.—The California Railroad Commission has authorized the Mount Whitney Power & Electric Company, which sells electricity in Tulare, Kern and Kings Counties, to put into force certain rules for extensions of electric service during the war. These rules obligate the company at its own expense to make all extensions in which the annual gross revenue equals a third of the cost. Where the annual gross revenue is less than the cost of the extension, but more than one-fifth, the company will give the service if the consumer advances the entire cost, which will be refunded to him on the basis of 20 per cent of the monthly bills. The consumer may at his own cost build enough of the extension so that the amount to be expended by the company shall not be more than three times the annual payment for service by the consumer. The Mount Whitney company is ordered to adjust all extensions made by it within one year prior to this order, if requested by the consumer.

Rate Relief in Wisconsin.—A decision of the Wisconsin Railroad Commission authorizing the Glidden Light, Power & Water Company to increase electric rates says in part: "There is bound to be more or less fluctuation in voltage with equipment such as that used at Glidden, but the commission does not believe that conditions at this time warrant the issuance of an order requiring the utility, in view of its finances and in view of the present high prices of apparatus, to go to the expense of installing auxiliary equipment so that absolutely uninterrupted service may be rendered. . . . It is evident that some adjustment of the rates is necessary to give the utility relief. . . . If the flat rate for business use as filed were strictly applied the increase would be greater. Inasmuch as the practice of supplying electric service to commercial users on a flat-rate basis, except under certain restricted circumstances, is contrary to the best accepted practice in electric plant operation, the commission has endeavored to eliminate such flat rates whenever possible. In the present case the finances of the utility do not warrant the purchase and installation of meters upon all flat-rate consumers at this time. We believe, however, that the flat rates should be increased and, further, that steps should be taken by the utility so that flat-rate users who desire to be metered may purchase the meters at cost from the utility, the latter to refund 50 cents monthly to each such consumer until the amount paid has been returned to him."

G. H. Smart, commercial manager of the Knoxville (Tenn.) Railway & Light Company, has resigned.

Ivy Carr has succeeded F. H. Miller, manager of the Crawfordsville (Ind.) Electric Light & Power Company.

George M. Patterson has been appointed manager for the Central Maine Power Company at Bucksport, Me.

William H. Fitzhugh, superintendent of the Bay City (Mich.) electric light department from November, 1885, to the present time, has resigned.

John D. Ryan, president of the Anaconda Copper Mining Company and of the Montana Power Company, has been appointed director of aircraft production for the army.

Dr. A. E. Kennelly, professor of electrical engineering at the Massachusetts Institute of Technology, has been appointed acting head of the electrical engineering department of the Institute during the absence of Professor Jackson, who has been commissioned a major.

Frank V. Burton has been appointed to the newly established position of general sales manager of the Bryant Electric Company of Bridgeport, Conn. He was educated in the public schools of Albany, N. Y., and in 1891, at the age of seventeen, in partnership with his brother, embarked in an electrical contracting business which continued about three years. He entered the electrical contracting firm of Berger, Rogers & Potter of Troy, N. Y., and in 1895 became connected with the Western Electric Company at New York, first in the construction department and later in the supply department, where he remained for more than six years. His short connection with the electrical engineering firm of Sanderson & Porter in New York followed, and in the sum-

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

W. W. Erwin has been appointed chief operating engineer of the New York Edison Company to succeed the late J. P. Sparrow. Mr. Erwin joined the



W. W. ERWIN

forces of the Edison company in October, 1900, as a mechanical draftsman. He was made chief draftsman in 1903 and superintendent of construction in 1906, which position he held until his appointment to the present one.

Lieut. William Sikes Tucker, formerly connected with the sales department of the Electric Storage Battery Company, Philadelphia, has been awarded the French war cross for bravery.

F. W. Lachicotte, Jr., manager of the Chester (S. C.) branch of the Southern Public Utilities Company, has been transferred to become superintendent of the electrical department of the Charlotte (N. C.) branch of the company.

Frank L. Fox, for the last four years manager of the Thomasville (S. C.) branch of the Southern Public Utilities Company, has been transferred to the managership of the Chester (N. C.) branch, succeeding F. W. Lachicotte, Jr.

W. W. Hanks, superintendent of the electrical department of the Charlotte (N. C.) branch of the Southern Public Utilities Company, has resigned to become associated with the Charlotte Electric Repair Company, in which he is interested.

H. W. King, superintendent of distribution for the East St. Louis Light & Power Company, has resigned that position to become associated with the Sangamo Electric Company of Springfield, Ill. A farewell banquet was given him at the Planters' Hotel in St. Louis by the St. Louis Electric Club.

G. N. Turner was recently appointed manager of the Washington-Idaho Water, Light & Power Company at Castle Rock, Wash., succeeding H. A. Bottomly.

Cyrus Schumacher, for the last ten years superintendent of the Bluffton (Ohio) Light and Water Works, has resigned to go into the business of manufacturing air motors.

R. C. Coffy, formerly manager of the Puget Sound Gas Company, Everett, Wash., will succeed George H. Wilmarth as manager of the Sapulpa (Okla.) Electric Company.

George H. Wilmarth, formerly manager of the Sapulpa (Okla.) Electric Company, has been appointed manager of the Muskogee Gas & Electric Company, Muskogee, Okla., succeeding J. F. Owens, who has been promoted.

Prof. Dugald C. Jackson, the head of the department of electrical engineering of the Massachusetts Institute of Technology, has received the commission of major in the Engineers' Reserve Corps and has been ordered to France. Major Jackson began his educational work as professor of electrical engineering at the University of Wisconsin, where he stayed from 1891 till 1907, when he was called to the Massachusetts Institute of Technology to fill the chair of electrical engineering. In the same year he was named in charge of the department at the Institute, a position which he still retains. In 1913 he became in addition a member of the staff of the electrical engineering research laboratory. This laboratory led to the establishment at the institute in 1917 of a division of electrical research, of which he was one of the directors. Major Jackson has been president of the American Institute of Electrical Engineers and of the Society for the Promotion of Engineer-



F. V. BURTON

mer of 1902 Mr. Burton entered the employ of the Bryant Electric Company, where he has remained ever since, first as service correspondent, in 1907 as eastern sales manager and now as general sales manager. Mr. Burton is active in several of the sections of the Associated Manufacturers of Electrical Supplies.



D. C. JACKSON

ing Education and a member of other national associations, the American Society of Civil Engineers and the American Society of Mechanical Engineers, also of the English Institution of Electrical Engineers and the Société Internationale des Electriciens. He has contributed largely to the literature of electrical engineering.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

FILLING OF STEEL ORDERS ON PRIVATE ACCOUNT HELD UP

Facilities of Mills and Blast Furnaces Devoted Solely
to Government Requirements for
Thirty Days

At a meeting of fifty iron and steel manufacturers held in New York City April 26, after a conference with government officials, it was decided to hold in abeyance practically all orders for commercial steel. By this action the heads of the industry engaged to put their entire plants at the disposal of the United States and the allied governments for the production of material for the munition factories and shipyards, thereby sidetracking indefinitely contracts entered into with private buyers. Therefore manufacturers of electrical apparatus, machinery, supplies, accessories and a long line of specialties and staples for which steel is essential, unless requirements have been anticipated and sufficient stock is on hand to meet the demand, will be obliged to curtail or defer production and postpone promised deliveries.

Exceptions from this program, it is understood, will be only those buyers of commercial steel who secure government authorization for the early completion of their orders. The initial steps in this schedule for concentration were taken several weeks ago, when a number of companies decided to shelve for thirty days all commercial orders.

Furthermore, a fresh survey of steel consumption throughout the country made by the government requires that each seller of steel be told by his customer or the buyer the precise use to which steel already ordered is to be put. All tonnage either on government or civilian orders is to be so itemized. The various rulings that have been made as to priorities in manufacture and shipment are to be elaborated, so that in substance there will be a definite sequence all along the line, the lesser essential commodities to be placed nearer the bottom of the list.

PRODUCERS AND DISTRIBUTERS MARK UP WEATHERPROOF WIRE

Increasing Cost of Cotton Is the Cause—Scarcity of
Tin May Affect the Rubber-Covered
Product

Weatherproof wire has responded to the increasing cost of cotton by an advance of from 1 cent to 2 cents a pound recently. Cotton has more than doubled in cost within a year, and therefore weatherproof manufacturers feel justified in adding their extra expense to the finished article. In fact, the cost of production has steadily been going up fractionally for some time. Jute, which is used as an insulating material on copper cable, is also high and difficult to obtain, and a revision of quotations may be made on the finished product.

A difference of figures is noted as between various producers. One large company, selling in quantities, quotes 26½ cents a pound for weatherproof, declaring that no change in price has occurred for several months. A second manufacturing concern of equal standing, which specializes on power-house orders, quotes from 25 cents to 26 cents, and states that it is glad to handle all business it can get at that figure. With 23½ cents as the government price on raw copper the concern says it finds ample margin in such transactions. A third firm, which also sells almost exclusively to power houses, confessed it was high in naming 27½ cents.

Jobbers estimate their requirements on a 30-cent base,

the ELECTRICAL WORLD quoting weatherproof in 100-lb. lots, New York, 28¼ to 34¼ cents; Chicago, 33.42 to 38.35 cents, which has ruled for some time. Jobbing houses accept these prices, but it is probable that an order of some size may be booked on a closer figure. One prominent distributor has notified the trade of an advance of 2 cents a pound.

Rubber-covered wire, on account of the unprecedented cost of tin, may also be subjected to a revision if the metal goes much higher. This week Straits tin cannot be bought at any price, and it is nominally quoted at \$1 a pound, with a possibility of \$1.50 next month. Chinese tin, which is not so pure as Straits, containing a greater percentage of arsenic, but answering perfectly for coating bare copper wire for rubber covering, sold at 92 cents, May arrival.

FUEL ORDER BRINGS ECONOMY IN WASHING-MACHINE INDUSTRY

Idea That Savings Would Need to Be Made or
Output Curtailed Stimulated Manufacturers to
Renewed Efforts to Increase Efficiency

According to a report issued from the American Washing Machine Manufacturers' Association, the industry operated under restrictions in accordance with its pledge and the fuel order for the month of January, 1918. The monthly reports from members in practically every case showed that the manufacturers practiced the economies to which they had pledged themselves without decreasing their volume of production, except as such a decrease was caused by the Garfield holidays and the lack of transportation facilities. Most of the manufacturers co-operated with the War Service Committee and with the government. This co-operation meant a saving of labor per unit of production, a saving of materials, including fuels, and a saving in transportation facilities.

Increasing costs and increasing federal taxation were doing much to reduce the margin of profit in the industry even before the manufacturers heard of the proposed restrictions. Skillful managers had already begun the burdensome task of trying to reduce the cost of production. The proposed restrictions, however, acted as a club to make the manufacturers begin to put into operation plans to save fuel, material and labor.

LARGE DROP IN FEBRUARY ELECTRICAL GOODS EXPORTS

For First Time in Many Months Figures Fall Below
Four-Million-Dollar Mark—Eight Months Ended
with February Show Total of \$34,735,741

Official figures on the exports of electrical merchandise manufactured in the United States during February last give a total of \$3,446,801, or more than \$100,000 less than in February, 1917. This is the first time in many months that the export of electrical goods has fallen below the four-million-dollar mark. There is a very noticeable decrease in the exports of wire and cables. These had been falling off to some extent for a considerable period. Not all of this falling off has been in volume, however; some of it is accounted for by lower prices.

The figures for the eight months ended February last show a total of electrical exports of \$34,735,741, as compared with \$31,793,041 for the corresponding period of the previous year. The following figures were compiled by the Bureau of Foreign and Domestic Commerce:

	February		Eight Months Ended February	
	1917	1918	1917	1918
Articles				
Batteries	\$227,105	\$140,742	\$1,769,158	\$2,213,082
Carbon		148,776		979,036
Dynamos or generators	277,953	247,028	1,744,064	1,496,102
Insulators	66,243	21,955	254,764	362,686
Heating and cooking apparatus		49,614		365,799
Insulated wire and cables	526,879	270,334	4,557,567	4,038,350
Interior wiring supplies, including fixtures	72,524	109,894	696,196	987,280
Incandescent lamps	842	387	7,793	7,702
Carbon-filament lamps	13,248	9,626	96,950	117,112
Tal-filament lamps	153,475	228,866	1,048,174	1,882,873
Igniters, spark plugs, etc.		152,222		2,290,168
Meters and measuring instruments	105,943	159,753	681,977	939,533
Transformers	335,093	386,168	3,602,232	4,157,481
Costs and controllers		8,520		115,139
Switches and accessories		210,643		1,506,842
Telegraph apparatus, including wireless ..	18,324	24,601	191,712	198,703
Telephone	157,796	125,855	1,155,108	1,499,085
Transformers	84,105	125,240	740,446	1,304,468
Other	1,535,543	1,026,577	15,246,900	10,274,300
Total	\$3,575,073	\$3,446,801	\$31,793,041	\$34,735,741

METAL MARKET SITUATION

Propaganda for 25-Cent Copper—Weatherproof Wire Advance—Tin Exceedingly Scarce and High

A determined effort on the part of the producers and refiners is being made through propaganda to persuade the War Industries Board to advance the price of copper from 23.50 cents to 25 cents a pound. Reports are spread that this is now assured by those in "close touch with the producers." The increase, to follow the same authority, to give the refiners 1¼ cents a pound and the producers 1 cent. The production is also said to have decreased 17 per cent and the consumption of the metal to have swollen enormously. Yet one authority says: "It is very doubtful if this claim will be recognized by the government, public statements issued by the various companies show that, compared with other metal industries, copper at 25.50 cents is the rich sister and spelter the Cinderella of the metal trade. There is no indication that recent production has not been equal to all demands." A week ago Holland placed an embargo on tin from the Dutch East Indies; indeed, one has practically been in effect since March. Weatherproof wire has advanced slightly in price. No Straits tin is purchasable for any delivery or shipment. A nominal quotation of \$1 was made this week. Chinese, May delivery, is quoted at 90.50 cents to 91 cents a pound. The Commercial Economy Board of the Committee of National Defense has been conferring with a large number of manufacturers, including producers of electric appliances, babbitt metal and solder. The purpose is to adopt means for the conservation of the tin supply, with a view of obviating an acute shortage of the metal. Lead metals only show a shading in lead.

NEW YORK METAL MARKET PRICES

	April 22				April 29		
	l	s	d		l	s	d
Copper: London, standard spot.....	110	0	0	Cents per Pound	110	0	0
Prime Lake	Govt. price 23.50			Cents per Pound	Govt. price 23.50		
Electrolytic	Govt. price 23.50			Cents per Pound	Govt. price 23.50		
Casting	Govt. price 23.50			Cents per Pound	Govt. price 23.50		
Wire base	26.25 to 26.75				26.25 to 26.75		
Lead, trust price	7.00				7.00		
Silver, ingot	50.00				40.00		
Sheet zinc, f.o.b. smelter.....	Govt. price 15.00			Cents per Pound	Govt. price 15.00		
Electro, spot	6.83 to 6.87				6.85 to 6.90		
Strait	92.00				92.00		
Aluminum, 98 to 99 per cent.....	Govt. price *32.10				Govt. price *32.10		

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire.....	21.50 to 22.00	21.50 to 22.00
Cass, heavy	13.50 to 13.75	13.50 to 13.75
Cass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	5.75 to 6.00	5.75 to 6.00
Lead, old scrap	5.50 to 5.62½	5.50 to 5.62½

*In 50-ton lots; car load, 32 cents per lb.

THE WEEK IN TRADE

WITH a few changes in prices the sale of electrical goods in all parts of the country is maintaining a fairly high level. Commercial business, as against the tremendous buying of material and equipment for war uses, is rather quiet; but at that the volume and value are considerable. Floodlighting requirements for cantonments, camps and shipyards are large. There are also gratifying sales of domestic appliances, especially washing and sewing machines and vacuum cleaners. Rush shipments of conduit have relieved the situation in the Far West to some extent, but in the East stocks in several sizes continue scarce, owing, of course, to transportation delays.

Labor in manufacturing centers is becoming still more scarce, and the demand upon essential man power grows heavier. This is leading to a stronger demand for all kinds of labor-saving equipment and the more general employment of women.

Predictions that the great drive for the third Liberty loan would control collections do not seem to have been fulfilled. Credits are closely watched.

NEW YORK

District distributors and local jobbers are doing a very satisfactory business, civilian and governmental. Officials scour the market for electrical goods needed in manifold ways in the installation and upkeep of industrial enterprises engaged wholly or in part in the production of war material. The trade is lending every assistance in this respect cheerfully and promptly, and with no little pride. The drawing on reserve stocks of staple merchandise, along stupendously liberal lines at times, is reducing the visible supply of many items, particularly conduit.

Some price advances have been made, and others are mentioned as likely to occur. As an example of how goods are moving it may be reported that shipments of electric apparatus from the plant of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in March amounted to 1200 carloads, a new month's record.

Collections are referred to as running from fair to excellent, and credits firmly maintained.

HOUSEHOLD SPECIALTIES.—The stock of sewing machines is none too abundant, owing to the trouble and delays incident to obtaining fractional motors, the supply having shrunk in an unexpected way within the last month or longer. The production of vacuum cleaners of standard makes is also curtailed for lack of metal essentials—steel and aluminum. A shortage is probable, if not already present. Prices are stationary. Sales of electric washing and ironing machines are reported as heavy; in instances the demand exceeds the supply. This activity is stimulated by the scarcity of domestic help and the high wages insisted upon by laundry operatives. Two leading factories a few weeks since advanced prices 10 per cent on both ironing and washing machines. A Western-made washing machine was recently marked up 15 per cent. A local distributor announced these increases for the Eastern territory April 1. A shortage in both ironing and washing machines, owing to the difficulty of getting copper and galvanized iron, is impending. Deliveries have lengthened on this account to about thirty days.

FUSES.—Renewable fuses are having a very good sale. Deliveries are what may be said to be prompt, no later than a week or ten days at the outside, owing largely to transportation delays. Where parcel post is utilized shipments are still shorter. Discounts to dealers in standard packages are quoted by one concern as 45 per cent; half package, 40 per cent; one-fifth package, 33 per cent. To

jobbers carrying the regulation stock the discounts are more liberal.

SOLDERING IRONS.—There was a run of short duration on local stock by jobbers. None of the orders was large. They came just prior to the schedule advance.

PORCELAIN.—Knobs, cleats and bushings are coming into the market very slowly, factories being swamped with orders and shipping restrictions creating no end of interference. The labor situation at the plants in Indiana, Ohio and West Virginia is occasioning grave concern.

POLE-LINE MATERIAL.—Yellow-pine cross-arms, oak brackets and locust pins are not available for small requirements. The government has requisitioned locust so heavily that the trade may have to consider substitutes. Rock elm is already employed in some localities.

CONDUIT.—Stocks are closely held, and conduit of all sizes is not being freely offered. Fittings for exposed work are in great demand, but jobbers are encountering difficulty in relying upon factory shipments, a condition which has prevailed for several months.

LAMPS.—Government and commercial requirements are being gradually caught up with by the producers, owing, it is said, to the enforcement of the daylight-saving law. The rumor of a higher price for lamps, which is being industriously circulated in some circles, is contrary to the language of the lamp contracts. Accordingly, no higher prices can be expected prior to 1919. No reserve stock has been accumulated at the factories.

ASBESTOS INSULATION.—Reported advances in asbestos mineral, which has been on the rise for a year and more, have not as yet affected the cost of asbestos insulation. Manufacturers state that no revision is contemplated, but with fluctuations in other lines "change without notice" may rule in this case.

CHICAGO

Seasonable goods of all kinds are selling freely, considering the various drawbacks by which the electrical trade is hampered. Dealers report better collections, which also are reflected in the statement of jobbers. The jobbing houses express a belief that there will be a serious shortage in motor fans, of the smaller sizes especially, and are advising retailers to place orders as soon as possible.

TELEPHONE BRACKETS.—There has been an extraordinary demand through jobbers for telephone brackets and extension arms. Most of this equipment is going to the government, probably to equip new offices which are being established. Two months' delivery is being quoted.

BOSTON

The volume of trade is still somewhat below that of a few weeks ago. The dearth of building operations is unquestionably a factor in the situation. It was announced a few days ago that the government plans to expend about \$7,000,000 in increasing the repair facilities at the Boston Navy Yard. Collections are somewhat improved, despite the retrenchment to be seen in purely civilian business. Deliveries, on the whole, are better. Liberty loan financing occupies the center of the stage, and appliances are said to be moving a little slower in retail circles for this reason. Labor appears to be getting scarcer all the time. With the successive additions to the National Army the drain upon industrial man power grows heavier, and it will become more and more a factor in the sale of labor-saving equipment and the introduction of women into the commercial fabric.

ELECTRIC RANGES.—The demand for these exceeds the ability of central stations in the larger areas to provide the necessary service. Prices are steady. The principal limitation to a widespread extension of electric range application appears to be the restrictive policy of central stations regarding new services.

WASHING MACHINES.—Business continues remarkably healthy in these units. Even the smaller contractors and dealers are taking up the merchandising of washers successfully. No recent price changes are noted.

CONDUIT.—Nothing very encouraging can be said about deliveries. Some jobbers who stocked up long ahead of the present demand for larger-sized pipe are still filling orders promptly. With the government's restrictions upon conduit shipments the outlook is not very satisfactory for stock accumulation along broad lines.

APPLIANCES.—Business is a little quieter, owing, according to some observers, to popular absorption in the third Liberty loan campaign. Vacuum cleaners are moving well, as are irons, toasters and heating pads.

MOTOR-DRIVEN COAL LOADERS.—The demand is very healthy for portable machines of this type. One New England manufacturer is placing at least one outfit a week in service by making delivery over the road and ordering stock from Boston distributors. The small alternating-current motors used are now being obtained with little delay through city jobbers.

FLASHLAMPS.—Dealers report a shortage in miniature lamps and some difficulty in filling stocks due to railroad delays. Government demands are very heavy for miniature lamps and have interfered with the production of standard types. Sales to cantonments and navy yards are in good volume, the former paralleling the various draft movements campward.

FARM LIGHTING SETS.—Inquiries are coming in faster as the road conditions improve in the interior, and the outlook is excellent for the summer's business. An advance in the price of storage cells was scheduled for May 1, but the increase on farm lighting sets recorded some weeks ago appears to absorb this without present need of further rise.

FUSES.—Stocks are substantial and business is well maintained.

ASBESTOS AND EBONY BOARD.—The demand for this material is very heavy for both land and marine work. Labor is scarce, and prices were advanced about two weeks ago. Factory facilities are hard pushed to get out the orders now on the books, and there is a present scarcity in the more common thicknesses of this insulating material.

PORCELAIN FITTINGS.—Some improvement in deliveries is noted. The available stocks are rather spotty in regularity of sizes and types, but the situation is showing signs of real betterment.

ATLANTA

Although indications point to a lessening of activity in industrial ventures and construction for this week, the volume of building appears to be holding up fairly well, considering the fact that all energies are now being utilized to put across the third Liberty loan. New organizations are confined principally to cotton products, oil refineries and minerals. Government expenditures in the South continue as anticipated. Extensive construction is being carried on in Alabama, Florida, Georgia, North Carolina and bordering States. This construction covers barracks, hospitals, warehouses, aviation field developments and cantonment extensions. Manufacturers report a falling off in inquiries and actual sales to central stations. The volume of sales in large apparatus has reached a low level.

TRANSFORMERS.—The call for distributing-type transformers from the central stations shows a decrease, with a corresponding report from factories that capacities up to 100 kva., 2300 volts to 6600 volts, are promised for four weeks, 33,000 volts for six weeks. Ratings up to 200 kva. covering the same voltage range are promised for eight weeks. The slowing up of central-station demand is offset to some extent, however, by steady government buying of ratings from 50 kva. to 200 kva. Local stocks are in good shape in capacities to 25 kva. While freight embargoes are affecting all lines more or less, transil oil, especially, is slow in coming in. Rumors are afloat that transformers are due for a jump in price soon.

SERIES LIGHTING OUTFITS.—Manufacturers report that business from the central stations is light. A strong demand continues, however, from government sources. A substantial demand exists, too, from textile mills for village

street lighting. This class of business has created a strong demand for the pole-type constant-current transformer. Stocks of the stationary-coil type are good. Shipments on the movable-coil type are promised for four to six weeks.

FLOODLIGHTING.—The volume of sales to industrials and government account is big, with a decided increase over the past few months. For spot-light purposes the 400-watt is popular, but for general floodlighting the 1000-watt unit seems to come in for greater utility. Shipments are slowing up materially, owing to the fact that factories are deluged with orders. Local stocks are kept depleted by constant government requirements necessitating immediate delivery. Prices remain steady.

INSTRUMENTS.—Substantial sales are recorded for the various switchboard types. The volume of sales originates at industrial sources, however, as very little business of this nature is coming from central stations at this time. The demand for portables is steady and satisfactory. Shipments are very good considering present conditions.

METERS.—A decided slump has been noted of late, covering both the popular residence and the polyphase power type. The present volume of business compared with last year shows a decrease of approximately 50 per cent.

OIL CIRCUIT BREAKERS.—A steady demand exists from industrial sources. Central-station sales are off, showing only spotty tendencies of improvement. Shipments continue slow.

SEATTLE

A gratifying volume of sales for the past month is being maintained along the line of domestic appliances. There has been a noticeable increase, particularly in sales of washing machines and vacuum cleaners of the small hand type. Sales of sewing machines also show a decided increase over the past week. Retailers report the movement of sewing and washing machines as unexcelled. The feature of the week's business, however, was the award of a contract for a large amount of general electrical supplies for shipyards in the Portland territory. The larger part of the order was schedule materials, although there was some power apparatus. With but one exception this contract was the largest awarded since the first of the year. There were no fluctuations in prices during the week, although some were expected.

The arrival of several cars of conduit assisted materially in relieving the strained condition which has existed the past month. Notices were received by local jobbers of other cars en route, and the situation at present looks considerably brighter. A carload shipment of sewing machines will fill back orders and replete exhausted stocks. The lamp shortage in Seattle is relieved somewhat, still there is a dearth of larger sizes. Sales to shipyards and industrials in the Seattle field show no decided increase or decrease. The Gray's Harbor and Portland fields report increasingly heavy sales. The establishment of several projected concrete shipbuilding plants in the Northwest at Everett, Tacoma and Vancouver, Wash., is attracting considerable attention.

Authorities state that the actual production of lumber under the eight-hour day in the Pacific Northwest continues to be approximately 10 per cent less than under the normal ten-hour capacity. Indications point to heavily increased government buying to care for additional cantonment building, ship materials and for 100,000 freight cars. It is unofficially reported that car building at plants in Seattle, Tacoma and Portland will share in the government's car-building program.

Reports from various cities in the Northwest indicate that building operations this summer will be much greater than in many years. In line with other shipbuilding cities in the Northwest Astoria, Ore., has taken steps to secure a portion of the fifty-million-dollar fund appropriated by Congress for the relief of the shipyard housing problem. Spokane is experiencing unusual activity in building with particular reference to repairs and improvements of medium-priced residence properties. Smaller towns throughout the Inland Empire also report increased building.

Within the next few weeks an army of 3000 soldier farmers will be released from military duties at Camp Lewis to

assist farmers in eastern Washington and Oregon in planting spring crops.

Pole-line materials, replacements and general maintenance work, especially in eastern Washington, have resulted in increased sales of poles, cross-arms, insulators, etc. The volume of sales in the Puget Sound territory is below expectations. Along this line utility companies are confining themselves strictly to maintenance work. In porcelain the predicted advance has not materialized. Recent heavy sales have reduced stock materially. New stocks are comparatively hard to obtain. Collections are not suffering from the Liberty loan drive.

SAN FRANCISCO

The electrical business is slowing up, especially in the volume furnished by dealers and contractors.

Collections are reported slower than for a few weeks past. The most notable building permits are still for canneries, Rosenberg Brothers reporting a five-hundred-thousand-dollar packing and storage plant. And it is significant that similar work in Mountain View has been held up for lack of industrial housing. Representations have already been made to Washington in this regard. The United States government has leased forty additional acres for its San Pedro cantonment and intends to enlarge the Letterman Hospital in San Francisco and the Benicia Arsenal. Notable shipbuilding construction is a four-way equipment for the Union Construction Company at the Oakland mole and a larger plant and concrete dry dock for the Rolph Shipbuilding Company on the Alameda shore of the bay.

BELLS.—Sales of small iron box bells are slow, but there is a big call for large bells, especially waterproof bells and specially wound types for shipbuilding work. This demand is so large and so well maintained that some manufacturers are carrying large-sized bells of this sort wound for 100-volt direct current for Pacific Coast delivery. Also to be noted is the increasing use of transformer bells.

HOUSE GOODS.—This line, which includes annunciators, push-buttons and other fancy electrical hardware, is very slow, owing to lack of house and hotel wiring.

SCHEDULE MATERIAL.—Demand has suffered in common with all other staple contracting lines. Because of increase in freight rate the prices on standard sockets and switches are to be advanced 10 per cent. The best-moving schedule item just now is the National Code fuse, which is being supplied in lots of 1000 and 5000 to shipbuilding plants.

FIRE-ALARM MATERIAL.—Each week brings its quota of inquiries, most of which originate from lumber plants and mines, although the increasing lawless element has caused several towns to consider some assistance. Particularly noticeable is the demand for electric sirens, which seem to have been standardized for effective alarm work.

CONSTRUCTION TOOLS.—The demand is very slack on account of a lack of extension work and because of the quiet winter, which was free from storms that necessitated reconstruction.

TAPE.—The total demand is about 20 per cent below that of last year, but tape is difficult to get from the Eastern factories, which usually require four weeks to fill an order. To this must be added forty days for delivery to the Pacific Coast.

STANDARD PORCELAIN MATERIAL.—The demand is very quiet because of lack of country house-wiring jobs. Stocks are good.

GLASS INSULATORS.—The price was recently advanced about 15 per cent because of the increased freight rate. There is very little demand owing to the almost complete shut-down on all power extensions. Local stocks are good, in fact, too good for present conditions.

RAILWAY EQUIPMENT.—Stocks are big, with absolutely no demand, save for a few extra field coils. Practically no railway motors are being shipped.

LAMPS.—Deliveries and sales are good, and, as the market is in a very healthy condition, the sales from lamp agents are good and are well handled.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil.....	List to \$61.00
Coil to 1000 ft.....	10% to 57.25
	No. 12 Solid
Less than coil.....	List to \$71.00
Coil to 1000 ft.....	10% to 66.75

Twin-Conductor

	No. 14 Solid
Less than coil.....	List to \$104.00
Coil to 1000 ft.....	\$97.75 to 10%
	No. 12 Solid
Less than coil.....	List to \$135
Coil to 1000 ft.....	10% to \$126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%
	No. 12 Solid
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%

Twin-Conductor

	No. 14 Solid
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%
	No. 12 Solid
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to \$24.00
1/5 to std. pkg.....	20% to 19.80
Std. pkg.....	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+ 20% to 12%
1/5 to std. pkg.....	20% to List
Std. pkg.....	28% to 44%

BATTERIES, DRY

NEW YORK

	No. 6 Regular	No. 6 Ignitor
Each Net		
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

BATTERIES, DRY—Continued

CHICAGO

	No. 6 Regular	No. 6 Ignitor
Each Net		
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175-.3195	.3275-.3295
Barrel lots.....	.2875-.2895	.2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.....	Net to \$75.00	—15% to \$69.75
3/8-in. d. stp. + 10%.....	75.00	List to 72.00
1/2-in. s. stp.....	List to 100.00	—15% to 93.00
1/2-in. d. stp. + 10%.....	100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$75.00	\$63.75
3/8-in. double strip.....	78.25-78.75	71.25-71.75
1/2-in. single strip.....	100.00	85.00
1/2-in. double strip.....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$24.45	\$20.00-\$21.50
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00	\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.00-\$55.00	\$25.00	\$22.50
1/4-in.—	\$40.00-\$60.00	\$27.00 to \$29.00	\$25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37 1/2
2 1/2.....	.58 1/2
3.....	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	4% to 12%	7% to 15%
2500 to 5000 lb.....	6% to 14%	9% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	5.3% to 8.9%	8.3% to 11.9%
2500-5000 lb.....	7.3% to 10.9%	10.3% to 12.3%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....	\$6.00
Discount.....	30%

CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50
	600-Volt		
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	30%
1/5 to std. pkg.....	40% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28% to 30%
1/5 to std. pkg.....	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.....	\$5.00
1/5 to std. pkg.....	4.50
Standard packages, 500.....	List, each \$0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.....	\$6.25
1/5 to std. pkg.....	5.25
Standard packages, 500.....	List, each \$0.07.

LAMPS, MAZDA			
105 to 125 Volts			
Regular, clear:	Std. Pkg	List, Each	
10 to 40-watt-B.....	100	\$0.30	
60-watt-B.....	100	.35	
100-watt-B.....	21	.70	
75-watt-C.....	50	.70	
100-watt-C.....	24	1.10	
200-watt-C.....	21	2.20	
300-watt-C.....	24	3.25	
Round bulbs, 3 1/4-in., frosted:			
15-watt-G 25.....	50	.53	
25-watt-G 25.....	50	.55	
40-watt-G 25.....	50	.55	
Round bulbs, 3 3/4-in., frosted:			
60-watt-G 30.....	24	.77	
Round bulbs, 4 3/8-in., frosted:			
100-watt-G 35.....	24	1.10	

DISCOUNT—NEW YORK	
Less than std. pkg.....	Net
Std. pkg.	10%

DISCOUNT—CHICAGO	
Less than std. pkg.....	Net
Std. pkg.	10%

LAMP CORD	
Cotton Covered, Type C, No. 18	
NEW YORK	
	Per 1000 Ft. Net
Less than coil (250 ft.)....	\$31.00 to \$34.90
Coil to 1000 ft.....	26.20 to 27.90
CHICAGO	
	Per 1000 Ft. Net
Less than coil (250 ft.)....	\$29.00 to \$30.00
Coil to 1000 ft.....	21.50 to 22.30

LAMP GUARDS, WIRE	
Standard packages from 50 to 150	
NEW YORK	
Net per 100	\$24.00
CHICAGO	
Net per 100.....	\$21.75 to \$25.75

OUTLET BOXES		
Nos.	List, per 100	
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00	
102—B.A., 6200, S.E., 300, A.X., 1 1/2 4 S.....	30.00	
103—C.A., 9, 4R, B 1 1/2.....	25.00	
106—F.A., 7, C.S., 1 1/2, 3 R.....	20.00	

DISCOUNT—NEW YORK		
	Black	Galvanized
Less than \$10.00 list....	25%	20%
\$10.00 to \$50.00 list....	42%	37%

DISCOUNT—CHICAGO		
	Black	Galvanized
Less than \$10.00 list....	40%	35%
\$10.00 to \$50.00 list....	50%	45%

PIPE FITTINGS	
DISCOUNT—NEW YORK	
Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%
DISCOUNT—CHICAGO	
Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED	
Two and Three Wire	
NEW YORK	
	Per 1000 Net
Less than 1/5 std. pkg.....	\$20.00 to \$38.00
1/5 to std. pkg.....	19.00 to 20.00
Standard package, 2200. List per 1000.	\$20.
CHICAGO	
	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000.	\$20.

PORCELAIN KNOBS			
NEW YORK			
Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
	5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$27.50 to \$29.00	\$30.75	
1/5 to std. pkg.....	15.60 to 20.75	24.20	
CHICAGO			
Per 1000 Net	Std. Pkg.	3500 Std. Pkg.	4000
	5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85	\$30.75	
1/5 to std. pkg.....	11.10 to \$11.40	24.20	

SOCKETS AND RECEPTACLES		
	Std. Pkg.	List
1 1/4-in. cap key and push sockets. 500	\$0.33	
1 1/4-in. cap keyless socket.....	500	.30
1 1/8-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK	
Less than 1/5 std. pkg.....	Net to \$25.00
1/5 to std. pkg.....	15% to 20%
NET PER 100—CHICAGO	
Less than 1/5 std. pkg.....	24% to 25.00
1/5 std. pkg.....	30% to 23.00

SWITCHES, KNIFE		
250-Volt, Front Connections, No Fuse		
High Grade:		
30-amp. S. P. S. T.....	\$0.80	
60-amp. S. P. S. T.....	1.20	
100-amp. S. P. S. T.....	2.25	
200-amp. S. P. S. T.....	3.48	
300-amp. S. P. S. T.....	5.34	
30-amp. D. P. S. T.....	1.20	
60-amp. D. P. S. T.....	1.78	
100-amp. D. P. S. T.....	3.38	
200-amp. D. P. S. T.....	5.20	
300-amp. D. P. S. T.....	8.00	
30-amp. 3 P. S. T.....	1.80	
60-amp. 3 P. S. T.....	2.68	
100-amp. 3 P. S. T.....	5.08	
200-amp. 3 P. S. T.....	7.80	
300-amp. 3 P. S. T.....	12.00	
Low Grade:		
30-amp. S. P. S. T.....	0.42	
60-amp. S. P. S. T.....	0.74	
100-amp. S. P. S. T.....	1.50	
200-amp. S. P. S. T.....	2.70	
30-amp. D. P. S. T.....	0.68	
60-amp. D. P. S. T.....	1.22	
100 amp. D. P. S. T.....	2.50	
200-amp. D. P. S. T.....	4.50	
30-amp. 3 P. S. T.....	1.02	
60-amp. 3 P. S. T.....	1.84	
100-amp. 3 P. S. T.....	3.76	
200-amp. 3 P. S. T.....	6.76	

DISCOUNT—NEW YORK	
	High Grade
Less than \$10 list.....	List to + 5%
\$10 to \$25 list.....	11%
\$25 to \$50 net.....	14% to 15%
	Low-Grade
Less than \$10 list.....	5% to 10%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24% to 25%

DISCOUNT—CHICAGO	
	High Grade
Less than \$10 list.....	+ 5%
\$10 to \$25 list.....	11%
\$25 to \$50 list.....	14%
	Low-Grade
Less than \$10 list.....	5%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24%

SWITCHES, SNAP AND FLUSH		
5-Amp. and 10-Amp., 125-Volt Snap Switches		
	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt. D. F.....	100	.66
10-Amp., 250-Volt Push-Button Switches		
	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd		
DISCOUNT—NEW YORK		
Less than 1/5 std. pkg.....	1st	
1/5 to std. pkg.....	15%	
Std. pkg.....	28%	
DISCOUNT—CHICAGO		
Less than 1/5 std. pkg.....	+ 20% to list	
1/5 to std. pkg.....	List to 15%	
Std. pkg.....	30%	

SWITCH BOXES, SECTIONAL CONDUIT	
Union and Similar--	List, Each
No. 155	\$0.34
No. 160 .....	.60

DISCOUNT—NEW YORK		
	Black	Galvanized
Less than \$2.00 list.....		
\$2.00 to \$10.00 list.....	List to 40%	Net to 30%
\$10.00 to \$50.00 list.....	10% to 50%	5% to 40%
	20% to 64%	15% to 52%

DISCOUNT—CHICAGO		
	Black	Galvanized
Less than \$2.00 list.....		
\$2.00 to \$10.00 list.....	25%	20%
\$10.00 to \$50.00 list.....	25%	20%
	25%	20%

TOASTERS, UPRIGHT	
NEW YORK	
List price	\$6.00
Discount	30%

CHICAGO	
List price	\$4.50 to \$6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR	
NET PRICE—NEW YORK	
	Per Lb. Net
No. 18, less than full spools.....	\$0.41 1/4 - \$0.44 1/4
No. 18, full spools.....	0.36 1/4 - 0.43 1/4

CHICAGO	
	Per Lb. Net
No. 18, less than full spools.....	\$0.57 1/2 to \$0.65
No. 18, full spools.....	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C		
Solid-Conductor, Single-Braid		
NEW YORK		
	Price per 1000 Ft. Net	
	Less than 500 to 1000 to	
No.	500 Ft.	1000 Ft.
14..	\$15.00-\$18.00	\$12.50-\$13.00
12..	23.25- 25.40	21.30- 21.80
10..	32.40- 35.20	29.70- 30.20
8..	45.70- 49.15	41.90- 42.10
6..	72.40- 77.85	66.35- 66.75
		\$9.85-\$11.50
		15.95- 19.35
		22.10- 27.00
		30.85- 38.00
		48.95- 60.30

CHICAGO		
	Price per 1000 Ft. Net	
	Less than 500 to 2500 to	
No.	500 Ft.	5000 Ft.
14..	\$18.00	\$13.00
12..	25.33-\$26.25	22.02-\$25.33
10..	30.49- 36.54	27.94- 31.26
8..	42.54- 51.57	38.99- 44.13
6..	66.46- 88.38	56.15- 75.61
		\$11.50
		18.35-\$20.93
		22.86- 29.23
		31.90- 41.36
		50.53- 70.70

WIRE, WEATHERPROOF	
Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc.	

NEW YORK	
	Per 100 Lb. Net
Less than 25 lb.....	\$33.25 to \$35.10
25 to 50 lb.....	31.40
50 to 100 lb.....	30.40 to 31.14

CHICAGO	
	Per 100 Lb. Net
Less than 25 lb.....	\$33.42 to \$40.00
25 to 50 lb.....	34.42 to 39.35
50 to 100 lb.....	33.42 to 38.25

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Heavy-Duty Polarized Attachment Plugs

An attachment plug designed to be used interchangeably with heavy-duty polarized wall and flush receptacles has been recently placed upon the market by Harvey Hubbell, Inc., Bridgeport,

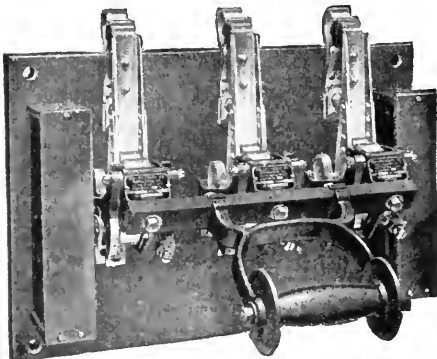


KNIFE-BLADE CONTACTS PLACED AT
RIGHT ANGLES

Conn. This heavy-duty polarized attachment plug is rated at 660 watts and 250 volts. The knife-blade contacts are placed at right angles to each other to assure polarization.

Circuit Breaker with Self-Timing Attachment

A self-timing circuit breaker for the protection of motors during starting or running is being manufactured by the Roller-Smith Company, 233 Broadway, New York City. Interposed in the path of the trip armature is a pivoted hook-shaped barrier under two independent controls. One control is thermal and depends upon the expansion of an iron rod. This rod is heated at the same rate as the motor, which is being protected by the same current that operates the motor. When the rod expands it retracts the barrier, causing the breaker armature to trip when the



BARRIER CONTROLLED BY TWO INDEPENDENT METHODS

heating is excessive. It does not matter how this excess comes about—it may be either a prolonged starting current in the motor or a variable load with high requirements.

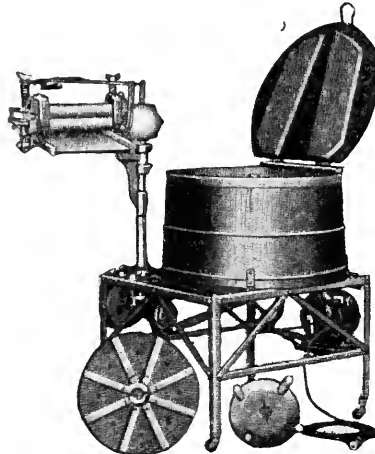
The other control, which is electro-

magnetic, retracts the barrier instantaneously if a mechanically dangerous load is suddenly applied.

Both controls are adjustable for either the maximum current which may continuously flow or the emergency overload value. They may be adjusted independently if desirable. Ordinarily, however, the controls are set to protect the average motor of normal ampere rating, therefore no further adjustment is required.

Combined Washer and Wringer

A combined washer and wringer in which a dolly and a disk are used to agitate the clothes is being manufac-



REVERSIBLE WRINGER MAY BE PLACED IN
FOUR DIFFERENT POSITIONS

tured by the Superior Machine Company, Sterling, Ill. It is known as the "Submarine" type and is belt-driven by a 0.25-hp. electric motor, which also operates the wringer by means of gears and rod drive. The wringer is reversible and may be placed in four different positions, so that all of the operations, involving rinsing, wringing, etc., can be performed easily. This line of washing machines is manufactured in several different styles including a short-bench type, a twin-tub washer with wringer in between, and an extended-stave-leg type.

Attachment Plug with Few Parts

An attachment plug that has no screws to disassemble or lose is being manufactured by Mueller Electric Company, 423 High Avenue, Cleveland, Ohio. The plug has screw connections, so soldering is not required for connection to the appliance. An interest-

ing method is used to connect the terminal to the brass shell of the plug. The brass shell, as shown in the accompanying illustration, is removed, and the terminal is inserted through the slot in the composition shank. The



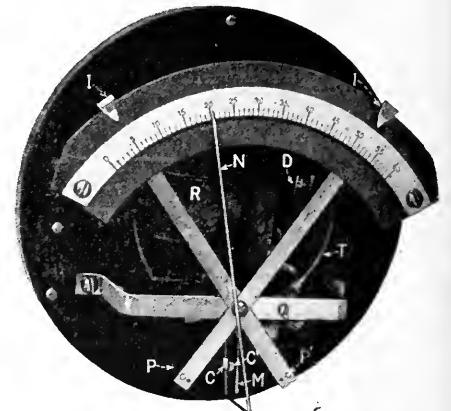
TERMINAL CONNECTION MADE BETWEEN
SHELL AND COMPOSITION SHANK

brass shell is then replaced and when screwed on to the composition shank holds the terminal against the shank in such a manner as to provide a permanent connection. The device is small and adapted for any kind of electric appliance.

Automatic Pressure Governor

A pressure governor to control standard self-starters for motor-operated pumps and compressors has been developed by the General Electric Company, Schenectady, N. Y. The governor will maintain a pressure between predetermined limits on any gas or liquid systems that will not corrode the Bourdon tube.

This governor is listed as CR 2922 and can be used on any standard alter-



POSITION OF STOPS IN SCALE CONTROLS
RANGE OF PRESSURE IN TANK

nating-current or direct-current circuit. It is rated for pressures of from 60 lb. to 500 lb. (89 kg. to 69 kg. per sq. cm.) and will operate within settings of from 3 lb. to 12 lb. (1.4 kg. to 5.4 kg.) between high and low pressures. Gov-

errors for higher pressures can be supplied if desired.

The governor consists of a Bourdon tube, an indicating needle, a graduated pressure scale, adjustable pressure stops and a relay which actuates the contacts in the control circuit of the self-starter. The free end of the tube *T* in the illustration produced herewith is mechanically connected to the indicator needle *N* and moves it over the scale as changes of pressure affect the tube.

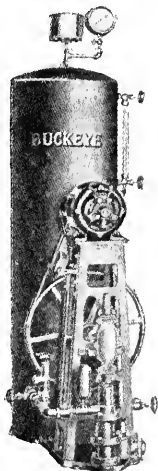
When the pressure is at the low limit the contact *C* on the needle *N* completes the circuit through the contact *C'* on the movable arm *M*, which at the low-pressure limit rests against the stop *P*. When this contact is made the circuit is completed through the relay coil *R*, causing the armature to close, and causes the motor to operate. The relay armature is attached to the spring which holds the contact *C* firmly against *C'* until contact is broken at *P*.

As the pressure increases the needle pointer moves to the right, and its lower part, to which the contact *C* is attached, moves to the left, followed by the movable arm *M*. When the high-pressure limit is reached the movable arm is prevented from traveling further by stop *P*. The needle continues its course, breaking the circuit by separating contacts and de-energizing the relay *R*.

Automatically Controlled Electric Pump

Mast, Foos & Company, Springfield, Ohio, have recently placed on the market the "Buckeye" electric house pump for use with cisterns and shallow wells. It can be operated by energy from electric service or trolley lines or from a farm lighting and power system.

The pump is controlled by an automatic switch and is provided with large oil pockets for all bearings. It therefore requires very little attention. The



AIR CHAMBER INSURES STEADY FLOW OF WATER

driving mechanism is totally inclosed and runs in grease. Felt washers prevent the grease escaping or dirt getting into the bearings. Roller bearings of a special type are used that insure easy starting, a minimum amount of power

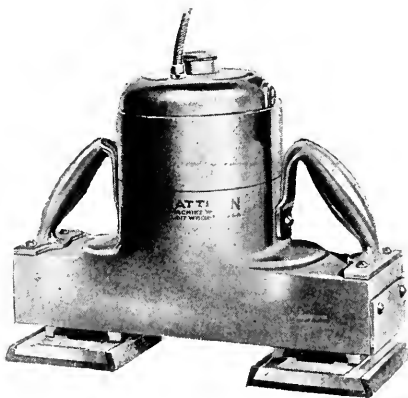
for operation, perfect alignment, and durability.

The outfit is rated at 180 gal. (681.3 l.) per hour, which is said to be sufficient for supplying all the water that would be required for the bathroom, kitchen and laundry of an ordinary dwelling. It is equipped with an air chamber and vacuum chamber to prevent water hammer and to insure a steady flow of water. The valves are faced with rubber to eliminate any noise in operation.

Very small floor space is required for this outfit because the pump is of the vertical type of construction and the motor and driving mechanism are placed directly above the pump proper.

A Motor-Operated Rubbing Machine

A motor-operated rubbing machine for wood-surface finishing has been developed by the Mattison Machine Works of Beloit, Wis. The machine is operated by a General Electric Company fractional-horsepower motor which moves the rubbing blocks together and



DUST-PROOF CASE PREVENTS INJURY TO THE MOVING PARTS

apart at an even speed. The speed is governed by a regulator which can be varied according to the class of work to be done. The machine is inclosed in a dust-proof aluminum case and weighs about 35 lb. (15.8 kg.). This weight gives sufficient pressure for ordinary purposes, but additional pressures can be applied by the operator if it is desired. The device can be used for rubbing surfaces 15 in. (3.8 cm.) in length and of practically any width. It may be attached to an ordinary light socket and consumes about 250 kw.-hr. of energy.

Hand and Face Drying Machine

A machine that will heat and blow air through an adjustable nozzle for drying the face and hands has been placed upon the market by the Groton Electrical Devices Company of New York City. The machine consists of a white-enamelled iron standard with a motor, fan, heating element and mirror.

It may be connected to ordinary lighting circuits. The machine is set in operation by means of a foot lever at the base of the standard. The nozzle through which the air is discharged is adjustable so that the air may be directed on the hands or up into the face. This device is particularly adaptable to general washrooms in hotels, office buildings and public places.

Disk Stove Chafer

A device that can be used as a chafer disk stove, a frying pan or a saucepan has been developed by Landers, Frary



ELECTRIC STOVE OF MANY USES

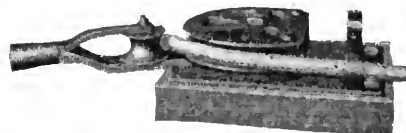
& Clark of New Britain, Conn. The two-heat appliance is equipped with a clamp which holds the pans in place on the stove. Either pan may be placed upon the stove separately or the stove may be utilized as an ordinary disk stove.

Loom Fastener for Outlet Box

A loom fastener, approved by the National Board of Fire Underwriters, that will fasten two pieces of loom at one time to an outlet box is being manufactured by J. J. Duck, 432 St. Clair Street, Cleveland, Ohio. The fastener will grip a piece of loom extending only 0.25 in. (0.63 cm.) through a box or plate. When a stud is used on the outlet box the same bolt or screws that hold the stud will also serve to hold the fastener in place. The device is made of spring brass and will hold 0.21 in. (0.56 cm.) and 0.25 in. (0.63 cm.) flexible tubing.

Open-Construction Pipe Bender

An open-construction pipe bender that will bend conduit or pipe at any angle from 1 deg. to 180 deg. is being manufactured by the Akron Electric Company of Akron, Ohio. The bender is light in weight and is strongly constructed.



PIPE MAY BE INSERTED AND REMOVED WITH EASE

It consists principally of a small bending wheel and a roller. Only a very small amount of energy is required to bend the pipe. It is constructed so that the pipe may be inserted and removed easily.

Trade Notes

G. A. BINE, formerly manager of the meter department of the Varnall-Waring Company, Philadelphia, has been appointed sales manager.

N. M. GARLAND of New York City, district manager of the Ohio Brass Company, Mansfield, Ohio, has been elected a member of the board of directors.

THE PARAGON ELECTRIC COMPANY of Chicago on May 1 removed from 9 South Clinton Street to larger quarters in the Old Colony Building, 37 Van Buren Street.

THE JEFFERY-DEWITT COMPANY, manufacturer of high-tension disk insulators, will after June 1 move its factory from Detroit, Mich., to Kenosha, W. Va.

LANDERS, FRARY & CLARK of New Britain, Conn., have purchased the business of the National Electric Utilities Company, of New York City, and will increase and develop it.

THE SUNDH ELECTRIC COMPANY of New York City on May 1 removed its main offices and factory to Avenue C and Parkhurst Street, Newark, N. J. The New York office is at 51 East Forty-second Street, room 301.

ALBERT TATE SMITH, lately manager of the R. U. V. Company, 50 Broad Street, New York City, has returned to the Permutit Company, with which he was formerly connected, to take the position of assistant manager of sales. Mr. Smith is widely known in the water purification field.

THE MACLEOD MANUFACTURING COMPANY of Chicago announces that it will move from its present factory at 420 Orleans Street to its new building at the corner of Austin and Wells Street. This company manufactures extension brackets for telephones and other office supplies.

THE SPRAGUE ELECTRIC WORKS OF THE GENERAL ELECTRIC COMPANY, New York City, announces the removal of its office in Boston from 201 Devonshire Street to 81 State Street, room 906; also the removal of its quarters in St. Louis from the Chemical Building to the Pierce Building, room 1352.

CHARLES C. SCHNEIDER, manufacturers' agent, has moved from 329 to 327 Broadway, Market Building, Detroit, Mich., where larger quarters have been secured. Mr. Schneider, who represents the Pittsburgh Lamp, Brass & Glass Company, has recently added to his line the transformers made by the Cumberland Electric Company of Memphis, Tenn.

THE NATIONAL BANK OF COMMERCE of New York City has printed the export trade associations act (Webb act), as approved April 11, with annotations, in convenient pamphlet form. The enactment of the law is a decisive step in the direction of an expansion of foreign trade. Copies may be had by applying to the foreign department of the bank.

FRED W. GODFREY has severed his connection with the Republic Electric Company to become associated with the American Carbon & Battery Works of the National Carbon Company, Inc., of East St. Louis, Ill. Mr. Godfrey will cover all of Minnesota, North and South Dakota, Nebraska, Colorado, Montana, Wyoming, Utah, Idaho and New Mexico. He has traveled the Central West for many years.

W. W. EWING, special agent of the Department of Commerce, Bureau of Foreign and Domestic Commerce, of Washington, D. C., has just finished an investigation, made on the ground, of Colombian markets for construction materials and machinery. In this report will be found a general introduction covering industries, resources, means of communication, architecture and construction, etc., in Colombia, S. A., and chapters devoted to specific building activities, markets for particular lines of materials and machinery, and commercial practices and requirements—all the preliminary data needed to form an estimate of the possibilities of the field. Mr. Ewing finds that Americans have a bigger business in Colombia now than when the war started and sees no insurmountable obstacles in the way of doing even better when peace is made. Copies of the report can be obtained by writing to the superintendent of documents, Washington, D. C., or to any of the district offices of the Bureau of Foreign and Domestic Commerce. The co-operative offices have copies for those who apply in person.

GERMAN-RUSSIAN TARIFF DISPUTES.—The strained tariff relations that existed between Russia and Germany much of the time between 1890 and the outbreak of the war are described in a report just

made public by the Bureau of Foreign and Domestic Commerce, Department of Commerce. The author of the report, Louis Dameratzky, tariff expert of the bureau, gives it as his opinion that, aside from political contingencies, which were not without influence on the tariff relations of the two countries, Russia has been at a disadvantage in negotiating commercial treaties with Germany. The author considers it extremely hazardous to make any forecast as to the future tariff relations between the two countries, but discusses at some length the situation as it existed a few months before the war started. Copies of "Tariff Relations Between Germany and Russia," Tariff Series No. 38, can be obtained at the nominal price of 5 cents from the superintendent of documents, Government Printing Office, Washington, D. C., or from any of the district or co-operative offices of the Bureau of Foreign and Domestic Commerce.

Trade Publications

COAL CONVEYOR.—A single-rope coal conveyor is described and illustrated in a circular distributed by John F. Godfrey of Elkhart, Ind.

VACUUM CLEANERS.—The "Liberty" cleaner, Model C, is described in a folder issued by the Innovation Electric Company, Inc., 585 Hudson Street, New York City.

PLANERS.—The Powell Machine Company, Worcester, Mass., is distributing descriptive bulletins of its various patent planers for high-speed cuts and for standard work.

BUSBAR SUPPORTS.—The Electrical Engineers' Equipment Company is distributing advance sheets on its bulletin No. 107, which describes its new line of busbar supports.

ELECTRIC APPLIANCES.—A catalog and price list of electrical appliances is being distributed by the Hotpoint division of the Edison Electric Appliance Company, Inc., of Ontario, Cal.

SECTIONAL CABINETS.—Sectional cabinets for display counters and for holding tools are illustrated in a bulletin recently issued by Stevens & Company, 375 Broadway, New York City.

CLAMP INSULATOR SUPPORTS.—The General Devices & Fittings Company, Mid-City Bank Building, Chicago, has recently issued a bulletin describing its new clamp supports for pipe and flat mounting.

BLUEPRINT RACKS.—The "Presto" quick-acting holder for blueprints, records, charts, drawings, newspapers, etc., is illustrated in a circular distributed by the National Company, 275 Congress Street, Boston.

REGULATORS AND ADAPTERS.—Regulators and adapters for motion-picture projection for Mazda lamps are covered in a bulletin recently issued by the Argus Lamp & Appliance Company, 322 Euclid Avenue, Cleveland, Ohio.

MOTOR-GENERATOR SETS.—Bulletin No. 3602 is being distributed by the Emerson Electric Manufacturing Company of St. Louis, describing its alternating-current motor-generator sets both with and without switchboards and rheostats.

CIRCUIT BREAKERS.—The Roller-Smith Company of 233 Broadway, New York City, is distributing bulletin No. 501, describing its "self-timing" circuit breakers. These circuit breakers are both thermally and electromagnetically controlled.

SWITCHES.—The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has recently issued a small two-color envelope folder, publication No. 242, which illustrates and describes the single and two-circuit brass shell used in its porcelain pendent switches.

OXY-HYDROGEN GENERATOR.—The Electrolytic Oxy-Hydrogen Laboratories, Inc., 15 William Street, New York City, have issued a bulletin describing the Levin oxygen and hydrogen generator. The products of this company are sold under the trade name of "Electrolabs."

CENTRIFUGAL PUMPS.—The Wheeler Condenser & Engineering Company of Carteret, N. J., has recently published a bulletin, No. 108-B, embracing its line of centrifugal pumps. The bulletin shows the latest Wheeler turbine-driven geared centrifugal pumps of various types. Pumps are made for nearly all requirements where large volumes of water must be pumped against low heads.

INCLOSED SWITCHES.—The Square D Company, Detroit, Mich., has issued a new catalog, No. 24-B, describing the Square D

steel inclosed safety switches. The book is of convenient size and can be carried in the pocket for ready-reference purposes. Prices and descriptions of the entire Square D line are given, together with a table of wiring data for single-phase, three-phase and direct-current motors.

LIGHTING APPARATUS.—"Stage and Studio Lighting Apparatus and Electrical Effects" is the title of a new catalog issued by the Universal Electric Stage Lighting Company, 240 West Fifth Street, New York City. The bulletin illustrates and describes many developments in stage lighting which have recently been accomplished. Accessories for motion-picture photography are also included in the bulletin.

STOKERS.—The Sanford Riley Stoker Company, Ltd., Worcester, Mass., has issued a new catalog describing the Riley underfeed stoker. The booklet is well illustrated and shows the construction features and installations of the stokers. Engineering data are also given, together with outline drawings showing the cross-sections and views of different boiler installations. A separate circular included in the catalog gives a list of representative installations of Riley underfeed stokers.

COPPER CASTINGS.—The Titanium Bronze Company, Inc., Niagara Falls, N. Y., has issued a bulletin entitled "High-Conductivity Copper Castings." The bulletin describes copper castings, their manufacture and method of rolling, and tells why high conductivity is needed. Small quantities of impurities present in copper castings may reduce their conductivity by even one-half. Tables are given showing the effect of a mixture of copper with specific quantities of various substances.

ELECTRICAL DEVICES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued several additions to its catalog, describing overhead relays, automatic starters and portable hoists and dumbwaiter motors. The company has also published electrification data in a bulletin entitled "Electrification of Railroads as a War Measure." This bulletin gives the mechanical features of electrification and shows the various characteristics of electric locomotives used in the electrification of steam railroads.

New Incorporations

THE BRANTLEY ELECTRICAL COMPANY of Terrell, Tex., has been chartered with a capital stock of \$2,000 by A. L. Brantley and others.

THE HELD ELECTRIC COMPANY of Utica, N. Y., has been incorporated by J. E. Vaeth, H. I. and J. P. Held of Utica. The company is capitalized at \$5,000 and proposes to manufacture electrical goods.

THE STERLING ELECTRIC COMPANY of Sacramento, Cal., has been incorporated with a capital stock of \$25,000 by W. A. Weight, C. Weight, C. E. Turner, T. L. Nightingale and Lee Gebhart, Sacramento.

THE ACME-ELECTRIC OIL COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$250,000. The incorporators are: Charles D. Allee, J. B. Bailey and L. B. Phillip of Dover, Del.

THE IDEAL ELECTRIC THERAPEUTIC APPARATUS CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$5,000 by A. and S. Cooper and D. Hertman, 160 East Twenty-third Street, New York City.

THE SLUGLAND POWER COMPANY OF NEW JERSEY has filed articles of incorporation with a capital stock of \$250,000. The incorporators are: Leonard Slugland, Frank P. Venable, John H. Mussiner, Louis J. Patmos, all of Paterson, N. J.

THE W. & R. MANUFACTURING COMPANY of New York, N. Y., has been incorporated with a capital stock of \$100,000 by A. J. Lalibert, L. T. Fetzer and H. Macintyre, 220 West Forty-ninth Street, to make heating and lighting systems.

THE PROGRESSIVE ELECTRIC COMPANY of New York, N. Y., has been chartered by George F. Broyn, 1462 Vyse Avenue, Bronx; Joseph Segal and Philip Segal of New York, N. Y. The company is capitalized at \$5,000 and proposes to manufacture and deal in electric equipment.

THE TIRRELL MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at \$50,000 and proposes to manufacture electric-light controllers. The incorporators are: C. L. Rimlinger, M. M. Clancy and F. A. Armstrong of Wilmington, Del.

New England States

PLYMOUTH, N. H.—The Plymouth Electric Light Company is erecting an electric transmission line to the village of Livermore Falls, a distance of 2 miles, to supply electrical service there. Electricity will also be supplied to residents along the line.

PORTSMOUTH, N. H.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 6, under specifications 2904, for furnishing and installing an intake tunnel and circulating pump at the navy yard at Portsmouth, N. H. The cost is estimated at \$45,000.

BOSTON, MASS.—Bids will be received by the lighthouse inspector, Boston, Mass., until May 7 for two oil-engine-driven air-compressing outfits. Further information may be obtained at the above office.

PALMER, MASS.—Plans are being prepared by the Wright Wire Company, 69 Hammond Street, Worcester, for the erection of a new power house, 100 ft. by 125 ft., at its local plant. Griggs & Myers, 110 West Fortieth Street, New York, N. Y., are architects and engineers.

BRIDGEPORT, CONN.—Contract has been awarded by the Bryant Electric Company to Martin & Son for the construction of an addition 60 ft. by 128 ft. to its plant.

Middle Atlantic States

BUFFALO, N. Y.—Plans are being prepared by Frank M. Williams, state engineer, Albany, for a freight and transfer warehouse for the New York State Barge Canal Terminal, Erie Basin, Buffalo, which will be equipped with crane and conveying equipment.

BUFFALO, N. Y.—The final schedule of streets is now being arranged in connection with the installation of the proposed new underground conduits to replace the present overhead wires in various districts of the city. The work will be done by the New York Telephone Company, the Buffalo General Electric Company and other public utilities operating in this section.

MASSAPEQUA, N. Y.—Contract has been awarded by the Board of Supervisors of Nassau County to the Tucker Electric Construction Company, 114 West Thirtieth Street, New York City, for the electrical work in connection with the erection of the new tuberculosis hospital at Massapequa.

MOHAWK, N. Y.—Plans are being prepared by Frank M. Williams, state engineer, Albany, for the construction of a hydraulic power plant on the State Barge Canal at Mohawk, N. Y.

NEW YORK, N. Y.—Contract has been awarded by the board of trustees of Bellevue and Allied Hospitals, 415 East Twenty-sixth Street, to Charles K. Daly, 172 Paynter Street, Long Island City, for the construction of a power house.

NIAGARA FALLS, N. Y.—Plans for power development by the merged Niagara Falls Power Company, the Cliff Electrical Company and the Hydraulic Power Company, authorized by the State Legislature, have been approved by the War Department. Construction work, involving an expenditure of about \$16,000,000, to permit the development of 400,000 hp. from 20,000 cu. ft. authorized to be diverted from the Niagara River by the British-American treaty, will begin as soon as the federal government sanctions the consolidation.

SYRACUSE, N. Y.—Plans are being prepared by the Syracuse Lighting Company for the construction of an electric plant on South Warren Street.

SYRACUSE, N. Y.—The Continental Can Company of Syracuse has awarded contract for the construction of a power house and coal pocket at its factory, to cost about \$60,000.

WATERVILLE, N. Y.—Plans are under consideration by the Waterville Gas & Electric Company for the construction of a new electric plant.

BLOOMFIELD, N. J.—Plans are being considered by the Town Council for improvements to the electric fire-alarm system.

BORDENTOWN, N. J.—Plans are being considered by the City Commissioners for the installation of electrically-operated pumps at the waterworks pumping station.

CAMDEN, N. J.—Permit has been taken out by Kind & Lantesmann for the construction of a new boiler plant at the head of Fifth Street.

HAMBURG, N. J.—The township committee is considering the installation of a new electric street-lighting system.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

JERSEY CITY, N. J.—Plans are being considered by Swift & Company, 154 Ninth Street, for building an addition to their engine and power plant on Henderson Street, to cost about \$23,700.

NEWARK, N. J.—Plans have been filed by A. Fink & Son, 810 Frelinghouse Avenue, for the erection of an addition to the engine house at its works.

PERTH AMBOY, N. J.—The Standard Underground Cable Company, 26 Washington Street, is reported to be considering the construction of a new plant in Ideal Park, on property recently acquired. The company manufactures cables, electric conduits, etc.

PHILIPSBURG, N. J.—Improvements to the electric street-lighting system, including the installation of a number of new lighting units, are under consideration by the Town Commissioners.

POMPTON LAKES, N. J.—The Council is considering the construction of a new municipal electrical power plant on Corning Lake. An ordinance authorizing an issue of \$46,900 for this purpose has been adopted by the Council.

ALTOONA, PA.—Plans have been prepared for an addition, 50 ft. by 130 ft., to the plant of the Altoona Storage Battery Company, 802 Chestnut Street, to cost about \$10,000.

COATESVILLE, PA.—Plans are being considered by the West Chester & Conestoga Traction Company for the construction of an electric railway from the proposed terminus, commencing at the South City line on First Avenue and extending to the iron and steel mills in the center of the town.

HAZLETON, PA.—The Cranberry Creek Coal Company is planning to equip its Cranberry mines for electrical operation by 1920. Overhead trolley wires have been abolished and the mine motors are now charged by storage batteries. The pumps will also be driven by electricity.

HAZLETON, PA.—The Lehigh Valley Coal Company contemplates equipping its entire chain of mines in the Lehigh field for electrical operation as soon as the war is over. The Oneida stope No. 4 will be equipped with electrically-driven machinery this summer. The Gowen & Wolf mines, just put into service, are equipped with electrically-operated machines and hoists.

HOLTWOOD, PA.—The Pennsylvania Water & Power Company is erecting an electric transmission line, 10 miles long, from Holtwood to a point on the Gunpowder River for the government. This line will transmit electricity to the proving grounds of the government at Aberdeen.

MANORVILLE, PA.—Work has begun on the construction of a new power house in connection with the new local plant of the Triple Airless Tire Company of Pittsburgh. The cost of the entire work is estimated at about \$85,000. Herbert & Henderson of Kittanning are architects.

PHILADELPHIA, PA.—Contract has been awarded by the E. F. Benson Company, 926 North Delaware Avenue, to the William Steele & Sons Company, 32 South Fifteenth Street, for the construction of an addition to its engine plant.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 6, under specification 2923, for a motor-driven, two-stage duplex air compressor, having a capacity of 1000 cu. ft. of free air per minute at the navy yard, Philadelphia, Pa.

PHILADELPHIA, PA.—Contract has been awarded by the Badenhausem Boiler Company, 1425 Chestnut Street, Philadelphia, for the construction of a machine shop, 200 ft. by 350 ft., at its boiler works, Cornwells. The company is also planning to erect a five-story office building, 25 ft. by 175 ft., on Walnut Street, Philadelphia, to cost about \$50,000.

PITTSBURGH, PA.—Contract has been awarded by the Heppenstall Forge & Knife Company, Forty-seventh and Hatfield Streets, for the erection of a new boiler plant at its works to C. Huntsman, Pittsburgh, to cost about \$23,000.

SCRANTON, PA.—The Mill Creek Coal Company has recently placed a contract with the Scranton Construction Company for the installation of electrical equipment at its Morea colliery. Energy for operat-

ing the machinery in the mines and also for lighting the interior of the mines and the outside plants will be supplied by the Eastern Pennsylvania Electric Light, Heat & Power Company of Pottsville. The cost of the improvements is estimated at \$200,000.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until May 10 for furnishing two 3½-ton motor trucks for use in the water department. Specifications may be obtained from the purchasing officer, Room 320, District Building, Washington.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 13, under specification 2905, for power plant improvements, to cost about \$35,000. Further information may be obtained from the chief of bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 10 for furnishing, under Schedule 4298½, one generating set at the Brooklyn Navy Yard. Bids will also be received until May 6, under Schedule 4315½, for furnishing 5800 ft. single-conductor cable at Portsmouth, N. H.; Schedule 4318½, for one generating set to be delivered at Pensacola, Fla.; Schedule 4322½, for howlers, annunciators, bells and buzzers to be delivered at Detroit.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 6 for furnishing, under Schedule 4180½, electrical material, including switchboards, switches, lamps, etc. Bids will also be received, under specification No. 2879, for furnishing and installing a complete switching equipment for the control of machines in the substations and for the various incoming and outgoing feeders and all connections between panels and the machines.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 6, under specification 2913, for an electric traveling crane in the structural shop at Norfolk, Va. The cost is estimated at \$8,500.

North Central States

CINCINNATI, OHIO.—Bids will be received by the Board of Education of Cincinnati, Denton Building, until May 13 for furnishing and installing a system of electric clocks and bells in the Lincoln Public School Building. Plans and specifications are on file at 511 West Court Street.

CINCINNATI, OHIO.—All bids submitted for the installation of lighting fixtures in the new court house building have been rejected by the new court house building commission, all bids received having been too high. The lowest bid, which was submitted by the St. Louis Brass Manufacturing Company, was \$62,477. The price fixed as the base figure upon which subsequent bids are to be made is \$60,000. Some changes in design of the fixtures, to make them less elaborate, will be made.

HAMILTON, OHIO.—Plans are being considered for improvements to the municipal electric-light plant.

ST. PARIS, OHIO.—Bonds to the amount of \$5,500 have been voted for improvements to the municipal electric-light plant.

TOLEDO, OHIO.—Press dispatches from Washington state that the War Department has announced that government nitrate plant No. 3, composed of two half units, would be located in Toledo, Ohio, and at Elizabethtown, near Cincinnati. The half unit to be erected at Toledo will be located on the outskirts of the city in the vicinity of the new Acme generating station of the Cities Service Company. The government will expend about \$22,000,000 on this plant and will require a 24-hour load of 35,000 kw. of electric energy, which will be furnished by the Acme Power plant. To provide for this service a second 20,000-kw. generating unit will be installed, making the total output of the plant 40,000 kw. Financing for the installation of the new unit and the erection of the transmission line to the nitrate plant will be provided by the government. Work on the new plant, it is expected, will begin at once.

CHARLESTOWN, IND.—Bids will be received by the township of Charlestown until May 11 for the construction of a new high school building, including electrical wiring and ventilating apparatus. The cost of the building is estimated at about \$36,000. Charles F. O. Pangburn is trustee.

INDIANAPOLIS, IND.—The capital stock of the Merchants' Light & Heat Company has been increased from \$2,000,000 to \$2,500,000.

INDIANAPOLIS, IND.—Plans are being considered by Governor Goodrich and a committee of the Legislature for the erection of one wing of a proposed building and power house for the Indiana University Medical College. The proposed building and power house will cost complete about \$150,000. It is planned to expend \$130,000 of the emergency and contingent fund for the erection of the first wing immediately.

MORGAN, IND.—Work has been resumed on the local plant of the Farmers & Merchants' Light & Power Company.

RICHMOND, IND.—The Kilo Meter Company, it is reported, is planning to erect a plant at Richmond for the manufacture of electric meters. The company's plant at Indianapolis was recently destroyed by fire.

ATHENS, ILL.—The Athens Electric Light & Power Company has filed a petition with the Illinois Public Utilities Commission for permission to erect a high-tension transmission line over the tracks of the Chicago, Peoria & St. Louis Railroad.

HOMER, ILL.—The Homer Electric Light & Power Company has been granted a franchise to install and operate an electric-lighting system in Fairmount.

PECATONICA, ILL.—The Council contemplates the installation of an electrically operated pump at the pumping station after July 1.

MENASHA, WIS.—The City Council is considering the installation of an additional engine in the municipal electric-light and water-works plant.

MILWAUKEE, WIS.—The Universal Machinery Company, 784 Thirtieth Street, Milwaukee, has purchased a site at the north limits of West Allis, on which it is planning to establish a new plant. Tentative plans provide for the erection of a machine shop, 150 ft. by 300 ft.; foundry, 90 ft. by 160 ft.; transformer building and boiler house, 40 ft. by 60 ft., and auxiliary buildings. J. E. Purdy is secretary and treasurer.

MILWAUKEE, WIS.—Bids will be received by the board of industrial education of the city of Milwaukee, Manufacturers' Home Building, Milwaukee, until May 9 for furnishing material and construction, including electric light wiring and air line conduit work, sewer and water supply work, for the first unit of the Central Continuation School, to be erected at the corner of Seventh and Prairie Streets. Plans and specifications are on file at the above office and the office of Van Ryn & De Gelcke, architects, 726 Caswell Block, Milwaukee.

RIPON, WIS.—The Wisconsin Power, Light & Heat Company of Chicago, Ill., is reported to have purchased the property of the Ripon Light & Water Company and its branches, the Greenlake (Wis.) Electric Company, the Wisconsin Power, Light & Milling Companies at Rosendale and Eldorado, the Markesan Light & Power Company and the Kingston Electric Company. These companies, it is understood, will be consolidated under the name of the Central Wisconsin Utility Company.

WINNECONNE, WIS.—The Winnebago Electric Company of Winnebago, recently incorporated, contemplates establishing an electric plant here to supply electricity for lamps, heaters and motors. Richard W. Button is one of the incorporators.

ELDORA, IOWA.—Bids will be received by Calvin Boyland, county auditor, Eldora, until June 11 for construction of boiler house, concrete or brick smokestack, concrete tunnel, heating plant and drainage.

OTTERVILLE, MO.—The installation of an electric-lighting plant, to cost about \$6,500, in Otterville, is under consideration. Jesse Straten is reported interested.

PRAIRIE HOME, MO.—The Simmons Electric Company is contemplating changing its system to 110-volt direct current, using storage battery 24-hour service, consisting of 23 Delco light units with one 60-amp. -hour, 56-cell battery. Kelly Simmons is vice-president.

JAMESTOWN, N. D.—Bids will be received by the City Council until May 6 for furnishing one double suction, two-stageolute pump with a capacity of 700 gal. per minute, against a maximum head of 20 pounds, directly connected to a 2300-volt, three-phase, 60-cycle, slip-ring motor, to be delivered on or before July 1.

MILLER, S. D.—Plans are being prepared for the reconstruction of the municipal electric-light plant and water-works system, for which \$55,000 is available. The proposed plans provide for the instal-

lation of two units (directly connected), at least two boilers, re-building distribution system, etc. Definite plans have not yet been decided upon. William Saltmarsh is manager.

BURNS, KAN.—Bids will be received by the city of Burns until May 7 for the installation of an electric-lighting system, consisting of one 30-hp oil engine, one 25-hp direct-current, 110-volt generator, one 160-amp.-hour storage battery, complete pole line, etc. Archer & Stevens, New England Building, Kansas City, Mo., are engineers.

DIGHTON, KAN.—The contract for equipment, including engines, boilers, generators, switchboard, etc., for the municipal electric-light plant has been awarded to the Merkle Machinery Company. The plant heretofore has been operated by oil engines.

YATES CENTER, KAN.—The proposal to issue bonds for a municipal electric-light plant was defeated. The Yates Center Electric Light & Power Company is contemplating selling its plant. Charles H. Opperman is manager.

Southern States

COMMERCE, GA.—At an election held recently bonds to the amount of \$15,000 were voted for the installation of an electric-light and power plant. Contracts, it is understood, have been placed for machinery and equipment. L. F. Brooks is superintendent.

MARYVILLE, TENN.—The Aluminum Company of America of Pittsburgh, Pa., is planning to build a plant to manufacture nitrate as a by-product of its present aluminum works and hydroelectric development, to cost about \$2,000,000. Electricity to operate the plant will be transmitted from the Alcoa (Tenn.) dam, now under construction, on the Little Tennessee River, 50 miles from Knoxville.

HEADLAND, ALA.—Bonds to the amount of \$10,000 have been voted for improvements to the municipal electric-light plant and water-works system.

LITTLE ROCK, ARK.—Contract has been awarded by the school board for the erection of a grade and junior high school building, to cost about \$128,000, to H. F. Ault, of Little Rock. Heating and lighting systems not yet decided upon. Charles L. Thompson and Thomas Harding, 504 Southern Trust Building, Little Rock, are architects.

MONROE, LA.—Bids, it is reported, are being received by the Standard Gin Company of Monroe on cotton gin and power plant equipment. The company was recently organized with a capital stock of \$60,000. John P. Parker and J. T. Austin are among the incorporators.

BLOCKER, OKLA.—The Tri-State Coal & Coke Company, recently incorporated with a capital stock of \$100,000, is reported to be in the market for mining and power plant equipment. J. A. Dill is among the incorporators.

TULSA, OKLA.—The Atchison, Topeka & Santa Fe Railroad Company contemplates the erection of a passenger station at First and Second Streets, to cost about \$100,000. The company will build a freight depot with terminal yards having a track-are of about 10 miles, and install an electrical interlocking system. The cost of the entire work is estimated at about \$2,000,000.

YALE, OKLA.—The City Council is considering issuing \$200,000 in bonds for the installation of an electric-light plant and water-works system.

BEAUMONT, TEX.—The Kansas City Southern Railroad Company is planning to install electrical equipment to operate its drawbridge across the Neches River in Beaumont.

Pacific and Mountain States

EPHRATA, WASH.—Application has been made to the Commissioners of Grant County by the Ruff Lighting Company of Ephrata for a franchise to erect and maintain electric transmission lines along the highways in Grant County. The company asks for a 50-year franchise to include the unincorporated town of Ruff.

SEATTLE, WASH.—The Skyhomish Power Company has filed with the City Council modified plans for the development of the Stillaguamish power site, submitting estimates covering proposed additional development as follows: Dam to be built at an elevation of 950 ft., with ultimate elevation of 1050 ft. With the development of the

Stillaguamish stream alone, this dam would generate 66,000 hp. at an elevation of 400 ft., or 90,000 hp. with dam at 1050 ft. Building two steel penstocks for standpipe to turbine, 600 ft. long and 8 ft. in diameter, installation of two vertical units generating 30,000 hp., power house of reinforced concrete with provision for future extension to provide space for two additional units of same capacity, to change railway to go north of reservoir and join the present line at the east end of the line. The cost of the above plant, including riparian rights, is estimated at about \$5,000,000. The report has been referred to the City Utilities Commission.

TACOMA, WASH.—The proposal to issue \$5,000,000 in bonds for the purchase of the property of the Tacoma Railway & Power Company was defeated at an election held recently.

GOLD HILL, ORE.—The City Council has taken over, under lease, the city water system from the new owners of the defunct Rogue River Public Service Corporation, which has been operating the system under a 20-year franchise, and which expires in 1920. The arrangement is only temporary, as the city owns the McClure power plant on the Rogue River, with a 500-hp. right, which is to be developed for municipal light and water purposes. Bonds to the amount of \$25,000 were voted for that purpose in 1914.

TOLEDO, ORE.—The Thorsen-Hendrickson Mill Company of Toledo, recently reorganized, it is reported, will take over and operate the local electric-light plant.

LOS ANGELES, CAL.—Plans are being prepared by the Board of Education for the construction of a machine shop, 70 ft. by 100 ft., at the San Pedro High School.

REDDING, CAL.—At an election held recently the proposal to issue \$40,000 in bonds for the installation of a municipal electric-lighting system was carried.

Canada

REVELSTOKE, B. C.—The Lanark Mines Company, it is reported, contemplates the construction of a dam and power plant in Revelstoke to furnish electricity for its mine and mill. The cost is estimated at from \$25,000 to \$30,000. W. B. Dornberg of Spokane, Wash., is manager.

WINNIPEG, MAN.—The provisional government of Manitoba contemplates replacing the present telephone system in Winnipeg with the automatic service, at a cost of about \$1,500,000. Within the next five years, it is estimated that an expenditure of \$600,000 will be required for extensions to the system.

HALIFAX, N. S.—New equipment, including electric street cars, electrical equipment and generating machinery is reported to be under consideration by the Nova Scotia Tramways & Power Company. G. A. Fowler, Lower Water Street, Halifax, is engineer.

BISMARCK, ONT.—The Township Council of Gainsborough, Lincoln County, is considering utilizing Hydroelectric power.

COBALT, ONT.—The Mining Corporation of Canada is reported to be contemplating the purchase of electric motors, pumps, etc.

MONTREAL, QUE.—Extension to its carbide and electrode plants is reported to be under consideration by the Shawinigan Water & Power Company.

MONTREAL, QUE.—Tenders will soon be asked for the construction of a power house for Lamontagne, Ltd., 338 Notre Dame Street, West, to cost about \$10,000. E. Laurie & Company, 243 Bleury Street, Montreal, are architects and engineers.

GULL LAKE, SASK.—The Canadian Pacific Railway Company is contemplating the construction of a pumping station and installation of machinery at Gull Lake, to cost about \$100,000. J. M. Cameron of Calgary, Alta., is manager.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until May 20 for furnishing dynamite, steel cable, copper tubing, vulcanizing material, boiler lagging, pipe covering, roll asbestos paper, etc. Blanks and further information relating to this circular (No. 1217) may be obtained at the above office or the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 3 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, W. J. Sharp, Little Rock, Ark. Annual convention, Hot Springs, Ark., May 21-23.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, September, 1918.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Building, San Francisco. Convention, Del Monte, Cal., May 9-11.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, M. C. Gilman, Toronto Electric Light Company.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

CONNECTICUT ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shlras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Hot Springs, Va., May 21, 22 and 23.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavelly, Royal Insurance Building, Montreal, Can.

PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago. Meeting, Hot Springs, Va., May 30, 31, June 1.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting, May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga. Annual meeting, June, 1918, Tybee Island, Ga.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law, Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, City College of New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MASSACHUSETTS ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. E. Wilson, 263 Summer St., Boston, Mass.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

MISSOURI ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, A. J. Purns, 318 West Tenth St., Kansas City, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, H. C. Brown, 110 West 40th St., New York.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York. Convention, Atlantic City, N. J., June 13 and 14.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Convention, Cedar Point, Ohio, July 10, 11, 12.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekun Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PENNSYLVANIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D. Convention, Sioux Falls, S. D., May 15 and 16.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual meeting, June 19-20, Atlanta.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Bargebaugh, 703 First National Bank Building, El Paso, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Va.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago.

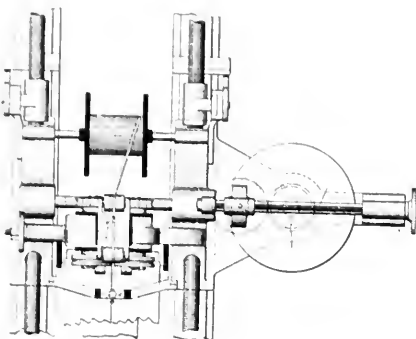
WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercutt, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, Green Bay, Wis.

WISCONSIN ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

(Closed April 16, 1918.)

- 1,262,652. TELEPHONE EXCHANGE; Henry P. Clausen, Mount Vernon, N. Y. App. filed Sept. 11, 1917. Improvements.
- 1,262,651. AUTOMATIC CIRCUIT BREAKER FOR CON. CONTROLLED TELEPHONE SYSTEMS; Hirschel M. Connor and Don D. Miles, San Francisco, Cal. App. filed Feb. 20, 1917. Improvements.
- 1,262,618. TELEGRAPH SYSTEM; Oscar A. Danielson, Plainfield, N. J. App. filed May 2, 1917. For repeating telegraphic signals.
- 1,262,641. AUTOMOBILE-DOOR LATCH; Ernest S. David, Sterling, Ill. App. filed March 21, 1916. Improvements.
- 1,262,653. PROCESS AND APPARATUS FOR AUTOGENOUS WELDING; Pietro de Paolini, Milan, Italy. App. filed Aug. 24, 1916. Improvements.



1,262,749—Automatic Welding Machine

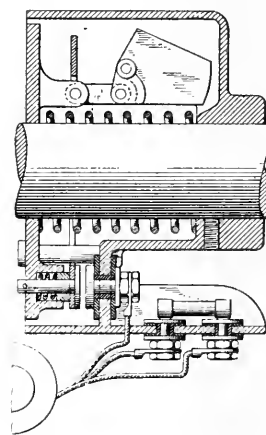
- 1,262,654. SELECTING SYSTEM; Amos F. Dixon, Newark, N. J. App. filed Sept. 30, 1915. For use in printing telegraph communication.
- 1,262,655. SELECTING SYSTEM; Amos F. Dixon, Newark, N. J. App. filed Sept. 30, 1915. For use in printing telegraph systems.
- 1,262,683. ELECTRIC FUSE; Robert A. Lewis and Edwin C. Weisgerber, Pittsburgh, Pa. App. filed Dec. 1, 1916. Detector indicates whether or not the fusible element has been blown.
- 1,262,692. MAGNETO-ELECTRIC GENERATOR; Richard A. Oglesby, South Bend, Ind. App. filed Feb. 23, 1915. Improvements.
- 1,262,702. ADDING MACHINE; Frank C. Rinsche, Detroit, Mich. App. filed July 24, 1913. Key-driven type.
- 1,262,704. AUTOMOBILE-LOCK AND IGNITION-SYSTEM TESTER; George M. Scott and Herbert H. Scott, Chicago, Ill. App. filed April 8, 1916. Improvements.
- 1,262,716. SIGNALING DEVICE FOR AUTOMOBILES; Louis Thomas, Cleveland, Ohio. App. filed March 22, 1917. Improvements.
- 1,262,721. CONTACT SPRING; Herbert A. Wallace, Pittsburgh, Pa. App. filed Aug. 27, 1914. Improvements.
- 1,262,727. PAY-ROLL-CALCULATING MACHINE; Theodore D. Williams, Rochester, N. Y. App. filed Sept. 1, 1915. Small keyboard.
- 1,262,746. EXCESS WATTMETER; Alfred W. Burke, Wilmington, Del. App. filed March 2, 1915. Improvements.
- 1,262,747. EXCESS WATTMETER; Alfred W. Burke, Wilmington, Del. App. filed Dec. 4, 1915. Automatically corrects the error in wattmeters.
- 1,262,749. AUTOMATIC WELDING MACHINE; William J. Callahan, Garwood, and Joseph W. Raynor, Plainfield, N. J. App. filed Oct. 10, 1913. For automatically welding articles together by means of an electric arc drawn between a metallic electrode and the articles to be welded.
- 1,262,752. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed April 26, 1917. Improvements.
- 1,262,774. DYNAMO-ELECTRIC MACHINE; Ralph E. Gilman, Pittsburgh, Pa. App. filed Oct. 3, 1914. Damper windings.
- 1,262,784. INSULATING SUPPORT; Arthur J. Hall, Wilkinsburg, Pa. App. filed June 8, 1917. Improvement.
- 1,262,802. LAMP SUPPORT; George T. Irwin, Toronto, Ontario, Canada. App. filed Dec. 2, 1915. Improvements.
- 1,262,805. AUXILIARY SIGNAL; Harry L. Kaser, Canton, Ohio. App. filed Oct. 28, 1916. Improvements.

Record of Electrical Patents

Notes on United States Patents

- 1,262,824. SPEED CONTROL FOR INDUCTION MOTORS; Frederick W. Meyer, Pittsburgh, Pa. App. filed June 20, 1914. Speed may be controlled throughout a wide range.
- 1,262,831. ELEVATOR SAFETY DEVICE; George Nissenson, New York, N. Y. App. filed Oct. 8, 1915. For controlling and starting a water, steam or otherwise operated elevator machine.
- 1,262,838. ELECTROMAGNETIC APPARATUS; Frederick P. Poole, La. Grange, Ill. App. filed April 11, 1917. Energizing winding may be accurately located and positively secured in definite relation to the end of its core.
- 1,262,843. AUTOMATIC TELEPHONE SYSTEM; Arthur J. Ray, Chicago, Ill. App. filed June 16, 1913. Improved means for handling long-distance calls.
- 1,262,861. SECONDARY FUSE BLOCK; Andrew F. Sproul, Oakland, Cal. App. filed Jan. 29, 1917. Cheaply constructed device which is positive in action and may be easily repaired.
- 1,262,895. ELECTROMAGNETIC CONTROL SWITCH; George S. Wood, New York, N. Y. App. filed May 3, 1917. Improvements.
- 1,262,912. MEANS FOR PREVENTING DISTURBANCES IN SUBSTATION TELEPHONE SETS. App. filed Dec. 22, 1916. Improvements.
- 1,262,914. SYSTEM OF DISTRIBUTION; Joseph Bijur, New York, N. Y. App. filed Dec. 21, 1910. For electric lighting of railway vehicles.
- 1,262,916. CONTROLLING DEVICE FOR SELF-FOCUSING ELECTRIC-ARC LAMPS; John L. Boyle, Boston, Mass. App. filed Jan. 13, 1913. Arc automatically maintained at a predetermined point.
- 1,262,917. REGULATOR FOR CHARGING STORAGE BATTERIES; Stephen F. Briggs, Milwaukee, Wis. App. filed Feb. 12, 1915. Improvements.
- 1,262,936. ELECTRIC LAMP; Frank L. Fowler, Philadelphia, Pa. App. filed June 17, 1916. Interlocks the lamp bulb with its base.
- 1,262,964. PORTABLE LAMP; Harrison D. McFaddin, East Orange, N. J. App. filed March 12, 1915. Clamping mechanism for detachably securing a lamp to the arm of a chair, bedpost or other support; an improved shadeholder which permits of the shade being readily tilted or adjusted as desired.
- 1,262,969. KEY SOCKET; Harry J. Morey, Syracuse, N. Y. App. filed Aug. 3, 1916. Fixed and moving parts of the device are held on the single-piece porcelain base.
- 1,262,988. SWITCH BOX; Clarence M. Siefert, Evansville, Ind. App. filed Dec. 5, 1916. Improvements.
- 1,263,005. LOW-TENSION SPARK PLUG. App. filed Sept. 21, 1916. For internal combustion engines.
- 1,263,010. SEMI-AUTOMATIC TELEPHONE SYSTEM; Bernard D. Willis, Chicago, Ill. App. filed Oct. 14, 1913. Improved trunking arrangement.
- 1,263,013. TELEPHONE METER-SERVICE SYSTEM; George A. Yanochowski, Chicago, Ill. App. filed Sept. 2, 1915. Improvements.
- 1,263,021. HEATING DEVICE; Alexander Bender, Chicago, Ill. App. filed Feb. 11, 1918. Structure to which an electrical iron can be readily secured and which has radiating walls for throwing off into the room the heat received from the iron.
- 1,263,028. SECTION INSULATOR AND SWITCH; Newton K. Bowman, Canton, Ohio. App. filed March 9, 1917. Insures perfect insulation of the sections when the switch is open and perfect contact when the switch is closed.

- 1,263,039. ELECTRICAL RESISTANCE; John G. Clemens, Buffalo, N. Y. App. filed Sept. 29, 1917. Resistance to passage of current will gradually decrease as it becomes heated.
- 1,263,050. CONNECTING DEVICE WITH INSULATORS; Arthur H. Fargo, Wilmington, Del. App. filed April 4, 1914. Adapted to be connected to a ground pipe.
- 1,263,069. TELEPHONE-EXCHANGE SYSTEM; Charles W. Kceider, Newark, N. Y. App. filed July 12, 1917. Impossible to establish a connection between two telephone lines using portions of two connecting circuits.
- 1,263,073. SIGNALING DEVICE; August J. Kaloneck, New York, N. Y. App. filed Jan. 28, 1914. For producing high-frequency electrical currents.
- 1,263,078. INDUCTION MOTOR; Justin Lebovici, Oakley, Ohio. App. filed May 14, 1917. Secondary windings adapted for reconnection after starting.
- 1,263,083. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Aug. 16, 1916. A line in trouble may be cared for.
- 1,263,140. TELEPHONE TRANSMITTER; Lonnie B. Stone, Louisville, Ky. App. filed April 4, 1914. Improvements.
- 1,263,150. RECIPROCATING SAFETY SWITCH; Horatio S. Tittle, San Francisco, Cal. App. filed Nov. 27, 1916. For delivering a current to the apparatus to be started without the current passing through the fuses during the starting period.
- 1,263,181. ELECTRIC STOVE; Stover C. Wingler, Los Angeles, Cal. App. filed Dec. 11, 1917. Simple means for regulating the heat.
- 1,263,190. THERMOSTATIC CIRCUIT CLOSER; Albert I. Bennett, Fort Atkinson, Wis. App. filed April 14, 1917. Electric automatic fire alarm.
- 1,263,204. APPARATUS FOR RECEIVING ELECTRICAL OSCILLATIONS; Elmer E. Butcher, Interlaken, N. J. App. filed May 14, 1914. Improvements.
- 1,263,247. ELECTRIC CONTACT DEVICE; Gottlob Honold, Stuttgart, Germany. App. filed July 21, 1917. Mechanically controlled interrupter for use with the ignition devices of internal-combustion motors.
- 1,263,280. SPEED ALARM FOR AUTOVEHICLES; Peter E. Paulson, Eastedge, N. D. App. filed April 20, 1915. Means for sounding a bell alarm when the speed limit is exceeded.
- 1,263,292. BIAS-FABRIC ASSEMBLING TABLE; William C. Stevens, Akron, Ohio. App. filed May 20, 1916. Improvements.



1,263,078—Induction Motor

- 1,263,308. MEASURING APPARATUS; William H. Bristol, Waterbury, Conn. App. filed June 22, 1917. Single pointer operates over a chart to produce a multiplicity of records of separate and distinct operations.
- 1,263,314. APPARATUS FOR ELECTROLYSIS; Philip A. Emanuel, Aiken, S. C. App. filed Dec. 24, 1917. Improvements.
- 1,263,344. ELECTRIC SWITCH; Carl Bramming, Chicago, Ill. App. filed Feb. 19, 1917. Single and compact device.
- 1,263,350. ELECTRIC HEATER; George J. Schneider, Detroit, Mich. App. filed Dec. 31, 1908. Improvements.
- 1,263,351. ELECTRIC HEATER; George J. Schneider, Detroit, Mich. App. filed Dec. 31, 1908. Improvement.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Volume 71

New York, Saturday, May 11, 1918

Number 19

Interconnection of Generating Systems Important

WE HAVE so often preached the desirability of physical connection between adjacent generating plants that under ordinary circumstances it would hardly seem necessary to call attention again to its obvious advantages, but the lessons of the last winter and industrial conditions that are rapidly arising impress the need of going further than ever before in the matter of interconnection. The coal problem is still far from completely solved. In fact, the situation may at any time take on an acute phase, so that no plant can feel absolutely secure as regards its fuel supply or its ability to insure continuity of service under all the conditions that may arise. Would it not be wise, therefore, to undertake some concerted action for comprehensive emergency interconnections, so that any station which is through its distribution within reach of another station should make provision for the exchange of current and make it in advance of a sudden necessity?

Numerous cases may arise in which this step would be of very great advantage. Industrial power in considerable amount may be required, for instance, from a plant which is not readily able to supply the added load on short notice. If it is able promptly to borrow energy from a neighbor, work can go ahead speedily; if it has to wait in these strenuous days until new machinery can be installed, important manufactures may be held up. Again, a station with a widespread distribution may require similar assistance from a more conveniently situated neighbor to avoid the investment and loss of time required to reinforce its feeders. A plant may readily be caught in a temporary coal shortage when two or three days of assistance would suffice to tide over the emergency without inconvenience to anybody.

Big plants and small plants alike may need help often on very short notice. Most stations now run a twenty-four-hour service, but there are some small ones which are not conveniently equipped to do so and therefore would be at least temporarily unable to deliver power for manufacturers which otherwise could be profitably handled. The power load is assuming every month great and greater importance. Factories are often situated with reference to considerations more important than power supply, and their needs should be met if possible. The obvious step would seem to be a thoroughly systematized effort at interconnection between adjacent territories. There is a strong enough spirit of comity in these days to enable arrangements of this kind to be made without much difficulty, and the

main thing is to make them promptly and to carry out the necessary construction so that if help becomes of vital importance it can be obtained at once. There are innumerable places where with comparatively small expenditure this plan could be carried out, but in most instances it demands material and labor that cannot be summoned on the spur of the moment. Here is a good field for the activities of the National Electric Light Association, which has already done so much in securing united and efficient action for the public service.

Predicting the Residence Load

PREDICTING from past experience the probable growth of load on residence circuits is not so easy. The general method applied by P. O. Reyneau in this issue is substantially that which he has already used in other classes of lighting. He builds up a working curve by adding graphically the sums of the monthly maximum averaged over three years, giving thus a general view of the variations of the past from month to month. For convenience the values from the curves are reduced to a table of percentages in which the load for each month appears as a percentage of the load for every other month in the year. Then, knowing the present load for any given month, one has fairly sound data on which to predict the probable value of the load in some future month. The precision of this prediction of course depends on the reliability of the rate of growth established by the periods entering into the average.

Motor Drive for Woodworking Machines

EVERY sort of machinery has its own idiosyncrasies when one comes to adapt it to electric drive. David R. Shearer's paper in the current issue takes up the situation regarding the application of motors to individual woodworking machines. The general peculiarity of many of these is that the load is irregularly periodic, very heavy at times and light during the intervening periods of inactivity. The tendency in fitting out equipment of this character with electric motors has been to overpower the outfit to a very considerable extent. Group driving reduces the general amount of overloading but does not free the motor from the danger of an aggregate peak as in the case of any group of irregularly loaded machines. Now and then all the loads fall upon the group motor simultaneously, with a fairly good chance of putting it out of service. The remedy is precisely the same in this

case as in that most aggravated example of irregular load, the rolling mill; that is, the installation of a fly-wheel heavy enough to help out the motor during the brief periods of heavy demand and in storing up energy between peaks for the next effort.

Our contributor's load curves, derived from actual practice, put the case in the clearest possible terms. It is shown that it is perfectly possible to get a very heavy peak, say four times the average load, out of three quite innocent-looking components. The installation of a flywheel on any single machine produces an immediate and striking effect in smoothing out the load curve. In the example shown the peaks occurring at periods of ten or twelve seconds were brought down to less than two-thirds of their ordinary value, a result which not only is gratifying with respect to the size of motor necessary to install but produces a most salutary result on the power demand from the system at large. With the fairly heavy motor from which these curves were taken the sudden variations in demands for power would be quite sufficient to disturb very seriously the regulation of anything except a large generating plant. With the flywheel working the peaks become relatively inconsequential and the load is very much softened. The case is one which may be found, too, in various other branches of industry in which there are frequent and sharp increases in load. A fairly heavy flywheel, designed with reference to the work to be done, affords a highly successful remedy for these irregularities and not only diminishes the size of motor necessary to install but renders its operation much easier for the plant and saves possible overheating and stalling of the motor itself.

First Fruits of Daylight Saving

THE actual result of daylight saving is something almost impossible to predict save in the most general way. Previous experience abroad has shown that the reduction in demand for energy has been a measurable but very uncertain quantity, varying considerably from place to place. Our readers will therefore welcome a group of load curves obtained from stations in the Middle West showing roughly the actual results thus far obtained in carrying out the daylight-saving program. They apply, of course, to the first month of the new schedule, April, during which the conditions were not yet steadied by every-day experience with the new régime, and when the actual hours of sunrise and sunset had not reached their extreme positions. The main showing thus far is that the reduction in output is of the order of magnitude of 5 per cent for this particular month. This implies, of course, a greater reduction in gross revenue from the fact that the deficit comes out of the lighting rate, which is relatively high.

As respects the load curve of the station, daylight saving has created a new valley in the lighting between 5 and 8 o'clock p. m. The short span of this valley tends to lessen the actual saving in coal, since a large part of the boiler capacity will have to be carried over it ready for service. On the other hand, there has been in some instances a slight increase in the daily load factor which probably is of small significance. The annual load factor will be upon the whole

somewhat reduced, to the injury of costs of production. It will be interesting to follow the changes in load as time goes on. For a guess, there will be no striking change for several months to come; but during late September and October the conditions should produce a considerable lessening of the evening valley and the addition of a morning peak. Were the daylight-saving plan carried throughout the year the chances would be good for an improvement in the annual load curve, and particularly that portion of it which lies in the winter months. It would not be surprising, indeed, to see the requirements of energy for lighting through October tending in some material degree to offset the earlier losses. We can only tell by watching just what is going to happen, but it is fairly evident that the saving in fuel is going to be small compared with the possible loss of revenue; that the latter probably will not be so large in the total as has been expected, owing to the effect of the later portion of the daylight-saving period, and that the benefits secured to the public are not to be reckoned so much in the saving of lighting bills as in the advantage to be gained by the added hours of out-of-doors freedom.

Economies of Higher Steam Pressures

WITH the rising price of coal the necessity of its economical use in central stations becomes daily more imperative. The electric generator itself has been pushed pretty nearly to its ultimate efficiency. For example, when a generator is giving 95 per cent efficiency at or near full load the chances of improvement to any material degree whatever are obviously negligible. One must look somewhere else in the line of transformation for a chance to make savings. The mechanical power plant offers this opportunity, from the boilers to the shaft that spins the generator. Within a recent period this journal has published important notes on the savings to be made by larger and better boiler units, by increased vacuum, by saving of waste heat in the piping, and by increasing both pressures and superheat in the steam system. In the current issue J. T. Foster gives the results of a study of the relation of steam pressures to economy, particularly economy of the dollars and cents variety.

That raising the steam pressure increases the thermal efficiency of the prime mover admits of no dispute. Furthermore, it does so to a determinate extent which can be computed with a very satisfactory degree of precision; but as a matter of fact engineers have been very cautious in raising pressures, chiefly for the reason that equipment is not "standard" for pressures materially above 200 lb. (14 kg. per sq. cm.), and, as everybody knows, a request for variation from so-called standards is immediately followed by a punitive expedition in force from the estimating department of the manufacturer. But, as practice has crawled upward from the square-stayed boilers of the olden times and pressures not much higher than those in a vapor-heating system to highly organized water-tube installations at 200 lb. or more per square inch (14 kg. and up), so advance is bound to come from these latter conditions up to the point at which the cost of equipment for added pressure counterbalances the saving to be made, a point which is ever creeping upward as costs of

fuel rise. Mr. Foster's paper gives a very convenient practical method of investigating the economic conditions accompanying increased steam pressure. As a matter of fact, added superheat generally goes with steam pressure, also the best vacuum which is commercially obtainable, but the pressure item alone shows large savings.

The difficult thing to estimate in this, as in all similar cases, is the probable increase of the total cost of the plant in going, say, from 200-lb. to 500-lb. (14-kg. to 35-kg.) normal pressure. We are inclined to think that Mr. Foster's estimates in this particular are somewhat lower than they would run at the present moment, but in more normal times they would sound very reasonable. At all events, these suggestions mark a move in the right direction, as we indicated not long ago in describing the Joliet plant to which Mr. Foster refers. The steam turbine has probably not yet reached its ultimate efficiency in the same sense that the dynamo has, yet it has certainly developed to a point where mere increase of output is not likely to better things materially. There is still room for considerable improvement in boiler plants, chiefly through increase of working capacity. The condenser is fairly near its limits, so that the opportunity for saving lies in superheat and in steam pressure.

The Precise Measurement of Alternating Currents

IN THE electrical engineering laboratory the measurement of continuous currents has ordinarily a higher degree of precision than the measurement of alternating currents. This is for the reason that continuous-current precision measurements commonly employ null methods, whereas alternating-current precision measurements commonly employ deflection methods. The potentiometer, essentially a null-method instrument, is very generally employed in continuous-current work; but although the alternating-current potentiometer exists, it is relatively little known.

The ordinary electro-dynamometer for measuring alternating currents is essentially a deflection instrument. Either the scale deflection produced by an alternating current is compared with a similar scale deflection produced by a known continuous current or the deflections are in turn reduced to zero through the application of a scale-measured torque. This scale-reading use of the instrument necessarily limits the precision of its use. The article by C. O. Gibbon in this number describes an interesting and novel use of the dynamometer whereby the torque produced by an

alternating current is balanced against the opposing torque produced by a measured continuous current, thereby employing the instrument in a null method and enabling the degree of alternating-current precision to be raised nearly to that of the continuous-current measurement involved. The idea originated in the Bureau of Standards and has been actually tested in a dynamometer especially wound for the purpose. The results obtained indicate that by the use of the null dynamometer about one part in eight hundred could be secured, on the average, or nearly the third order of precision. When, however, certain improvements shall have been made in the instrument it is hoped that the fourth order, or one part in ten thousand, may be approached. We understand that the instrument has been already carried to a further stage of development since the article now printed was written.

The null dynamometer measures the root mean square of a complex harmonic alternating current in terms of the root mean square, or stationary value, of a measured continuous current. It is actually difficult to obtain a check measurement of the instrument unless, as is described in the article, a simple harmonic alternating current, or pure sine wave current, is very nearly realized for the purpose. In such a case the Drysdale a.c.-d.c. potentiometer enables a check to be secured. It seems likely, however, that the precision of the null dynamometer can be made even superior to that of the Drysdale a.c.-d.c. potentiometer, so that an accurate determination of the null dynamometer's precision may be difficult to obtain. However, other direct-current potentiometers are being developed, and the prospects are therefore good of eventually securing almost as high a degree of precision for complex harmonic alternating-current measurement as is already obtainable for continuous currents.

The easiest application of the null-dynamometer principle is to the measurement of alternating currents of the order of a few centiamperes. This is for the reason that the suspended coil can then receive its current supply through thin suspension wires, which have relatively little torsional moment. The amount of unbalanced electromagnetic torque giving rise to a noticeable deflection from zero is therefore small, and the balancing precision becomes correspondingly high. As the current strength that has to be carried to the suspended coil is increased, the difficulty of securing small torsional moment at the zero point increases likewise. If, however, the null dynamometer wins favor in the electrical engineering laboratory for centiampere measurements, it seems likely that improvements in design will make it similarly useful for ampere measurements.

THE scarcity of fuel during the past winter, the possible repetition of such a condition next winter and the recent order regarding the distribution of coal make it especially important that all companies depending on fuel for power generation should arrange to exchange ideas on the economical utilization of low-grade coals. Some light will be thrown on this subject by an article which we will present shortly outlining experiences in the Northwest with powdered coal. Another subject which is becoming of greater importance as electric service systems and generating units become larger is that

The Coming Issues

of the phenomenon which takes place when sudden short circuits occur. Prof. N. S. Diamant will discuss this subject in an early issue, giving a thorough, critical and relatively simple explanation of the action that takes place. Efficiency in the meter department and how one company remodeled its system to carry increased loads are other subjects that will be discussed. A map of the United States showing the coal zones as prescribed by the Fuel Administration will be presented with the ELECTRICAL WORLD as a colored supplement in connection with the Fuel Administration's order.

Value of Flywheels in Woodworking

They Have Proved Especially Desirable in Plants Where Individual Motor Drives Are Installed—Permit Using Smaller Motors, Improve Load Factor, Power Factor and Efficiency, and Relieve Equipment of Stresses

BY DAVID R. SHEARER

OWING to the fluctuations in load obtained with certain kinds of woodworking machinery, it has frequently been the practice to over-motor the machines in order to carry the peak loads. As a result the load factor, the power factor and the over-all motor efficiency have been detrimentally affected and more than the necessary outlay of money has had to be invested.

In several instances the writer has found that the average load on a given woodworking machine is only 50 per cent of the installed motor capacity and that some load peaks run as high as 100 per cent above the motor rating. In other words, some peaks occur which are four times the average load.

If the first cost of the motors were the only factor to be considered, much larger motors than are demanded by the machines might not be so objectionable; but the fact that any motor operating much below its rating will not operate at its maximum efficiency throws a different light on the subject. In the case of induction motors the power factor decreases with the load so that the system may be seriously disturbed if the motors are underloaded, especially if fed by a small local or isolated plant. The highest efficiency is usually obtained from an induction motor at full-load rating and the highest power factor at slight overloads. With one standard motor of the induction type the efficiency dropped 2 per cent from full load to half load, and the power factor dropped 12 per cent with the same decrease in load. Below half load the results are still more serious.

On account of the trouble experienced with some motor-driven woodworking machines in the past, some apprehension has arisen regarding the advantages of individual drive which should be dispelled, inasmuch

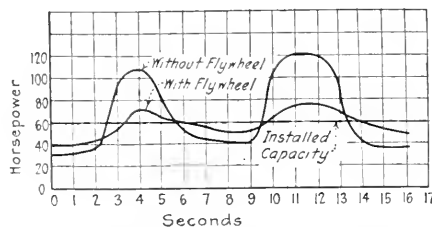


FIG. 1—LOAD CURVE OF A GANG-EDGER OPERATING ON GREEN LUMBER WITH AND WITHOUT A 1500-LB. (680-KG.) FLYWHEEL

The motor driving this machine is rated at 60 hp. and is directly connected to operate at a speed of 1800 r.p.m. on 440-volt, three-phase energy supplied by an isolated plant. The operating conditions were practically the same in both tests so that the value of the flywheel can be readily observed. Without the flywheel the demand increased above the maximum capacity of the motor for an instant. It caused excessive heating and sometimes stalled the machine. After the flywheel was attached the motor was operated at a lower temperature and never stalled during periods of heavier cutting.

as the trouble has generally been caused by improper application of the motor. So strong has been this objection that in some instances the individual drive has been taken out and group drive substituted so that the machine peaks could be carried by the overload ca-

capacity of a larger motor. This method of drive may be the correct thing in some cases, but is less desirable than the individual drive on account of the necessary shafting and belting with the attendant losses in efficiency. Furthermore, the group-drive motor may be subjected to concurrent peaks (Fig. 2) which may

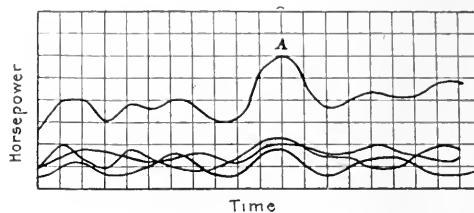


FIG. 2—INDIVIDUAL POWER-DEMAND CURVES OF THREE MOTORS WITH THE GROUP DEMAND PLOTTED ABOVE

None of these machines was equipped with a flywheel. The curves show that a concurrent group peak is possible which may require over-motoring of the group when flywheels are not used. In the plant at which these tests were conducted a total plant concurrent peak occurred on an average twice in ten hours.

pull it out of step, thus shutting down the whole installation and causing serious delay.

The simplest and cheapest way to obviate pronounced peaks is to install individual flywheels on the motor shafts of each machine and retain the advantages of the individual drive. With this arrangement the loads can be carried by motors considerably lower in rating than would be required if flywheels were not used, and in addition the motors will operate more nearly at normal load. Of course, the flywheel must be especially designed for each machine as the operating characteristics vary considerably.

The duration of the cut and the period during which the machine is running idle are the principal factors which should determine the flywheel effect necessary. As an example, the duration of a trimmer cut is very short, while the idle period is slightly longer. A slasher cut is similar to that of a trimmer, but considerably more power may be required when a butt slab is being cut. A gang-edger cut is considerably longer than either of the foregoing operations. A short interval exists between cuts which must be taken into consideration in the design of the flywheel and in deciding upon the size of driving motor to install.

Sometimes it is convenient to test the instantaneous power demands on the machine while operating it from a motor somewhat larger than is necessary. From these tests the average load and maximum peaks can be determined. If the test results are plotted as curves, it is comparatively easy to decide how many foot-pounds must be added to the motor power during peaks by a flywheel to bring the power demand on the motor down to a desirable value. During the period when the machine is not cutting the motor stores energy in the flywheel, which can later be used while the tool is cutting.

Another factor to consider when using flywheels is

the rotor resistance of the driving motor when it is of the three-phase induction type. As the rotor resistance is increased the slip will increase, allowing a greater reduction of speed under heavy load and thus permitting the flywheel to give up some of its stored energy. If the load surges are frequent and pronounced, this characteristic of the motor tends to minimize the line disturbances, but if the peaks are of long duration a high-resistance rotor will allow the speed of the machine to drop too low for the proper action of the cutting knives or saws.

MACHINES ON WHICH FLYWHEELS ARE MOST DESIRABLE

The woodworking machines on which it is most necessary and economical to install flywheels, when operated by individual motor drive, include circular rip and cut-off saws, edgers, trimmers, slashers, timber trimmers, some types of planers and flooring machines, "hogs," and in general any machine which has periodic loads and periods of non-production. Flywheels are not of much advantage on band saws, because these machines

usually have sufficient flywheel effect in the band wheels which carry the saw.

As the friction load of any woodworking machine is practically constant, it is advisable to determine this load first, then the average power necessary to do the actual cutting. These two factors will determine the motor size if a flywheel is used to reduce the peaks to a value which can be handled by the overload capacity of the motor.

As a result of the tests indicated by Figs. 1 and 2 and others made upon different woodworking machines the writer has come to the conclusion that better results would be secured with individual drive by the more general use of suitably designed flywheels. The necessary generating plant capacity would be decreased, the size of the individual motors could be reduced, the load factor would be improved, the efficiency increased and the power factor raised. Furthermore, flywheels will relieve the motors and starters from excessive stresses occasioned by the pronounced surges of power demand.

Predicting Load on Residence Circuits

Data Which Assist in Making Intelligent Estimates of Future Requirements on Feeders Carrying Residence and Store Lighting Loads, Including Table Showing Ratio of Each Month's Load to Load of Remaining Months

BY P. O. REYNEAU

Distribution Engineer Detroit Edison Company*

IF THE demands for electric service which are made each year are to be met economically, they must be anticipated far enough in advance to enable provisions to be made for serving them when it is most economical to do so. About the only way to make intelligent estimates of future requirements is to couple an analysis of past rates of load increase with a far-sighted judgment which will take into account the effect of future conditions on the past rate of growth.

Predicting the load on circuits carrying a load consisting of residence and store lighting is usually simplified by the fact that the growth is relatively constant and that the other factors that come in to modify the estimates can be analyzed and allowance can be made for them.

In the following it will be shown how an analysis of the conditions causing the increase has been attempted for a number of single-phase circuits fed by 200,000-circ. mil. underground cables and No. 0 or No. 0000 overhead wires.

The data available for such a study consist of a set of curves, one for each circuit, showing the monthly maxima over a period from September, 1914, to the present time. These curves are not all of the same outline, yet there are certain characteristics appertaining to all which could be expressed in one curve to be considered typical. A typical curve would serve as a fairly firm foundation on which to base estimates for the future.

The changes in circuit loads shown by an inspection of the monthly maxima are caused by a number of

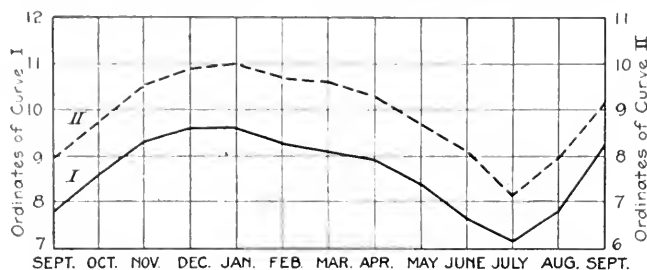
easily defined factors. The first is a seasonal condition due to the change in the length of days and the result of cold weather keeping people indoors; the second is an increase in the use of electricity by each customer caused by the greater appreciation of the uses of electrical energy in the home; the third is due to increase of population within the boundaries of each circuit; the fourth is due to the embracing of new territory by the circuit or to the loss of old caused by switching of load on account of overload or other operating necessities.

The first two factors are constants in their own particular sense—that is to say, the rate of increase due to these factors is a fairly constant value—and the third is partly so, for it may be subdivided into two, the factor of normal increase in population and that of abnormal increase. Normal increase will be encountered in practically every section of the city, abnormal only in sections not yet closely built up and to which people are attracted by real estate activity or the circumstances of industrial development. The fourth factor is a result of the preceding three and must be considered as indefinite, as it appears both for and against increases of load. It is a factor, however, for which correction may be made, since its use lies within the control of the operating company.

The ordinates of curve I are proportionate to the sums of the maxima monthly loads on the circuits averaged over three years. It was considered that the indeterminate factor of changes in territory would not affect the curve, inasmuch as they appeared in different circuits at different times of the year and their effect would be reduced to a comparatively small value with

*Assisted by Frank R. Innes.

an average equal effect on all the ordinates of the curve, in view of the long period of time covered. This assumption is borne out by the comparison of curve I with curve II. This last curve covers a period of only one year—September, 1916, to September, 1917—and was corrected for changes in territory. The corrections were made by deducting from the totals of each month the amount representing the load in the same territory appearing in two circuits in the same month. This condition of duplication of load is due to the fact that when a change in boundary for the relief of any



TYPICAL CURVES TO SHOW INCREASE IN MONTHLY MAXIMA

circuit is made the load on the section cut off appears in the maxima of both the circuits relieved and relieving. It would be possible naturally to take a well-built-up district including several circuits and establish a curve showing the growth per year of that nature of load, leaving the new circuits with abnormal growth for a special study. This refinement is hardly necessary, as the percentage of growth would not be much diminished. In the method used here there is introduced a small factor of safety.

In order to make the curve more easily applicable it has been reduced to a table of percentages in which the load for each month in the year appears as a percentage of every other month in the year. It is possible by the use of this table to take the load on any circuit for any given month and predict on that circuit the load for any future date, always considering that the boundaries of the circuit remain unchanged and that there are no particular conditions in that circuit which will cause an abnormal increase or decrease in the load.

It is not the intention that this curve, or the percentage table developed from it, shall figure as an absolute method for estimating future loads, but merely as a basis on which are to be imposed the particular conditions obtaining for each territory under consideration. The table contains no allowances for abnormal conditions, and the results derived from it may in some cases have to be considerably modified by such conditions as changing of circuit boundaries, rapid increase in rate of settlement and others. However, the table is sufficiently accurate to serve as a basis in estimates on the necessity for future work, unless the speed of growth of the city is greatly diminished or increased from the average rate maintained for the past three years.

The table gives the load on any circuit for any month in terms of any other month, and by correct selection of factors it is possible to predict with reasonable accuracy the future maximum load in amperes on any circuit if a present or previous reading on that circuit is given. For example, the November, 1917, load on a circuit is 223 amp., and it is desired to estimate

its load for January, 1919. Taking the November load as 1 in the table, the load for the following September is 0.993 of the November load; then taking this September load as 1, the load for the following January is 1.23 of this calculated September load. In this case, therefore, the January, 1919, maximum load of this circuit will be $223 \times 0.993 \times 1.23 = 272$ amp. This table should be read downward for predicting future load, upward if past loads are to be determined.

Having established a table for predicting the load on any circuit, this table is used, corrected as explained above for factors beyond its scope, for laying out new circuits for the coming year. It means providing substation capacity, switches, cable and overhead feeders and the primary wire necessary for the changes in boundaries. A map is made showing the circuit outline and indicating the estimated load for the coming year for each circuit. It is used for determining the best location for the new circuits. A careful examination is made of the circuit boundaries with a view to finding the best places for tying in or separating the primaries of the old circuits and of the new circuits to be installed. Up-to-date maps of the distribution system are of great value in this work. After analysis it is usually found that there are, owing to street or alley conditions, boulevards, railroads and other physical conditions, natural boundary lines, and that the best economy will be reached by using them. It is also advisable to look ahead as much as possible beyond the one year increase and so handle the work that new boundaries can be easily established later. The table is also used to determine at what time it is possible to do the necessary temporary transferring of territory that will ultimately permit the establishment of the boundaries as planned for the time of peak load.

Perhaps the most important factor from the economical standpoint is the proper loading of each circuit feeder. Residence and store lighting load has a very low load factor and reaches its maximum for only a few weeks every year. It is therefore very important to limit as much as possible the investment required

RATIO OF EACH MONTH'S LOAD TO THE TOTAL LOAD FOR THE REMAINING MONTHS OF THE YEAR

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Sept....	1	0.892	0.825	0.815	0.812	0.831	0.836	0.862	0.911	1.003	1.098	0.988	0.831
Oct....	1.113	1	0.913	0.907	0.904	0.925	0.931	0.958	1.013	1.117	1.223	1.100	0.925
Nov....	1.210	1.087	1	0.986	0.983	1.006	1.012	1.042	1.102	1.216	1.330	1.196	1.006
Dec....	1.226	1.101	1.012	1	0.996	1.018	1.026	1.057	1.117	1.231	1.348	1.212	1.018
Jan....	1.230	1.105	1.015	1.003	1	1.022	1.029	1.061	1.121	1.236	1.352	1.216	1.022
Feb....	1.203	1.081	0.993	0.980	0.977	1	1.006	1.037	1.096	1.208	1.332	1.188	1
Mar....	1.195	1.073	0.986	0.974	0.972	0.993	1	1.030	1.088	1.200	1.312	1.182	0.993
Apr....	1.159	1.041	0.957	0.945	0.943	0.964	0.970	1	1.056	1.163	1.273	1.146	0.964
May....	1.096	0.986	0.906	0.895	0.892	0.912	0.918	0.946	1	1.100	1.204	1.083	0.912
June....	0.995	0.894	0.822	0.812	0.809	0.827	0.833	0.858	0.906	1	1.093	0.984	0.827
July....	0.910	0.818	0.752	0.742	0.739	0.756	0.761	0.784	0.829	0.914	1	0.900	0.756
Aug....	1.010	0.908	0.835	0.825	0.822	0.841	0.846	0.872	0.922	1.014	1.110	1	0.841
Sept....	1.203	1.081	0.993	0.980	0.977	1	1.006	1.037	1.096	1.208	1.322	1.188	1

for its handling. Having established an average maximum load allowance on the underground cable and made provisions as desired for maintaining standard quality and continuity of service, the table above described and the analysis of circuit conditions are a means of providing for the coming year an adequate load on every circuit so that the equipment will work as near as possible to maximum efficiency. The matter of quality and continuity of service is beyond the scope of this paper. It can be briefly said that the reliability

the service all along the line from the power house to the service taps of the individual consumer, and especially the reliability of the underground cable and of the overhead feeder, will determine the required throw-over facilities that will give satisfactory service.

It is of interest to note that the maximum average load in the last three years has increased 27 per cent, the total number of circuits increasing 75 per cent. The allowable average maximum has not been reached yet, but it is hoped that it may be reached in the future. It can be truly said that such condition would represent the highest efficiency obtainable under the given condition.

PROTECTING INTERESTS OF OWNERS OF SMALL COMPANY

Turners Falls Power & Electric Company Makes Contract for Purchase of Amherst Substation with Provisions Carefully Prepared

TO PROTECT the interests of stockholders in the Amherst (Mass.) Gas Company, which owned a 1525-kva. substation supplied with energy by the Turners Falls Power & Electric Company, an interesting procedure recently took place in connection with a transfer of the substation to the power company. Philip Cabot of Boston is president of both companies, but the stockholders are not the same, though the two companies have the same management.

With the growth of the Turners Falls system of hydroelectric supply in the central Connecticut Valley, it appeared desirable to the management that the substation should be sold to the larger company and a new contract executed for electrical supply. Instead of taking action along this line, the management called a special meeting of stockholders to consider the advisability of selling the substation to the Turners Falls company, and a committee was appointed to investigate and report upon the matter.

The committee reported unanimously in favor of the sale of the substation at its book value (about \$145,000, including three small tenements for operators), pointing out that this price represents the total original cost of the plant and equipment without deduction for depreciation or obsolescence. The committee held that the gain in the financial strength of the gas company through the cancellation of approximately \$145,000 floating debt in this way would result ultimately in a far greater benefit to the stockholders than the privilege of receiving in the future stock rights of problematical value.

Under the gas company ownership of the substation, energy was received from the power company at the full value of the substation. Under the new ownership the plan is for the gas company to receive energy at the full substation value, involving a new contract and affording a good opportunity for the gas company to require the Turners Falls company to adjust the price for the electrical energy sold to it on a more equitable basis when compared with prices paid by other public lighting companies and municipal plants.

It was pointed out that if the Turners Falls company thus obtained a practically modern substation at a price materially below the present cost of building, it

ought at the same time to be willing to place the gas company in as favorable a position with regard to rates as it does other central stations of equal size in the Connecticut Valley.

The report stated that unless a satisfactory contract for the delivery of electrical energy under the new conditions could be obtained it might be advisable to hold the substation and to continue to operate under the previous terms. The committee recommended that the life of the contract should be at least fifteen years; that the basic price for energy should be not over 1.25 cents as compared with 1.5 cents per kilowatt-hour; that any coal clause should operate only between July 1 and Dec. 1 of each year, should be drafted upon a basic

COST OF REPRODUCING AMHERST SUBSTATION

TRANSFORMERS, REGULATORS AND LIGHTNING ARRESTERS	
Three 225-kva., 66,000/2300-volt self-cooled transformers	\$3,500
Three 250-kva., 66,000/2300-volt self-cooled transformers	5,000
Two 50-kva., 2300/4400-volt self-cooled transformers	1,150
Four 50-amp., 2300-volt feeder regulators	4,500
Three 25-kw. street-lighting transformers	1,200
Thirteen lightning arresters	13,500
	\$28,850
SWITCHBOARD AND SWITCHING EQUIPMENT	
Eight 66,000-volt, three-phase oil switches	\$20,000
Eighteen 66,000-volt, three-phase disconnecting switches	4,500
Six 66,000-volt potential transformers	5,400
Six 66,000-volt current transformers	1,800
Fourteen-panel, 2300-volt switchboard	9,800
Station service switchboard	775
	42,275
STATION ACCESSORIES	
Including storage battery, oil filters, oil pumps, oil piping, battery-charging set, telephone booths, chain hoists, stockroom equipment, garage fittings, plumbing and heating equipment	6,000
MATERIAL FOR WIRING	
All wire and cable and conduits, twenty-one 66,000-volt bushings, low-voltage wall bushings	9,400
LABOR	
Labor to install all equipment and wiring material	5,900
OTHER ITEMS	
Land, 10.23 acres	5,115
Building, 179,000 cu. ft.	55,000
Engineering	7,760
Total	\$160,300

price for coal of not more than \$4.50 per ton and should contain a provision that in no event should the price of electrical energy delivered exceed 1.5 cents, and that so far as possible payments, including settlements on account of coal charges, should be made monthly. The method of determining the true cost of coal from time to time, the committee felt, should be left to the management.

A new contract was executed between the companies as recommended, including the transfer of the substation as a part of the proceedings incidental to the investigation. An estimate was prepared of the cost of reproducing the substation under 1917 prices. This totaled \$160,300 (about \$105 per kva.) and is detailed in the tabulation printed here, as prepared by the engineers of the Turners Falls company.

The Effect of Daylight Saving on Load

Data and Curves Showing How the Daylight-Saving Law Affects Typical Central Stations in the Middle West—No Large Coal Saving—Creation of a New Evening Valley

IT IS difficult at this time to predict accurately what ultimate effect the daylight-saving law will have on central stations. Experience will be necessary to show exactly what will happen in properties of different classes. Enough data have been gathered, however, to indicate the trend of events in some properties and the probable consequences which must follow the shift in the clocks. In the collection and analysis of these data as much care as possible has been exercised to choose only fairly typical instances and those free from influences other than the advance in standard time. It should also be pointed out that the curves and data herewith were taken only from public utilities in the Middle West, where Eastern time had not been adopted prior to April 1.

SOME INTERESTING DEDUCTIONS

Among the facts apparent and the deductions drawn as the result of the investigation in these properties are:

That the plan as it now is will not effect any great saving in coal.

That a new valley has been created in the average load curve between the hours of 5 p. m. and 8 p. m.

That the average reduction in output in kilowatt-hours due to the daylight saving is around 5 per cent.

That the reduction in gross revenue will be larger proportionately than the reduction in output on account of the fact that the reduction comes mostly out of the "high-rate" business.

That while the change may for the present, in some instances, better the daily load factor, it will no doubt reduce the annual load factor, thus increasing the ratio of investment to income.

That the central stations are accepting the situation in the spirit of patriotism, but with full realization that relief from the general situation of increasing costs and stationary incomes must be granted.

The ten load curves herewith, received from plants in the territory reaching from Ohio to Iowa and from Kentucky to Minnesota, all bring out clearly the creation of the new evening valley. Of course, the amount of electric power and railway load carried by the individual plants determines in a general way how great the depth of this valley is, for it is created by the curtailment of lighting almost entirely.

Moreover, these curves are of interest in the fuel-saving argument. In the first place, the central stations burn only a small percentage of the nation's fuel. They burn it with more than ordinary efficiency. Now, the reduction in load which the daylight bill produces comes at such a time and in such a way that good operation will probably dictate carrying over the new valley many boilers ready to steam. So while a few kilowatt-hours less will be produced, the reduction in coal burned will be very small.

Judging from the general trend of the curves, it is reasonable to expect that the small-town utility will

lose much more than the average large town property. The data on outputs show that in some places the reduction in kilowatt-hours per day was as low as 3.5 per cent, but this could not be accepted at its face value since the daily addition of large power loads to the plants in question must undoubtedly have operated to offset the real decreases. The figure of 5 per cent is selected as the nearest weighted average obtainable. The figures in many cases are higher, especially in non-industrial cities where additional war business is not being added daily.

There appears to be no dissent from the opinion that gross revenue will be reduced by a greater percentage than the output. Those who have the temerity to estimate this place it at around 10 per cent to 15 per cent on the average.

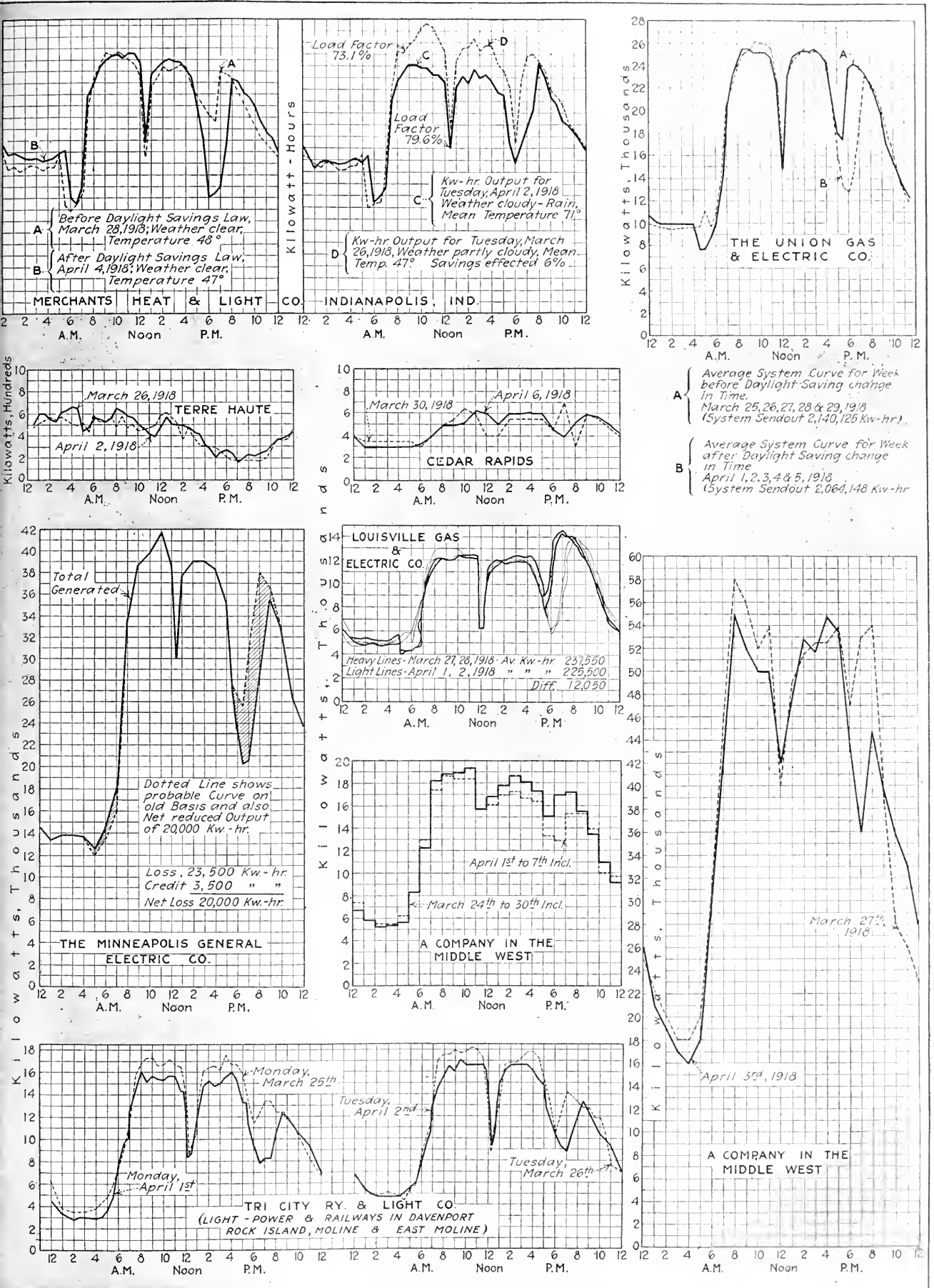
Where it has been possible to secure data on daily load factors, the figures have shown as much as 6 per cent increase for an individual day. Over longer periods the average increase in load factor shown has not been more than 2 per cent or 3 per cent. In fact, it is possible that in some instances worse daily load factors may be obtained under the new time than under the old. This matter of load factors in connection with daylight saving seems to be one of vital interest to central stations, for linked up with it is the question of extending the daylight saving plan to twelve months in the year instead of only seven months as the present law provides. On this subject one Middle Western central-station manager has written:

From the standpoint of conservation of fuel I do not believe that the present plan will accomplish a great deal, but it undoubtedly would if the plan covered the entire year. The plan as decided on will reduce the annual load factor and consequently increase operating and investment cost per unit.

If the plan were carried throughout the year, there would be an increase in the annual load factor, with a consequent reduction in both operating and fixed charges per unit, but more especially there would be a substantial reduction in the output, with a consequent conservation of fuel and reduction in the peak load, owing to the greater diversity obtained. This reduction in the peak load would release a great deal of equipment and enable many central stations to take on additional power business, which is extremely desirable, and would also conserve capital, labor and material by making it unnecessary to add to existing equipment to the same extent that would be necessary under the present plan.

The peaks would undoubtedly come in the morning in most latitudes, if the plan extends throughout the year, but would not be of the magnitude of the evening peak under the present plan.

During the months of November to January inclusive there is an overlapping of the lighting, power and railway loads, due to the fact that the lighting load comes on earlier than during the rest of the year. This makes it necessary for the central stations to provide a large excess of plant capacity to meet this peak load, which is only on about an hour and a half a day during these months. In order to meet this peak load banked fires are carried for twenty-two and one-half hours a day, and this represents an absolute waste of coal. All central-station companies are unquestionably willing to go the limit in carrying out any policies



EFFECT OF DAYLIGHT-SAVING LAW IN MIDDLE WEST CENTRAL STATIONS

which the administration may think necessary to the winning of the war, but, on the other hand, the federal, state and municipal authorities must take cognizance of orders which are increasing the cost to the central station and see to it that not only central stations but public utilities of all kinds receive such increases in rates as will enable them to keep pace with the growth of the communities, and this can only be done if they are permitted to increase rates to a point which will keep them in relatively as favorable a position in respect to earnings as during pre-war years.

The following from another central-station executive is of interest as showing the reality of the need for relief in the way of increased rates. He said:

I think that while this is a real economy and results in a saving of money to the people and a little fuel to the companies, it does not reduce the companies' cost to anything like the extent that it reduces their revenue, as the whole of their organizations must be kept up and the only saving is in fuel. In other words, this will operate as an additional hardship to the electric companies, and it affords one more good reason why the public authorities should take steps to ameliorate the conditions of electric companies brought about by rapidly advancing costs on the one side and stationary revenue on the other.

It must be remembered that while the decrease in kilowatt-hour output is only 5 per cent or 6 per cent, the decrease in revenue is very much larger. The decrease does not come off the power load, but comes almost entirely off the residence lighting load, which with all companies is the highest-priced energy that is sold. A considerable part of the cost of serving residences is what is called "stand-by" costs. These are not diminished at all, nor is the cost of standing ready to answer complaints. In fact, there is no saving except the saving in fuel, and this is very small compared to the loss in revenue.

Should the law not be amended to move the clocks ahead all the year, that new valley will probably be made the target of many a new-business manager. Ways and means of filling it will be the topic of the day. That being the case, it is reasonable to expect intensive solicitation of business that comes on between 5 p. m. and 8 p. m. Electric range loads, electric sign loads, electric truck loads and such business will become increasingly popular with the central station.

That such loads can be secured to fill a part of the valley is one bright gleam on the horizon. What may probably be another is to be found in the experience of a French central station. It was one of the largest concerns generating energy for sale in Paris. Before the daylight plan was adopted it was furnishing some 31,000 kw. per day. Within a day or two after the change this figure fell to 29,000 kw. When the normal daytime distribution of hours was restored in October the same plant was running at a nightly load of 35,000 kw., which within a few days of the change jumped to 53,000 kw.

This might be taken to indicate that the change back to the old standard time, which will take place next October, will be of greater significance to the electric companies than was the change to the new schedule in the spring. Authorities on lighting believe that this can be accounted for by the same theory that accounts for the use of lamps of larger and larger sizes by the general public as lighting has become more efficient. In this development it has been found that it is easy for the public to acquire the habit of using more light but that it is difficult for it to go back to lower standards of illumination when once it has been educated to higher intensities.

A LITTLE PLAIN TALK ON WATER POWERS

[From an address by Senator Jones of Washington in the United States Senate on April 27]

Why does not Congress enact legislation which will make possible the development of our water powers? Why is this not done when we have it on the high authority of the Chief Executive of the land that next to matters relating strictly to the immediate conduct of the war it is the most important public business before Congress?

For ten long years restrictive federal water-power laws have prevented the utilization of the energy contained in our descending waters. This mighty resource has been allowed to waste while enormous quantities of coal and oil have been taken from the earth and used up to meet the ever-increasing demand for electric energy, which during the last decade has increased sixfold.

The development of water powers is pioneer work of a hazardous nature, subject to many risks and uncertainties, and, under regulation of rates by public authorities, the hydroelectric business is and must be conducted upon a close margin of profit. Capital, therefore, will not invest nor men put in their time in hydroelectric development except upon a basis which, so far as government requirements are concerned, will at least not jeopardize the investment or prevent a fair return thereon. The time has come when the country needs the force and energy contained in its wasting water powers to supplement its man power, and the penalty of delay is enforced by fate against the unready.

Let us put the blame where it belongs. The fault is with Congress and with Congress alone. It is the lawmaking body. It cannot escape that responsibility. The controversy in the country over the character of legislation under which water powers can be developed has been reflected in Congress, and thus far we have been unable to get together. Each extreme has held fast to its own view and our water powers have been idle and wasting.

If Congress had acted five years ago and passed suitable legislation, millions and millions of water power would have been utilized that are still going to waste, and the successful carrying on of the war would have been enormously aided, fuel and labor shortage greatly lessened and the transportation problem rendered much less acute.

Failure of Congress to pass a workable water-power law at this session will be nothing short of crime and disloyalty to the dire necessity of our country. Germany and Austria have developed 90 per cent of their water powers and we but 10 per cent of ours.

Senators, the development of our water power would make the United States impregnable in time of war, commercially dominant in time of peace—impregnable in time of war through furnishing the energy required for production of explosives and munitions, for operation of railroads, and in a thousand ways in the conduct of hostilities, thus releasing our man power for the army and navy; commercially dominant in time of peace through furnishing energy for industrial activities, electrical and electrochemical processes, for transportation, for agriculture, and for the innumerable things into which the use of power enters in the daily life of our citizens. The safety, the welfare, the prosperity and the progress of the nation demand and require the prompt enactment of water-power laws in which protection of the public interest shall be co-ordinated with fairness toward capital. The House should pass a bill soon. If amendatory of ours, it should be sent to Congress and our differences harmonized.

Control of Station Auxiliaries

Placing Contactors Near Transformers Saves Copper—Emergency-Supply Circuit Equipped with Instruments to Serve as Test Circuit—Description of Other Methods Used to Good Advantage by Chicago Company

FEATURES of recent additions to the Northwest station of the Commonwealth Edison Company were brought out in last week's issue of the *ELECTRICAL WORLD*, particular attention being called to the excitation system adopted and the relay and protective devices employed. In this article, which concludes the account, it will be pointed out how the auxiliary motors are controlled, how copper has been saved in the circuits feeding them, and how an emergency-supply circuit is provided which may also be used for testing the performance of the auxiliaries.

POWER SUPPLY FOR THE AUXILIARIES AND THEIR CONTROL

Power for the motor-driven auxiliaries used in connection with the first three units installed was supplied at 220 volts, 60 cycles, from two 750-kva., 12,000/230-volt oil-cooled transformers. The circulating pumps were steam-driven. When the last three units were added all circulating pumps were provided with motor drive since the steam units already operating supply sufficient exhaust steam to meet the requirements of the entire station. All of the miscellaneous small auxiliaries of the plant have been added to the original 220-volt system. A 440-volt system has been installed to feed the motors of the circulating pumps and the economizer fans and the external blower fans on units Nos. 5 and 6. The possibility of saving copper dictated this change of potential.

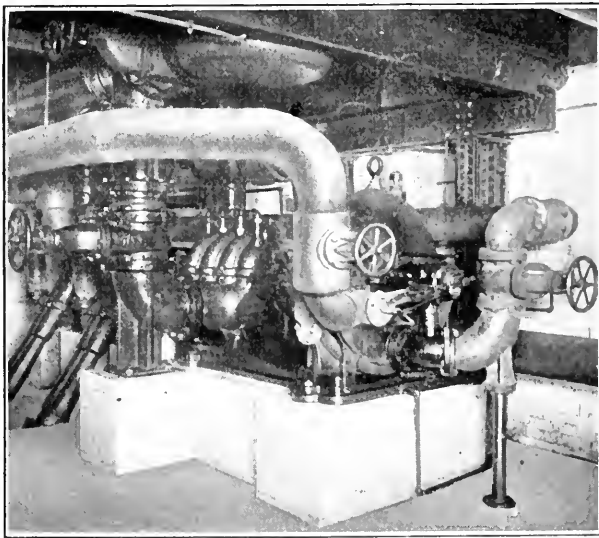
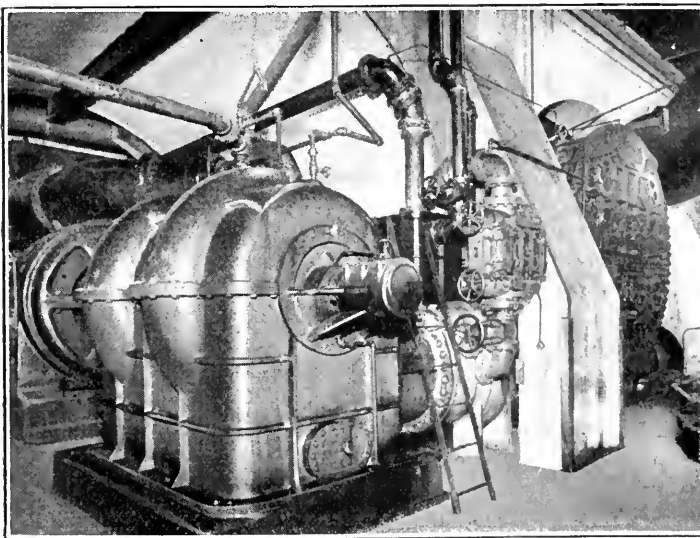
To supply 440-volt power three oil-insulated, water-

equipped with reverse power relays to permit parallel operation and with high and low voltage protection. They feed a 250-volt and a 460-volt bus, the lower potential being used for starting and the higher for running. The power transformers and the switchboards are installed in the transformer house about 300 ft. (91.4-m.) from some of the motors served.

Push-button control is employed for starting all of the motors on the 440-volt system. Industrial-type control was selected because the equipment is operated mostly by a class of labor which can hardly be intrusted with a 440-volt manual-control switching equipment. Moreover, it is less expensive.

The general scheme of control is shown in Fig. 3. The circuit for each 150-hp. economizer motor, of which there are five per unit, is connected with the 250-volt starting bus and 460-volt running bus through two three-pole contactors remote-controlled from push-button stations near the driving motor. Pushing the starting button automatically actuates the three-pole starting and running contactors in turn. Placing the contactors near the transformers, which, as has been said, are quite remote from the motors, has eliminated the necessity for one set of heavy three-conductor No. 4/0 cables per motor which otherwise would have been required for starting service.

An equally interesting plan has been worked out in connection with the emergency service for these motors. As may be seen from the diagram, one 440-volt emergency circuit serves all fifteen economizer motors. Two



FIGS. 1 AND 2—MOTOR-DRIVEN CIRCULATING PUMP AND TURBINE-DRIVEN CONDENSATE AND HYDRAULIC AIR PUMP

cooled, 2000-kva., 12,000/460-250-volt transformers were installed. The 12,000-volt supply for each transformer is taken from the switch house in the same manner as that for the transmission lines.

Polyphase watt-hour meters record the energy consumption on these three lines. The transformers are

sets of contactors are provided at the switchboard, and at each motor station the emergency circuit is connected to the bottom clips of a double-throw selector switch, the normal service to the motor being connected to this upper clip. Auxiliary contacts on this switch automatically transfer the control from the normal to

the emergency circuit when the switch is thrown. The throw-over to emergency is under lock and key, so that only the authorized attendants can have access thereto. The emergency circuit is the only economizer motor circuit in which instrument transformers are connected, it being the idea to use it exclusively if tests are being made.

The cables serving the three 650-hp. circulating pumps on units Nos. 4, 5 and 6 and the two 300-hp.

blowers assure more reliable service than any other source of supply which could be provided. Energy for these solenoids is taken from the station operating bus. The contactors for the various motors of each unit, Nos. 4, 5 and 6, are fed from a separate direct-current bus to localize trouble in emergencies. This grouping of contactors is shown in Fig. 3. Each individual direct-current bus is connected with the station operating bus by means of a single-pole solenoid-operated

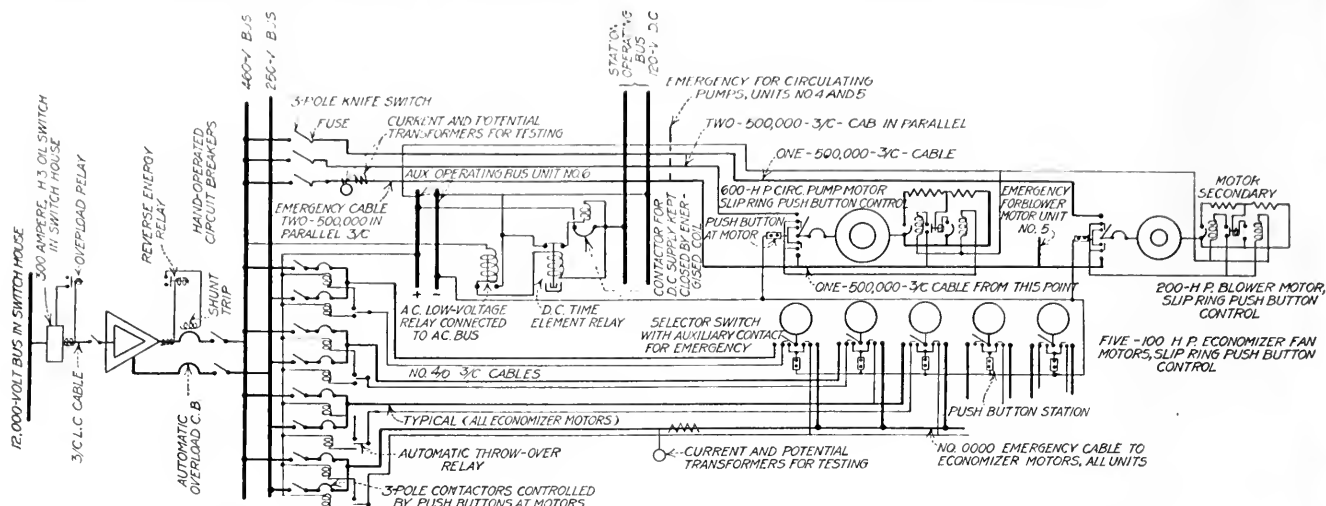
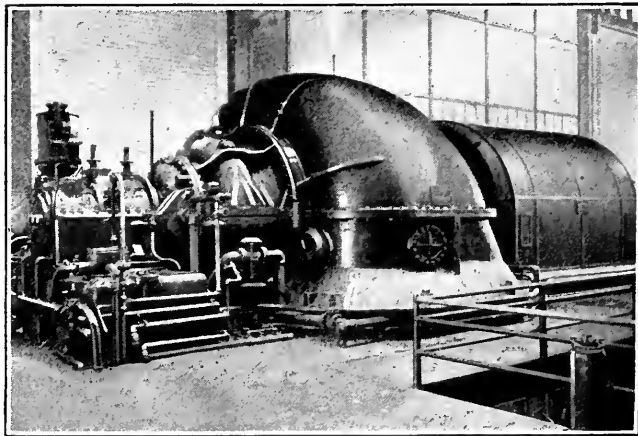
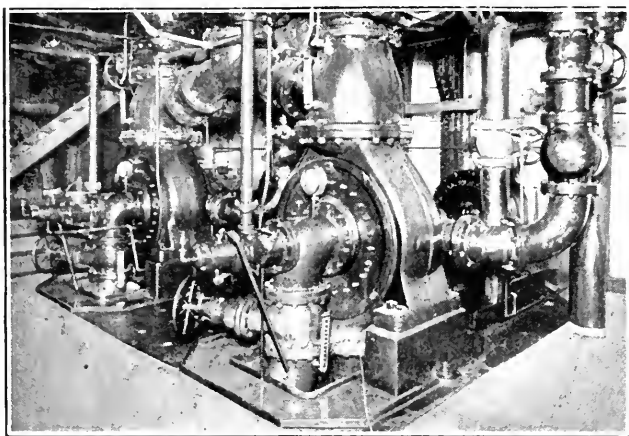


FIG. 3—METHOD OF CONTROLLING AUXILIARIES THAT INCREASES RELIABILITY OF SERVICE

blowers on units Nos. 5 and 6 consist of two three-conductor 500,000-circ. mil lead-covered cable. These are connected to the 460-volt bus through knife switches equipped with fuses. At the starting contactor panel the circuits are connected to double-throw selector switches. The motors, which are of the slip-ring type, are started by push-button control, industrial-type contactors being used to cut resistance out of the rotor circuit instead of employing the 250-volt starting bus. This is done to eliminate heavy rush of current in starting these motors. An emergency feed which is separate from that used for the economizer motors is

switch which is held closed by a two-element low-voltage relay. This consists of an alternating-current instantaneous relay of the circuit-closing type which closes the circuit through a direct-current time-element relay of the circuit-opening type. The two-element relay operates if the potential on the 460-volt bus drops as low as 230 volts for ten seconds.

Additional protection for the auxiliary equipment is provided by the installation of signal lamps near the push-buttons controlling all of the 440-volt motors. The lamps are fed from the 250-volt bus. The buttons are not to be operated unless the lamps are lighted, in-



FIGS. 4 AND 5—COMBINED AIR AND CONDENSATE PUMPS SERVING 35,000-KW. TURBO-GENERATOR AT RIGHT

provided for the motors. It is connected to the selector switches at the contactor panels and is equipped with instrument transformers for testing purposes.

All of the contactors on the 440-volt system are operated by 120-volt direct-current solenoids. Direct current was selected because the storage batteries em-

dicating that the starting bus is energized. This precaution has been taken to prevent the starting of motors on full potential.

The entire electrical design of the Northwest station was handled by the inside plant division of the engineering department of the company.

Value of Higher Steam Pressures

A Statement of the Yearly Saving Which Can Be Realized from Higher Steam Pressures, with Capitalized Value of This Saving for Various Loads, Coal Rates and Rates of Capitalization

BY J. T. FOSTER

Engineer Public Service Electric Company of New Jersey

DECREASED net profits due to the rapidly mounting cost of operation have forced the central-station industry to face a serious situation. While it is true that a measure of relief has been obtained by the granting of petitions for increased rates, the greater part of the difference between normal profits and present-day profits has to be made up by rigid economy. This condition is not limited by the duration of the war because there is always a greater or less degree of inflation which causes the high prices of material and labor to continue for some years after the actual conflict has ceased.

The need for practicing economy, however, is not a new experience for utility companies, as the whole development of the industry has been along the lines of more economical operation. Since the steam turbine first came into use the attention of operating and designing engineers has been directed to its improvement because the greatest heat loss by far occurs in this part of the power-plant equipment. Condensing apparatus was improved and superheat increased so as to operate on the most efficient part of the steam cycle, and in addition the mechanical features of the turbine were redesigned to make the actual machine show a

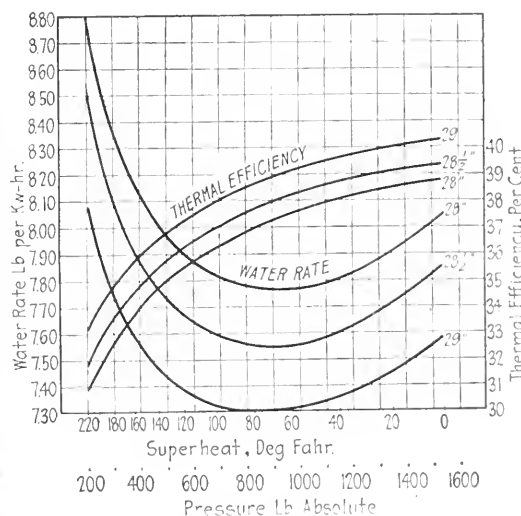
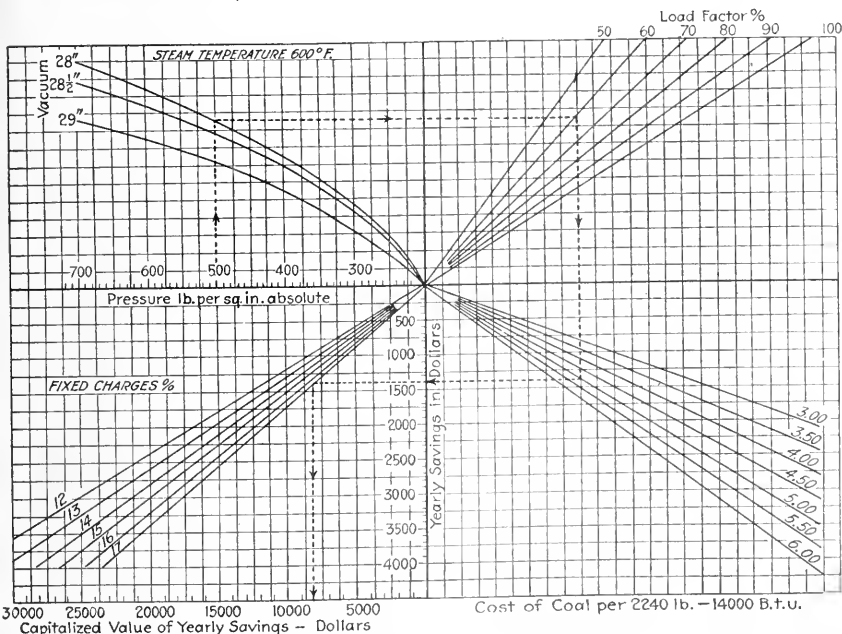
performance as close as possible to that of the ideal turbine.

It is probable that because of mechanical limitations the ratings of turbines will not increase much above those of the largest units now in use and that any further progress will necessarily involve increasing the steam pressure.

The installation at the Joliet plant of the Public Service Company of Northern Illinois of a 10,000-kw. turbine designed for 300-lb. (21 kg. per sq. cm.) steam pressure is an advance in this direction, and it is believed that water-rate tests on this unit will show a surprisingly low steam consumption for a turbine of this capacity.

It is probable that within the next five years operating pressures will be increased to 500 lb. or 600 lb. (226.8 kg. to 272.2 kg.), so it is interesting to calculate just what will be the probable effect on fuel cost under these conditions. Fig. 1, which is a curve* of theoretical Rankine-cycle water rates and thermal efficiencies, may be used to ascertain the money value of any change to higher pressures. Fig. 2 indicates the yearly saving and the capitalized value of this saving for various load factors, coal costs and rates of capitalization. The method of calculating the points is illustrated by Table I, printed on the following page.

The use of the chart for obtaining this information is illustrated by the following problem:



FIGS. 1 AND 2—THERMAL EFFICIENCIES AND WATER RATES OF TURBINES WITH DIFFERENT STEAM PRESSURES, AND METHOD OF ASCERTAINING CAPITALIZED VALUE OF SAVING POSSIBLE WITH HIGHER STEAM PRESSURES

performance as close as possible to that of the ideal turbine.

Probably the most profitable line of development was that of increasing the capacity of turbo-generators, as this resulted in a marked improvement in thermal efficiency and a consequent decrease in steam consumption. Recent developments, however, have led some en-

Problem.—What would be the yearly saving and value of the saving, capitalized at 17 per cent, resulting from an increase in pressure from 200 lb. (14 kg.) to 500 lb. (35 kg.), keeping the steam temperature constant at 600 deg. Fahr. and the vacuum at 28 in. (70

*Reproduced from an article by the author in the ELECTRICAL WORLD of Dec. 8, 1917.

em.). Boiler and furnace efficiency is assumed to be 70 per cent, load factor 60 per cent and cost of 14,000 B.t.u. coal \$5 per 2240 lb. (1016 kg.).

Solution.—On the 500-lb. line in the upper left-hand quadrant of the chart project upward to 28-in. vacuum line, then horizontally to the 60 per cent load-factor

TABLE I—RELATIVE COAL COSTS AT 200 LB. AND 500 LB. STEAM PRESSURE
Steam Temperature, 600 Deg. Fahr. Vacuum, 28 In.

	200 lb.	500 lb.
Rankine thermal efficiency (per cent)	30.9	35.0
Rankine efficiency ratio (per cent)	76.7	74.0
Combined boiler efficiency (per cent)	70.0	70.0
Load factor (per cent)	60.0	60.0
Coal cost, 2240 lb., 14,000 b.t.u.	\$5.00	\$5.00
B.t.u. equivalent of one kw.-hr	3415	3415
Unit of capacity (kw.)	1000	1000

Cost per day (200 lb. pressure):
$$\frac{3415 \times 1000 \times 24 \times 0.60 \times 5}{0.70 \times 0.309 \times 0.767 \times 2240 \times 14,000} = \$17.20$$

Cost per day (500 lb. pressure):
$$\frac{3415 \times 1000 \times 24 \times 0.60 \times 5}{0.70 \times 0.35 \times 0.740 \times 2240 \times 14,000} = \$43.35$$

Daily saving = \$47.20 - \$43.35 = \$3.85.
Yearly saving = \$3.85 × 365 = \$1,405.
Capitalized value of \$1,405 at 17 per cent = \$8,265.

line, vertically downward to the \$5 coal line, then horizontally again to the left, where the annual saving (\$1,400) will be found. Continue vertically to the left to the 17 per cent capitalization line, then vertically downward, and read the capitalized value as \$8,250.

This means that \$8.25 per kilowatt is the maximum increase in cost which could be paid for the benefits of 500 lb. pressure under the conditions. It is interesting in this connection to refer to Table I, which shows an estimate of the increase in cost of equipment to take care of higher pressures.

It may be noted that for 500 lb. pressure the estimated increase in total cost of the plant is 4.40 per cent. Referred to a cost of \$80 per kilowatt of plant capacity at 200 lb., the cost of a 500 lb. plant would be approximately \$83.50, or \$3.50 more per kilowatt. This partly offsets the \$8.25 per kilowatt obtained from Fig. 2.

TABLE II—PER CENT* INCREASE IN TOTAL COST OF PLANT WITH ADOPTION OF DIFFERENT PRESSURES

Item	PRESSURE (LB.)			
	300	400	500	600
Boilers	0.75	1.50	2.20	2.90
Turbines	1.40	1.40	1.40	1.40
Condensers	-0.20	-0.40	-0.50	-0.60
Economizers	0.00	0.00	0.00	0.00
Piping	0.50	0.90	1.30	1.70
Total percentage increase	2.45	3.40	4.40	5.40

*Referred to 200 lb. as a datum.
but still leaves \$4.75 as the net gain. The yearly saving corresponding to this capitalized figure is \$810 per thousand kilowatts of capacity. While there may be some factors which will decrease this amount somewhat, it is believed that the change will be profitable and that a large part of the estimated gains will be realized.

An Ornamental Corona Discharge

The illustration shows an interesting example of the use of a corona discharge for a practical purpose. The A. I. E. E. emblem was formed of copper wire, No. 18 B. & S., embedded in a mica shield and energized with



PUTTING A PHENOMENON TO PRACTICAL USE

30,000 volts at a frequency of 200,000 cycles per second. This is probably the first time that a corona phenomenon has been turned to practical advertising use. The demonstration took place very recently at a meeting of the Toronto Section of the A. I. E. E. On this occasion a paper was read by W. P. Dobson on the subject of "High-Voltage Phenomena."

Electrification at St. Louis

The Anheuser-Busch Brewing Association, St. Louis, Mo., is building a seven-story structure covering an entire city block. In the design of this "Bevo Building" arrangements were made for thirteen railroad tracks about ten cars long, extending into the basement of the building and between umbrella sheds for the purpose of loading cars. It was realized that it would be unsatisfactory to have steam locomotives do the switching under this building. This necessitated the adoption of electric locomotives for that portion of the line.

The Manufacturers' Railway, which consists primarily of switching yards in St. Louis with interchange connections with the other railroads, in following its policy of general improvement has now decided to extend the electrification from the Bevo Building switching yard so that electric locomotives can be used in interchanging cars with other lines.

The substation for this electrification is at about the center of the electrified zone. Energy will be purchased from the Union Electric Light & Power Company at 13,200 volts alternating current and will be distributed at 600 volts direct current. The transformation will be performed by one 1050-kva., three-phase, 13,200-volt transformer and one 1000-kw. rotary converter, started from half-voltage taps. Provision was made for installing an extra converter at some future time when the steam locomotives are not helping with the switching, as they are at present.

Precise Measurement of Alternating Currents

Elements of Two Identical Electrodynamometers so Connected in Wheatstone Bridge that Alternating Current Through Elements Can Be Ascertained by Measuring Direct Current That Produces Zero Torque

BY C. O. GIBBON

A PRECISION method of measuring alternating currents which involves relatively simple apparatus and in which disturbing influences of all kinds are eliminated or minimized so that their effects are negligible has been investigated by the writer to determine the accuracy of the method. In brief, the apparatus required consists of two identical electro-dynamometers, the fixed and movable coils of which are inserted in the arms of a Wheatstone bridge so that if an alternating current is allowed to flow through the coils its value can be ascertained by measuring the direct current required in the same coils to produce zero torque.* In other words, conditions are adjusted so that there is no deflection of the electro-dynamometer and the value of the alternating current is determined by measuring the direct current with a potentiometer.

Theory Involved.—The principles which are involved can be explained by considering the bridge circuit $fbgd$ (Fig. 1). Let A and a represent respectively the fixed and suspended coils of one electro-dynamometer, and C and c the coils of an exactly similar instrument. Denoting the resistance by R , the self-inductance by L and the mutual inductance by M , with the proper subscripts to designate the various arms of the quadrilateral or bridge circuit, let it be assumed that the following electrical conditions are satisfied:

$$\begin{aligned} R_A &= R_C = R_a = R_c && \text{ohms (1)} \\ L_A &= L_C, L_a = L_c && \text{henries (2)} \\ M_{Aa} &= M_{Cc} && \text{henries (3)} \end{aligned}$$

R_A includes, of course, the whole resistance in the arm fb , and similarly with the other elements.

If across the terminals b and d of such a circuit a continuous emf. be impressed by inserting a storage battery controlled by the switch S_c , a continuous current of I_c will flow through the external circuit $bS_c d$. Owing to the conditions assumed, this current will divide equally between the two sides of the bridge, $I_c/2$ amp. flowing through the side bgd , and $I_c/2$ amp. flowing through the side bfd . Since the resistances of the arms are equal, the potential difference from f to g caused by the continuous current is zero. Hence f and g may be connected together with a wire, or any conditions desired may be imposed upon the external circuit $fS_a g$, without either disturbing the continuous currents through the various arms of the bridge or affecting the external circuit $bS_c d$. Conversely, any variation in the external circuit $bS_c d$ will in no way either affect the external circuit $fS_a g$ or disturb the

distribution of continuous currents through the various arms of the bridge circuit.

Likewise, if an alternating emf. be impressed across the terminals f and g of the bridge circuit by closing the switch S_a , an alternating current of I_a r.m.s. amp. will flow through the external circuit $fS_a g$. Owing to the conditions assumed at the outset, this current will divide equally between the two sides of the bridge, $I_a/2$ amp. flowing through the side fbg , and $I_a/2$ amp. flowing through the side fdg . The potential difference from b to d caused by this alternating current will be zero. Hence b and d may be connected together by means of a wire, or any desirable conditions imposed upon the external circuit $bS_c d$, without either disturbing the alternating current through the various arms of the bridge circuit or affecting the external circuit $fS_a g$. Conversely, any variation in the external circuit

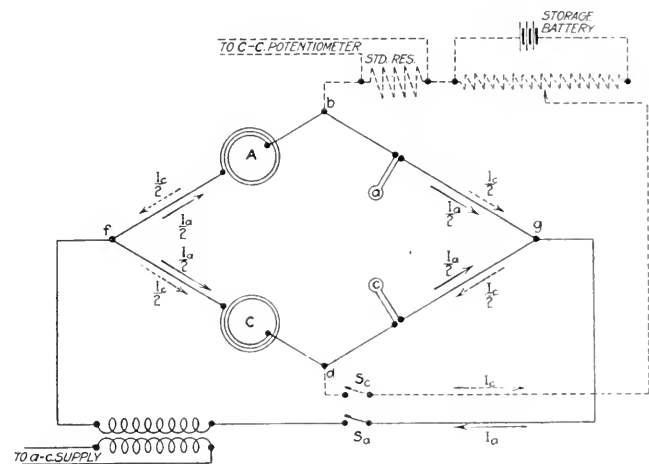


FIG. 1—D.C.-A.C. BRIDGE IN SIMPLIFIED FORM

$fS_a g$ will in no way either affect the external circuit $bS_c d$ or disturb the distribution of alternating currents through the various arms of the bridge circuit.

From the above considerations it is evident that a continuous emf. may be impressed across bd simultaneously with an alternating emf. across fg without the resulting currents interfering with each other beyond the terminals of the bridge circuit. Within the bridge circuit, however, the alternating and direct currents will be superposed through the coils of each of the electro-dynamometers A, a and C, c .

Resultant Torque.—Considering instrument Aa only, let i equal the instantaneous value of the complex harmonic current, of r.m.s. value I_a , which flows through the instrument. Then

$$i = \sqrt{2}[I_1 \sin \omega t + I_2 \sin (2\omega t + \beta_2) + I_3 \sin (3\omega t + \beta_3) + \dots] \quad \text{instantaneous amp. (4)}$$

and, as can be easily demonstrated,

$$I_a^2 = I_1^2 + I_2^2 + I_3^2 + \dots \quad \text{r.m.s. amp. (5)}$$

The even harmonics are usually negligible.

During one-half of the cycle the current through the

*The employment of an electro-dynamometer in a null or zero-reading method for precise measurements of alternating currents was originally suggested by Drs. P. A. Wenner and E. Weibel at the Bureau of Standards. It was communicated by them to Dr. A. E. Kennelly at Harvard University, under whose direction the writer made this investigation on the use of the method. Since the conclusion of the research information has been received from the Bureau of Standards that the method has been tested there with very satisfactory results. Inasmuch as the method was first developed at the bureau, the writer is indebted to that body for permission to announce his results, and he is also under obligation to C. W. Whitall for assistance in making the tests at the Massachusetts Institute of Technology.

fixed coil A (Fig. 1) is $(I_c/2 - i/2)$ amp., and that through the suspended coil a is $(I_c/2 + i/2)$ amp., taking the positive directions of the continuous currents as designated by the dotted arrows. During the other half of the cycle the fixed coil receives $(I_c/2 + i/2)$ amp., and the suspended coil $(I_c/2 - i/2)$ amp.

The instantaneous torque developed by an electro-dynamometer, being proportional to the product of the

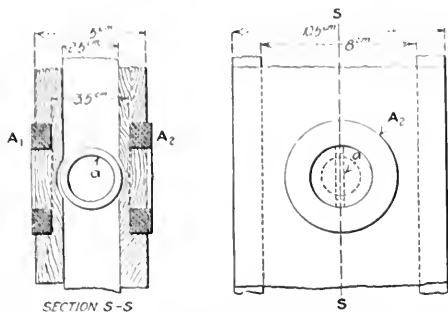


FIG. 2—FORM AND ESSENTIAL DIMENSIONS OF ONE OF THE ELECTRODYNAMOMETERS AFTER REMODELING

All coils are of enameled copper wire. The two fixed coils A_1 and A_2 have a combined resistance of about 116 ohms at 25 deg. C. and a combined inductance of nearly 0.15 henry. Each is composed of 1390 turns of No. 30 A. W. G. wire of bare diameter 0.255 mm., enameled to about 0.274 mm. The movable coil contains 676 turns of No. 38 A. W. G. of bare diameter 0.101 mm., enameled to about 0.112 mm. It has a resistance of about 115 ohms at 25 deg. C. and an inductance of 14.5 millihenries.

instantaneous currents in fixed and movable elements, is at any moment

$$T' = (k/4) (I_c + i) (I_c - i) \quad \text{dyne perp. cm. (6)}$$

where k is a constant depending upon the construction and adjustment of the instrument and is so chosen that T' will be the torque, in dynes perpendicular to a radius of 1 cm., set up by a current of 1 amp. passing steadily through both elements. Then

$$T' = (k/4) (I_c^2 - i^2) \quad \text{dyne perp. cm. (7)}$$

The average resultant torque T during one complete cycle of the fundamental frequency is

$$T = \frac{k}{4} \times \frac{1}{2\pi} \int_{\omega t = 0}^{\omega t = 2\pi} (I_c^2 - i^2) d(\omega t) =$$

$$\frac{k}{4} \times \frac{1}{2\pi} \left[\int_{\omega t = 0}^{\omega t = 2\pi} I_c^2 d(\omega t) - \int_{\omega t = 0}^{\omega t = 2\pi} i^2 d(\omega t) \right] \text{ dyne perp. cm. (8)}$$

$$= \frac{k}{4} I_c^2 - \frac{k}{4} \times$$

$$\frac{1}{2\pi} \int_{\omega t = 0}^{\omega t = 2\pi} 2[I_1 \sin \omega t + I_2 \sin (2\omega t + \beta_2) + \dots]^2 d(\omega t) \text{ dyne perp. cm. (9)}$$

$$= \frac{k}{4} [I_c^2 - (I_1^2 + I_2^2 + \dots)] = \frac{k}{4} (I_c^2 - I_a^2) =$$

$$k \left[\left(\frac{I_c}{2} \right)^2 - \left(\frac{I_a}{2} \right)^2 \right] \text{ dyne perp. cm. (10)}$$

The first integral in equation (8) is the steady torque which would be produced by a continuous current $I_c/2$ in both elements acting alone. The second integral is the average resultant torque which would be produced by the alternating current passing through both coils and acting alone.

The resultant torque T must therefore vanish when the alternating current is of such strength that its torque just equals the torque produced by the continuous current. According to equation (10) this will occur when the root-mean-square value of the alternating current I_a in the external circuit $fSag$ is numerically equal to the steady value of the continuous current I_c in the external circuit bSd . Exactly the same conclusions may be reached by a consideration of the instrument C,c (Fig. 1).

Therefore an alternating emf. may be impressed across gf , the current I_c regulated with a suitable rheostat till the deflection of A,a is zero, and I_c then determined to any desired degree of precision by measuring, with a direct-current potentiometer, the drop in potential across the standard resistance in Fig. 1. The r.m.s. value of I_a will then be numerically equal to the measured value of I_c .

Simplification Possible.—Since only the instrument A,a needs to be observed, the instrument C,c , which serves merely as a pair of impedances to balance the impedances of A,a , need not be constructed in the form of a dynamometer. However, to facilitate satisfying the conditions previously mentioned it is advisable to use a duplicate dynamometer instrument in which the movable coil, instead of being suspended, may be so adjusted as to occupy any desired position relative to the fixed coil. If, so far as their electric and magnetic circuits are concerned, the two instruments are thus exact duplicates, equations (1) and (2) will be satisfied; while if the position of c relative to C is adjusted to exactly that of a relative to A , equation (3) will be satisfied. By arranging the working instrument so that the zero position of a is perpendicular to A , and adjusting the coils of the "dummy" electro-dynamometer so that they are mutually perpendicular, then there is no appreciable stray magnetic flux from one instrument to the other if the two are sufficiently separated. Thus mutual inductance is eliminated from consideration and

$$M_{Ac} = M_{Aa} = M_{Ca} = M_{Cc} = 0 \quad \text{henries (11)}$$

The Experimental Instrument.—In order to secure the necessary equalities among the constants of the bridge circuit and to avoid any possible trouble from eddy currents in the frames of the instruments, a pair of wooden-box laboratory galvanometers were used for conversion into electro-dynamometers, one as the working instrument and the other as the "dummy." The

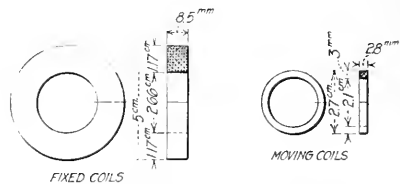


FIG. 3—DETAILED DIMENSIONS OF COILS USED IN ELECTRODYNAMOMETER

two instruments were identical except that the movable coil of the dummy instrument was mounted in a wooden spindle so that it could be set at any desired angle with respect to the fixed coils.

Although theoretically possible, it is not practically feasible to construct two exactly similar instruments which will conform with adequate precision to equations (1) and (2). To obtain the exact balance of the

quadrilateral or bridge circuit required for precise measurements, it was necessary to add small adjustable resistances and inductances in the various arms external to the instruments themselves (Fig. 4).

To render the working instrument independent of the earth's magnetic field, a compensating bar magnet was so placed that when the movable coil is energized alone with continuous current, by having key m and a plug at h open and closing key w , no deflection occurs. The deflection of the movable coil was observed in the

ACCURACY WITH NULL-READING ELECTRO-DYNAMOMETER METHOD OF MEASURING ALTERNATING CURRENTS

Reading No.	A. C. (Amp.)	D. C. (Amp.)	Difference* (Amp.)	Difference* (per Cent)
1	0.005415	0.005530	+0.000115	+2.08
2	0.009700	0.009745	+0.000045	+0.462
3	0.011705	0.011717	+0.000012	+0.118
4	0.013615	0.013610	-0.000005	-0.0368
5	0.015410	0.015424	+0.000014	+0.0906
6	0.018315	0.018321	+0.000006	+0.0337
7	0.035075	0.035010	-0.000065	-0.185
8	0.053037	0.053167	+0.000130	+0.246
9	0.081510	0.081641	+0.000131	+0.161
10	0.098560	0.098443	-0.000117	-0.119

*The percentage errors are based upon the direct-current readings; + indicates that the direct-current reading is greater than the alternating-current; - indicates that the alternating-current reading is greater than the direct-current.

usual manner by means of a mirror and beam of light reflected from a scale into a telescope. The motion of the movable coil is damped by means of a mica vane submerged in oil.

Method of Balancing and Results Obtained.—The continuous current used for balancing the alternating current was obtained from a storage battery, while the alternating currents to be measured were supplied through the choke coils Z and t from the secondary coil of a transformer excited by a 60-cycle sine-wave alternator. As indicated in Fig. 4, both the alternating and direct currents, after being balanced on the differential electro-dynamometer, were measured in succession by one and the same Drysdale-Tinsley a.-c.-d.-c. potentiometer. The dynamometer was balanced by adjusting the slide wire of resistance r until no deflection was observed on opening or closing m . The alternating-current and direct-current drops of potential across the standard 10-ohm non-inductive resistances R and R' were then measured by the potentiometer.

A sinusoidal current is essential to this check, because the tuned vibration galvanometer used with the alternating-current potentiometer responds selectively to the fundamental frequency and will indicate a balance only for I_1 in equation (5). Furthermore, as has already been demonstrated by the algebraic analysis, the differential electro-dynamometer balances for the root-mean-square I_a —see again equation (5)—of any ordinary alternating wave form, unless such relatively high-frequency harmonics should be present that capacitance effects are produced between the layers in the windings. In this case an error might be produced in the effect of that particular component. The effect of such errors of small high-frequency components upon the resultant root-mean-square value, however, may be regarded as insignificant.

From the table it may be seen that the average difference between the alternating current and direct current above 10 milliamp. is 0.125 per cent, or 1.25 per mil. By studying the behavior of the instrument with a view to improvement it is believed that a still higher degree of precision could be obtained over a considerably wider range.

Important Where Alternating Current Is Applied.—There is a slight advantage in impressing alternating emf. across bd and a continuous emf. across fg because the zero position of the movable coil need not then be perpendicular to the fixed coil, a feature of considerable advantage from the practical viewpoint. This is true because if the moving coil of the working instrument should deflect so as to increase the inductance of both elements, more alternating current will tend to flow through C, c than through A, a , with an alternating emf. impressed across fg , thus causing false balances in the differential electro-dynamometer. On the other hand, if an alternating emf. be impressed across bd , the increase in inductance between A and a will in no wise disturb the distribution of the alternating currents through the various arms of the Wheatstone bridge.

As a practical laboratory instrument, the differential electro-dynamometer should be self-contained. The dummy might advantageously be mounted in the pedestal of the working instrument, with its fixed and movable coils mounted rigidly perpendicular to each other. The fixed and movable elements of each might be designed so as to have very nearly equal resistances and inductances, and so small over-all adjustments of each could be made for the final precision balance. A single set of alternating-current and direct-current adjustments could then be made to equalize the four arms of

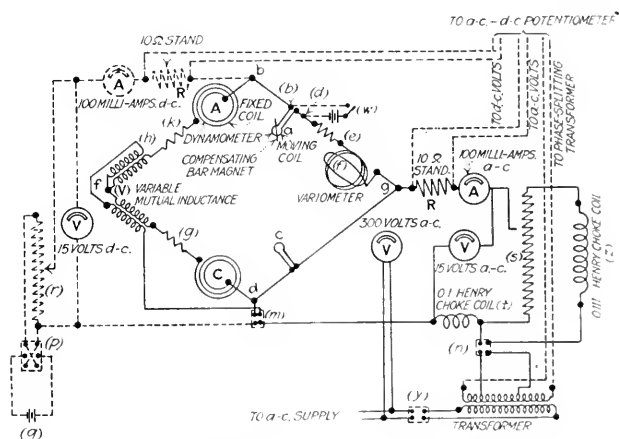


FIG. 4—COMPLETE TEST CIRCUIT EMPLOYED

The alternating-current external circuit is indicated in heavy lines and the direct-current external circuit in broken, light lines. These two external circuits are carefully insulated from each other. A double key m permits both circuits to be closed or opened simultaneously. The quadrilateral is adjusted into resistance balance, to satisfy equation (1) by means of the three adjustable resistances e , g and k . Being non-inductive, these resistances can be adjusted without changing the inductance of the arms. The Campbell variable mutual inductance V and the variometer f make it possible to obtain the inductance balance without disturbing the resistance balance, since the inductance balance can be adjusted thereby to satisfy equation (2) without changing the resistance in the arms. Each arm is balanced against the corresponding arm with both continuous and alternating currents. Mutual inductance between the fixed and movable coils is eliminated, as indicated in the paragraph immediately preceding equation (11).

the quadrilateral. Such an instrument, once adjusted, should prove a very convenient, inexpensive and extremely accurate device for making precise measurements of alternating currents.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

CHARTING INSTRUCTIONS TO GET BETTER ECONOMIES

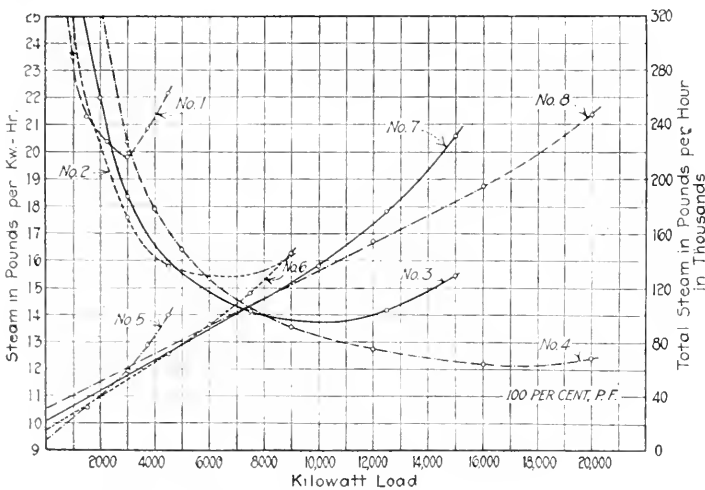
How an Iowa Company Instructs Its Plant Operators to Handle Different Loads and Secures a Record of the Way Plant Is Actually Run

Realizing that the over-all efficiency of its station will reach its maximum if the various generating units are combined to run at the most economical loads for the particular load condition encountered, the Moline-Rock Island Manufacturing Company, Davenport, Iowa, has worked out a scheme for showing its plant operators how to combine the generators to get the best results. Tests were run on the units to determine their efficiencies in terms of steam consumption at various loads within their ratings. While the results of these tests (Fig. 1) can be used by any one having technical skill and judgment to determine the proper combination of machines to carry any load, the company desired to present the information in such form that any operator, regardless of his technical judgment, may determine instantly what to do under ordinary conditions. Consequently all of the more common operating conditions that are likely to arise are listed

CHART OF TURBINES TO OPERATE AT DIFFERENT LOADS TO RELIEVE OPERATOR FROM NECESSITY OF RELYING ON HIS OWN JUDGMENT

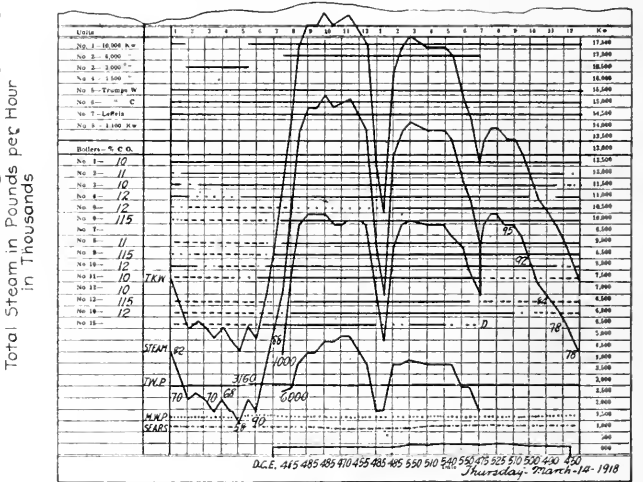
Kw. Load	Units in Service	Kw. Load per Respective Unit
Up to 1750	3,000	Total load
1,750-4,500	6,000	Total load
4,500-8,000	10,000*	Total load
10,000	10,000 6,000	8,000-9,000 2,000-1,000
12,000	10,000 6,000	9,000-8,000 3,000-4,000
14,000	10,000 6,000	10,000-9,000 4,000-5,000
16,000	10,000 6,000 3,000	10,500-11,000 5,300-4,800 200
18,000	10,000 6,000 3,000	11,500-11,000 6,300-6,800 200
20,000	10,000 6,000 3,000	12,000 7,200 800
22,800	10,000 6,000 3,000	12,000 7,200 3,600

*If two units are used run 6,000 at 200 kw.



STEAM CONSUMPTIONS OF DIFFERENT UNITS AND PORTION OF LOG SHEET USED BY DAVENPORT (IOWA) COMPANY

Curves Nos. 1 and 5 represent the water rates and total steam consumption of a 3000-kw. turbine at 100 per cent power factor and 0 deg. superheat; Nos. 2 and 6 represent the corresponding quantities for a 6000-kw. turbine at 90 per cent power factor and



100 deg. superheat; Nos. 3 and 7, the values for a 10,000-kw. turbine at 95 per cent power factor and 100 deg. superheat, and Nos. 4 and 8, the values for a 20,000-kva. turbine at 80 per cent power factor and 125 deg. superheat.

in a table like that shown herewith, giving the combinations of units to use and the loads on which each unit shall be operated. With this table the operator needs to do no figuring and does not even have to consult the curve sheet.

As a detail in connection with the actual making of these charts and curves, it is interesting to observe that the tabulated data are blue-printed on separate sheets and then pasted on the curve sheet. This saves time in changing the tracings as well as the curve

sheets when changes in the operating schedule are necessary.

Of next importance to providing proper instructions for handling various loads is the matter of seeing that the instructions are carried out intelligently. The officers of the company keep in touch with this situation through a system of daily power-house reports. In addition to the usual data asked for on daily power-house reports, these reports call for the load curves from each of the plants, the total load curve and a

graphical statement of the hours of operation of each turbine and boiler unit. A part of one of these reports is reproduced herewith. The horizontal lines drawn through the load curves are the feature of the report. Each line, it may be observed, is opposite the designation of a turbine or boiler unit at the right margin of the page. The length and position of these lines indicate what machines were used at each hour, and also show in definite relation to the load curve how accurately instructions have been carried out. The lines used to show boiler operation also show whether the boiler was steaming or was banked.

B. J. Denman, president of the Moline-Rock Island Manufacturing Company, is a strong believer in the value of this method of charting operating methods. He has applied it in the past to other plants under his direction, and each time improved economy has resulted.

USE OF SIMPLE PANEL FOR THE TESTING OF FUSES

**Permanently Connected Lamps and Fuse Blocks
Permit Testing Plug or Cartridge Fuses
in Short Space of Time**

A panel is in use at the New Haven (Conn.) office of the United Illuminating Company which makes it very convenient to test fuses. As shown herewith, it consists of two 10-watt lamps and two fuse blocks mounted at the top of a 10-in. (25.4-cm.) by 14-in. (35.5-cm.) by $\frac{1}{2}$ -in. (1.27-cm.) wooden board equipped with a $\frac{1}{8}$ -in. (0.32-cm.) wire brace permitting the device to be set upon the counter easel fashion. The fuse blocks are wired in multiple as indicated so that either a plug fuse or a cartridge-type fuse up to those rated at 30 amp. may be tested at a moment's notice. The



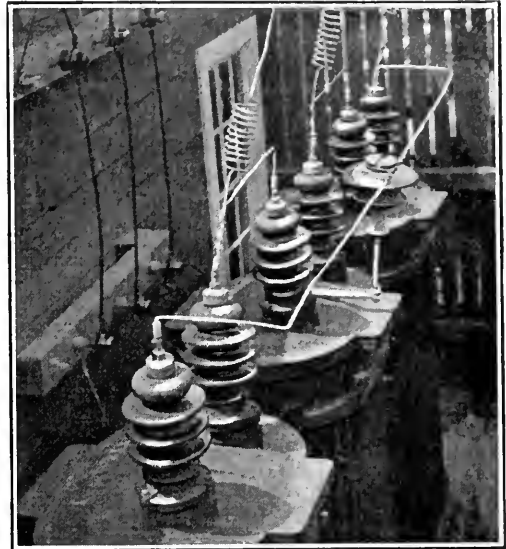
OUTFIT TO TEST CONTINUITY OF PLUG OR CARTRIDGE FUSES

test is for continuity only, the lighting of the lamp above the tested fuse indicating a satisfactory circuit through the fuse under examination. One plug fuse and one cartridge fuse remain in circuit constantly. The thread in the receptacle at the left, where the plug type of fuse is tested, has been hammered down so that no screwing in of the plug is required in testing.

AN INEXPENSIVE MOUNTING FOR TRANSFORMER BUSES

**Steel Strap Attached to Case Supports Pin Insulator,
Which in Turn Carries Bus—Method Is Both
Safe and Neat**

When installing small three-phase delta-connected transformer blanks the difficulty of placing the connection between the two end transformers may often be solved, as shown in the accompanying figure, by mount-



BUS CONNECTING TERMINALS AT OPPOSITE ENDS OF BANK
SUPPORTED BY PIN INSULATOR ATTACHED TO
TRANSFORMER CASE

ing a pin-type insulator directly on the case of the middle transformer. The pin is bolted to a piece of galvanized strap steel, which may in turn be fastened either to one of the cover bolts or one of the bushing bolts of the transformer. The resulting installation is safe, neat and inexpensive and is preferable to buses supported by strain insulators attached to the side walls of the substation or to poles. Where the bushings are of the inverted type it is usually necessary to attach a pin-type insulator to the case of each end transformer.

STAR-CONNECTED DISTRIBUTION VERSUS DELTA-CONNECTED PLAN

**Relative Advantages of These Two Systems of Oper-
ation as Determined from Experience in
Changing System at Madison, Wis.**

Summarizing his experience in changing the Madison Gas & Electric Company's distribution system from 2300-volt delta delta-connected to 2300/4000-volt star-delta-connected circuits, George Wagner, superintendent of distribution, said before the recent Wisconsin Electrical Association:

On account of the increased voltage in the three-phase, four-wire system, the amount of copper required for transmitting the same load over the same distance is very much less than is necessary with the other systems. The change to the four-wire system does not cause a change in voltage on the step-down transformers; therefore the transformers need not be changed. On account of the "Y" connection and the simplicity of regulation attending its use the four-wire system can be used for supplying energy for light, heat and

power purposes from one circuit, thereby overcoming the necessity of parallel circuits. This produces an additional saving in copper.

In order to protect all parts of the circuit against excessive voltage to ground, and to protect the single-phase lighting transformers against excessive voltage, the neutral wire of a three-phase, four-wire circuit should be grounded not only at the station but at a sufficient number of points along the line. Furthermore, the neutral of three-phase transformer banks should be isolated. When the neutral point of a three-phase transformer bank is connected with the neutral wire of the circuit the delta-connected secondaries tend to equalize the phase voltages. Therefore, this should not be done except with transformers of large capacity. If a single-phase load is supplied from one phase of the delta-connected secondaries of a three-phase bank of transformers, the transformer on that phase will supply only one-half of the single-phase current, and the other two transformers will supply the remainder whether the primary neutral point is connected to the neutral wire or not.

PRECAUTIONS TO OBSERVE IN THE STORING OF COAL

Ample Ventilation or Total Exclusion of Air Should Be Afforded—Suggestions for Preventing the Starting of Fires

Heat due to oxidation rather than pressure was given as the main cause of spontaneous combustion of bituminous coal by Prof. H. H. Stoeck of the University of Illinois before a recent meeting of the Western Society of Engineers at Chicago. He said that coal should be stored so as entirely to exclude any air, or else adequate ventilation should be provided to keep the coal at a low temperature. Any intermediate conditions are dangerous and should be avoided.

Among precautions which were suggested for preventing spontaneous combustion were: Coals of different varieties should not be mixed while in storage, and the coal should not be piled high on account of the difficulty of moving it in case of fire. If sufficient heating occurs to raise the temperature to 150 deg. Fahr., close watch should be kept on the pile; if the temperature increases to 175 deg. Fahr., it should be moved and cooled before more coal is added. Equipment for storing coal should be arranged to make it possible to move the coal quickly in case of an emergency. To avoid the starting of fires pieces of wood and greasy waste should be carefully removed from storage piles and the coal in storage should be kept away from external sources of heat, such as steam pipes.

PROTECTION OF APPARATUS FROM LIGHTNING STORMS

Types of Arresters to Use With Different-Size Transformers—Necessity of Limiting Discharge Current Through Electrolytic Arresters

"Protection of Electric Apparatus Against Lightning" was the subject of an address given recently before the transmission and distribution men of Ohio by V. E. Goodwin, lightning arrester engineer of the General Electric Company. He recommended that transformers of 15-kw. rating and less should be protected with the compression-type arrester. Transformers of 150-kw. rating and less should be protected with the graded shunt multi-gap arrester. All transformers above 150-kw. rating should be protected with the elec-

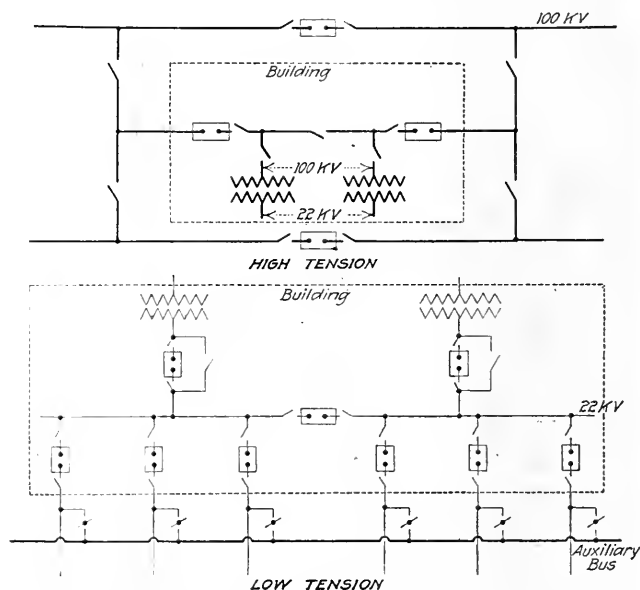
trolytic lightning arrester. Lightning arresters should be installed to protect particular apparatus and therefore should be placed as near the apparatus as possible. The cost of high-tension apparatus, such as transformer lightning arresters, etc., increases as the cube of the voltage ratio increase.

Considering the care of electrolytic arresters, Mr. Goodwin pointed out that this type of arrester is designed for approximately one-half hour's continuous discharge. This is a rather severe condition, however, and should not occur very often. When an electrolytic-type arrester discharges an increase in temperature takes place which will dissolve the film and thereby eliminate the resistance offered to the flow of electricity. This discharge would cause a short circuit if permitted to continue. Fuses in series with the horn-gaps would limit the discharging current and thereby protect them from difficulties of this kind. The ground connection was considered the most vital part of any of the lightning arresters; therefore great care must be used in choosing such grounds and only selecting locations which will assure a normally stable ground.

ARRANGEMENT THAT SERVES PURPOSE OF DOUBLE BUS

Advantages to Be Gained by Using Double Busbars Did Not Justify Increased Cost of Construction—Switches Serve Purpose

In building the Antioch substation of the Great Western Power Company it was decided that the cost of a double busbar system was not warranted solely by the flexibility it would afford. As an alternative plan a



SINGLE-BUS SYSTEM IN SUBSTATION THAT ANSWERS THE PURPOSE OF DOUBLE-BUS ARRANGEMENT

single-bus system was installed embodying an arrangement of cut-out switches that would permit obtaining about the same results as when a double-bus system was used.

The accompanying diagram shows the principle utilized, which provides for the isolation of practically every piece of apparatus in the station without interrupting the service. It is estimated that a saving of about \$8,000 resulted from the use of the arrangement which is here described.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

CHANGING A POWER CONTRACT TO OBTAIN GREATER PROFIT

Massachusetts Company Instead of Charging Railway for Direct-Current Energy Now Charges for Alternating Current, Including Losses

Power for the operation of the Northern Massachusetts Street Railway, serving the Athol-Gardner district of the State, has been furnished by the Athol Gas & Electric Company since 1912. At that time a contract was entered into by which the central station agreed to furnish power measured as direct current at the rate of 1.8 cents per kilowatt-hour and to assume all converting and machine losses. Under the terms of the contract it was necessary for the railway company to build and maintain a three-phase high-tension transmission line from Westminster to the Athol fair grounds, costing about \$36,000. On the basis of an annual consumption of 3,000,000 kw.-hr., the interest charge on this investment amounted to \$1,800 (at 5 per cent) or 0.06 cent per kilowatt-hour, to which was added the interest and depreciation on the company's steam plants, held in reserve, amounting to 0.8 cent per kilowatt-hour, and thus making the total cost of power to the railway company 2.66 cents. A further condition of the contract was that the railway company should maintain the high-tension line in good condition, but little work had to be done on this in the early years of the contract.

Owing to the fact that the load factor was at times much below normal and that the machine loss was large in the substation installation, the central station found itself unable to furnish power under this contract during certain hours at a profit. The railway claimed also that the service did not attain a standard which would enable it to maintain its schedules at all times. In 1916, when the original contract had eleven years more to run, the Northern Massachusetts company and the Athol company entered into a new contract, extending to 1927, upon a basis which would allow a larger profit to the central station and thus give it the incentive to furnish an improved power supply. As the result of this new arrangement the former troubles have been eliminated and the power supply is now continuous and satisfactory to the managers of the railway.

Under the new contract the cost of power to the road (which has about 31 miles of track), less a discount for payment of bills within fifteen days, is fixed at 1.84 cents per kilowatt-hour, and the energy is measured as alternating current. The railway assumes all converting and machine losses. These amount to at least 20 per cent in the case of this road, or 0.36 cent per kilowatt-hour. Adding interest and depreciation on the cost of the railway company's stand-by steam equipment increases the cost 0.8 cent per kilowatt-hour, making the total cost to the railway 3 cents. The central station took over the transmission line at a cost of \$36,-

000 in making the new contract. The Athol company purchased part of its energy from the New England Power Company at about 1.1 cents per kilowatt-hour and resold as above outlined.

DATA ON RURAL ELECTRIC SERVICE IN WISCONSIN

Analysis Shows How Business Is Handled, Under What Conditions It Is Profitable and Its General Trend

The report of the committee on rural service of the Wisconsin Electrical Association, of which the chairman is A. C. Babson of Watertown, for the year ended Dec. 31, 1917, covered the following points: the number of utilities in the State of Wisconsin serving rural customers and the standard methods of making extensions to serve them; the connected loads, transformer capacities and annual revenues; rural business increase or decrease during the year 1917, and evidence indicating whether this class of business is or is not desirable and profitable.

An analysis of Table I, which covers reports from twenty-six companies, brings to light the following facts: First, in a moderate majority of cases the farmer pays for the extension of primary lines; second, the cost of transformer installations is carried by the farmer in less than one-half the cases reported and by the company in the remaining cases; third, in about one-half the cases the farmer pays for the extension of the secondary lines; fourth, in a majority of cases no refund on the cost of the extensions is made to the farmer where he has contributed to the expense of such extension; fifth, in about one-half the cases single-phase motors only are provided for on rural extensions and provisions for motors rated at more than 5 hp., single-phase, are exceptional; sixth, in a majority of cases lines have not been constructed exclusively for rural-service customers, but have been extended from city lines into well-settled suburban or rural districts—a considerable portion of the rural customers obtain service from low-voltage transmission lines, where the transmission voltage (up to and including 6600 volts) is stepped down direct to 110 or 220 volts; seventh, reports as to whether this class of business is considered profitable or not are divided about equally, yes and no. The average selling price per kilowatt-hour is 6.9 cents. It is interesting to note, however, that this figure is obtained with an average transformer capacity per customer of 1.6 kw. and an average connected load per consumer of 1.4 kw.

Table II recapitulates the findings of the committee in condensed form and compares the findings with those of 1916. The following inferences may be reasonably deduced from the data shown: First, there is an apparent increase in the number of companies furnishing rural service and in the number of rural consumers;

second, the reported maximum distance of distribution has decreased, indicating an increase in saturation; third, a decrease in total kilowatt-hours consumption, but an increase in total operating revenue, the decrease in consumption being due to one of the largest companies reporting 217,000 kw.-hr. less consumption in 1917 than in 1916, and the consumption in general showing an increase; fourth, a slight decrease in connected load and the same step-down transformer capacity per consumer but a noticeable decrease in the average revenue per consumer, which, on account of the greater consumption per customer, would indicate a greater use of the connected load but a lower average rate; fifth, an apparent increase in the kilowatt-hours sold per kilowatt of transformer capacity, which would indicate also a tendency toward greater use of the connected load; sixth, an apparent increase in revenue per kilowatt of transformer capacity, even though at a lower rate per kilowatt-hour, would also indicate a greater use of the connected load.

It should be noted that in computing the units under the last three headings of Table II figures were used only where both component parts of the desired unit were reported. This method gives a reliable unit for all companies reporting the necessary information to compute a given average unit.

Several of the largest electrical utilities of the State, including such as the Milwaukee, Madison, Racine, Kenosha and Waukesha companies, have not as yet indulged extensively in the rural service experiment. The new schedule adopted by the Wisconsin Gas & Electric Company, referred to in last year's report and first applied in the Watertown division during 1917, promises to give fair results owing to the reasonably high minimum monthly charge. Eleven farms were

connected up during the year and more are preparing for connections.

Owing to a general retrenchment of all companies in the programs of capital expenditures during the last

TABLE II—RECAPITULATION OF COMPARATIVE STATISTICS FOR 1916 AND 1917, WISCONSIN RURAL SERVICE, LIGHT AND POWER SERVICES COMBINED

	1916	1917	Increase, per Cent
Total companies reporting	40	37	†-7
Companies reporting customers*	20	24	20
Number of customers	419	738	76
Average number of customers per company reporting rural customers	21	30	42
Maximum distance from station	18	10	...
Total connected load, kw.	331	871	163
Kw.-hr. sold per year	446,493	311,460	†-32
Total transformer rating, kw.	364	786	116
Total operating revenue	\$18,609.00	\$22,271.02	19

DATA PER CUSTOMER (ARITHMETICAL AVERAGE)

Connected load, kw.	2.0	1.4	†-30
Kw.-hr. sold per year	367	475	29
Transformer capacity	1.6	1.6	Same
Operating revenue per year	\$39.00	\$33.00	†-15

DATA PER KW. OF TRANSFORMER RATING (ARITHMETICAL AVERAGE)

Kw.-hr. sold per year	233	255	9
Kw. connected load	0.8	0.8	Same
Operating revenue per year	\$20.00	\$22.00	10

OPERATING REVENUE PER KW.-HR. (ARITHMETICAL AVERAGE), CENTS

	9	6.9	†-23
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*One company reporting 248 customers in 1917 did not report in 1916.
†Decrease.

half of 1917, very little was done along the line of extensions, especially rural extensions. However, even with the present prospect of a shortage of capital for extensions of all kinds, the development of rural ser-

TABLE I—CHARACTERISTICS OF RURAL DISTRIBUTION IN WISCONSIN

Location of Company	TOTAL				PER CUSTOMER				PER KW.	RATING OF TRANSFORMERS				Farmer Pays for	CURRENT				Transformer Voltage	Lines Step Down Direct							
	No. of Customers	Kw. Connected Load	Kw.-hr. per Year	Rating of Transformers, Kw.	Connected Load, Kw.	Kw.-hr. per Year	Rating of Transformers, Kw.	Operating Revenue per Year		Connected Load, Kw.	Operating Revenue per Year	Revenue per Kw.-hr., Cents	Maximum Distance from Station		Prim.	Trans.	Sec.	Meter			Refund	CURRENT					
																						Single-Phase	Three-Phase	Direct			
Appleton	35	27	10,000	35 0	\$967 00	0.8	286	1 0	\$27 63	286	0.8	\$27 63	10	4	N	N	N	N	Y	Eit her	...	5	Y	Y	2,200	Y	
Baraboo	52														N	N	N	N	Y	Eit her	...	5	N	Y	6,600	Y	
Beloit	33	73	17,745	99 0	1,405 50	2.2	538	3 0	42 59	179	0.7	14 19	8	3 1/2	Yx	N	N	N	Y	Eit her	...	20	Y	Y	2,300	Y	
Burlington	2	2	440	1 0	42 76	1.0	220	0.5	21 38	440	2.0	42 76	10	1	Y	N	N	N	Y	Y	...	7 1/2	N	Y	26,400	N	
De Pere	6	48		60 0							0.8				Yx	N	N	N	Y	Y	...	1	Y	N	2,200	Y	
Durand	6	8		12 0	180 00	1.3		2 0	30 00		0.7	15 00		5	N	N	N	N	Y	...	...	5	Y	N	6,600	Y
Edgerton	53	43	12,928	60.5	913 06	0.8	244	1.1	17 23	214	0.7	15 10		7	Yx	N	N	N	Y	...	...		Y	Y	2,300	Y
Fort Atkinson	17	26	8,618	23 5	670 71	1.5	509	1.4	39 45	368	1.1	28 54	8	1 1/2	Y	Y	N	N	Eit her	...	...	5	N	Y	2,300	Y
Glenwood	7	8	1,986	12 0	238 00	1.1	284	1.7	34 00	166	0.7	19 83	12	3 1/2	Y	Y	N	N	Y	...	...	15	N	Yx	2,300	Y
Grafton	11	15	3,500	40 0	375 00	1.1	250	2.9	26 79	88	0.4	9 38	11	3	N	N	N	N	Y	...	...		N	Y	2,200	Y
Green Lake	3	4	1,143	33 0	124 05	1.3	381	11 0	41 01	36	0.1	3 76	11	2	N	N	N	N	Y	Eit her	...	2	N	Y	...	...
Hudson	4	35		40 0	455 00	8.8		10 0	113 75		0.8	11 38		7	Y	Y	N	N	Y	...	...	10	N	Y	13,200	Y
Janesville	29	55	20,187	53 5	1,095 38	1.9	696	1 8	37 77	377	1.3	20 47	5	5	Yx	N	N	N	Eit her	...	...		Y	Y	6,600	Y
Lake Geneva	8	7	5,771	19 0	338 54	0.9	721	2 4	42 32	304	0.4	17 82	6	10	Y	Y	Y	Y	Y	...	...	5	Y	Y	26,200	N
Lake Mills	12	25		20 0	624 00	2.1	650	1 7	52 00	390	1.3	31 20	8	5	Y	Y	Y	Y	Y	...	...	2	Y	...	6,600	N
Mineral Point	10	3	2,066	4 0	229 72	0.3	207	0 4	22 97	517	0.8	57 43	11	1	Y	Y	Y	N	Y	...	...		N	...	13,200	N
Oakfield	4		3,538		227 39		885		56 85					7	5	Y	Y	Y	N	...	...	15	Y	N	6,600	Y
Oshkosh	37		7,293		756 00		197		20 43					10					...	...	...		N	...	...	...
Rhineland	4	3	1,709		117 43	0.8	427		29 36					7	2	Y	N	N	N	Y	10	N	N	12,000	N
Rice Lake															N	N	N	N	Y	...	...	15	N	N	6,600	Y
Sheboygan	120	197	109,919		4,878 64	1.6	916		40 65					4	9	Yx	N	N	N	Eit her	...	...	Y	N	13,200	Y
Sturgeon Bay															Y	Y	Y	N	N	Y	10	N	N	6,600	Y
Washburn	10														Y	Y	Y	N	N	Y	3	N	Y	2,300	Y
Watertown	11	15	6,000	29 0	490 00	1.4	545	1 8	36 36	300	0.8	20 00	7	3	N	N	N	N	Y	...	...		Y	N	2,300	Y
Wausau	8	12	5,478		514 96	1.5	685		64 37					11	10	Y	N	Y	N	Y	10	N	?	(4,800)	Y
Winona (office reporting)	248	256	\$5,279	158.5	7,634 88	1.0	344	0 6	30 79	538	1 6	48 17	9	3	N	N	N	N	Eit her	...	...		Y	N	22,000	N
Wittenberg	5	9		9 5	103 00	1.8		1 9	20 60		0 9	10 84		12					Eit her	...	...	3	N	Y	6,600	Y
Totals	738	871	311,460	786 0	\$22,271 02																						

*Estimated. †1916 report. ‡Reports rural service, but gives no detail. \$No details reported. *Partly Minnesota. xPartly.

vice near existing lines may proceed because of the shortage and demands of farm labor.

Finally it appears to the committee that: First, the construction of purely rural service lines is not ordinarily warranted unless the saturation of service is such that a reasonable return on the added investment and sale of energy may be shown; second, rural service consumers on transmission lines of not more than 6600 volts connecting towns or villages are ordinarily profitable if a suitable minimum charge is made; third, a suitable minimum charge to cover the higher cost of service for rural consumers should be made, variously estimated at from \$2 to \$3 or more per month; fourth, a low second step in the energy rate should be provided so as to encourage a sufficient use of the service by the farmer to make it practical and attractive to him.

ADVERTISEMENT SERIES ON PUBLIC RELATIONS

Vancouver (B. C.) Electric Railway Property Runs Sixteen Frank Talks of Broad Character in Local Newspapers

Under the title "Your Electric Service," the British Columbia Electric Railway Company has published a booklet containing a series of talks on electric service which appeared in the daily papers of Vancouver. The talks, sixteen in number, appeared under the following heads: "Servants of the Public," "Our Business Policy,"

"The Investments for Your Service," "Service at Cost," "Down to Bed-Rock," "A Statement of Finance," "Lower Rates Coming," "Your Street-Lighting Bill," "What Your Service Costs," "Equalizing the Load," "Electric Service Quality," "Striking an Average," "Local Conditions Count," "Preparing for the Future," "The Fixed Costs of Your Service," and "The Future Co-operation."

Three of the talks are reproduced here to show the frankness of this company in its public statements.

APPLIANCE SALES COMMISSION FUND FOR THE SALESPeOPLE

Washington Company's Policy of Distributing Percentage of Profits Develops Organization Spirit and Co-operation

To give an added impulse to appliance sales this year, the Potomac Electric Power Company, Washington, D. C., is setting apart a 5 per cent commission on everything sold out of the electric shop which is paid into a monthly fund and distributed to the members of the sales department. This distribution is made by equal division; that is, if the profit for the month is \$250 and there are ten salesmen on the staff, each one receives a check for \$25. It is found that this is aiding materially in the development of an organization spirit because of which the men are co-operating eagerly and "tipping each other off" to opportunities discovered outside the discoverer's own territory.

Our Business Policy

You've met some people who could not see the wood for the trees.

Well, a public utility company is like the wood with a lot of people. Because of the wide ramifications of its business and the multitude of little questions that arise, people are apt to forget what a public utility is for.

Isn't it to give the public service? Everything else works in that direction. Nothing else counts—even the return the investor gets works for the public service.

The policy of the B. C. Electric is to give the public the best possible service at cost.

What comprises cost may be summed up in these items:

The employees of this company are entitled to good wages so that they may live comfortably and so that the company may keep the best workers with it.

The company ought to receive sufficient for its service to keep its equipment strictly up-to-date so that the service may not deteriorate and enough to pay for accidents and contingencies.

The investor must receive a fair return on the capital he has honestly and prudently put into the business. The company must be able to pay its fair share of the cost of government, but not more than its share.

The price of this company's public service ought, in the public interest, to enable it to meet all these charges—public service commissions have so ruled.

We will welcome the appointment of a public service commission but our policy of giving service at cost will be maintained, commission or no commission.

B.C. Electric

Service at Cost

The public should receive public service at cost.

In making this statement we are not voicing any altruism nor hiding anything behind a meaningless remark. Public service commissions rule that the public shall not be exploited; that public utilities shall not compete; that they shall not make exorbitant rates of return.

But these commissions agree that the cost of service includes a fair rate of return, for otherwise the public would suffer through poorer service. Let the commissions explain the reason:

"If the rates fixed by the commission will yield only a return insufficient to attract capital into needed public service, it is THE PUBLIC and not the investor who will suffer"—Oregon Public Service commission.

"The interest of THE PUBLIC demands that carriers engaged in inter-state commerce, if properly constructed and wisely managed, shall receive revenue which will enable them to keep their property and equipment in good repair and maintain their service at the highest point of efficiency"—Interstate Commerce commission.

"What is a fair rate to meet the above annual charges and say a fair return on the investment? It should be a rate which, when applied to the probable output of the company, will produce a revenue sufficient to yield such a dividend on an amount of capital exactly equal to the fair value of the property as will induce others to invest capital in similar enterprises with the expectations of getting their recompense from the normal earnings of the enterprise"—Maine Public Utilities commission.

"The public cannot reasonably demand rates so low that the defendant's income may be reduced to the point where there would not be a sufficient earning to enable it to provide for necessary facilities to take care of THE PUBLIC DEMAND for service"—California Railroad commission.

"These facts tend to show that the burden upon the commission is to constantly promote efficiency in the way of granting a return to utilities which will induce them to place in operation modern appliances as they are put upon the market"—Wisconsin Railroad commission.

To sum up: Efficient service, which even before cheap service, is the purpose of a public utility, demands a fair return being paid on the investment.

B.C. Electric

Equalizing the Load

The cost of electric current depends a lot on how fast you use it. If you wanted 10,000 gallons of water in an hour, you would need bigger pipes and bigger pumps than if you spread out your 10,000 gallons over the whole day.

If you were to use 24 kilowatt hours of electricity evenly throughout the whole day, it would be much cheaper than if you took the 24 kilowatt hours in one hour.

Why? Because with the steady demand, a small machine, running constantly could keep you supplied whereas with the one-hour demand, a machine 24 times as large would be needed and it would lie idle the rest of the day.

In the first place, you would have a 100 per cent load-factor; in the second, a little more than a 4 per cent load factor. Our residence consumers use current on an average load factor of less than 8 per cent.

Fortunately there are other uses for electricity, such as for driving machinery, elevators and such like, although some of the demands such as for running street cars occur at the same time as the demand for lighting current and reduce the load factor still more.

But the more factories can use the generators as they lie idle between the "peaks" of the lighting and street car demand, the more they will earn to relieve these "peak" hour users. To this end, we offer reduced rates for factories that will take a steady supply of current. Of course, if there are not enough factories here, or if conditions are such that no matter how low the power rates are, they would not use electricity, the load factor will remain high.

The power plant starts under a handicap in the first place for its load factor is reduced 30 per cent, by the loss of current in transmission and transformation, before it reaches the city. All companies suffer in like degree.

The diversity factor is only one in the cost of current; as important is the demand, meaning the number of customers we can serve for the same outlay for poles and wires.

B.C. Electric

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Asynchronous Motors with High Power Factor and Controllable Slip.—R. V. PICOU.—Description of a method of improving power factor by the use of an asynchronous motor so arranged that it has a power factor practically equal to unity at all loads and that the slip can be controlled without sensible alteration of output. The machine can be used as a generator as well as a motor without the aid of auxiliary apparatus to give it an imposed frequency. The construction proposed permits a notable increase of the air gap without detriment to the motor characteristics—an evident mechanical advantage.—*Revue Générale de l'Electricité*, March 30, 1918.

Lamps and Lighting

Fundamentals of Illumination Design.—WARD HARRISON.—The writer deals with the subject in the following sequence: the candle, the mean spherical candlepower, the lumen, the foot-candle, the relation between the foot-candle and lumen, photometric measurements, including the horizontal photometer and the sphere photometer, and the calculation of the candle-power distribution curve. Concluding, he says: "In calculating the flux of light in various zones, we usually find it convenient to calculate for zones of 10 deg., and it is sufficiently accurate for most purposes to assume that the candlepower value at the center of each 10-deg. zone represents the average candlepower of the zone." He then gives the factors by which such candlepower values should be multiplied to give the lumens in each zone.—*General Electric Review*, May, 1918.

Generation, Transmission and Distribution

Questionnaire on Power Conservation.—Economies that can be effected in both hydroelectric and steam generating plants and information on present-day conditions in California are outlined.—*Journal of Electricity*, April 15, 1918.

Increasing Power Plant Economy.—C. T. BAKER.—Considerable saving may be effected by proper maintenance of apparatus, says the writer, who points out causes of high maintenance expense and suggests methods of preventing them.—*Power Plant Engineering*, April 1, 1918.

Canada's Water Powers and Their Relation to the Fuel Situation.—J. B. CHALLIES.—Water power must take a very prominent part, the writer points out, if the best use of the varied fuel resources of Canada is to be achieved. Furthermore, there must be evolved a national fuel policy which will permit the best possible co-ordinated and concomitant development and use of all the fuel resources in the Dominion. The relation of "white coal" to coal, wood, peat, oil and gas is gone into. The Pacific and Atlantic provinces are self-sustaining as regards fuel, but one area in Canada is largely dependent on imported coal. Canada is fortunate in the extent and location of her water powers, but only a

small portion, not 10 per cent, of Canada's available water power is developed. Summarizing the use of water power in Canada, the author says that about 78 per cent of the total power developed (1,348,490 hp.) is taken for municipal use, including domestic and ordinary industrial purposes; about 14 per cent (248,075

TABLE I—APPROXIMATELY ACCURATE DATA ON PROVINCIAL DISTRIBUTION OF DEVELOPED AND UNDEVELOPED WATER POWERS IN SETTLED PART OF DOMINION*

Province	Power Available	Power Developed
Ontario.....	5,800,000	789,466
Quebec.....	6,000,000	520,000
Nova Scotia.....	100,000	21,412
New Brunswick.....	300,000	13,390
Prince Edward Island.....	3,000	500
Manitoba.....	.....	76,250
Saskatchewan.....	3,500,000	100
Alberta.....	.....	32,860
British Columbia.....	3,000,000	269,620
Yukon.....	100,000	12,000
Totals.....	18,803,000	1,735,598

*Prepared by the Dominion Water Power Branch.

hp.) is utilized for paper and pulp industries, and about 8 per cent (140,000 hp.) is employed for electrochemical and similar processes. The products of the electrochemical industry are extremely diversified, and include aluminum, silicon, calcium carbide, cyanamide, ferro-alloys, graphite, carborundum, chlorine, etc. The electrometallurgic industry is in its infancy and prom-

TABLE II—EXTENT OF WATER DEVELOPMENT IN EUROPE AND NORTH AMERICA*

Country	Area, Sq. Miles	Population	Hp. Available	Hp. Developed	Per Cent Utilized	Hp. Available per Square Mile	Hp. Developed per Square Mile	Hp. per Capita	
								Avail-able	Devel-oped
U. S. A.	2,973,890	98,783,300	28,100,000	7,000,000	24.9	9.4	2.35	0.28	0.071
Canada, A†	2,000,000	8,033,500	18,803,000	1,735,598	9.2	9.4	0.87	2.34	0.216
Canada, B‡	927,800	8,000,000	8,094,000	1,725,000	21.3	8.7	1.86	1.01	0.216
Austria-Hungary	261,260	51,173,800	6,460,000	566,000	8.8	24.8	2.17	0.13	0.011
France	207,500	39,601,500	5,587,000	1,100,000	11.6	26.8	3.14	0.14	0.016
Norway	124,130	2,391,780	5,500,000	1,120,000	20.4	44.3	9.02	2.30	0.468
Spain	190,401	19,588,700	5,000,000	440,000	8.8	26.3	2.31	0.26	0.022
Sweden	172,960	5,522,400	4,500,000	704,500	15.6	26.0	4.08	0.81	0.127
Italy	91,400	28,601,600	4,000,000	976,300	24.4	43.8	10.7	0.14	0.034
Switzerland	15,976	3,781,500	2,000,000	511,000	25.5	125.2	32.0	0.53	0.135
Germany	203,800	64,926,000	1,425,000	618,100	43.4	6.8	2.96	0.02	0.010
Great Britain	88,729	40,831,400	963,000	80,000	8.3	10.9	0.91	0.02	0.002

*Dominion Water Power Branch estimate, slightly revised. †A excludes Yukon and northern area unlikely to be immediately developed; B included in A is area actually settled.

ises great expansion, especially in the production of NiCu steel in Canada. The article also includes a diagrammatic representation of the Canadian coal situation and a statistical chart showing the fuel power resources of Canada.—*Toronto Electrical News*, April 15, 1918.

Traction

Four Improved Types of Electric Locomotives.—Traffic demands and economic considerations have brought about recent developments in electric locomotives which are described in this article. Performance characteristics and several drawings of the electric locomotive are included.—*Railway Electrical Engineer*, April, 1918.

Rolling Stock in the United States.—J. CARLIER.—An elaborate article well illustrated and covering many electric railways in America and also some in England. The author says that the economic future of European railways demands their Americanization, particularly as regards large cars, automatic power, standardized material and construction that minimizes hand work.—*Revue Générale de l'Electricité*, March 30, 1918.

Installations, Systems and Appliances

Transmission-Line Practice.—LIEUT. E. C. DRIVER and E. V. PANNELL.—Fifth installment on the subject, dealing with some problems involved in transmission-line construction and operation. Data are given on the spacings required with pin and suspension-type insulators for different voltages, the number of disks required in suspension insulators for different voltages under different weather conditions, and the maximum operating voltages which will not cause corona in fair weather.—*Toronto Electrical News*, April 1, 1918.

Automatic Substation.—R. J. WENSLEY.—The economies which have been effected in automatic substations adopted by the Ohio Electric Railway Company are discussed.—*Electric Railway Journal*, April 13, 1918.

Compression Rheostats.—ARTHUR H. ALLEN.—Carbon possesses the following properties which make it particularly useful for rheostats: (1) low internal and high contact resistance; (2) it is not readily oxidized; (3) it is imperishable; (4) it passes immediately from a solid to a gaseous state if raised to high enough temperatures and, having no plastic or liquid state, will not weld; (5) it is not affected by moisture, not readily acted upon by chemicals and not subject to corrosion; (6) its specific heat is high, and, when out of contact with circulating air, it will endure high temperatures approximating those of the electric arc; (7) its temperature coefficient is negative. The use of carbon in compression rheostats is discussed in this article.—*Journal of the Engineers' Club of Philadelphia*, April, 1918.

Electricity in the Silk Industry.—CH. VALLET.—The most important advantage of electricity in the weaving industry, the author says, is the almost perfect regularity of speed, which prevents the frequent breaking of the thread that is likely to result with the use of steam or gas engines. Speed regularity is not necessarily contingent on a constant rate of charge, and the degree of speed can be increased to a certain extent without many more broken threads resulting. Electric operation has brought about an increase of production ranging from 5 to 20 per cent, and it has made possible more compact installations, with a large saving in the cost of buildings, shafts and belts. The author examines at length the question of individual versus group operation. Speaking generally he holds that control by groups is preferable in a workshop containing a great number of

machines working in virtually identical conditions and in a uniform manner. This is the case in silk manufacturing.—*L'Industrie Electrique*, March 10, 1918.

Cincinnati's New Source of Electrical Energy Supply.—The condensers are set very low to reduce the amount of pumping necessary, and large overhead bunkers are avoided to reduce the amount of steel required in the building. The most radical departure is the location of the switch house over the turbine room. This construction permits extensions being made in several directions when necessary.—*Power Plant Engineering*, April 1, 1918.

High-Voltage Circuit-Breaker Details.—L. R. GOLLADAY.—High voltage necessitates greater insulation distance between the conducting parts and grounded tank, so large oil tanks are used. For the higher voltages the simple porcelain terminal bushings are not satisfactory and stronger and more effective condenser types are required. The higher voltages also make it necessary to have a greater travel of the moving contacts and wider separation of the fixed contacts. For this reason moving parts are heavy and there is difficulty in accelerating and decelerating them. A high rate of acceleration is desirable in order to reduce to a minimum the time the arc exists between the contacts. One type of oil circuit breaker which meets the requirements is described.—*Electric Journal*, April, 1918.

Designing and Operating Substations for Maximum Efficiency.—Apparatus standardization and the elimination of equipment not necessary for safe and reliable operation are the principal subjects discussed. Features of the Cedar Avenue substation of the Cleveland Railway are described.—*Electric Railway Journal*, April 13, 1918.

Electrical Reversing Rolling Mill.—The electrical equipment necessary for reversing rolling mills in steel works is described.—*London Engineering*, March 15, 1918.

Electrophysics and Magnetism

Lifting Magnets.—J. REYVAL.—A well-illustrated review of the different situations presented in the lifting and carrying of the materials of industry with respect to the manner in which electromagnets can be utilized for this work.—*Revue Générale de l'Electricité*, March 16, 1918.

Active Power and Reactive Power.—J. B. POMEY.—The author's object is to extend the known relations between active power and reactive power by means of vectorial calculations. He shows that the mean active electrical power is equal to the mean calorific power and that there is a constant relation equal to 4ω between the mean reactive power and the mean of the difference between the electrical energy and the magnetic energy.—*Revue Générale de l'Electricité*, March 2, 1918.

Terrestrial Magnetism.—L. B. BAUER.—The results of magnetic, atmospheric electric, terrestrial magnetic and terrestrial electric observations and other work done by the department of terrestrial magnetism are set forth in this article.—*Annual Report of Directory of Department of Terrestrial Magnetism*, Carnegie Institute of Washington.

The Sign of the Zinc Electrode.—WILDER D. BANCROFT.—With electrodes which form cations the electromotive force is a measure of the difference of the

chemical potentials, but the sign is opposite; with electrodes which form anions the sign is the same. Therefore, since the electrical potential of the copper in the Daniell cell is higher than that of the zinc and since the zinc electrode manifests the lowest electrical potential, though highest chemical potential, we ought to use the minus sign when speaking of the electrical potential difference Zn ZnSO₄.—Extract from a paper read before the American Electrochemical Society, May 3, 1918.

Electrochemistry and Batteries

Electrolytic Behavior of Manganese in Sulphate Solutions.—G. D. VAN ARSDALE and C. G. MAIER.—Manganese may be deposited at the cathode from neutral solutions with a high-current efficiency of 80 to 90 per cent and at pressures of 3 volts upward. The effect of increase of acidity is practically to prevent the deposition of Mn at a concentration of 0.36 per cent free H₂SO₄. The deposit is powdery, and ordinary expedients for improving deposition do not result in an appreciable increased efficiency. MnO₂ may be deposited at the anode at nearly 100 per cent efficiency. The effect of acid is to decrease the efficiency in cold solutions, but on heating to 65 deg. or 75 deg. C. there is a lesser effect. MnO₂ may be deposited from warm acid solutions containing more than 5 per cent MnSO₄ in the form of a dense, black, lustrous film at current densities up to 25 amp. per square-foot (275 amp. per sq. m.) with a high deposition efficiency. Impurities which are reducing agents cause a decrease in current efficiency in proportion to the amount present.—Extract from a paper read before the American Electrochemical Society, May 3, 1918.

Experimental Carbon Cell.—S. ALBERT REED.—A primary battery is described in which the electrolyte is fused borax containing manganese dioxide, the negative pole is broken carbon in contact with a graphite grid, while the positive poles are strips of gold foil. The air oxidizes the electrolyte in contact with the outer gold strips, while the carbon reduces the electrolyte inside. Mixtures of CO₂ and CO are produced at the anode. The emf. averages 0.8 volt with a temperature of 935 deg. to 990 deg. C.—Extract from a paper read before the American Electrochemical Society, May 3, 1918.

Calculation of Storage-Battery Capacities.—C. W. HAZELETT.—The development of a circular slide rule for calculating storage-battery capacities is discussed and methods of selecting the charging and finishing rates are suggested. The author points out that it is important that final voltages be standardized as a continuous function of the time rate of discharge in order that the critical point of sulphation shall not be exceeded and so that the drop of voltage in the cell due to sulphation shall be the same at the end of discharge regardless of the rate. In other words, it would be desirable to subtract from the practical final voltage used at the lowest current rates the drop in voltage due to a given time rate of discharge which cannot be attributed to sulphation. Good practice during many years of experience shows that 1.85 final volts per cell is entirely satisfactory at the lowest current rates.—Extract from a paper presented before American Electrochemical Society during its trip through the Southeast, May 3, 1918.

Units, Measurements and Instruments

Value of "g" in Engineering and Physical Work.—SANFORD A. MOSS.—The article deals with the gravitational factor in the following sequence: Standard value of *g*, accurate local values of *g*, actual values of *g* in the United States, the reduction of forces to standard values, the correction factor for latitudes in the United States, the correction factor for elevation, gravity in formulas including forces due to the earth's attraction, and an appendix giving a summary of methods of computing *g*.—*General Electric Review*, May, 1918.

Telegraphy, Telephony and Signals

Amplifiers in Telephony.—G. VALENSI.—The results obtained in the United States by the use of lamp amplifiers in long-distance telephony are reviewed, and the performance of these amplifiers, the different methods of using them, the types of relays and the modifications that the use of telephonic relays necessitate in a network are considered.—*Revue Générale de l'Electricité*, April 6, 1918.

Miscellaneous

Resistances for Starters and Controllers.—Methods of assembling resistance materials for starters and controllers are described in this article.—*London Electric Review*, Feb. 1, 1918.

Neutral-Tint and Variable-Tint Screen.—E. KARRER.—Neutral-tint screens which have high transmission coefficients suitable for use in a compact photometer are described.—*Journal of Franklin Institute*, April, 1918.

Industrial Electric Heating.—E. A. HOLLOWAY, J. B. BLACK and E. B. WALTHALL.—Data dealing with applications of electric heating apparatus are embodied in this article.—*Journal of Electricity*, April 15, 1918.

Midland Railway Company's Electric Fleet.—Data are presented to show the results obtained by the Midland Railway Company in operating seventy-six electric vehicles for the collection and distribution of merchandise in London and provincial centers. The vehicles have been tested on three classes of work, (a) long-

AVERAGE ANNUAL COST* OF MAINTAINING AND OPERATING ELECTRIC VEHICLES AVERAGING 10,000 MILES PER YEAR

	IRONCLAD-EXIDE BATTERY		EDISON BATTERY		30-Cwt. Parcel Van	Average 15-Cwt. 5000 Miles
	2-Ton	3½-Ton	2-Ton	3½-Ton		
Energy.....	£ s. d. 33 10 0	£ s. d. 45 0 0	£ s. d. 42 0 0	£ s. d. 56 0 0	£ s. d. 25 0 0	£ s. d. 11 10 0
Tires.....	22 10 0	32 0 0	22 10 0	32 0 0	16 5 0	6 8 0
Repairs.....	20 0 0	25 0 0	20 0 0	25 0 0	16 0 0	9 11 0
Maintenance, including battery attention.....	11 0 0	12 0 0	10 0 0	11 0 0	4 6 0	4 6 0
Oil and stores.....	2 0 0	2 0 0	2 0 0	2 0 0	1 5 0	1 5 0
Standing charges.....	140 0 0	165 0 0	125 0 0	156 0 0	102 0 0	63 0 0
Total.....	£239 0 0	£281 0 0	£221 10 0	£282 0 0	£164 16 0	£96 0 0
Cost per mile..	5 73d.	6 74d.	5 33d.	6 76d.	3 95d.	4 61d.

*Exclusive of drivers' and attendants' wages.

distance suburban business, (b) full direct loads, and (c) miscellaneous collection and delivery involving frequent calls. The loading was so organized that the vehicles were operated at the highest possible efficiency. The accompanying table gives the results obtained.—*Electric Vehicle*, March, 1918.

Book Reviews

THE PETROLEUM AND NATURAL-GAS REGISTER. Published by the *Oil Trade Journal*, 120 Broadway, New York City. 548 pages. Price, \$12.

This is a comprehensive directory of the petroleum and natural-gas industries, co-ordinating the various branches of the oil trade in the United States, Canada and Mexico. Names of officers, capital stock, location of properties and other valuable data are given.

INDUSTRIAL RESEARCH IN THE UNITED STATES OF AMERICA. No. 1 of a series of papers under the title "Science and Industry" and bearing on industrial research. By A. P. M. Fleming. London: Department of Scientific and Industrial Research of the British Government. 60 pages. Price, 1s.

We are wont in this country to complain about a lack of research facilities, but looking over this pamphlet one cannot help being proud of the quality and quantity of the research institutions and laboratories which, according to Mr. Fleming, exist in the United States. One feels that the author not only desires to give specific information to his British readers, but also intends to hold up this country as an example for them to follow. He divides industrial research into five groups: (1) Research applied to the elimination of manufacturing troubles; (2) research having some new and specific commercial object; (3) researches in pure science with no specific commercial application in view; (4) research applied to public service; (5) research for the purpose of establishing standard methods of testing and standard specifications connected with the purchase of raw materials. Some of the features of the research work of the laboratories connected with American industrial manufacturing corporations that impressed the author most forcibly are: (1) The installation in many cases of full-scale manufacturing facilities, which makes it possible to relieve the works of experimental developments and also gives the laboratory staff first-hand knowledge of the complexities of actual manufacture; (2) the growing tendency to devote more and more of the resources of the laboratories to pure science investigations with a view to making discoveries; (3) the growing appreciation of men with scientific training not only in the research laboratory, where such training is essential, but also in regular manufacturing employment; (4) the value of research laboratories as a means of inspiring confidence in the minds of customers and as an effective advertisement; (5) the employment of the laboratories by financiers for the purpose of ascertaining the merits of new industrial propositions of which the value has not been commercially established. The author describes the research laboratories of some twenty leading American manufacturers and their associations and also has chapters devoted to research work done by colleges, national institutions, private laboratories, etc. The last chapters are devoted to the selection and training of research men, co-ordination and distribution of scientific data, and the relation of research to the capitalist, the manufacturer and the educator. In the final chapter of the book the possible schemes for a better organization of industrial research in Great Britain are discussed. The book is profusely illustrated with photographs and will be read with interest by those inter-

ested in the actual status of industrial research in this country. It affords the additional advantage of seeing ourselves as others see us.

RADIO COMMUNICATION, THEORY AND METHODS, WITH AN APPENDIX ON TRANSMISSION OVER WIRES. By John Mills. New York: McGraw-Hill Book Company, Inc. 205 pages, 120 illustrations. Price, \$1.75 net.

This little red textbook is particularly useful in supplying much needed information for electrical engineers concerning the characteristics of vacuum tubes. In recent years and months there have been developed in a few special radio laboratories certain new vacuum-tube receivers, transmitters, oscillators, amplifiers and detectors; so that a particular branch of electric signal engineering that might be called vacuum-tube engineering has come into existence, with the manifest intention of staying and growing. This volume deals with the physical characteristics of these tubes in a quantitative way which appeals to the student. The book is also a pioneer in advancing the algebraic theory of oscillating-current circuits. The fundamental theorems of this type of circuit have already been propounded, but very few applications have hitherto appeared in textbooks. The method of presentation may not please every reader, however. The chapters of the book are devoted respectively to the following topics: Alternating currents, the telephone receiver, the vacuum tube, detection of high-frequency currents, production of damped sinusoidal currents, production of undamped high-frequency currents, radio-telegraphy and radiotelephony, practical appliances and methods of radio-telegraphy, transmission over wire circuits, and problems. The book will be useful to students of radio-telegraphy and radiotelephony.

Books Received

AIRCRAFT IN WARFARE. By F. W. Lanchester. New York: D. Appleton & Company. 222 pages, illustrated.

THE LANGUAGE OF COLOR. By M. Luckiesh. New York: Dodd, Mead & Company. 281 pages. Price, \$2.50.

ANNUAIRE POUR L'AN 1918. Published by the Bureau of Longitudes. Paris: Gauthier-Villars et Cie. Price, 2 francs.

POWDERED COAL AS FUEL. By C. F. Herington. New York: D. Van Nostrand Company. 211 pages, 77 illustrations. Price, \$3.

POWER WIRING DIAGRAMS. A Handbook of Connection Diagrams of Control and Protective Systems for Industrial Plants. By A. T. Dover. New York: Whitaker & Company. 208 pages, 254 illustrations. Price, \$2.25.

THEORY AND OPERATION OF DIRECT-CURRENT MACHINERY. Prepared in the Extension Division of the University of Wisconsin. By C. M. Jansky. New York: McGraw-Hill Book Company, Inc. 285 pages, 214 illustrations. Price, \$2.50.

THE CALORIFIC POWER OF FUELS. With a Collection of Auxiliary Tables and Tables Showing the Heat of Combustion of Fuels, Solid, Liquid and Gaseous. By Herman Poole. New York: John Wiley & Sons. 267 pages, illustrated. Price, \$3.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

USE OF ELECTRICITY IN PROPULSION OF SHIPS

W. L. R. Emmet Comments on London Cable Concerning Electrically Propelled Merchant Ship Construction in England—Our Great Progress

London cable advices published in the newspapers this week state: "The first electrically propelled merchant ship ever built in England and the largest electric vessel in the world is now undergoing its finishing touches at a British shipyard and will soon start on its first voyage."

The ELECTRICAL WORLD asked W. L. R. Emmet, consulting engineer General Electric Company, to comment on the foregoing. Mr. Emmet says:

"I had seen the paragraph which you quote, but know very little concerning it. Some time ago an electrically driven ship installation on a vessel called the Mjolner was made by Ljungstrom in Sweden, and later a number of such installations were planned. I do not know how many of these have been completed in Sweden, but I have been informed that rights for Ljungstrom designs were taken up in England some time ago and that electrically propelled ships with machinery built after his method were contemplated. I presume that this paragraph relates to one of these.

"I feel pretty sure that the statement that this is the largest electrically propelled vessel must be erroneous. The United States collier Jupiter, equipped with electric propelling machinery designed by me, was put into commission in February, 1914. The Jupiter is 542 ft. long and of 20,000 tons displacement; her propelling machinery develops normally 7000 shaft horsepower and can be operated at considerably larger power.

"The United States battleship New Mexico, of 32,000 tons displacement and 36,500 shaft horsepower, has just been completed at the New York Navy Yard and will make her trial trip within a few days. In addition to these, we have contracts for electric propelling machinery for three other battleships of similar size and power, the California, the West Virginia and the Maryland. We also have contracts for machinery for three battle cruisers of 32,000 tons displacement and 180,000 shaft horsepower each.

"In addition to this machinery for the navy, we are building electric propelling machinery for two cargo boats which are being built by the Pennsylvania Shipbuilding Company. Each of these equipments delivers 3000 shaft horsepower.

"Some of the ship equipments are by far the largest electrical applications ever made. Each of the eight motors on one of the battle cruisers has four times the capacity of the largest motor previously built."

An article by Mr. Emmet, published in the ELECTRICAL WORLD of Jan. 6, 1917, gives general information concerning battle-cruiser installations, and a paper in

the *Proceedings* of the Society of Naval Architects and Marine Engineers for 1915 also discusses the advantages of electric drive for large warships.

FUEL ADMINISTRATIVE ENGINEER FOR PITTSBURGH

Thomas R. Brown Appointed by Federal Fuel Administration—Policy to Be Extended to All States and Districts

The Federal Fuel Administration has announced the appointment of Thomas R. Brown of Pittsburgh as administrative engineer for the Pittsburgh district. C. P. Billing has been appointed his first assistant.

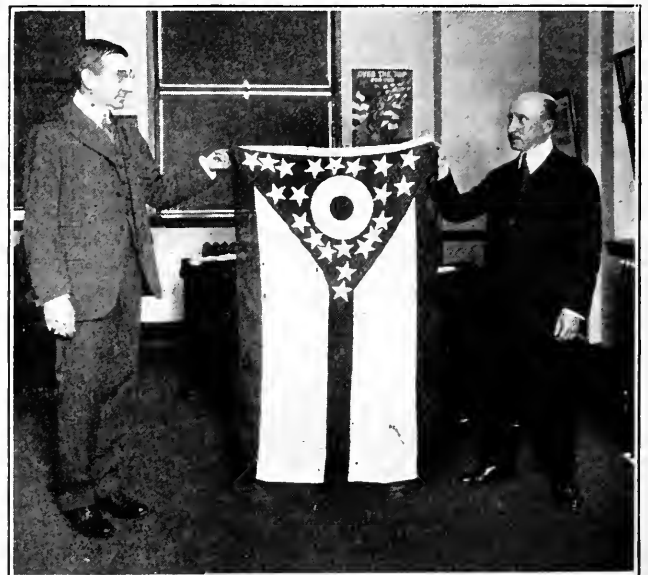
These appointments were made as a preliminary step toward putting into operation a general plan for fuel conservation in power plants. It is expected that the Pittsburgh experiment will serve as a model for other states and districts and that the total saving in the country at large as a result of the movement will be between 25,000,000 and 50,000,000 tons of coal.

A personal inspection is to be made of every plant.

Classification and rating of every power plant will be based upon the thoroughness with which owners conform to the recommendations of the Fuel Administration on generation and use of power, heat and light.

An administrative engineer is to be placed in charge of the work in every state and district. It will be one of his duties to rate the plant upon information received from inspectors.

An Achievement for the Third Liberty Loan



George DeB. Greene, chairman advisory trades committee, presenting twenty-one-star honor flag to Theodore Beran, chairman electrical industries committee for Greater New York, which exceeded the quota by 1000 per cent.

PURPOSE OF THE TEST IN ELECTRIC WELDING FOR SHIPS

Extension of Electric Welding to Major Part of Shipbuilding Will, It Is Hoped, Show Economy in Time and Money

A report of the purposes and possible benefits of the ship-welding test now being conducted by the Emergency Fleet Corporation at the Federal Shipbuilding Company plant at Newark, N. J., under the direction of Arthur J. Mason, has been made to Charles Piez, vice-president of the corporation. The part which the committee headed by Prof. Comfort A. Adams as chairman has in this work was outlined in the *ELECTRICAL WORLD* of March 3, 1918, page 683.

REPORT ON SCOPE OF CONTEMPLATED WORK

The text of Mr. Mason's report follows in part:

The committee of which Prof. C. A. Adams is chairman has been enlarged and is active in bringing to bear all the knowledge and apparatus available.

Electric welding in its various phases has for years been employed in shipyards and in the arts generally, but for a number of reasons the work has been confined to odd jobs and repairs. The proposal to extend its use to the major part of ship construction has met with gratifying approval from the shipbuilder. It remains for us through this large test to demonstrate its economy in time and money and its adequacy to build a staunch ship.

The purpose of this test is to demonstrate these advantages—to do it in such a way that all may see and contribute, and finally to test the structure itself so completely that there will follow a heart-whole and unanimous belief in the method.

The test itself will take the form of building part of a hull at the Federal Shipbuilding Company's plant, Newark, N. J.

It has been necessary to design a ship to suit the material available, without encroaching on that needed for the regular ship construction at the plant. This has been done. The hull will have the outline, dimensions and strength conforming to the ships the Federal company is building.

It has been thought best to conduct the work at a site apart from the shipways, so as not to interfere with that program.

A 10,000-ton ship, costing \$2,000,000, now costs but \$70,000 to rivet. It must be plain that if electric welding only promises to modify this amount no very substantial gain offers.

Splendid benefits we all feel do offer themselves in the possible change in the whole régime of shipbuilding. Our test has in view abolishing or greatly diminishing:

1. The railroad journey from rolling mill to fabricating plant, when the latter is not at the shipyard.
2. The templet makers' work.
3. The markers' work.
4. The punching.
5. Much of the work of the fitters and bolters who flog and pull the pieces to fit on the ways. There lies in the above items an excellent likelihood to save a month's time in construction and a saving of no less than \$40 a ton in the cost of steel structure, at least \$100,000 a hull on a 10,000-ton vessel.

Briefly the program is to assemble a hull rapidly by spot welding, tacking the ship together much as a tailor bastes his work in assembling a suit of clothes. The structure then becomes a house favorable for work in all weather and at night in which the completion of the ship may go on.

After the material is thus assembled and fastened with spot welds, so that it is sufficiently strong to hold its shape, the work is completed by arc welding all seams to insure strength and render the work watertight. Roughly we expect the spot welds to be about 10 in. (25.4 cm.) apart.

The preparation of the site is well under way; the pile driving will be completed within ten days. The severe tests of strength contemplated needed about 300 piles.

One quarter of the structure will be riveted, the other

three-fourths welded, so that the tests of strength will afford a basis of comparison.

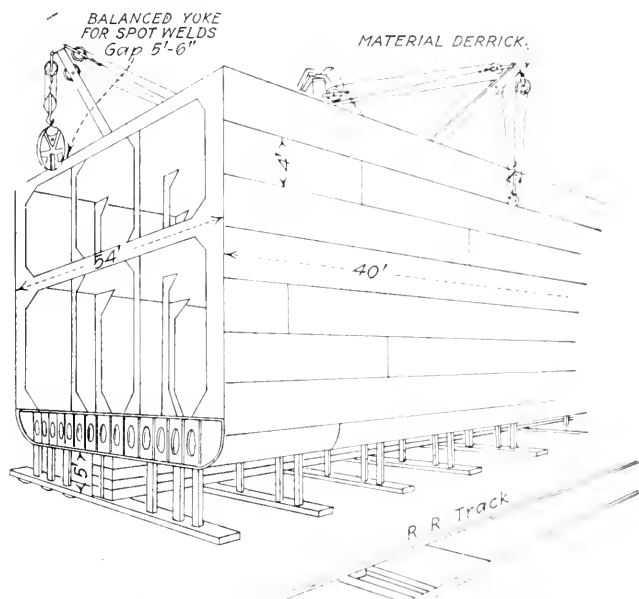
Electric welding offers a great field for lightening a ship. In this design various views of this opportunity will be tried out. The field here is very great—ultimately 10 per cent of the steel may be eliminated.

One derrick will bring material, the other derrick support the spot-welding yoke, whose function is to tack the material together, fastening the plates either to the frames or to the adjoining plates.

If one visits the ways at any shipyard, it becomes obvious that at any instant only a modicum of the men are for the moment at work. This is unavoidable under the present system. We hope to establish a plan of assembly with more continuity and less waiting on one another.

Only a fifth of the men on a hull are riveters. The spot-weld yoke will forthwith pull the parts to place with a much more vigorous agency than flogging and pulling to place by numerous bolts, now done by the other four-fifths.

The problems of fitting in place the parts of a hull are almost wholly problems arising out of the necessity to make



PART OF SHIP'S HULL THE PLATES OF WHICH ARE BEING JOINED PARTLY BY RIVETING AND PARTLY BY WELDING

a number of little holes in a plate made by one man at one time and place fit a number of little holes made by another man at another time and another place.

Once all holes are left out of the material, all parts fit. The creeping and kindred problems so perplexing to the shipbuilder disappear. Every plate becomes a closer. Every plate justifies itself.

The manufacture of the spot-welding yoke and appliances is placed in the hands of the Universal Electric Welding Company of Long Island City. The design of the yoke is completed, the patterns are made and steel castings will be forthcoming in the next ten days. The early stages of the arc welding are to be accomplished by the Wilson Electric Company, which was so successful in the work on the German ships' repairs, but it is the intention to call in all men with ideas and apparatus and to give them a field to test out in actual work. To this end Professor Adams' committee is searching out all available talent.

An adequate system of testing the work when done is under consideration. The primary test will consist of filling the hull with water and shifting the points of support under continual and close scrutiny, as one-quarter of the whole will be riveted in the normal manner. There will be always a gage of comparison between this portion and the portion which is welded.

Likewise there will be a chance for comparison of the two forms when subjected to abuse by bumping with rams and in various other ways.

It is a pleasure to report on the strong interest and ready help extended by the Federal ship people, whose plant and organization we are using for the purpose.

ELECTRIC BRASS FURNACES DISCUSSED BY OHIO MEN

This and Other Topics Form the Program of Final Meeting of New-Business Co-operations Committee at Cleveland

The industrial power and heating section of the new-business co-operations committee of the Ohio Electric Light Association held its final meeting in the rooms of the Electrical League of Cleveland on May 8. Mathias Turner, assistant general manager of the Cleveland Electric Illuminating Company, welcomed the delegates. The first paper, "The Present Status of the Electric Brass Furnace," was presented by H. M. St. John, research engineer of the Commonwealth Edison Company, Chicago. The positive and negative features of this type of electric installation were ably brought out, and an interesting discussion was led by F. F. Bailey, president Electric Furnace Company, and E. F. Collins, manager industrial heating engineering department of the General Electric Company.

Judge Vickery of the Common Pleas Court delivered a patriotic address at the luncheon, following which, at the afternoon session, two papers were presented—"Motor Hook-Ups, a Comparison of the Methods of Silent Chain Belts and Gears," by Paul V. Wheeler, engineer drive chain department, Link Belt Company, Cleveland, and "War-Time Economies," by W. A. Wolls, new-business manager Columbus Railway, Power & Light Company.

ELECTRICITY AT THE HOG ISLAND SHIPYARD

At Boston Banquet W. H. Blood, Jr., Speaks of Large Quantity of Electrical Machinery and Material Required

The importance of engineering service in relation to war work was the keynote of the ninth annual banquet of the engineering profession at the Boston (Mass.) City Club April 30. C. M. Spofford, president of the Boston Society of Civil Engineers, presided, and James W. Rollins of Boston officiated as toastmaster. Among the speakers were Alfred D. Flinn, secretary of the Engineering Council, New York; Major-General Harry F. Hodges, U. S. A., commandant at Camp Devens, Mass.; H. O. Westendarp, General Electric Company, Boston; Mayor Andrew J. Peters of Boston, and W. H. Blood, Jr., American International Shipbuilding Corporation, Philadelphia, Pa. All the speakers recognized the necessity for co-operation among engineers for war service and their value in military and naval tasks.

The chief address of the evening, by Mr. Blood, was an illustrated talk upon the development of the Hog Island shipyard. In the course of his remarks the speaker touched upon the large quantity of electrical machinery and material required at Hog Island, said to be the largest shipyard in the world. This included the installation of 3,000,000 ft. of wire, 40,000 electric lamps, 650 motors, a telephone exchange of 12,000 stations, and a connected load of 41,000 hp. supplied by the service of the Philadelphia Electric Company. At present the yard is 70 per cent completed; about \$10,000,000 per month is being expended on its construction, and eleven ships have been started, of a total of 240 to be constructed as soon as possible, all of the fabricated

steel type. Mr. Blood emphasized the importance of being able to contract for central-station service in this case, some 30,000 hp. having been set aside at Philadelphia for this great plant, where there was not enough time in which to build a local station for the yard, even had the latter been desirable. During the evening the need was emphasized of engineers for certain branches of naval service to supervise the actual construction of anti-submarine devices developed by American physicists. About 300 engineers attended.

CANADIAN NIAGARA POWER POOLED FOR WAR PURPOSES

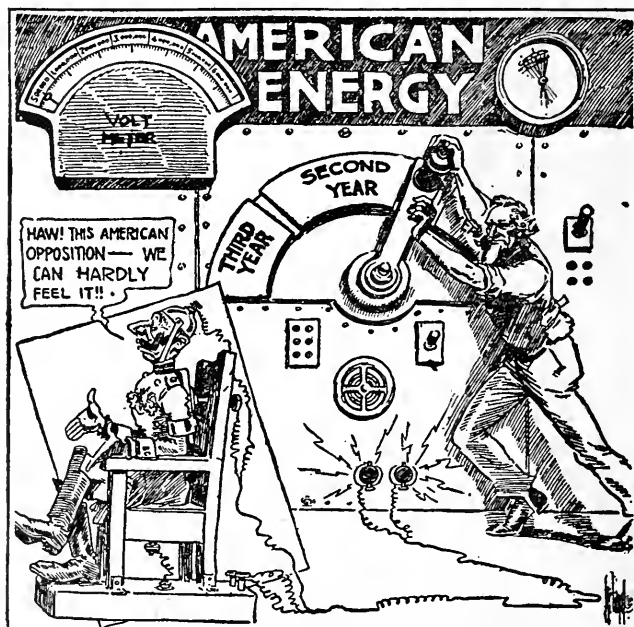
Steam Plants of Toronto Electric Light Company and Other Corporations to Be Operated to Speed Munitions Output

A Canadian order-in-council provides virtually for the pooling of Niagara power on the Canadian side of the border. Sir Henry Drayton, the Dominion Power Controller, has also made arrangements with the Toronto Electric Light Company, the London Electric Company, Ltd., and other companies whereby those corporations will resume operation of steam-power plants. The power will be at the disposition of the authorities until the needs of munitions and other essential industries are met.

It is reported that Sir Henry Drayton received assurances in Washington that sufficient coal would be made available without reduction of the allotment of coal to Canada.

Canadian officials in charge of the control of power and fuel have indicated in public statements that in all probability further restrictions will have to be placed on the use of light, power and coal by non-essential industries, merchants, storekeepers and private citizens.

It was also stated by the power and fuel control officials that people must expect to suffer some inconvenience from coal shortage next winter.



"DON'T BE IMPATIENT, BILL, YOU'RE GOING TO FEEL IT"

—Columbus (Ohio) Dispatch.



AMERICAN ELECTROCHEMICAL SOCIETY AT HOTEL TUTWILER, BIRMINGHAM, ALA.

ELECTROCHEMISTS FINISH THEIR TOUR IN THE SOUTH

Government's Nitrate Plants at Muscle Shoals, on the Tennessee, Are Inspected, and a Technical Session Is Held in Birmingham

The American Electrochemical Society completed its tour of Southern industrial centers with visits to Sheffield (Muscle Shoals), Birmingham and Anniston, Ala. Particular interest centered in the inspection of the government nitrate plants at Sheffield. One of these is to make use of the modified Haber ammonia process and the other of the cyanamide process. The final product of both plants will be ammonium nitrate. Plant No. 1, using the ammonia process, will have a capacity of 200,000 lb. of nitric acid per day and plant No. 2, using the cyanamide process, will have ten times the capacity of the first. In connection with plant No. 2, the Air Nitrates Corporation, which is directed by officers of the American Cyanamid Company, has been confronted with the problem of building and governing a city as well as constructing the technical plant. Thirteen thousand men are now employed.

LUNCHEON FEATURES AND TECHNICAL SESSION

As guests of the local committees at Sheffield, the party was taken to Lock 6 on the Muscle Shoals canal of the Tennessee River, where a barbecue dinner was served and a number of addresses were delivered explaining the proposed hydroelectric developments at Muscle Shoals, on the Tennessee River. Returning to Florence by boat, an informal reception was held at the Elks' Hall. At Birmingham on the following day the entire party was taken by automobile to the Ensley iron and steel plant, Tennessee Coal, Iron & Railroad Company, and later to Bayview Reservoir, where a barbecue lunch was served. Later in the day the new steel-plate plant at Fairfield was visited. This plant is being constructed especially for the manufacture of ship plates.

The technical session was held in the evening at the Hotel Tutwiler, Birmingham, following a complimentary dinner.

The final day of the tour was spent at Anniston, visiting the plants of the Southern Manganese Corporation and Anniston Steel Company. The former is manufacturing ferromanganese in the electric furnace, and the latter is making electric pig iron from scrap. These two plants are the largest electric furnace developments in the South.

FACTORY LIGHTING CODE OF STATE OF WISCONSIN

Industrial Commission to Make Rules Effective July 1 on New Work and Give Two Years to Bring Existing Work Up to Standard

Work on the factory lighting code of the Industrial Commission of Wisconsin has progressed to such a stage that it is now expected to make it effective on new work after July 1, 1918. If this plan is carried out, existing installations will be required to be brought up to specification within two years after that date.

As the code now stands it makes adequate lighting mandatory. Intensities at the work are specified. The code gives data on what the commission will require as minimum intensities and also gives higher intensities as "recommended practice." These data are based on practice that has been found satisfactory. In its studies the engineering force of the commission has been able to bring out data to show that increased production has resulted from the installation of adequate lighting. Other features of the code are that it makes a provision against glare and also one for uniform distribution. Maintenance of lighting systems is provided for.

CONSERVATION OF TIN IS NECESSARY AS WAR MEASURE

General War Service Committee of the Electrical Manufacturing Industry Warns Manufacturers of Danger from Shortage

A bulletin to electrical manufacturers, issued by the General War Service Committee of the Electrical Manufacturing Industry, contains a warning to conserve tin. Stating that the government has assumed control of the importation and distribution of tin, the committee adds: "Demand is made that the use of tin cease for all non-essential purposes and be reduced elsewhere to the minimum consistent with the production of material and apparatus which will function safely and satisfactorily."

If electrical manufacturers are to obtain their supply of tin, the committee says, it will be necessary for every one to economize to the fullest extent possible.

Suggestions are made for reduction in the consumption of tin to the necessary minimum. "The war needs of our industry in this respect are fundamental," the committee concludes, "consequently your immediate, active co-operation is of vital importance."

GOVERNOR OF MAINE ON WATER POWER CONDITIONS

Governor Milliken Tells "Electrical World" that He
Favors Development—Wants Investigation
and Constructive Public Policy

Proposed state ownership of water-power developments in Maine has reached a snag in Governor Milliken's firm decision to call no extra session of the Legislature to consider this subject, it was learned last week at Portland. At the Republican state convention in Portland in March Representative Baxter tried to further the cause of public ownership along the Ontario plan, but the proposition fell flat in face of the heavy cost of public development, especially under war conditions. There seems to be no general demand for an extra session at this time.

Speaking of the water-power situation to a representative of the *ELECTRICAL WORLD*, Governor Milliken said:

"A rapid and complete investigation of the whole subject of water-power development, leading to a constructive public policy, is of vital importance at this time. The value of water power as a great natural resource is emphasized by the present uncertainty and scarcity of the fuel supply. Discussion of the problem of development is important and exceedingly timely. So far as existing laws give us authority, we are compiling information regarding Maine's water-power resources with some attention to cost of development. The next Legislature should provide sufficient funds to insure a prompt and exhaustive report."

The Governor believes that the State should retain its water-power within its own borders for the use and benefit of its own people, this having been the settled policy of the Republican party within the State since 1909. The *ELECTRICAL WORLD* is in a position to state, however, that the opinion is taking form in Maine that the exportation of surplus hydroelectric power, when available, should be permitted, in view of the economic advantages of interconnection among transmission systems. Governor Milliken fears the exploitation of Maine water powers for their own profit by interests outside the State, and said:

"It is argued against this policy that it delays development. The same argument was made years ago in regard to Maine's timber lands, and in the pursuit of supposed progress that valuable birthright was lost to the people of the State. It is better to develop our water powers slowly than to lose them altogether. It is my belief that all new charters of power companies should contain a clause forbidding the transmission of power outside the State without the express consent of the Legislature and that every existing power company asking for an amendment to its charter at any session of the Legislature should have this amendment added also.

"I will not approve any new water-power charter nor any material amendment to an existing charter without the addition of this clause. Within the State it is our plain duty to encourage the development of water power under conditions that will assure its availability for industrial and household use at reasonable rates without injustice to capital honestly and prudently invested in such projects."

The Governor is keenly aware of the economic value

of water power as brought out by the coal crisis of last winter. Already Maine has the highest per capita water-power development in the country and stands third among the states of the Union in total development. He is anxious to have the subject opened up to the fullest possible extent.

There is little doubt, in view of the coal shortage in the Northeastern States last winter, that water-power matters will receive a good deal of attention at the coming biennial session of the Legislature in 1919. At the last session the movement to sanction exportation of power attained considerable headway, and it seems likely that the issue will again be raised. Among the operating companies there is a tendency to favor exportation at least of surplus power, with interconnection and the possibilities of interchange during periods of non-coincident low water. It was ascertained last



GOV. CARL E. MILLIKEN

week that the federal government is studying the possibilities of interconnection among transmission and hydroelectric systems along the borders of Maine and New Hampshire as a war measure to meet any power shortage or unfavorable water conditions on adjacent streams in adjoining states. The power requirements of shipyard and munition plants are large in the aggregate, and the whole subject is tied in so closely with fuel conservation that it is a most vital one at this time.

INVESTIGATION OF WATER POWER BY MAINE PUBLIC UTILITIES COMMISSION

Through the courtesy of Judge B. F. Cleaves, chairman of the Maine Public Utilities Commission, the *ELECTRICAL WORLD* is permitted to outline the plans of the board for a special investigation of water powers, existing and potential, in the principal river basins of Maine.

This investigation will be conducted by the engineering department of the commission under the direction of its chief, Paul L. Bean, and is to be assembled in a report to the next Legislature. The investigation will be in four parts—first, a study of the principal rivers; second, a comprehensive treatment of the cost and selling price of steam, oil-engine and hydroelectric power; third, a survey of power uses and markets; fourth, the legal aspects of water-power development.

The river study, of particular interest to hydraulic

engineers, will cover such main topics as the determination of power at developed and undeveloped sites, determination of storage sites, increase in the economic capacity of Maine rivers and total power in the State developed and undeveloped. Under the second division the report will cover the cost of power from different types of prime movers, the relatively low cost of unit power by developing storage, the cost of electricity for lighting and power as shown by comparisons of contracts and rates, and the detailed cost of power production, including operating expenses and fixed charges. This section will be of special interest to bankers. The power market section, with emphasis upon Maine uses, will be of great interest to the layman, and the legal section will contain much valuable material on water-power rights.

This investigation, of course, will not exhaust the subject, and the need of appropriations to carry the study further and especially into the field of smaller powers will be clear at the coming session of the Legislature.

WATER-POWER CONTROVERSY IS BEING WAGED IN MAINE

Campaign Against State Ownership Is Begun, and the Claims of Its Advocates Are Vigorously Attacked in the Newspapers

To offset the agitation for the public ownership of water powers which has lately been revived in Maine, a vigorous publicity campaign has been opened in the representative newspapers under the auspices of most of the leading electrical utilities of the State. William M. Pennell of Portland has been retained to conduct the campaign, which is already attracting widespread interest.

In the first publicity matter of the campaign, printed as a signed advertisement, attention is called to the claim of the public ownership advocates (headed by Representative Baxter of Portland) that 1,500,000 hp. of water power is going to waste in the State and that most of this formerly belonged to the State. Emphasis is laid upon the fact that a great number of these sites were owned by individuals long before Maine became a state. The State never had any ownership in the powers on the Saco or Presumpscott River. Its holdings on the Androscoggin, if any, were confined to the upper waters near the Rangeley Lakes. On the Kennebec the State owned no powers south of Madison, and on the Penobscot no powers were ever owned by the State within 50 miles north of Bangor. The only powers the State could claim any interest in were those situated in the so-called "wild lands" district. When the State sold these lands it conveyed title to the powers therein. Several times in many instances these power have been conveyed, and the Supreme Court has established the validity of the titles.

Advocates of state ownership claim that the inadequacy of water-power development by private capital resulted in much unnecessary suffering by industries and by the general public during the period of fuel shortage last winter. As a matter of fact there were fewer shutdowns in Maine resulting from coal shortage than in almost any other state of the Union. For example, the mills of Lewiston and Auburn, with one exception, were able to run because of hydroelectric power.

This condition obtained at Bath, a large shipbuilding center; at Portland, where ships and munitions are being produced; at Westbrook, Sanford, Waterville, Skowhegan, Biddeford, Saco and other manufacturing centers where the mills were unhampered by the coal situation except in the matter of heating.

The contention of the public ownership advocates that the development of water powers under private control has been very slow during the last seven years is being vigorously denied by the utilities. During the last seven years the Azischos dam has been completed on the Magalloway River, storing 9,500,000,000 cu. ft. (266,000,000 cu. m.) of water and increasing the minimum flow of the Androscoggin River more than 100 per cent. The cost of this development was \$1,000,000. On the west branch of the Penobscot River the Ripogonus dam has been built, impounding 22,000,000,000 cu. ft. (616,000,000 cu. m.) of water, and thus adding greatly to the efficiency of all the water powers on that stream. The cost of this development was over \$1,000,000. These two developments will generate when needed more than 40,000 hp.

At Rumford Falls there is being developed added power to the amount of 18,000 hp. and at a cost of over \$1,000,000. On the Saco River during the past seven years there have been completed two of the largest developments on the river, viz., at Bonny Eagle and at Hiram, where the present installation of waterwheels equals 16,000 hp., with a reserve when needed of 4000 hp., at a cost of \$2,000,000. At Grand Falls, on the St. Croix River, there has been developed by the St. Croix Paper Company 8000 hp., with an added reserve capacity of 4000 hp. The expenditure at this development was more than \$1,000,000. At Oakland the Central Maine Power Company is developing 3000 hp., and during the last seven years it has expended \$3,500,000 in increasing the capacity and the efficiency of its plants. The Portland & Lewiston Interurban Railroad, using the surplus power of the Androscoggin Electric Company, was built and placed in operation during the last seven years at a cost of more than \$1,000,000. A total of over 90,000 hp. has been developed during the last seven years, instead of less than 50,000 hp., as asserted by the public ownership advocates. But for the war conditions a 14,000-hp. development would also have been made at Clark's Rips, on the Androscoggin River, a task which will be performed as soon as normal conditions again obtain.

One of the contentions of the advocates of public ownership in Maine is that there is enough undeveloped water power to heat and light a large percentage of the homes of the State by electricity. The utilities are criticised by these interests as being behind the times in regard to the development of house heating by hydroelectric energy. The rejoinder of the utility companies points out that a residence burning 10 tons of coal for heating would consume about 60,000 kw.-hr., and at a price of from 1 cent to 3 cents per kilowatt-hour the cost would therefore be from \$600 to \$1,800 for the period. Tests have shown that it requires at least 13.5 kw. to warm a dwelling of six rooms. There are probably 160,000 dwellings in Maine averaging six rooms each, and if all the undeveloped power which could be developed in the State were used to heat houses only, there still would not be sufficient energy to heat one-fourth of these dwellings.

Home-Made "Tank" Central Station's Liberty Loan Parade Feature



In the recent parade on behalf of the third Liberty loan at Portland, Me., the Cumberland County Power & Light Company made a decided hit by contributing an imitation "tank" to the pageant. The "tank" was designed by H. J. Howarth, superintendent of the meter department and L. G. Scott, superintendent of underground construction.

WAR POWER PROBLEMS MET BY CALIFORNIA COMMISSION

**Necessary Construction Recommended to Conserve
Fuel Oil and Assure Further Development
of Hydroelectric Resources**

The California Railroad Commission has rendered a decision in the matter of the construction and operation of electric utilities during the emergency created by the war, as applied to the transmission and sale of power from the California-Oregon Power Company and the Northern California Power Company to the Pacific Gas & Electric Company. The commission has fixed the following rates for power to be delivered:

California-Oregon Power Company—Delivery to Northern California Power Company at Kenner.

Guaranteed delivery and purchase, 8500 kw. at 70 per cent load factor, equivalent to 52,122,000 kw.-hr. a year.

Rate (3.75 mills a kilowatt-hour) a year, \$195,500.

Energy delivered in excess of 8500 kw.-hr. at 70 per cent load factor, 52,122,000 kw.-hr.

Rate, 2.75 mills a kilowatt-hour.

California-Oregon Power Company and Northern California Power Company—Delivery to Pacific Gas & Electric Company at Colusa.

Guaranteed delivery and purchase, 8000 kw. at 70 per cent load factor, equivalent to 49,056,000 kw.-hr. a year.

Rate (4.9 mills a kilowatt-hour) a year, \$240,000.

Guaranteed purchase of maximum of 4000 kw. additional on a basis of 50 per cent annual load factor, based upon the average peak available supply throughout the year at Colusa in excess of 8000 kw.

Rate: All additional energy in excess of 70 per cent guaranteed load factor on 8000 kw., 3.5 mills per kw.-hr.

It is also recommended: that the California-Oregon Power Company and the Northern California Power Company enter into agreements for the transmission and delivery to the Northern California Power Company of 8500 kw. at Kenner; that the California-Oregon Power Company, the Pacific Gas & Electric Company and the Northern California Power Company enter into agreements for the transmission and delivery to the Pacific Gas & Electric Company at Colusa of 8000 kw., together with excess power as set forth in the commission's decision and according to the rates fixed for the delivery.

It is further recommended that the several companies take immediate steps to conclude such agreements or

contracts and to construct the transmission lines and substations required for the delivery and utilization of such power at the earliest time commensurate with economy of construction.

The investigation in general was instituted by the Railroad Commission on its own motion to determine the special needs of electric utilities in the war crisis and to enable the commission to render prompt service to the government, the utilities and the public so that there should be no shortage or interruption of service to industries.

The investigation so far made has been directed principally to the matter of the conservation of fuel oil and the further development of hydroelectric power on the part of the electric utilities to prevent any shortage of power.

FIVE LARGE COMPANIES SERVE TERRITORY

More than a month ago the commission made recommendations as to conditions in the southern part of the State for certain interconnections and other improvements to meet growing requirements. The five larger companies serving in central and northern California are the Pacific Gas & Electric Company, the Great Western Power Company, the Sierra & San Francisco Power Company, the Western States Gas & Electric Company and the Northern California Power Company. These five companies generate practically all the hydroelectric power produced and sold in that territory.

The decision says:

The investigation made and the evidence presented in this case show that there is a shortage of hydroelectric power in the central part of the State; that none of the electric utilities have in progress of construction hydroelectric plants to meet the demand for power, which is increasing at an annual rate of approximately 25,000 kw. of demand and 150,000,000 kw.-hr. a year; that during the coming season less hydroelectric power will be produced than normally, due to the shortage in precipitation, and that all practicable means should be taken to conserve fuel oil and meet the necessary demands for power and thus not hamper the industries during the war.

Considering the continually decreasing oil storage in California and the threatened shortage which may occur, it behooves the electric utilities to do all that they reasonably can to keep their consumption down to a minimum, and assistance should be given to them in so far as practicable to increase the utilization of existing hydroelectric facilities and the further development of plants as soon as this is possible.

Investigations in connection with this matter show that the California Power Company has completed a hydroelectric plant known as Copco, near the California-Oregon line, with a capacity of 10,000 kw., which is not at present needed for the local requirements of that company, and further, that the Northern California Company has a surplus capacity of approximately 4000 kw. during the seven months of the year from October to April inclusive. Provided the companies can finance the required transmission facilities to deliver this power to the Pacific Gas & Electric Company, this additional power, representing approximately 60,000,000 kw.-hr. a year, delivered to the Pacific company could be made useful in meeting the growing requirements for power in the bay districts and reduce the oil requirements approximately 240,000 barrels a year.

Various plans were proposed to make use of this power, but on account of financial difficulties and rate controversies these were not accepted. Finally the following proposals were arrived at, on recommendations made by L. S. Ready, acting gas and electrical engineer of the Railroad Commission:

1. The California-Oregon Power Company to reinforce and reconstruct its transmission line from Copco to Costella and construct a 70,000-volt line from Costella to Kennet of sufficient capacity to transmit to the Northern California Power Company at Kennet 8500 kw. Estimated cost, \$330,000.

2. The California-Oregon Power Company to finance the Northern California Power Company to the extent required to reinforce that company's lines from Coleman to near Hamilton by the addition of No. 0 copper conductor to the west line so that there can be delivered throughout the year to the Pacific Gas & Electric Company at Colusa 8000 kw. Estimated cost, \$110,000.

3. The Pacific company to construct a 60,000-volt transmission line of sufficient capacity from Colusa Corners, near Colusa, to Drum-Cordelia. Estimated cost, \$440,000. A 100,000-volt line and install a substation of 12,000 kw. rating, from 60,000 volts to 100,000 volts, to deliver the power into that line. Estimated cost, \$200,000. Total estimated cost, \$640,000.

The Pacific company will be required to re-route the power from certain of its existing plants over its Wise-Stockton Mission-San José line to the southern district. This line is under construction at the present time and will be completed by the time power can be delivered at Colusa.

A general understanding was reached as the result of conferences as to the amount of power to be delivered and purchased, as follows:

1. The California-Oregon company is to guarantee to deliver at Kennet to the Northern California company, and the latter company to agree to take for transmission south, 8500 kw. at 70 per cent load factor.

2. The California-Oregon company and the Northern California company are to agree to deliver to the Pacific company at Colusa Corners 8000 kw. at 70 per cent load factor throughout the year.

3. The Northern California company is to agree to deliver to the Pacific company during the months of October to April inclusive 4000 kw. at 50 per cent seasonal load factor.

4. The Pacific company is to agree to purchase and take from the Northern company a minimum of 8000 kw. at 70 per cent load factor for twelve months and 4000 kw. at 50 per cent seasonal load factor for the seven months.

5. The agreements were to be incorporated in a contract to run for ten years, with the right to apply for change of rate in five years. It was further understood that the Northern California Power Company's delivery of power to the Pacific company at Chico, under contract relations, should in no way be affected by this contract.

The result of the above agreement, if carried out, will be the purchase by the Pacific company of a minimum of 59,000,000 kw.-hr. a year. This will represent an oil conservation of approximately 240,000 barrels a year.

SALE AND PURCHASE PROVISIONS

Under the proposed rates and agreements of sale and purchase, the California-Oregon company is to deliver to the Northern California company at Kennet a minimum of 52,122,000 kw.-hr. a year, equivalent to 8500 kw. of 70 per cent load factor, for \$195,000, and for energy supplied in excess of that amount to receive payment at the rate of 3.75 mills a kilowatt-hour. This power is to be transmitted by the Northern California company to the Pacific company at Colusa, where it is to be delivered at the minimum of 8000 kw. of 70 per cent load factor, equivalent to 49,056,000 kw.-hr. a year, for an annual payment of \$240,000. In addition to this amount, the Northern California company agrees to deliver the surplus power to a maximum of 4000 kw. to the Pacific company, and the Pacific company agrees

to purchase that power at a load factor based upon the average available peak of 50 per cent. All power purchased in addition to the minimum guarantee of 49,056,000 kw.-hr. to be at a rate of 3.50 mills a kilowatt-hour. Under this proposed agreement there should be delivered to the Pacific company at Colusa a minimum of 60,000,000 kw.-hr. a year, which will represent an oil conservation of at least 240,000 barrels a year.

OPERATING CONDITIONS OF SAN FRANCISCO COMPANY

Heavy Loss in Net Operating Revenue of Pacific Gas & Electric Company Due to Operating Expenses

At the recent annual stockholders' meeting of the Pacific Gas & Electric Company John A. Britton pointed out that the reason for the heavy loss in net operating revenue last year lies in the operating expenses of all departments. There was an increase in the maintenance of properties over 1916 of \$82,000, in operation of \$1,613,863, and in taxes and administrative expense of \$349,939, or a total increased expense of \$2,045,808 against increased revenue of only \$1,197,883.

In the electric department the average revenue per consumer in 1916 was \$56.54 as against \$55.87 in 1917. The electric construction costs during the year were \$853,041 net, or \$61.20 per consumer obtained. The cost per kilowatt-hour, including generation by water and steam, was 1.81 mills in 1916 and 2.55 mills in 1917, an increase of 0.74 mill. The increase in oil costs alone would have amounted to 0.76 mill, or more than the total increase, economies in other ways reducing the net loss to 0.74 mill.

The average of operating and maintenance expenses per kilowatt-hour increased from 6.9 mills in 1916 to 7.3 mills in 1917, an increase of 0.4 mill. In this time the cost of oil increased 0.89 mill per kilowatt-hour, showing that a compensating decrease in expenses had been made. Oil prices and water shortage, Mr. Britton pointed out, were responsible for the entire increased cost. The ratio of average load to plant capacity in 1916 was 53 per cent as against 46 per cent in 1917. This reflects the shortage of stored water and affected 74,000,000 kw.-hr., having a value in oil of \$500,000.

Reference was made to the 15,000-kw. turbine for Station "A" in San Francisco, which is to be delivered about the first of next year, and to the possibility of a tie-in with the California-Oregon and Northern California Power Companies. These improvements to the system will cost approximately \$2,000,000. With these extensions, Mr. Britton said, all demands on the system that may be deemed by the government of a necessary character could be met.

Workmen injured in the course of their employment in 1917 numbered 673, and the average cost per employee was \$8.53, as against \$9.34 in 1916. The cost of these accidents was less than one-half of 1 per cent of the year's gross earnings, while if casualty and compensation insurance had been carried, the cost would have been approximately \$225,000, or 1.4 per cent. The total number of accidents to employees and other persons was 1908, a decrease of 351 over the previous year.

To Speed Aircraft Production



JOHN D. RYAN

John D. Ryan, president of the Montana Power Company and the Anaconda Copper Mining Company, has been appointed, Secretary of War Baker announces, director of aircraft production for the army.

THE LARGER PROBLEMS OF OUR FOREIGN TRADE

M. A. Oudin Discusses "American Economic Interests in the Asiatic East" at Fifth National Foreign Trade Convention

An address on "American Economic Interests in the Asiatic East" was made by M. A. Oudin, manager foreign department, General Electric Company, before the Fifth National Foreign Trade Convention, Cincinnati, last month. Some of the remarks of Mr. Oudin, who has been in the East recently, follow:

America is not represented abroad by capital investments commensurate with her wealth. It is a problem in our foreign trade to find a sufficient number of Americans typical of our best home elements who are willing to live outside the United States and to make the furthering of our export trade their life's vocation. The consequence is that the American colonies in many foreign countries are small in numbers and constantly changing but relatively effective in developing markets for our products.

We must not blind ourselves to the fact that the pressure of economic necessity is the cause of nearly all wars. The present war is no exception. Precipitated by Germany in the expectation of extending its commercial opportunities, it has developed into a mad and desperate struggle on the part of that country for position—political, military and territorial—which with the coming of peace will enable its possessor to fasten its grip upon the world. So far the gainers have been the Central Powers, through their control of Belgium, parts of France, Russia, the Balkans, Roumania and the Transcaucasus. All the warring nations, except the United States, are purposely striving either to make or to retain a place for themselves in the economic sun. And this they are doing notwithstanding that they are engaged in a life and death struggle and that those who are fighting on European battlefields are spending billions of dollars and suffering an appalling sacrifice in lives.

In the United States there is a disposition to push aside all problems except the vitally important one of how to win the war. We are confident of the unselfishness of our motives and the disinterestedness of our aims. But no one can predict how far these policies and these principles will prevail at the peace conference. These principles must be backed up by more than a conviction on our part of their

high moral character, by more than powerful naval and military forces. We will invite embarrassment if we do not take stock of our economic and industrial and of our agricultural and mineral resources. We will court disaster if we unduly delay taking the necessary constructive measures for the improvement of our economic position. It is certain that at the peace table a knowledge of the exact state of our resources and those of our Allies and the possession of a strongly fortified economic position will be trump cards. They will help us secure a better peace for ourselves and for the world, in which our rôle is that of a leader of democratic peoples.

The maintenance after the war of the relative commercial opportunities of the nations as they existed at its commencement may help to postpone a future war by removing one of the principal causes of war. For the time being, however, the power of might rules in the world and no one can say for how much longer it will continue to do so.

There never was a greater need for sagacious and cautious statesmanship and for an enlightened public knowledge of world politics than in the present crisis of our country. So long as our people are unaccustomed to think in international terms, American interests will be frequently set aside for a supposedly greater gain in some other and less material direction. There should be, in addition to this wider public interest in international affairs, a closer co-operation between our administrators and the people, or at least those of our citizens who are specialists in these matters. It is not too much to urge that our business men study world politics and world economics in order to arrive at sound opinions upon all questions internal as well as external which influence our interests overseas; next, that labor realize to what an unexpected extent its welfare depends upon a steady and permanent outlet for the product of its efforts, which may be insured by an extensive foreign commerce, and lastly, that the government of the United States, following the example of all of the other great commercial nations, freely seek out and confer with those of its citizens who, because of their special knowledge and experience, are qualified to give expert advice on the complicated questions involved in our international relations.

MR. FARRELL ON FUTURE TRADE CONDITIONS

In his address James A. Farrell, president National Foreign Trade Council and president United States Steel Corporation, made the following forecast of conditions after the war:

There can hardly be a question that for a good many years after peace is restored the rehabilitation of the vast territory wasted by the war and the replacement in neutral countries of equipment which has necessarily suffered from deterioration while replacements have been impossible will provide a large outlet for surplus production.

Whatever may be the eventual terms of peace, one conclusion would seem to be reasonably certain: We and our allies will have sacrificed our blood and treasure in vain if we have not succeeded in insuring hereafter conditions of peace under which we shall be free to carry on our domestic and foreign commerce without the fear of military dictation.

Gerard Swope, vice-president Western Electric Company, spoke at the convention on the best form of co-operation in the export field.

At a luncheon of the American Manufacturers' Export Association held at Cincinnati in connection with the convention E. M. Herr, president Westinghouse Electric & Manufacturing Company, said:

"We are facing as serious and critical a situation in our foreign trade, especially our foreign trade in manufactured products, as the nation faced at the sinking of the Lusitania, and are doing almost as little toward real preparation for the proper development of this trade as we did as a nation at that time in preparation for the terrible war in which we are now engaged."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Synchronous Club, Los Angeles.—At the May 2 meeting J. M. Lee of the Los Angeles Bureau of Light and Power spoke on "Prime-Mover Economics."

International Association of Municipal Electricians.—The annual convention of the International Association of Municipal Electricians will be held at Atlanta, Ga., on Sept. 24 to 27.

Arkansas Association of Public Utility Operators.—The annual convention of the Arkansas Association of Public Utility Operators will be held at the Arlington Hotel, Hot Springs, Ark., May 21, 22 and 23.

San Francisco Electrical Development League.—At the May 1 meeting of this organization W. L. Goodwin outlined the plans which are being developed for organizing all branches of the electrical industry on a national scale.

Engineers' Society of Milwaukee.—J. J. Whelan, industrial commissioner, and V. S. Hillyer, construction engineer, of the Wisconsin-Minnesota Light & Power Company of Eau Claire, Wis., gave an illustrated lecture on the Wisconsin dam before the Engineers' Society of Milwaukee on May 8.

Joint Engineers Hold Meeting in Chicago.—At a joint meeting of the American Institute of Electrical Engineers, the Western Society of Engineers and the American Society of Mechanical Engineers in Chicago C. F. Kittering, president of the Society of Automotive Engineers, gave an interesting address on the "Automobile Power Plant."

A. I. E. E., Pittsburgh Section.—The May meeting of the Pittsburgh Section of the American Institute of Electrical Engineers will be held May 14 at the Chamber of Commerce auditorium. Dr. J. E. Sparks, president of the Pennsylvania State College, will present a paper on "Present Problems of Technical Education." This paper deals especially with army work.

Southwestern Electrical and Gas Association.—At the fourteenth annual convention of the Southwestern Electrical and Gas Association, a report of which was published in the May 4 issue of the *ELECTRICAL WORLD*, it was decided to hold local meetings of the three sections three times a year in different cities and so arrange these meetings that members near these cities can attend with small expenditure of time and money.

Wisconsin Association of Electrical Contractors and Dealers.—The need of co-operation between industries, the government and the public were emphasized by Burton Williams, internal collector of revenue for the Wisconsin

district, in an address at the banquet of the Wisconsin State Association of Electrical Contractors and Dealers held recently in Madison. Among the important papers presented at the two-day convention was one on "Selling Electrical Appliances on the Installment Plan," by R. B. Snyder, general sales manager for the Milwaukee Electric Railway & Light Company.

Joint Committee of Technical Societies of Southern California.—George A. Damon of Pasadena was elected chairman and W. K. Barnard of Alhambra secretary at a recent meeting of the Joint Committee of Technical Societies of Southern California in Los Angeles. This organization contains members of the branches of seven national engineering societies in southern California in one body of more than 1000 electrical men. The membership includes architects, electrical, civil, chemical, mining and mechanical engineers.

State Factory Inspectors.—At meetings of state factory inspectors of Pennsylvania and New Jersey recently Prof. C. E. Clewell of the University of Pennsylvania gave lectures on the "Specification of Quantity of Light," "Relation of Glare to Factory Lighting" and "Distribution of Light in Factory Spaces." The addresses dwelt upon the importance of quantity of light and emphasized various other important factors. The necessity of taking into account physiological as well as physical requirements, the allowance for the worst conditions, excessive variations of daylight and the practical measurement of quantity of illumination were also discussed. At one of the meetings G. H. Stickney, president of the Illuminating Engineering Society, outlined the various efforts which have led to the formation of factory lighting codes and the present status of such codes throughout the United States.

O. E. L. A. Transmission and Distribution Committee.—At the last conference of the season for the transmission and distribution men of Ohio, which was held at Youngstown recently, various Pennsylvania as well as Ohio companies were represented. R. R. Krammes of the Central Ohio Power Company presided at the meeting and introduced V. E. Goodwin, lightning-arrester engineer of the General Electric Company, Pittsfield, Mass., who gave an interesting address on "Protection of Electrical Apparatus Against Lightning." Mr. Goodwin answered various questions as to the operation and construction of the various forms of arresters, including the electrolytic arrester. In the discussion of Mr. Goodwin's paper it was brought out that the present form of electrolytic arrester is the best form of available protection against lightning. Another paper, "Overhead Crossings of Electric Light and Power Lines for Voltages Greater than 10,000 Volts," was read by M. H. Wagner, transmission and distribution engineer of the Dayton (Ohio) Power & Light Company. It showed that exacting and abnormal clearances are required by some railroads.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Negligence in Injury to Property.—A light and power company was liable for breaking a plate-glass window while installing a light if the damage was the proximate result of its negligence or that of its servants within the scope of their duties, not contributed to by negligence of plaintiff or its servants, it was held by the Court of Appeals of Alabama in *Birmingham Railway, Light & Power Company vs. E. & W. Dry Cleaning Company* (77 S. 922).

Loss of Profits Is the Damages Resulting from Cutting Off Current.—The true standard or test for determining the loss resulting from the impairment of a business by a cause readily remediable, as by the wrongful discontinuance of electric energy during eight months or less, primarily is not depreciation in rental value of the building occupied, the occupancy thereof not otherwise being disturbed, but rather loss of profits of the business therein conducted because of the interruption of the energy, the Supreme Court of West Virginia held, in *Chambers vs. Spruce Lighting Company* (95 S.E. 192).

Damages Collectible if Service Is Not Furnished When Promised.—A municipal corporation authorized by law to sue and be sued, contract and be contracted with, acquire, hold, possess and dispose of property, and to provide for the lighting of streets and furnishing the city or town and the inhabitants therewith with gas or other lights, as well as to allow the use of streets and alleys of the city to any person or corporation who might desire to establish works for supplying the city and its inhabitants with water or lights upon such reasonable terms as the council should prescribe, granted defendant corporation a franchise to erect poles and string wires in the streets of the town, the ordinance requiring defendant to give a bond conditioned that it should have a certain portion of its service in full operation within nine months after the grant of the franchise and should maintain it so as to furnish electricity adequate for light and power purposes. Defendant accepted the terms of the grant and accepted and executed its bonds, but failed to erect poles or in any way to comply with the requirement that it should have a certain percentage of its service in full operation within nine months. It was held by the Supreme Court of Oregon in *City of Grants Pass vs. Rogue River Public Service Corporation* (171 P. 400) that the municipality might without proof of any special or actual damages recover the amount of the undertaking.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

California Commission Expense.—The expense of conducting the California Railroad Commission is less than one-tenth of 1 per cent of the revenue of the utilities regulated by it.

Bureau of Mines Needs Trained Men.—Important chemical and other technical engineering work necessary for the prosecution of this war is being carried on by the Bureau of Mines experiment station at Washington, D. C. The services of trained men of several classifications, including electrical engineers, are urgently needed.

Denver's Committee on Safety and Efficiency.—One of the innovations of the Denver Gas & Electric Light Company is the committee on safety and efficiency, presided over by T. O. Kennedy, general superintendent, which meets monthly to listen to suggestions from all departments. A prize for the best suggestion is awarded. H. P. Tewksbury was a recent winner, his suggestion being that all departments be ordered to observe rigid economy in the use of electricity and gas for the further conservation of fuel.

Increased Rates at Fond du Lac.—The Railroad Commission of Wisconsin has rendered a decision in the application of the Eastern Wisconsin Electric Company to increase its electric rates at Fond du Lac. The company requested authority to apply a surcharge of 1½ cents per kilowatt-hour to all lighting and power bills, including bills for street lighting. The decision of the commission authorized a surcharge of ½ cent per kilowatt-hour to be applied against all lighting and power business for six months, beginning May 1.

Lighting Lectures Delivered to Pennsylvania and New Jersey Factory Inspectors.—The committee on lighting legislation of the Illuminating Engineering Society, under the chairmanship of L. B. Marks, has drafted and issued a code of factory lighting which has been used as a guide in the preparation of the codes of Pennsylvania and New Jersey. To promote a better understanding of the fundamental principles of the factory lighting codes now in force in these two states, the department of electrical engineering of the University of Pennsylvania, of which Harold Pender is professor in charge, co-operating with the State Labor Departments of Pennsylvania and New Jersey, arranged a series of lectures covering two all-day sessions for April 25 and May 9. Visiting inspectors were invited to look into the various laboratories of the electrical engineering department between the lecture sessions or to visit other buildings on the university campus.

Samuel Insull Speaks at Rockford.—Samuel Insull, president of the Commonwealth Edison Company and chairman of the State Council of Defense for Illinois, spoke before the Rockford (Ill.) Chamber of Commerce on April 24. During his stay in Rockford he also visited the National Army cantonment at Rockford, where he was conducted over the camps for an inspection of each of them by Gen. O. H. Martin and Lieut. Jack Eddy.

Large Turbine Overhauled After Long Run.—The Commonwealth Edison Company recently took down for inspection and overhauling its unit No. 3 at Northwest station. This unit is a 30,000-kw., 25-cycle General Electric compound unit. This was the first overhauling the unit had received since it originally went into service two and one-half years ago. It is interesting to know that during this length of time the machine generated 475,000,000 kw.-hr.

Cincinnati Rate Case.—City Solicitor Saul Zielonka of Cincinnati, Ohio, is seeking before the Ohio State Supreme Court to prevent the Public Utilities Commission from exercising jurisdiction in the electric light rate controversy. Mr. Zielonka had been notified by the commission that a decision on his motion to strike from its files the application of the Union Gas & Electric Company for a modification of the order fixing 8½ cents as the rate for Cincinnati would be withheld until after the hearing on the application. This motion raised the question of jurisdiction, and this is the reason for the appeal to the Supreme Court. The order for the 8½-cent rate was issued after the city and the company had agreed upon it, and the city solicitor contends that the rate should be binding under this agreement for the term of the ordinance, five years.

Priority in Kansas City, Mo.—The first denial of priority instructions on equipment for the Kansas City Light & Power Company new central station has occurred with reference to its turbines. It is believed in Kansas City that the denial is tentative. Since information regarding it has been received in Kansas City nearly all the large industrial plants using energy have written to the Washington authorities urging that the company be allowed to complete its plant, as their need for more energy is imperative. All of those which wrote are on "short rations" of energy, and nearly all are in one way or another in war commodity production, including mills, steel and iron working plants and plants making actual munitions or accessories to army equipment. Several plants which had planned their schedule of production with the expectation of getting electrical power within the year also represented their situation to the board. Erection of the company's central station is temporarily held up awaiting adjustment of labor difficulties. The company will complete all details so far as possible whether the turbines are released meanwhile or not, but a renewal of the priority order is of great importance.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rates Found Too Low in Wisconsin.—Approving an increase in electric rates of the Cross Plains Electric Company, the Wisconsin Railroad Commission shows that analysis of the applicant's earnings and expenses indicates that for the year ended June 30, 1917, it failed to earn more than 5.3 per cent on its estimated value, and that the elimination of receipts from sale of fixtures, wiring, etc., would wipe out entirely the surplus available for returns during such year; that under the circumstances an increase in rates is justified. The company testified that it was losing money on farm consumers, owing to transformer losses. The greater percentage of profits has been from house wiring and sale of fixtures, a business it is no longer engaged in. In general, it was losing money because its light and power rates were too low in proportion to the cost of doing business. The commission authorized a new schedule of rates, which includes rates for commercial and street lighting, power service, rural service, and a penalty for failure to pay bills within ten days of date of bill.

Company Should Justify Higher Rates.—In declining an application of the Electric Light & Power Company of Burns for authority to increase rates, the Oregon Public Service Commission says: "In our opinion the market for electric energy in Burns will produce, under rates no higher than those now in effect and under conditions of adequate service and careful management, a return more reasonable in proportion to the investment necessary for such service than that now received. A request for an advance in rates is unreasonable and should not be considered until such time as the applicant can come before this commission and show clearly that it has made necessary provision to insure its patrons adequate service and that every possible opportunity has been accepted for increasing the revenue of the company by the development of such profitable business as may be available within the territory served by it. . . . Patrons display utter lack of confidence in the devices used for the measurement of the energy consumed, and the management itself does not by proper test or inspection keep itself sufficiently assured of the accuracy of this equipment in order that it may restore such confidence or defend its charges. In these and other respects the business methods of the management of this company are lax to such an extent as to eliminate the possibility of co-operation from the public."

Richard Eick has been promoted to the position of general agent of the Little Rock Railway & Electric Company.

Prof. Louis Vessot King of McGill University, Montreal, has been awarded by the Franklin Institute its Howard N. Potts medal for his improved method and researches in hot-wire anemometry.

C. C. Turley, for ten years manager at Vancouver, Wash., for the Portland Railway, Light & Power Company, has resigned to accept a position with the Utah Power Company at Salt Lake City.

William Marconi has been awarded the Franklin medal by the Franklin Institute. The medal will be presented on May 15 to Count V. Macchi de Celere, representing the Italian government, for transmission to Mr. Marconi.

W. L. Davis, until recently a traveling auditor on the staff of the American Power & Light Company of New York City, has been appointed auditor of the Lehigh Valley Transit Company, the Lehigh Valley Light & Power Company and affiliated companies at Allentown, Pa.

Prof. Thomas Corwin Mendenhall, physicist, former president of Worcester Polytechnic Institute and a United States delegate to the International Electrical Congress in 1893, has been awarded the Franklin medal by the Franklin Institute. The medal will be presented on May 15.

E. C. Vickers, assistant manager at Duquoin, Ill., has been promoted to the position of district manager of the Eldorado group of properties of the Saline Electric Company, a subsidiary of the Southern Illinois Light & Power Company, to fill the vacancy caused by the resignation of F. T. Morrissey.

Dr. A. E. Kennelly, acting head of the electrical engineering department of the Massachusetts Institute of Technology, has been awarded by the Franklin Institute its Howard N. Potts gold medal for his invention of the hot-wire anemometer and his application of this device to the measurement of convection from small heated wires.

O. W. Jones, commercial manager of the Texas Power & Light Company of Waco, Tex., has been transferred to Cleburne, Tex., as manager of the Cleburne district. Mr. Jones went with the company late in 1916, prior to that having been engineer of distribution of the Columbus (Ohio) Railway, Light & Power Company and later superintendent of the meter and distribution department of that company.

O. S. Maple, formerly purchasing assistant of the United States Shipping Board, Emergency Fleet Corporation, at Washington, D. C., has recently been appointed assistant purchasing officer of that corporation. Mr. Maple was formerly engineer on steam-plant design for the Fargo Engineering Company, Jackson, Mich. He joined this concern in the fall of 1916, going from the Texas Power & Light Company, for which he was assistant construction engineer.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

R. A. MacGregor has resigned as sales manager of the Merchants' Heat & Light Company, Indianapolis, to accept a position as sales engineer for the Lakewood Engineering Company of Cleveland in its Pittsburgh territory. Mr. MacGregor has become well known in the central-station industry through his connection since 1900 with such companies as the West Penn Company at Connellsville, Pa.; the C. H. Geist Company, Plymouth, Pa., and Chicago; the H. L. Doherty Company, New York, and the Connersville (Ind.) Light, Heat & Power Company. In the service of H. L. Doherty & Company, as sales manager of the Empire District Elec-



R. A. MACGREGOR

tric Company at Joplin, Mo., Mr. MacGregor and his sales force at one time made a record of closing 22,000 hp. of electric service in twenty months. As sales manager of the Merchants' Heat & Light Company he had charge of the construction and equipment of the company's appliance store, known as the "Daylight Corner," which is well known in the central-station trade as one of the modern electrical merchandise salesrooms of the Middle West.

Albert M. Grall, Webb City, Mo., representative of the new-business department of the Empire District Electric Company, has been made new-business manager of the Ashland (Ohio) Gas & Electric Company.

Jefferson L. Alexander, for many years superintendent of the lighting department of the Savannah (Ga.) Electric Company, has been transferred by the Stone & Webster Management Association to a similar position with the El Paso (Tex.) Electric Company.

R. E. Brown has been appointed commercial manager of the Little Rock (Ark.) Railway & Electric Company to succeed A. E. Smith.

W. R. Sammons, formerly of the commercial department of the Knoxville (Tenn.) Railway & Light Company, has succeeded G. H. Smart as commercial manager.

J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company, who, as announced in the ELECTRICAL WORLD for May 4, was elected president of the Oklahoma Gas, Electric and Street Railway Association, received his education in the University of Kansas and, after teaching for a few years, entered the utility business. He installed and managed the electric plant at Oswego, Kan., and then went to Oklahoma, where he installed the Wagoner plant and managed the property for three years. He then accepted the position of superintendent of the Caney River Gas Company, serving in that capacity for two years. In 1911 he became connected with the Byllesby interests as superintendent of the Muskogee Gas & Electric Company, being promoted in March, 1917, to the position of general manager of the Muskogee property. In March, 1918, he moved to Oklahoma City and was promoted to the position of vice-president and general manager of the consolidated Byllesby properties in Oklahoma.

Obituary

Charles F. Sise, founder of the Northern Electric Company of Canada, died on April 9. In 1879 he went to Canada for the purpose of organizing the telephone business of the Dominion on a national basis. For many years he was president of the Bell Telephone Company of Canada.

E. P. Warner, a pioneer in the field of commercial electrical design, died in Los Angeles recently, at the age of seventy-seven years. Mr. Warner was first engaged in the manufacture of telegraph apparatus. In 1872 he entered the employ of the Western Electric Company, retiring after thirty-eight years of service in 1910. For many years Mr. Warner was associated with the development of power apparatus and arc lights for the company. When he retired he was engaged in sales work.

Major Charles G. Baird, Signal Corps, U. S. A., reported dead from disease in Monday's casualty list from General Pershing, was the chief of the entire telephone and telegraphic service of the American Expeditionary Force in France. He entered the army immediately after Congress declared war on Germany and organized the 413th Telegraph Battalion, one of the first of the Signal Corps units ordered overseas. For a number of years Major Baird has been recognized as one of the leading experts in America on railroad signal equipment. He was thirty-eight years old.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

RESALE PRICE FIXING IS TO BE COMBATED

Recent Decision Establishes the Policy Which Will
Henceforth Be Followed by the Federal
Trade Commission

For a considerable time there has been a controversy throughout the country over the question of the right of manufacturers, wholesalers, etc., to fix resale prices at which their articles must be sold. The right to maintain such resale prices has been contended for by them, and the question whether such right exists has been brought before the Federal Trade Commission numerous times.

The Federal Trade Commission has just disposed of the first of the cases in which complaints have been issued charging violations of law through fixing the resale price of articles, and an order to cease and desist from this practice has been issued by it in the case of Chester, Kent & Company, Inc., of Boston, manufacturers of proprietary medicines.

Attorneys for the company admitted that in the past the practices complained of had been in use. The order, the first in cases of this character, forbids the company to (a) indicate to dealers the prices for which its proprietary or patent medicines shall be resold; (b) obtain agreements from dealers to adhere to such prices; (c) refuse to sell to dealers who fail to adhere to such prices; (d) refuse to sell to dealers who fail to adhere to such prices upon the same terms as dealers who do so adhere; (e) furnish any advantage to dealers who adhere to the resale prices while refusing similar treatment to dealers who do not adhere to the prices.

The Federal Trade Commission has made a statement saying:

"After full consideration the Federal Trade Commission has decided to issue complaints against all business concerns that refuse to sell unless the purchaser will agree to maintain a resale price fixed by the seller. The case just decided is the first formal finding by the commission to that effect. When once an article has passed from the maker to a purchaser he owns it, and the owner of such article may sell it at any price that he chooses provided he does not himself sell it at such price as to be below cost and thereby enter into unfair competition with other retailers selling the same article.

"This decision is going to be open to considerable controversy in relation to the subject matter thereof, and the matter will probably have to be settled by an act of Congress in the manner suggested by Mr. Justice Brandeis in his concurring opinion in the Supreme Court of the United States in the case of the American Graphophone Company. The Stephens bill which is now in Congress is in relation to that matter, but in the estimation of many business men and others it is thought to be broader than it should be. It may be that resale prices can be so regulated by placing somewhere power protecting against unfair prices as to make them work equitably and be a fair method of competition in commerce, but that question will undoubtedly have to be settled by Congressional action."

At almost the same time that this statement was made Judge Hand of the Federal District Court signed an order dissolving a combination alleged to have been created by the Victor Talking Machine Company. The complaint accused the Victor company of having entered into unlawful agreements with upward of 7000 dealers in various parts of the United States for the purpose of preventing competition, to limit the supply and to fix the prices of talking machines and records made by the defendant.

EFFECT OF THE WAR ON LAMP-BULB COMPOSITION

New Glass Has Many Advantages That Make for
Speed in Manufacturing Besides Lowering
the Cost of Production

As a result of the war a decided change in the making of glass bulbs for incandescent lamps has come about during the past year. This change, according to F. A. Poor of the Hygrade Lamp Company, Salem, Mass., will eventually result in the lowering of the cost of finished lamps. The importation of potash was stopped on account of the war, and to-day only a very small percentage of this material is used in lead-glass bulbs. Lime-glass bulbs have come into use as a substitute, the lime-glass bulb being made by automatic machinery instead of being blown by hand. The glass is also melted in large tanks, so that it is sometimes called tank glass, and this tends to reduce the cost of manufacture, since lead-glass bulbs are melted only in pots of small size.

Another advantage of lime glass is its softness and quicker speed of melting as compared with lead glass. In time this is likely to lead to faster production, and the light-green color is pleasing. The shrinkage has gradually been brought down from a maximum of 50 per cent to 15 to 30 per cent, depending upon the extent to which a factory substitutes lime glass for lead glass. The Hygrade company has found progressive improvement in shipments of lime glass. The practice of receiving lime-glass bulbs from the glass factories all cracked off will soon become standard, and this, with experience in handling the newer material, is likely to lead to decreased shrinkage and lower production cost throughout the usual range of commercial sizes.

NORTH AMERICAN GOODS IN SOUTH AMERICAN MARKET

Some Reasons Advanced Why Manufacturers in the
United States Are Not Able to Compete
with European Goods

That South America is a fruitful field for electrical goods is well known. It is equally well known that American goods have not sold in these southern republics as have European goods. An interesting sidelight on the reasons for American goods losing out in the competition for this market is given by Pedro Luis Gonzalez of Santiago, Chile, the editor of the Chilean government publication *Boletín de la Sociedad de Fomento Fabril*, which is probably the leading publication in Latin America devoted to industrial and commercial affairs. He said: "If there is one line of trade where American manufacturers and exporters would profit immensely by a genuine effort to comprehend the South American market, it is electrical specialties and electrical merchandise of all kinds. Latin America is not importing from the United States anything like the quantity of these goods it would do under different conditions, notwithstanding that our requirements are as great as or greater than they were prior to the war. This is simply and solely for the reason that American exporters have not seriously taken in hand the proposition as have the exporters of Great Britain and France, and as Germany formerly did and will do again when the war is over. I mean by that that these European manufacturers and exporters get close to the popular fancy of our people, and not only frequently

undersell the United States but make trading with them a satisfactory proposition all round.

"Then, again, better terms and prompter deliveries are to be considered. For several years past it has been the custom of the larger British and French exporters to keep at central points in South America fairly representative stocks of goods in warehouses, in charge of a manager with one or two salesmen. These stocks are being added to constantly and steadily replenished. The warehouses in no-wise differ in purpose or in scope from the stock rooms of the home factory where the goods are produced. They do not sell to the retailer, but are for the purpose of keeping the wholesaler (or 'distributor,' as we call him) supplied. In some cases these stock rooms are not sole agencies of a single manufacturer, but several manufacturers in non-competing lines of electrical specialties and general electrical equipment conduct them jointly, thus dividing the expense of maintenance.

"Now, contrast this way of doing business with that of the United States. If an order is placed with a United States manufacturer, the merchant must know just where to locate the manufacturer of the goods in the United States, the price and whether they are in stock for immediate shipment, wait twenty-three to thirty days for his order to reach the manufacturer and a like length of time for the shipment to reach him if the goods are shipped on the day the order is received (which frequently they are not), go through a troublesome routine of insurance, tariff and customs details, pay cash, risk loss from bad packing, and take the chance of finding, after all this delay and annoyance, that the goods sent are not in accordance with order."

METAL MARKET SITUATION

Conference with War Industries Board on Future Price of Copper—Rubber-Covered Wire Advances

A conference between the copper producing and refining interests and the War Industries Board was held in Washington, D. C., last week. The purpose was to have the official price for copper increased from 23.50 cents to 25 cents a pound.

There is a marked difference of opinion as to what action will be agreed upon regarding prices after June 1, when the present rate expires by limitation. Wire and cable manufacturers are inclined to believe a higher figure will be named; but there is strong opposition from those who are of the opinion that to change the existing schedule is unnecessary.

No Straits tin is being offered; a lone lot under urgent demand was sold at \$1 a pound. No. 1 Chinese is selling at 95 cents to \$1, and No. 3 at 91 cents, May shipment. A bill was passed by the House of Representatives last week placing tin under the control of the President, and a fixed price will doubtless be named when this bill becomes a law.

Nickel is down ten points and lead is softer. Changes in old metals are comparatively light.

NEW YORK METAL MARKET PRICES

	April 29			May 6		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
	Price per lb.			Price per lb.		
Prime Lake.....	Govt. price	23.50		Govt. price	23.50	
Electrolytic.....	Govt. price	23.50		Govt. price	23.50	
Casting.....	Govt. price	23.50		Govt. price	23.50	
Wire base.....	26.25	to	26.75	26.25	to	26.75
Lead, trust price.....	7.00			7.00		
Nickel, ingot.....	40.00			40.00		
Sheet zinc, f.o.b. smelter.....	Govt. price	15.00		Govt. price	15.00	
Spelter, spot.....	6.85	to	6.90	7.10	to	7.12 ½
Tin, Chinese.....	92.00			\$1.00		
Aluminum, 98 to 99 per cent.....	Govt. price	†3.10		Govt. price	†32.10	

OLD METALS

Heavy copper and wire.....	21.50	to	22.50	21.50	to	22.00
Brass, heavy.....	13.50	to	13.75	13.50	to	13.75
Brass, light.....	10.50	to	11.00	10.50	to	11.50
Lead, heavy.....	5.75	to	6.00	5.75	to	6.00
Zinc, old scrap.....	5.50	to	5.62 ½	5.50	to	5.62 ½

*No Straits offering. †In 50-ton lots; carload, 32 cents per lb.

THE WEEK

IN TRADE

A LONG regular or commercial lines trade in the electrical industry at large is not so active. Government requirements seem to absorb the time and attention of prominent jobbing manufacturers, distributors and producers of everything electrical that is used or can be adapted to war purposes.

Freight embargoes still interfere greatly with the delivery of needed stock, and certain staples are reported as in the anticipated shortage stage. Conduit in many sizes continues to be low in supply, especially on the Pacific Coast and in the Northwest. Large industrial enterprises in these sections are absorbing vast quantities of electrical material, for which they are dependent on Eastern factories. The slow deliveries are hampering the trade.

Collections are reported very satisfactory, with credits closely scrutinized.

NEW YORK

Jobbers report business very good. Government orders continue heavy, but in almost every case where they are likely to tax the resources of jobbers on certain items they are distributed among the manufacturers direct by an official representative in every branch of the electrical field. Business of this kind is taken care of efficiently and prompt deliveries follow.

Shipping promises are hampered by embargoes, and certain lines are none too strong. Labor scarcity is a drawback that becomes more menacing and in the judgment of producers must inevitably affect the price of finished goods. Collections are reported to be particularly good in certain lines for April.

FUSES.—Standard inclosed fuses have been reduced 5 per cent. This is owing, it is alleged, to the sharp competition and increasing sale of the renewable fuse.

LAMPS.—In regular sizes manufacturers have about caught up with the demand. Special lamps, of unique design and lighting effects, are being offered the trade. They are making a favorable impression and large sales are prophesied by progressive jobbers.

COLLECTIONS AND CREDITS.—Several jobbers report collections as good and even better than for some time. This is said to be partly due to the prompt manner in which the government is meeting bills. Statements are now rendered net ten days, and cash discounts are suspended, jobbers being satisfied that settlements will be made. Credits are held in a firm grip.

MOTORS.—A Western manufacturer shipping into Eastern territory states that on single and polyphase motors of 25 hp. commercial deliveries are made in from two weeks to a month, sometimes better, depending on priority orders. On larger-size motors and transformers, 150-hp. rating, shipments are made in from twelve to fourteen weeks. Prices remain steady, but strikes at the plant and ever-recurring labor troubles of one kind or another, if continued, will affect the costs situation. Each order is individually treated, and no quotations are made unless authorized by the factory. This applies also to promises.

LAMP CORD.—An Eastern producer states that, since cotton is a speculative material and the cost is fluctuating widely, no one can safely predict what may be the price in the future. Unless the cotton market shall become stabilized an advance should be expected, particularly when the stock on hand and coming through at old prices is exhausted.

INSULATING TAPES.—The market has been advancing steadily for a year or more, four price increases having occurred within twelve months. The last advance of 10 per cent was made a month ago, responsive to the high cost

of cotton cloths and also a higher price for oils and varnishes.

FANS.—With the carefully expressed opinion of several fan manufacturers which appeared in a recent issue of the *ELECTRICAL WORLD*, that a shortage was imminent, in mind, another producer of large facilities qualified the statement from his own point of view. He believed that if there were a shortage it would be in the Eastern States and New England. The West and Southwest are already amply provided, he asserted, and deliveries in many cases have already been accomplished. The only exception in making shipments, east and west bound, was from Philadelphia. Priority orders there seemed to him almost impossible, though no explanation was offered. However, the arrival of warm weather, the crucial test, might put a different complexion on the entire fan situation. A New York jobber is positive a scarcity will ensue, stating that the selling season has already opened, two months in advance of the usual time. A warm summer is anticipated and figured upon by dealers.

PORCELAIN.—Knobs and cleats are in fair supply, but shipments are held up at the principal factories by embargoes. Tubes are short. An advance of 3 to 7 cents apiece has been announced on Hubbell sockets and ceiling receptacles, effective as of May 1. Other manufacturers report that price increases were made on their products previously.

LAMP GUARDS.—An increase of 33 1/3 per cent has been made on Matthews lamp guards.

CHICAGO

Interest in the Liberty loan campaign in Chicago has not slowed up business to any greater extent than was expected. A good many of the men in the industry have been devoting the major portion of their time to the business of selling government bonds, but the trade has learned to expect this activity and to discount it in advance. Government buying of supplies is not as yet very heavy, but is constantly expected to grow. There is also a feeling that central stations will have to loosen up before long on purchases of certain classes. The real estate market here and there is beginning to show activity in the matter of groups of workmen's cottages consisting of from 50 to 100 units. More of this business is to be expected as the war progresses. On the whole, the business continues about the same as to volume. The Sanitary District is in the market for a large bill of pumping equipment.

The building activity for the week ending May 1 amounted to 106 building permits, totaling \$898,100. For last week 111 building permits were issued, totaling \$630,600. For the same week last year 146 building permits were issued, amounting to \$1,176,800. The electrical permits for the week of May 1 this year totaled 657. This included 7411 incandescent lamps and 1318 hp. Last week 671 permits were issued for 8362 incandescent lamps and 772 hp. For the same week last year 944 permits were issued.

COPPER WIRE.—Weatherproof wire has advanced to a 30-cent base. The increase of 2 cents was due to the rising price of cotton. Weatherproof is steady at this price.

CONDUIT.—The difficulty in getting the larger sizes still prevails.

PORCELAIN.—There is very little activity. Opinion in some quarters has it that something is about to happen in the porcelain market.

FANS.—Dealers outside of Chicago appear to be taking the jobbers' word for it that there will be a fan shortage this year, and a great many of the jobbers have their distributors signed up. In Chicago it appears that the retailers have a pretty fair stock left over from last season and are not so ready to take on new commitments as usual at this time.

INCANDESCENT LAMPS.—In the standard sizes the jobbers are pretty well caught up on stock. On the larger sizes and on the 220-volt lamps, however, shortages still exist.

BOSTON

Sales are holding up well this week, and the successful completion of the Liberty loan campaign is marked by good feeling in commercial circles. Collections are reasonably good, though credits are closely scrutinized in connection with new business. In most lines deliveries show some improvement, owing to better railroad conditions. Stocks are generally in excellent shape to meet present demands, with the exception of motors above 50 hp. in rating and the larger sizes of conduit. Appliances are moving well, and the market is oversold on one of the best makes of washing machines. Prices held steady throughout the week, with a tendency toward softness in the smaller sizes of copper wire on close competitive bidding, due to the lower price of cotton. The shortage of skilled labor is quite serious.

LAMPS.—Stocks are increasing locally in all except miniature sizes, which are in great demand for military and naval uses as well as for automobile and motorcycle service. Prices show no change. The factories are working hard to catch up with back orders, and considerable shipments have been added to local storage on the ordinary mercantile and commercial sizes. Orders keep up exceptionally well.

AUTOMOBILE BATTERIES AND STARTERS.—A boom is noted in these equipments with the rapid advance of the automobile season. Rebuilt cars are calling for much accessory apparatus of improved design, and it is hard to fill the current demands from local stocks; but it is being done, on the whole, very well. Prices continue steady.

SIGNALING SYSTEMS.—The low volume of new construction in building work has cut down the sales of telephone, signaling and annunciator systems materially to commercial buyers, and even the war-order plants are not installing interior telephone apparatus to a degree which offsets the lack of a normal market. Manufacturers of this type of equipment, however, are busy on special government orders. A shortage of skilled machinists is reported.

MOTORS.—Deliveries less than five months are still difficult to procure on motors of 50 hp. and upward, speaking generally. Stocks are increasing, on the whole, in the smaller motors, both alternating-current and direct-current. The demand seems to be decreasing slowly in the lower sizes, with prices still unchanged but subject to possible shading on resales if the present recession in small-motor consumption is long maintained.

STORAGE BATTERIES.—Distributors report continued heavy demands from the government and the automobile industry. The former dominates the factory output to-day, and labor shortage is seriously felt by the manufacturers. Deliveries cannot be made over the railroads fast enough to enable any sizable stocks to be accumulated. Prices hold firm, with little prospect of further advance in the near future.

CONDUIT.—Stocks are spotty in range and total deliveries are very unsatisfactory, and government control of basic materials tends to shut out the ordinary consumer from getting even reasonably fair shipments. The first claim on conduit is held by the Emergency Fleet Corporation, the government's general war work holding the second.

PORCELAIN.—While it is difficult to build up local stocks, the manufacturers are gradually catching up on orders, and the situation is a little better than a few weeks ago. House-wiring business is at such a low ebb that other requirements can be filled more easily than were a vigorous policy of central-station business expansion under way. No immediate changes in price are anticipated.

WIRE AND CABLE.—Government orders almost monopolize the market, including among these all war-service work. Prices are firm, but in some cases it is understood that slight recessions of the order of 1/4 cent per pound are quoted on small weatherproof wire with a relatively high cotton content in proportion to the metal constituent. No change in base prices has been noted as a result of the slump in cotton.

ATLANTA

Not all of the gains in business, where they appear, are in number and magnitude of transactions, and the distinction between volumes and values becomes more sharply defined as the rise in price along general lines continues. The steadily enhancing costs, together with financial difficulties, have a perceptible influence in repressing demands in not a few quarters. With the advancing season there has come an appreciable revival of activities in many directions, although the cold weather has militated against the best results in retail distribution. Residence and apartment construction in Atlanta and vicinity during the last two months shows up better than in the corresponding months of last year in face of less propitious general building conditions. A number of industrial concerns have been organized in the South the past week. The Lake Charles Naval Stores Company, Lake Charles, La., capitalized at \$900,000, has taken over some valuable turpentine land in Louisiana. The Aluminum Company of America will erect a nitrate plant at Maryville, Tenn., costing approximately \$2,000,000. Power will be transmitted from the new Alcoa plant on the Little Tennessee River, about 45 miles south of Knoxville. Specifications call for completion of this plant by Sept. 1.

In small lighting plants the outlook is much brighter this week for plants from 50 kva. to 250 kva. While most of the inquiries noted are coming from municipalities, a sprinkling of private demand is observed. Manufacturers report increasing sales of late, running anywhere from \$5,000 to \$50,000. This business is being handled by local bankers. Prices on this class of equipment are up approximately 20 per cent over last year. Shipments are being made from five to six months.

POLE AND LINE MATERIAL.—Jobbers report substantial sales to the smaller municipal plants covering cross-arms, pins and the general list of material under this head. This material is being used mostly for replacement work. Turnbuckles have advanced 20 per cent. Deliveries on the whole are still poor on line material.

FLASHLAMPS.—The volume of sales as reported by dealers indicates an increasing demand. Stocks are in good condition.

DRY BATTERIES.—With the advent of more seasonable weather this week a decline in sales is noted. Local stocks have accumulated during the last few weeks. Jobbers' outstanding shipments are coming in more rapidly.

SCHEDULE MATERIAL.—A heavy business is reported from all quarters, with sporadic and spotty pressures from government sources for large quantities. As a rule stocks are in fair shape and well distributed.

CONDUIT.—An excellent market exists, with a corresponding low stock condition, some sizes being entirely out. A rumor is afloat that conduit is going to take a jump shortly.

RUBBER-COVERED WIRE.—The rumor regarding an increase for conduit holds good as well for wire. It has been stated from reliable sources that No. 14 single-braid is going to be very scarce and exceedingly hard to get two or three months from now.

SEATTLE

The volume of business transacted during the past week by Northwest electrical jobbers was exceedingly satisfactory and was equal to that of the past several weeks. No exceptionally large orders were placed. The bulk was with the shipyards, particularly steel yards in Seattle and Portland territories. Several districts report increased buying from wooden shipyards which recently secured additional contracts. The largest steel shipyard in Tacoma in operation plans enlarging the yard by seven ways.

The close of the third Liberty loan drive brought a reaction in retail business, particular animation being shown in increased activity and volume in this trade. The conduit market condition remains the same. Stocks are very low and the larger sizes are extremely hard to obtain. The apparent reason for shortages in wire, motors and certain types of lamps lies in uncertain shipments from

Eastern factories. L. C. L. shipments are next to impossible to obtain. Several of the largest Seattle jobbers report the early arrival of shipments en route for the last sixty days. A Seattle car-building concern received an order for 14,000 box cars to be built for the government. It is assumed by West Coast lumbermen that fir will enter largely into the construction of this new rolling stock along the line of government plans to conserve steel. The effect of placing this order in the Northwest, calling for delivery at the earliest date, will be to strengthen the entire lumber market. Since the first of the year more than \$3,500,000 has been invested in new buildings. In Seattle the large bulk of the building consists of bungalows and frame residences. Selling activity in the residence districts continues unabated. During the week one Seattle realty firm alone took out permits for the immediate erection of thirty-three homes in Tacoma. During April the number of building permits and the cash value represented were twice as large as for the same month last year.

Credits and collections are keeping pace with sales. Both were very satisfactory during April. The third Liberty loan drive among the jobbers had little if any effect on business, the comparison between business transacted in March and in April showing small difference. Both were heavy months, April perhaps being a shade heavier. Very few new credits are being placed, business transacted being merely an extension of credit to old-established customers, which is considered preferable to placing new business with new concerns whose business integrity has not been tested. Inquiries for credit from shipbuilding concerns awaiting sanction from the government before starting operations are coming in. Credits are being more closely scrutinized.

SAN FRANCISCO

During the past week there have been a number of inquiries for ship-wiring material, particularly for electrical hardware, such as bells, push-buttons and annunciators. These have been the outstanding features of a rather dull week. Among the building permits announced are those for a six-story building for the San Francisco Federal Reserve bank and announcement of the construction of an industrial city at Clyde, near Bay Point. The city of San Francisco is calling for bids for the construction of a new pier. The Bethlehem Steel Works announces a two-million-dollar plant at Hunters Point, on San Francisco Bay, and the United States Army will construct a four-hundred-thousand-dollar balloon camp near Arcadia. Canneries and suitable industrial housing still remain the principal building items. A number of churches are also under construction, and there is also some reconstruction for the southern California area shaken by earthquakes.

CONTROL DEVICES.—There is a large call for control devices for heavy motors and for industrial systems, especially for shipyards and ship control.

SWITCHES.—An unusual demand exists for big switches. The number of smaller knife switches sold is low because of the lack of house-wiring jobs and because power companies are not selling as many ranges as they did last year. Still the fact that the State of California is now employing inspectors to see that its safety laws are enforced will cause an ever-increasing demand, even though a large portion of prudent manufacturers have already complied with this law. Eastern shipments are fair and local stocks good.

ELECTRICAL INSTRUMENTS.—The demand for electrical measuring recording instruments, particularly for styles and sizes previously regarded as unusual, is so great that the Eastern factories cannot cope with it. Three to six months' delivery is the rule.

LAMP CORD.—For lamp cord, reinforced cord and other house-wiring styles there is little regular demand, but the shipbuilding industries are requiring vast quantities of deck cable, orders for 10,000 ft. or 25,000 ft. of a size being now regarded as quite regular. The underwriters' recommendation that "Mazda C" lamps of certain capacities be wired with asbestos insulated lamp cord has not been thoroughly enforced and is not causing the expected demand.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor		List per 1000 Ft.
B. & S. Size		
No. 14 solid.....		\$61.00
No. 12 solid.....		71.00
No. 10 solid.....		90.00
No. 8 solid.....		106.00
No. 6 solid.....		145.00
No. 10 stranded.....		95.00
No. 8 stranded.....		115.00
No. 6 stranded.....		160.00
No. 4 stranded.....		205.00
No. 2 stranded.....		266.00
No. 1 stranded.....		315.00

Twin-Conductor		List per 1000 Ft.
No. 14 solid.....		104.00
No. 12 solid.....		135.00
No. 10 solid.....		185.00
No. 8 stranded.....		235.00
No. 6 stranded.....		370.00
No. 4 stranded.....		575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor		No. 14 Solid
Less than coil.....		List
Coil to 1000 ft.....	10% to	57.25
Twin-Conductor		No. 12 Solid
Less than coil.....		List
Coil to 1000 ft.....	10% to	66.75

Twin-Conductor		No. 14 Solid
Less than coil.....		List to \$104.00
Coil to 1000 ft.....	10% to	\$97.75
Twin-Conductor		No. 12 Solid
Less than coil.....		List to \$135
Coil to 1000 ft.....	10% to	\$126.00

DISCOUNT—CHICAGO

Single-Conductor		No. 14 Solid
Less than coil.....	15% to	+ 10%
Coil to 1000 ft.....	10% to	20%
Twin-Conductor		No. 12 Solid
Less than coil.....	15% to	+ 10%
Coil to 1000 ft.....	10% to	20%

Twin-Conductor

Twin-Conductor		No. 14 Solid
Less than coil.....	15% to	+ 10%
Coil to 1000 ft.....	10% to	20%
Twin-Conductor		No. 12 Solid
Less than coil.....	15% to	+ 10%
Coil to 1000 ft.....	10% to	20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to	24 cents
1/5 to std. pkg.....	20% to	19 cents
Std. pkg.....	34% to	18 cents

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+ 20% to	12%
1/5 to std. pkg.....	List to	20%
Std. pkg.....	28% to	44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.28 to .285	.29 to .295

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175-.3195	.3275-.3295
Barrel lots.....	.2875-.2895	.2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.50
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 100 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp...Net	15% to \$69.75
3/8-in. d. stp.+10% to	75.00
1/2-in. s. stp...List	15% to 93.00
1/2-in. d. stp.+10% to	100.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip....	\$75.00
3/8-in. double strip....	78.25-78.75
1/2-in. single strip....	100.00
1/2-in. double strip....	105.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	2.....	.47
3/4.....	.15	2 1/2.....	.55
1.....	.18	3.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60	\$60 to \$150
7/32-in.—	List	List
\$25.00-\$55.00	\$20.50-\$24.45	\$20.00-\$21.50
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00
		\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60	\$60 to \$150
7/32-in.—	List	List
\$36.00-\$55.00	\$25.00	\$22.50
1/4-in.—	\$40.00-\$60.00	\$27.00
		\$25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38 and 39

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37 1/2
2 1/2.....	.58 1/2
3.....	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Couplings, List	Elbows, List
1/4.....	\$0.05
3/8.....	.06
1/2.....	.07
3/4.....	.10
1.....	.13
1 1/4.....	.17
1 1/2.....	.21
2.....	.28
2 1/2.....	.40
3.....	.60

DISCOUNT—NEW YORK

Less than 2500 lb.	2500 to 5000 lb.
3/4 in. to 1/2 in. 4% to 12%	3/4 in. to 3 in. 7% to 15%
6% to 14%	9% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb.	2500 to 5000 lb.
3/4 in. to 1/2 in. 5.3% to 8.9%	3/4 in. to 3 in. 8.3% to 11.9%
6% to 10.9%	10.3% to 12.3%

(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	30%

CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	30%
1/5 to std. pkg.....	40% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	30%
1/5 to std. pkg.....	40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Less than 1/5 std. pkg.	Per 100 Net
1/5 to std. pkg.....	\$5.00
Standard packages, 500.	List, each \$0.07.

CHICAGO

Less than 1/5 std. pkg.	Per 100 Net
1/5 to std. pkg.....	\$6.25
Standard packages, 500.	List, each \$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B.....	100	\$0.30
60-watt—B.....	100	.35
100-watt—B.....	24	.70
75-watt—C.....	50	.70
100-watt—C.....	24	1.10
200-watt—C.....	24	2.20
300-watt—C.....	24	3.25
Round bulbs, 3 1/4-in., frosted:		
15-watt—G 25.....	50	.53
25-watt—G 25.....	50	.55
40-watt—G 25.....	50	.55
Round bulbs, 3 3/4-in., frosted:		
60-watt—G 30.....	24	.77
Round bulbs, 4 3/8-in., frosted:		
100-watt—G 35.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.....	Net
Std. pkg.....	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	Net
Std. pkg.....	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

Per 1000 Ft. Net	
Less than coll (250 ft.)....	\$31.00 to \$34.90
Coll to 1000 ft.....	26.20 to 27.90

CHICAGO

Per 1000 Ft. Net	
Less than coll (250 ft.)....	\$29.00 to \$30.00
Coll to 1000 ft.....	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100.....	\$24.00
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CHICAGO

Net per 100.....	\$21.75
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200, S.E., 300, A.X., 1 1/2 4 S.....	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list....	25%	20%
\$10.00 to \$50.00 list.....	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list....	40%	35%
\$10.00 to \$50.00 list.....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

Per 1000 Net	
Less than 1/5 std. pkg.....	\$20.00 to \$38.00
1/5 to std. pkg.....	19.00 to 26.00
Standard package, 2200. List per 1000,	\$20.

CHICAGO

Per 1000 Net	
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg....	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg....	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5 1/2 N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg....	\$11.85	\$30.75
1/5 to std. pkg....	11.10 to \$11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg. 500	List
1/4-in. cap key and push sockets.....	500	\$0.33
1/4-in. cap keyless socket.....	500	.30
1/4-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	15% to List
1/5 to std. pkg.....	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.....	24% to 25.00
1/5 std. pkg.....	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:		
30-amp. S. P. S. T.....		\$0.80
60-amp. S. P. S. T.....		1.20
100-amp. S. P. S. T.....		2.25
200-amp. S. P. S. T.....		3.48
300-amp. S. P. S. T.....		5.34
30-amp. D. P. S. T.....		1.20
60-amp. D. P. S. T.....		1.78
100-amp. D. P. S. T.....		3.38
200-amp. D. P. S. T.....		5.20
300-amp. D. P. S. T.....		8.00
30-amp. 3 P. S. T.....		1.80
60-amp. 3 P. S. T.....		2.68
100-amp. 3 P. S. T.....		5.08
200-amp. 3 P. S. T.....		7.80
300-amp. 3 P. S. T.....		12.00
Low Grade:		
30-amp. S. P. S. T.....		0.42
60-amp. S. P. S. T.....		0.74
100-amp. S. P. S. T.....		1.50
200-amp. S. P. S. T.....		2.70
30-amp. D. P. S. T.....		0.68
60-amp. D. P. S. T.....		1.22
100-amp. D. P. S. T.....		2.50
200-amp. D. P. S. T.....		4.50
30-amp. 3 P. S. T.....		1.02
60-amp. 3 P. S. T.....		1.84
100-amp. 3 P. S. T.....		3.76
200-amp. 3 P. S. T.....		6.76

DISCOUNT—NEW YORK

	High Grade	Low-Grade
Less than \$10 list.....	List to + 5%	
\$10 to \$25 list.....	11%	
\$25 to \$50 net.....	14% to 15%	
Less than \$10 list.....	5% to 10%	
\$10 to \$25 list.....	16%	
\$25 to \$50 list.....	24% to 25%	

DISCOUNT—CHICAGO

	High Grade	Low-Grade
Less than \$10 list.....	+ 5%	
\$10 to \$25 list.....	11%	
\$25 to \$50 list.....	14%	
Less than \$10 list.....	5%	
\$10 to \$25 list.....	16%	
\$25 to \$50 list.....	24%	

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List
1/5 to std. pkg.....	15%
Std. pkg.....	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	+ 20% to list
1/5 to std. pkg.....	List to 15%
Std. pkg.....	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....	List to 40%	Net to 30%
\$2.00 to \$10.00 list.....	10% to 50%	5% to 40%
\$10.00 to \$50.00 list.....	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25%	20%
\$2.00 to \$10.00 list.....	25%	20%
\$10.00 to \$50.00 list.....	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price.....	\$6.00
Discount.....	30%

CHICAGO

List price.....	\$4.50 to \$6.00
Discount.....	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.....	\$0.41 1/4 - \$0.44 1/4
No. 18, full spools.....	0.36 1/4 - 0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.....	\$0.57 1/2 to \$0.65
No. 18, full spools.....	0.50 1/2 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	
14..	\$18.00	\$12.50-\$13.00	\$9.85-\$11.50	
12..	\$23.25- 25.40	21.30- 21.80	15.95- 19.35	
10..	32.40- 35.20	29.70- 30.20	22.10- 27.00	
8..	45.70- 49.15	41.90- 42.10	30.85- 38.00	
6..	72.40- 77.85	66.35- 66.75	48.95- 60.30	

CHICAGO

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.	
14..	\$18.00	\$13.00	\$11.50	
12..	25.33-\$26.25	22.02-\$25.33	18.55-\$20.93	
10..	30.49- 36.54	27.94- 31.26	22.86- 29.23	
8..	42.54- 51.57	38.99- 44.13	31.90- 41.36	
6..	61.38- 88.38	56.15- 75.61	50.53- 70.70	

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$33.25 to \$36.40
25 to 50 lb.....	34.40
50 to 100 lb.....	30.10 to 34.25

CHICAGO

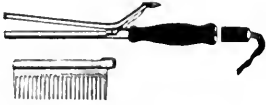
	Per 100 Lb. Net
Less than 25 lb.....	\$35.42 to \$40.25
25 to 50 lb.....	34.42 to 39.35
50 to 100 lb.....	33.42 to 38.25

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Improved Electric Curling Iron

Landers, Frary & Clark, New Britain, Conn., have made an improvement on their type of combination curling iron and hair drier that was described in the ELECTRICAL WORLD for

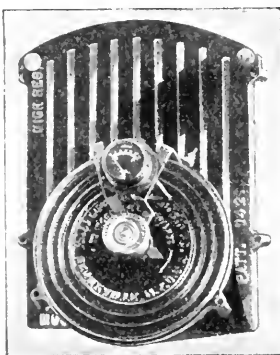


IMPROVED CURLING IRON FITS IN HANDBAG

Oct. 24, 1914. The handle receptacle is recessed, thus permitting the cord connector to enter the receptacle and make it more rigid. The curler rod of the latest type is an inch shorter than the old model, and the entire length of the appliance is reduced nearly 2 in. (5 cm.) and therefore allows the user to carry it more easily in a handbag. The heating unit consists of resistance wire flat-wound on a mica core and clamped between steel plates which have thermol contact with the curling tube through brass springs.

Regulator for Mazda Lamps

In order to use Mazda lamps for motion-picture projection the Argus Lamp & Appliance Company, 322 Euclid Avenue, Cleveland, Ohio, has developed the Sheck universal adapter for quickly adapting any carbon-arc motion-picture projecting machines and also a regulator for holding the voltage and current supply to the lamp at a constant value. If the voltage supplied to the lamp is too high, the life of the



REGULATOR INSURES ACCURACY BUT
REQUIRES LITTLE ATTENTION

lamp will be very short. To produce efficient results the current must be kept at the constant rated value of the lamp. A small reactance is used in the primary circuit to take care of all conditions of variations of line voltage.

An ammeter is placed in the secondary so that the Mazda projector light can be held in the constant current, thus insuring a steady, brilliant picture. The accompanying illustration shows the two-piece regulating rheostat—the constant resistance to be mounted outside the booth and the small regulative resistance to be mounted in an accessible position for the operator.

Complete Battery-Charging Outfit

A complete 150-volt motor-generator set and switchboard for charging storage batteries is being manufactured by the Emerson Electric Manufacturing Company, 2024 Washington Boulevard,



BATTERY-CHARGING OUTFIT CONTROLLED
FROM SWITCHBOARD BY PUSH-BUTTONS

St. Louis, Mo. The outfit is designed to charge two 6-volt batteries in series or one 12-volt battery. The switchboard is equipped with a rheostat for varying the charging rate, an ammeter for indicating the direction and amount of current flowing and a fuse block and cartridge fuses for protecting the motor. Push switches for starting the motor and for connecting the generator to the battery are also installed on the switchboard. The motor operates on a 110-volt, 60-cycle single-phase alternating-current energy supply.

One-Line Clamshell Buckets

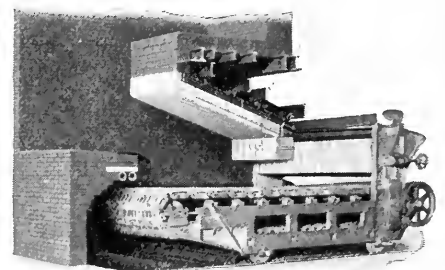
A combined clamshell bucket and carriage for use on overhead cables which requires only one hoisting rope, one single-drum engine or motor and one operator is being manufactured by the Blaw-Knox Company of Pittsburgh, Pa. The outfit is especially adapted for unloading and transferring materials

from cars, barges or storage piles, and for removing coal from open cars.

A stop is attached to the supporting cable at the point where it is desired to lower the bucket. This stop may be shifted along the cable as required or it may remain fixed. When the bucket is being hoisted or lowered, the lower end of the carriage is automatically locked to this stop. When, however, the bucket is hoisted to the carriage, the pull of the carriage against the stop automatically locks the bucket to the carriage and at the same time releases the carriage from the stop and allows it to move upward along the supporting cable until it comes to a stop where it is again desired to lower the bucket. Upon reaching the upper stop a latch attached to the carriage engages the stop in such a manner that the slacking on the hoisting rope releases the bucket from the carriage. The bucket may be dumped at any point along the line or after being lowered at either end of the line. Renewed pull on the line raises the bucket to the carriage and locks it there. At the same time it raises the latch, permitting the carriage to move away from the stop.

High-Set Furnace Arch

The Green Engineering Company, East Chicago, Ind., has developed a type of boiler furnace arch called the "Sealflex," that is shown herewith. These arches are set higher and are pitched more steeply than ordinary arches and therefore allow more combustion space. The large angle of the arch reflects the heat from the rear portion of the fuel bed up to the grate and gives an intense and rapid ignition of the fuel. The manufacturer claims that from a practical standpoint it is impossible to maintain an air-tight joint between the gate and the end of



COLD AIR HEATED BY MEANS OF PROJECT-
ING TILE

the arch under ordinary conditions because there is always a crack at this point through which cold air enters the furnace. Cold air also enters through the hopper between the gate and the coal. Usually this cold air retards

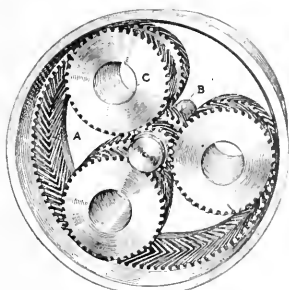
ignition when it comes in contact with the front portion of the arch. In this installation, however, the specially shaped tile projecting downward directly behind the stoker gate is grouted in place with the tile immediately behind it, thus forming a seal. All cold air entering the furnace at the stoker front must pass under this tile. It is heated so effectively by the tile before it can come in contact with the surface of the arch proper that the ignition is not affected. The arch proper is therefore not chilled and quickly reflects the rays of heat from the rear to the front of the stoker, where it is most needed for ignition. The single row of projecting tile and the front of the arch proper are set approximately 2 ft. (60 cm.) above the grate surface. The manufacturer claims that this arch gives increased ignition and more complete combustion, even with very low-grade fuel.

Combination Switch and Receptacle Plate

An outlet plate that is provided with a switch is being marketed by the Peerless Light Company, Halsted and Adams Streets, Chicago. The plate is made from heavy-gage brass finished to match any wood desired. It is advantageous for use in rooms that are without the necessary outlets because it saves the cost of extensive wiring.

Speed Reduction Gear That Requires Small Space

A mechanical drive for steam-plant auxiliaries and electric motor-driven units that allows driver and driven units to be lined up has been developed by the Poole Engineering & Machine Company of Woodberry, Baltimore, Md. The device requires small space for installation, and also saves considerable room in the power plant by allowing the two machines to be placed close together. The illustration shows the principle of operation, which consists of an internal gear attached directly to the slow-moving unit and a



"SPEED TRANSFORMER" ELIMINATES CHAINS AND BELTS

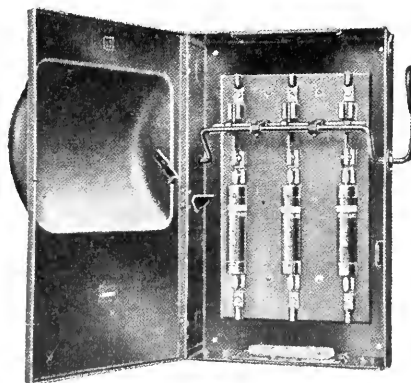
small pinion in the center directly connected to the internal gear by three planet gear idlers. The planet gears are held in a stationary position, but are free to turn around on their own axes. When the internal gear rotates it moves

the planet gears and thereby rotates the pinion. This action can be reversed—that is, the pinion can be driven to operate the planet gear and reduce the speed.

Steel-Inclosed Safety Switch

A safety switch with quick-break mechanism that is positive and insures simultaneous break at all blades is being manufactured by the Square D Company, Detroit. This line of steel-inclosed switches, which have been described in the ELECTRICAL WORLD at various times, are of simple construction and are completely inclosed in a sheet-steel box so designed that ample wiring space is provided inside to make the necessary connections. The box is provided with a hinged cover that is held closed by a spring, and the switch is operated by a crank handle on the outside. Raised letters on the box indicate the "on" and "off" positions of the switch.

The switch may be locked in the "off" position to prevent accidents while repairs are being made on apparatus controlled by it, provision being made for three individual padlocks. This padlock



SWITCH OPERATED FROM OUTSIDE BY MEANS OF CRANK

feature is advantageous when there is more than one man working on the line or equipment. When each man starts to work he locks the switch in the "off" position. This eliminates the possibility of either man throwing the switch "on" before all have finished working.

Aluminum Case Vacuum Cleaner

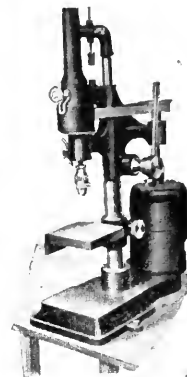
A nozzle which can be easily adjusted to clean thoroughly a carpet of any thickness is one of the features of a cleaner manufactured by the Innovation Electric Company, Inc., 585 Hudson Street, New York City.

The machine has an adjustable handle with rigid pistol grip made of polished hard wood. The handle automatically stands upright and can be arranged to hold the machine in any position for cleaning stairs. A push-button electric switch is attached to the handle in a convenient and accessible position. A tufted bristle brush is held in the nozzle by a rigid frame which

can be swung into a convenient position for cleaning without removing any screws or belts. The device is equipped with a General Electric motor mounted horizontally.

Electric - Driven Sensitive Bench Drill Press

A bench drill press for boring all holes of size up to 3/16 in. (0.47 cm.) driven by a vertical 0.1-hp. Robbins & Myers motor is shown in the accompanying illustration. The drill is only



DRILL PRESS THAT OCCUPIES SMALL SPACE

24 in. (60 cm.) in height, and has a base that is 7.5 in. by 18 in. (19 cm. by 45.7 cm.). A quick adjustable table is provided which has a working surface of 5.5 in. by 5 in. (14 cm. by 12.7 cm.), and will take work up to 4.9 in. (11.1 cm.) in height. The standard spindle speeds are 2100 to 6000 r.p.m., but special pulleys can be furnished if desired to give a main spindle speed of 10,000 r.p.m. The drill press is manufactured by the High Speed Hammer Company, Inc., of Rochester, N. Y.

Socket-Attachment Bell Transformer

A bell transformer provided with a plug to fit the ordinary lamp base is being marketed by B. F. Miller, 201 South Clinton Avenue, Trenton, N. J. The "Liberty Bell" transformer permits easy installation and eliminates the necessity of the soldering of any



SECONDARY MAY BE SHORT-CIRCUITED WITHOUT HARM

connections, as it is provided with secondary binding-post terminals. The manufacturers claim that the transformer will not be harmed if secondary terminals are accidentally short-circuited.

Trade Notes

THE ANDERSON ELECTRIC SPECIALTY COMPANY of Chicago moved its offices from 361 West Van Buren Street to 118 South Clinton Street on May 1.

THE WARD-LEONARD ELECTRIC COMPANY of Mount Vernon, N. Y., has placed a stock of its field rheostats, controllers and resistance units in San Francisco, Cal.

FRED D. WILLIAMS, connected with the H. W. Johns-Manville Company, Philadelphia, at head of the power specialties department, has resigned and will be associated with the L. H. Gilmer Company, Tacoma, Pa., as assistant general manager.

J. M. RIORDAN, until recently sales engineer of the Grant Lees Gear Company of Cleveland, Ohio, and formerly representing the Fellows Gear Shaper Company of Springfield, Vt., in the Central States, is now connected with the sales organization of the Cleveland Milling Machine Company at Cleveland.

THE WALKER VEHICLE COMPANY of Chicago, on April 23 entertained the local electrical men who are interested in the electric vehicle business and who are members of the Chicago electric vehicle section of the National Electric Light Association. Following luncheon the members were conducted through the Walker factory.

THE SORGELE ELECTRIC COMPANY of Milwaukee, Wis., has just completed extensions and improvements, having taken two extra floors on its premises at 138 West Water Street. This space is used for enlarging the repair shop and for motor stock room. Additional machinery was installed and the facilities for handling heavy machinery were improved.

THE GENERAL DEVICES AND FITTINGS COMPANY of Chicago, manufacturer of electrical products, has moved its executive and sales offices and engineering department from the factory, at 817-25 West Washington Boulevard, to the Mid-City Bank Building. It occupies the sixth floor of the building and by the move has secured greatly increased office facilities and drafting-room space.

THE BOSCH MAGNETO COMPANY of Springfield, Mass., and Plainfield, N. J., recently taken over for the government by A. Mitchell Palmer, custodian of alien property, was reorganized May 1. The new officers are: President, Joseph A. Bower of New York City; vice-president, Christian G. Cleveland; treasurer, George A. McDonald, Springfield, Mass.; secretary, William G. Fitzpatrick, Detroit; general manager, A. T. Murray, Allentown, Pa.; assistant treasurer, A. D. Altree, New York City. Domestic business will be carried on as formerly, it is announced.

THE WORTHINGTON PUMP & MACHINE CORPORATION, 115 Broadway, New York City, is now operating eight plants in the United States, as follows: The Worthington Works at Harrison, N. J., devoted exclusively to the manufacture of pumping machinery; the Blake & Knowles Works at East Cambridge, Mass., now entirely rebuilt and producing principally marine pumps; the Deane Works at Holyoke, Mass., which manufactures power pumps only; the Snow-Holly Works at Buffalo, N. Y., building the largest machines required in waterworks, blowing and gas-power engines and oil engines; the Power and Mining Machinery Works at Cudahy, Wis., which makes a complete line of crushing, concentrating and mining equipment; the Laidlaw Works at Cincinnati, Ohio, given over to air-compressing machinery only; the Jeaneville Works at Hazleton, Pa., working at present on a special product, and the International Gas Engine Works, at Cudahy, Wis., making a full line of gas and oil engines and accessories.

THE DEPARTMENT OF COMMERCE, Bureau of Foreign and Domestic Commerce, of Washington, D. C., according to a report published recently, says that American electrical goods have been in much greater demand in Australia since the war started than ever before. At present Australians do not have the same desire to adopt the semi-luxuries in electrical appliances that Americans of sufficient means will not do without. General conditions and methods of conducting business in Australia are described by the writer of the report, Commercial Agent R. A. Lundquist, who, however, devotes most of his space to detailed descriptions of the markets for particular lines of electrical goods, such as power-generating equipment, electric railway equipment, lamps and domestic appliances. The report is entitled "Electrical

Goods in Australia," Special Agents Series No. 145, and is sold for 15 cents by the superintendent of documents, Government Printing Office, Washington, D. C., and by all the district and co-operative offices of the Bureau of Foreign and Domestic Commerce.

Trade Publications

BALL BEARINGS.—Blotters advertising ball bearings have been issued by the Fair Bearing Company of New Britain, Conn.

ELEVATORS.—The Warner Elevator Manufacturing Company is distributing bulletins Nos. 3200, 3100 and 2850, describing its elevators.

BUCKETS.—Single-line clamshell buckets are described in an illustrated booklet recently issued by the Blaw-Knox Company of Pittsburgh, Pa.

FITTINGS.—"Conduit Fittings and Electrical Specialties" is the title of catalog No. 26 issued by Thomas & Betts Company, 63 Vesey Street, New York City.

LIGHTING FIXTURES.—The Daylite Fixture Company, 416 South Dearborn Street, Chicago, has issued a bulletin describing the Bel-Ko-Lite lighting fixture.

WIRE ANCHORS.—The Matthews "Sculix" guy-wire anchors are described in a circular post card being distributed by W. N. Matthews & Brother, Inc., of St. Louis, Mo.

RHEOSTATS.—The Ward-Leonard Electric Company, Mount Vernon, N. Y., has issued bulletin No. 50, entitled "Method of Determining the Size of Battery Charging Rheostat."

TRUCKS.—"Truck Talk" No. 22 is being distributed by the General Motors Truck Company of Pontiac, Mich. This number illustrates some installations and uses of the trucks.

FARM LIGHTING SYSTEMS.—The Domestic Engineering Company, Dayton, Ohio, has issued a circular reproducing advertisements to be published soon in the various popular magazines.

GAS-FILLED LAMPS.—The Whitelite Electric Company, 368 Broome Street, New York City, is distributing several booklets and blotters describing its gas-filled lamps for industrial and domestic uses.

FARM LIGHTING SYSTEMS.—The Electromatic System Company, 2136 Michigan Avenue, Chicago, is distributing circulars describing its farm lighting systems, which do not require a storage battery.

BRACKETS.—Bulletin No. 602 is being distributed by the National Metal Molding Company, Pittsburgh, Pa., showing its "National" brackets, which are complete with insulators and do not necessitate the use of tie wires.

LIGHTING FIXTURES.—The Beardslee Chandler Manufacturing Company, 216 South Jefferson Street, Chicago, has issued a folder describing and illustrating the Denzar lighting fixture for both ceiling and pendant-type installations.

ELECTRIC BARBER SUPPLIES.—The Racine Universal Motor Company, 53 West Jackson Boulevard, Chicago, has issued a folder showing its Moore electric hair cutter and vibrator and hair-drying attachment for the hair-cutter machine.

LIGHTING AND AUTOMOBILE SPECIALTIES.—The Anderson Electric Specialty Company, 118 South Clinton Street, Chicago, has issued a booklet describing and illustrating a line of small lighting specialties and electric automobile supplies.

MOTION-PICTURE TRANSFORMERS.—The Lea-Bel Company, 610 Schiller Building, Chicago, is distributing a circular describing the Lea-Bel transformer and current regulator to be used with Mazda gas-filled lamps for motion-picture projection.

ELECTRICAL APPARATUS.—The General Electric Company of Schenectady, N. Y., has issued a bulletin describing its pressure governor for alternating-current or direct-current circuits, No. CR 2922, and its bulletin No. 57,419, illustrating parts of type FP-10 oil circuit breakers.

DRINKING - WATER SYSTEM.—The Armstrong Cork & Insulation Company, Pittsburgh, Pa., has issued a circular entitled "Satisfaction or—" which discusses the subject of industrial drinking-water systems. Copies of the folder will be supplied by this company upon request.

WIRE.—The Driver-Harris Company, Harrison, N. J., has recently issued a circular describing its wire baskets for dipping purposes. These baskets are made of nichrome wire. The company is also distributing a folder describing pure sheet nickel for manufacturing purposes.

New Incorporations

THE ALABAMA PUBLIC SERVICE COMPANY of Jasper, Ala., has been incorporated with a capital stock of \$3,000 by P. L. Fuller, E. T. Rice and N. H. Prickett.

THE NIXON (TEX.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by J. F. Wood, Jr., W. L. Hoover and C. T. Morene. The company is capitalized at \$3,000.

THE SOUTHERN CITIES POWER COMPANY of Chattanooga, Tenn., has been incorporated by George B. Adams, J. C. Stickney, G. W. Erwin, J. H. Ramyer and John R. Evans. The company is capitalized at \$50,000.

THE TWIN DRY CELL BATTERY COMPANY of Cleveland, Ohio, has been incorporated by H. R. Palmer, A. C. Brainard, Robb O. Bartholomew, Ralph L. Bailey and John P. Nally. The company is capitalized at \$25,000.

THE WINNEBAGO ELECTRIC COMPANY of Winneconne, Wis., has been incorporated with a capital stock of \$5,000 to supply electricity for lamps and motors in Winneconne. The incorporators are: Richard W. Button and A. Q. Button.

THE BRITISH-AMERICAN PRODUCTS, Inc., has filed articles of incorporation with a capital stock of \$500,000 to do a general electrical, mechanical and constructing engineering business. The incorporators are: A. W. Britton, S. B. Howard and Paul S. Smith of New York, N. Y.

THE C. E. STAPP ELECTRIC COMPANY of Peoria, Ill., has been chartered with a capital stock of \$20,000 for the purpose of doing a general electrical contracting business and dealing in electrical supplies. The incorporators are: C. E. Stapp, C. F. Theobald and E. T. Cunningham.

THE SOUTH NEW CASTLE ELECTRIC COMPANY of New Castle, Pa., has been granted a charter with a capital stock of \$5,000 to supply electricity for lamps and motors in this borough. The directors are: J. C. Chesnut and L. B. Round of New Castle and A. E. Dedricks of Youngstown, Ohio.

THE CONLAN ELECTRIC CORPORATION of New York, N. Y., has been incorporated by David Conlan, Jr., Robert S. Conlan of the Bronx and Frank A. Butler of Ridgewood, N. J. The company is capitalized at \$10,000 and proposes to do a general electric contracting and manufacturing business.

THE DEXTER & ADAMS MACHINE COMPANY of New York, N. Y., has been incorporated by R. H. Garretton, G. Rosendale and S. C. Whitebeck, 52 Broadway, New York City. The company is capitalized at \$50,000 and proposes to manufacture machinery and appliances and to do a general electrical and mechanical engineering business.

COMPANIA DE SERVICIO PUBLICO DE SANTA MARTA has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$100,000 to construct and operate telephone, telegraph and electric light, heat and power systems. The incorporators are: Ferris Gles, E. M. Haslam and E. Lemon of Wilmington, Del.

THE INTERNATIONAL WESTERN ELECTRIC COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$20,000,000. The company proposes to manufacture all kinds of electrical instruments and machinery and to engage entirely in foreign trade. The incorporators are: William O'Keefe, E. E. Aberle and J. H. Dowdell of Wilmington, Del.

THE CENTRAL ELECTRIC DEVELOPMENT & HOLDING COMPANY of Humboldt, Iowa, has been organized for the purpose of building farmers' co-operative electric light and power systems, the cost of the individual systems to vary from \$600 to \$1,000. The officers of the company are: I. C. Elston, Jr., of Chicago, Ill., president; W. J. Brownell of Sioux City, vice-president; D. M. Sterns, secretary and general manager, and L. Winne, treasurer.

THE EMPIRE POWER CORPORATION of Niagara Falls, N. Y., has been granted a charter by the Secretary of State. The company is capitalized at \$3,000,000 and proposes to build a power plant at the head of the falls. The power house, intake tunnel and all buildings are to be built underground. The incorporators are: Frank B. Baird, 1069 Delaware Avenue; Edward L. Koons, 1131 Delaware Avenue, and Myron S. Hall, 184 Bidwell Parkway, Buffalo, N. Y.

New England States

EASTPORT, ME.—The Eastport Electric Company, recently organized with a capital stock of \$25,000, is installing a new plant in Eastport. S. D. Leavitt is president.

MANCHESTER, N. H.—A permit has been granted the Manchester Traction, Light & Power Company to erect a boiler house near Mast Street.

BELLOWS FALLS, VT.—The substation of the Rockingham plant of the Fall Mountain Electric Company was recently damaged by fire. Switchboards, transformers and high-tension wires were destroyed, causing a loss of about \$10,000.

ENOSBURG, VT.—The Butterfield Electric Company, recently incorporated with a capital stock of \$150,000, proposes to develop hydroelectric power on the Missisquoi River in the towns of Montgomery, Berkshire and Enosburg. The incorporators are: C. E. Nelson, B. F. Butterfield of Derby Line; Ralph Buck and C. T. Hall of Montgomery.

SPRINGFIELD, VT.—The Colonial Power & Light Company has secured a contract for supplying secondary power to the amount of 100 kw. to the woolen mill at Proctorsville. Plans are now being prepared for the erection of a new 11,000-volt transmission line to the mill.

BOSTON, MASS.—Bids will be received by the Commission on Waterways and Public Lands, Room 473, State House, Boston, Mass., until May 27 for the erection of a brick building, about 109 ft. by 41 ft., for pump house at the dry dock at South Boston, including rooms for offices and transformers, on concrete foundations. Frank W. Hodgdon is engineer.

BROCKTON, MASS.—Andrew L. Hunter, president of the Common Council, has asked that an investigation be made at once of the electric plant in the city hall to see if it cannot be repaired and utilized to supply electricity to light that building.

CAMBRIDGE, MASS.—Work has begun on the construction of an engine building, 43 ft. by 190 ft., one story, at the Massachusetts Institute of Technology at Cambridge.

BRIDGEPORT, CONN.—Contract has been awarded by the United Illuminating Company to the New England Iron Works, 94 Commerce Street, New Haven, for alterations and improvements to its local power house.

DANIELSON, CONN.—Preparations, it is reported, are being made for the erection of a power house at the Goodyear Cotton Mills. The cost of the proposed plant is estimated at \$150,000 and the equipment will include steam turbine engines. The company is controlled by the Goodyear Tire & Rubber Company of Akron, Ohio.

NEW HAVEN, CONN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 21 for furnishing and installing interior lighting fixtures in the United States post office at New Haven. Copies of plans and specifications may be obtained at the above office.

NEW HAVEN, CONN.—Upward of 2000 acres of land have been secured by the Connecticut Light & Power Company in the towns of New Fairfield and Sherman for a site for its proposed new storage reservoir, to be used as an auxiliary to the dam now under construction at Zoar Bridge. No power house is contemplated in connection with the second dam.

NORWICH, CONN.—The City Gas and Electric Department has awarded the contract for construction of the foundations for the two new boilers, turbine, two 12,000-gal. oil drums and small brick building for blowers to C. M. Williams.

WESTPORT, CONN.—A. S. Green of Westport has been awarded the contract to install a number of Western Electric searchlights at the government works at Fields Point, R. I.

Middle Atlantic States

BROOKLYN, N. Y.—The Clark Electric & Manufacturing Company, 149 Broadway, New York, has purchased a factory building at 22 Vanderbilt Avenue, near Flushing Avenue. The company manufactures electrical goods.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 13, extension of date from May 6, under specification 2913 for installing an electrically-operated traveling crane in the structural shop at New York, to cost about \$8,500.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

school buildings, Municipal Building, New York, until May 13 for electrical work at the Boys' Vocational School, Cary Building, Jay and Nassau Streets. Also for alterations, repairs, electric work, heating, etc., at Public School 153, Belmont Avenue, Ashford and Warwick Streets, borough of Brooklyn. A separate bid to be submitted on each item.

BUFFALO, N. Y.—Contracts will soon be awarded by the War Department, Cantonment Division, Washington, D. C., for the construction of buildings for an aero testing field at Buffalo, to cost about \$425,000.

BUFFALO, N. Y.—Contract has been awarded by the Kellogg Products Company, 98 Delaware Avenue, for the construction of a new pumping plant at 1317 Elk Street to B. I. Crooker, Builders' Exchange, Buffalo.

BUFFALO, N. Y.—Contract has been awarded by the Delaware, Lackawanna & Western Railroad Company for the construction of a power house at East Buffalo to John W. Cowper, Fidelity Building, Buffalo.

CHATEAUGAY, N. Y.—The Chasm Power Company has petitioned the Public Service Commission for permission to issue \$25,000 in bonds, the proceeds to be used to pay the expense of building an auxiliary power house and equipping same to be used in case of emergencies, the cost of which is estimated at \$23,500.

NEWFANE, N. Y.—Owing to an increase in rates from \$14 to \$21 each per year for street lamps the residents of the village of Newfane have voted to discontinue the street-lighting service. The contract with the Lockport Felt Company, which controls the electric plant in Newfane, will expire soon.

NEW YORK, N. Y.—The capital stock of the Novo Manufacturing Company, 4234 West Thirty-third Street, manufacturer of electrical goods, has been increased from \$100,000 to \$150,000.

NEW YORK, N. Y.—The capital stock of the E. J. Electric Installation Company, 221 West Thirty-third Street, has been increased from \$10,000 to \$50,000, the proceeds to be used for expansion purposes.

NEW YORK, N. Y.—Plans have been filed by the B. E. Davis Company, 250 Hudson Street, for the construction of a new eight-story battery building, to be located on Hudson Street, between Broome and Dominick Streets. Contract has been awarded to the Pershing Construction Company, 309 Broadway, New York City.

NEW YORK, N. Y.—Bids will be received by C. E. J. Snyder, superintendent of school buildings, Department of Education, Municipal Building, New York, until May 13 for electric work at Public School 43, 129th Street and Amsterdam Avenue. Also for bids for installing electric equipment in addition to and alterations in Public School 32 on East 183d Street, between Cambreling and Beaumont Avenues. Separate bids to be submitted on each item.

NIAGARA FALLS, N. Y.—Plans have been filed by the Star Electrode Works of the National Carbon Company for the construction of a new mixing and milling building. Braas Brothers, 110 Whitney Avenue, Niagara Falls, are contractors.

OGDENSBURG, N. Y.—Plans are being prepared by the New Jersey Zinc Company, 55 Wall Street, New York City, for rebuilding its local power house, recently destroyed by fire. The cost of the proposed plant is estimated at \$15,000.

POTSDAM, N. Y.—Work has been resumed by the St. Lawrence Transmission Company on the construction of its dam across the Raquette River at Colton, and at Bross Bridge, where it is erecting a power house for the development of the water power. Machinery, it is understood, has been purchased.

SYRACUSE, N. Y.—The Public Service Commission has granted the Syracuse Lighting Company permission to extend its electric transmission lines to Geddes to furnish electricity for lamps and motors in that town.

WEST HAVERSTRAW, N. Y.—Bids will be received by George Blagdon, president of the board of managers of the New York State Hospital for Care of Crippled and Deformed Children, West Haverstraw, until May 22, for laundry equipment for the New York State Hospital for Crippled and Deformed Children. Drawings and speci-

cations may be consulted at the above hospital, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York City, and at the Department of Architecture, Capitol, Albany, N. Y.

BLOOMFIELD, N. J.—Contract has been awarded by the Sprague Electric Company, Watsessing Street, for the erection of an addition to its plant to the Austin Company, Transportation Building, Philadelphia, Pa. The structure will be about 100 ft. by 180 ft., and the cost is estimated at \$35,000.

HOBOKEN, N. J.—The Lux Manufacturing Company, Fifteenth Street, has purchased a four-story factory on East Kinney Street, with about 50,000 sq. ft. floor space. The company manufactures large nitrogen and tungsten lamps. A. P. Baldwin is president and treasurer.

KEARNY, N. J.—Contract has been awarded by Swift & Company of Jersey City to the Ruggles-Robinson Company, 331 Madison Avenue, New York City, for the erection of a power house in connection with the construction of a new glue factory in Kearny. The cost of the entire plant is estimated at \$65,000. The company is also planning to build an addition to its engine house at 154 Ninth Street, Jersey City, for which plans have been prepared.

ORANGE, N. J.—A permit has been taken out by the Radium Luminous Materials Corporation for the erection of a new four-story building at 166 Alden Street.

TRENTON, N. J.—Preliminary plans are being prepared by J. Osborne Hunt, 114 Montgomery Street, Trenton, for the construction of a new power house at the plant of the John E. Thropp Sons Company, Lewis Street.

TRENTON, N. J.—Major Edmund J. Barry, who is in charge of the government munitions plant at Tullytown, Pa., has issued orders that additional power be supplied to the Trenton, Bristol & Philadelphia Street Railway from the power house of the Trenton & Mercer County Traction Company at Trenton. Transmission lines will be erected through the streets of Trenton across the Delaware River to connect with the line of the former company at Morrisville, Pa.

ERIE, PA.—The City Council has awarded the contract for lighting the streets of the city to the Erie County Lighting Company for a period of five years.

HARRISBURG, PA.—Bids will be received by the Board of Commissioners of Public Grounds and Buildings until May 14 for furnishing power plant specialties for the year ending May 31, 1919. George A. Shreiner is superintendent.

MIDDLEBURG, PA.—The Juniata Electric Company of Millin has taken over the plant of the Middleburg Electric Light, Heat & Power Company.

PHILADELPHIA, PA.—Bids will be received by the Department of Public Safety for improvements and alterations in the municipal power plant. William H. Wilson is director of public safety.

PHILADELPHIA, PA.—Permit has been taken out by the Royal Ascot Knitting Company, 92 Collum Street, for the construction of an addition to its boiler plant at 210 East Ashmead Street.

PHILADELPHIA, PA.—Plans have been prepared by the Electric Storage Battery Company for improvements to its building, including a new addition, at Nineteenth Street and Allegheny Avenue.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 20 under specification 2917 for furnishing an electric-lighting system for shipbuilding slip at Philadelphia. For further information address chief of bureau.

CUMBERLAND, MD.—Preliminary work, it is reported, has begun on the construction of the proposed plant for the Kelly-Springfield Tire Company of Akron, Ohio, in Cumberland. The present plans, it is understood, include the erection of a power station. The cost of the plant is estimated at \$1,000,000.

CHARLESTON, W. VA.—The Virginia Power Company is contemplating erecting additional transmission lines to Nitro, a distance of 16 miles, to furnish electricity to the federal government explosive plant. H. G. Scott of Charleston is general manager.

HARPERS FERRY, W. VA.—The Public Service Commission has approved of an issue of \$500,000 in bonds by the Northern Virginia Power Company, the proceeds to be used for the development of hydroelectric projects in the eastern panhandle of West Virginia.

ROSTOKE, VA.—The Norfolk & Western Railroad Company is planning to erect new shops and buildings at its Bristol yards to cost about \$500,000.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 13 for furnishing and installing cables, wire transformers, and accessories for the electric and telephone systems for dry-dock No. 4 at the navy yard at Norfolk. Drawings and specifications No. 2875 may be obtained at the above bureau or to the commandant of the navy yard named.

RICHMOND, VA.—The Virginia Railway & Power Company has awarded a contract to Nicholas & Linderman of Norfolk for alterations and improvements to its substation, to cost about \$11,700.

SEVEN PINES, VA.—Contract has been awarded by the War Department, Washington, D. C., to the Foundation Company, Woolworth Building, New York, N. Y., for the construction of a powder packing plant at Seven Pines, to cost about \$3,000,000. The project will include an electric power plant, heating equipment, large warehouse and 40 miles of railway trackage. E. J. du Pont de Nemours & Company of Wilmington, Del., will operate the plant for the Government.

WASHINGTON, D. C.—The Chesapeake & Potomac Telephone Company has awarded contract for the erection of a new telephone exchange building to the Samuel K. Prescott Company, 811 Thirteenth Street, N. W. The cost is estimated at about \$800,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 13, extension of date from May 6, under specification 2879 for installing substation switchboards at the navy yard, Washington. The cost is estimated at \$60,000.

WASHINGTON, D. C.—Bids will be received by the Commissioner of Indian Affairs, Indian Office, Department of the Interior, Washington, D. C., until May 20 for the installation of an electric-lighting plant at the Southern Ute School, Colorado. Plans and specifications may be examined at the United States Indian warehouse at Chicago, Ill., St. Louis, Mo., San Francisco, Cal., and the Builders' Exchange, St. Paul, Minn., and at the office of the superintendent of the Southern Ute School, Colorado. Cato Sell is commissioner.

North Central States

BELLAIRE, MICH.—A special election will be held on May 13 to submit to the voters the proposal to issue \$6,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant. It is proposed to establish a day service.

SPRINGWELLS, MICH.—Contract, it is reported, has been awarded by the Saxon Motor Company for the erection of a power plant in Springwells to Bryant & Detwiler.

COLUMBUS, OHIO.—An addition is being erected to the power plant of the Columbus Anvil & Forging Company. New equipment to increase the output of the plant nearly 50 per cent, it is understood, will be installed.

HAMILTON, OHIO.—Preparations are being made by the Shuler & Benninghofen Company of Hamilton for an extension to its power plant. Most of the equipment, it is understood, has been purchased.

LIMA, OHIO.—Steps have been taken by the Lima Advertising Club for the installation of an ornamental lighting system in the business district.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Company is installing transformers to be used in connection with the high-tension line connecting its station with the high-tension service of the Lake Shore Electric Railway Company.

SANDUSKY, OHIO.—Property owners just outside of the city limits, near the bay shore, have petitioned the Sandusky Gas & Electric Company for electrical service. The district to be served is just beyond the present service lines of the company.

WAPAKONETA, OHIO.—Plans are being prepared by Kruckemeyer & Strong, architects, Cincinnati, for the construction of a new telephone exchange building for the Wapakoneta Telephone Company. The system to be installed has not yet been decided upon.

EARLINGTON, KY.—The St. Bernard Mining Company is planning to construct a large power plant in Earlington to supply power for its mines in this territory. Contract for electrical work, it is reported, has been awarded to the Westinghouse Electric & Manufacturing Company of Pittsburgh. The cost of the plant is estimated at \$500,000.

FRANKLIN, IND.—The construction of a new science hall, 125 ft. by 95 ft., to cost

about \$125,000, is under consideration by the trustees of Franklin College. C. F. Goodell is president.

SOUTH BEND, IND.—The installation of electrical equipment in the forge department and machine shops, to cost about \$27,000, is contemplated by the Studebaker Corporation.

CALUMET, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, 380 South Michigan Avenue, Chicago, until June 6, for construction of the Calumet sewage pumping station as follows: Division A—consisting of a concrete and brick building, 80 ft. by 185 ft., with suction discharge basins, 15-ton hand crane, sluice gates and accessories, etc. Division B—pumping machinery, consisting of three 72-in. centrifugal pumps, with suction and discharge and vacuum piping, priming pumps and accessories; one 72-in. centrifugal pump in addition may be ordered at the option of the Sanitary District. Division C—electrical equipment, including six 1000-kva. transformers, three 1100-hp. synchronous motors, two 450-hp. synchronous motors, three 300-hp. synchronous motors, six 50-kva. transformers, two 75-kw. motor-generator sets, and oil switch equipment. Division C—switchboard, conduit and wiring, including control switchboard and accessories, conduit and wiring for connecting all electrical equipment and for station lighting and power, installation of electrical equipment. Specifications, forms of proposal and plans may be obtained at the above office.

CICERO, ILL.—Bids, it is reported, are being asked by the Western Electric Company of Chicago for the construction of a new factory, six stories, at Cicero, to cost about \$800,000.

JANESVILLE, WIS.—The Supervisors of Rock County are considering the installation of an improved lighting system at the County Asylum and Almshouse. Supervisor Perrigo is chairman of the special committee.

MILWAUKEE, WIS.—The Pfau Motor Pump Company, 248 Fourth Street, recently incorporated with a capital stock of \$30,000, is contemplating the construction of a new plant. The company manufactures electrically driven compressed-air water-pumping systems.

OSHKOSH, WIS.—The Oshkosh Gas Light Company is building a new power plant on the north bank of Fox River. The building will be about 100 feet square and 90 feet high. Three new boilers equipped with automatic stokers are being installed in the boiler room.

HASTINGS, MINN.—Bids will be received by the Minnesota State Board of Control, State Capitol Building, St. Paul, until May 14, for construction of the west wing to main building of the State Asylum at Hastings, including general contract work, heating and ventilating, electrical work and plumbing. Plans and specifications are on file at the office of the Board of Control, Builders' Exchange, at St. Paul and Minneapolis, and at the office of C. H. Johnston, architect, Capital Bank Building, St. Paul.

PRINCETON, MINN.—Bids will be received by the board of education, Princeton, until May 20, for the construction of a high school building. Separate bids to be submitted on mechanical equipment. Plans and specifications are on file in the office of A. B. Gramer, city clerk. Foss & Foss of Elbow Lake, Minn., are architects.

CLINTON, IOWA.—The Climax Engineering Company, it is reported, has purchased the property of the Klein Paper Mill on the Beaver Slough at the foot of Fifth Street, on which it will erect a new plant, including a power house, which will be equipped with a 500-hp. engine and generators. Orders have been placed for machinery.

LADORA, IOWA.—A company is being organized under the name of the Farmers' Electric Light Association to install and operate an electric-lighting system in Ladora.

MANCHESTER, IOWA.—The Delaware County Light & Power Company, recently incorporated, has purchased the Quaker Mill property about two miles up the river from Manchester, which it proposes to develop to generate electricity and transmit it to Manchester. The company will also continue the mill and feed grinding business. The company is capitalized at \$25,000. Joseph Hutchinson is president, and Harry Seeds, secretary and treasurer.

MONTICELLO, IOWA.—The Monticello Electric Company is contemplating extending its electric transmission lines out of the city to supply electrical service to the farmers west of the town as far as Linn County.

WASHINGTON, IOWA.—Bids will be received by the board of education, care of

R. W. Thompson, secretary, until May 17 for construction of a high school building, including heating, plumbing and electric wiring. The cost is estimated from \$140,000 to \$150,000. C. A. Doleman & Company, Grandby Building, Cedar Rapids, are architects.

YORKTOWN, IOWA.—The Leo Electric Light & Power Company has submitted a proposal to the Town Council offering to erect an electric transmission line to Yorktown from its line running from Shenandoah to Clarinda to supply electricity here for \$5,000.

KANSAS CITY, MO.—Bids will soon be awarded by the Kansas City Railways Company for the erection of a substation at 1017 Oak Street, to cost about \$25,000. C. E. Fritts, Fifteenth and Grand Avenues, is electrical engineer.

KANSAS CITY, MO.—J. F. Porter, president of the Kansas City Light & Power Company, has announced that work on the construction of its large plant at Brooklyn Avenue and the river front will be resumed. Work on the foundation was held up after the general strike.

KIRKSVILLE, MO.—Extensive improvements are contemplated by the Adair County Light, Power & Ice Company to its plant and system.

LITTLE BLUE, MO.—The Green Light & Power Company, which supplies electrical service in Lees Summit, is contemplating extending its lines to Little Blue.

PLATTSBURG, MO.—The Clinton County Telephone Company has authorized an issue of \$6,500 in bonds for improvements to its system.

COURTENAY, N. D.—A second generating unit, consisting of a General Electric 37½-kva., 60-cycle, 2300-volt alternator and a 35-hp. Muncie oil engine, is being installed in the municipal electric-light plant. As soon as improvements are completed a day service will be established. G. D. Roth is manager.

MADDOCK, N. D.—Preparations are being made for the installation of an electric-lighting system in the city of Maddock, for which bids have already been received.

GURLEY, NEB.—Preparations are being made for the installation of a municipal electric-light plant, for which bids have already been received. Royal D. Salisbury, 1415 East Colfax Avenue, Denver, Col., is consulting engineer.

LYNCH, NEB.—Bonds to the amount of \$7,800 have been voted for the installation of an electric-light plant in Lynch.

NORFOLK, NEB.—Plans are being prepared for the construction of a power house at the State Insane Hospital at Norfolk, to cost about \$40,000. Bids for construction, it is understood, will soon be asked by the Board of Commissioners of State Institutions. Plans are also being prepared for the construction of ward building for the above hospital, to cost about \$70,000. J. C. Stitt is architect for both buildings. Leo Matthews of Lincoln is secretary of board.

BROOKVILLE, KAN.—Bonds have been voted to provide funds for the erection of an electric distribution system in Brookville. Energy to operate the system will be purchased from the Central Kansas Power Company of Manhattan.

CONCORDIA, KAN.—The pumping station of the Concordia Electric Light Company was recently destroyed by fire.

EDGERTON, KAN.—At an election to be held May 14 the proposal to issue \$5,000 in bonds for the erection of an electric distribution system in Edgerton will be submitted to the voters.

GARDNER, KAN.—At an election to be held May 14 the proposal to issue \$10,000 in bonds for the installation of an electric-light plant will be submitted to the voters.

GARNETT, KAN.—The City Council has called an election to be held June 4 to submit the proposal to issue \$65,000 in bonds for improvements to the municipal electric-light plant and water-works system to the voters. Black & Veatch, 507 Inter-State Building, Kansas City, Mo., are engineers.

WICHITA, KAN.—Plans are being prepared for a power house and laundry for the St. Francis Hospital, to cost about \$20,000. E. Forsblom, Winne Building, is architect.

WICHITA, KAN.—The contract for electric wiring of the new addition to the Forum Building has been awarded to the Southwestern Electric Company. The cost of the entire work is estimated at \$130,000.

WINFIELD, KAN.—Work will start at once on the construction of a building for the St. Mary's Hospital. The plans provide for the installation of electric passenger elevator, dumb waiter, refrigerating system, electric wiring, etc. The cost is estimated at \$80,000. H. L. Stevens & Company, 900 South Michigan Avenue, Chicago, Ill., are architects and contractors.

Southern States

CHARLOTTE, N. C.—The city of Charlotte would like to receive proposals from manufacturers of pumping equipment upon certain centrifugal pumping units. Further information may be obtained at the office of the commissioner of public works or Anderson & Christie, consulting municipal engineers of Charlotte.

BRANCHVILLE, S. C.—Prescott Ott, it is reported, is in the market for equipment for an electric-light plant.

REIDSVILLE, GA.—Bonds to the amount of \$10,000 have been voted for the installation of a municipal electric-light plant.

SARASOTA, FLA.—A movement has been started by the Board of Trade for the purchase of the property of the Sarasota Ice & Electric Company, which now furnishes electrical service in the city. The company has a 30-year franchise with provision that the city may purchase the plant at the end of any 10-year period. The board proposes the purchase of the plant by the city and the installation of the necessary machinery to furnish a 24-hour service. The City Council has engaged a consulting engineer to make investigations.

LYLES, TENN.—The Bon Air Coal & Iron Corporation of Nashville, it is reported, will construct and operate a wood chemical plant for the United States government. The cost of the plant is estimated at \$1,300,000 and will include power house, stillhouse, 20 retorts, etc. The George A. Fuller Construction Company, Fuller Building, New York, N. Y., has the contract.

GADSDEN, ALA.—Work has begun by the Alabama Power Company on the installation of the division switchboard and meters to be used in delivering energy to operate the local water-works system. It is proposed to change the plant from steam to electric power. Orders have been placed for motors and pumps.

CLARKSDALE, MISS.—Bids will be received by the school board, addressed to R. E. Stratton, city clerk, Clarksdale, until May 22 for construction of school building including heating, plumbing, electric-lighting, etc. Bonds to the amount of \$95,000 have been issued for building and equipment. Plans and specifications may be obtained from R. H. Hunt of Chattanooga, architect.

GUEYDAN, LA.—The city is contemplating the installation of a municipal electric-light plant for which \$15,000 in bonds have been voted.

NEW ORLEANS, LA.—The Liberty Manufacturing Company, recently incorporated, has acquired a plant at Carrollton Avenue and Olander Street, and will engage in the manufacture of electrical and foundry machinery and other products. Eph. Rosenberg is president and B. B. Hans, secretary and treasurer.

JENNINGS, OKLA.—The City Council is considering calling an election to submit the proposal to issue \$25,000 in bonds for an electric lighting system, \$20,000 for water-works, \$20,000 for sewers, and \$18,000 for an ice plant to the voters.

MIAMI, OKLA.—Bids will be received until May 18 for the construction of a hospital at the Baptist Sanitarium at Miami. Separate bids to be submitted on vacuum steam heating, plumbing, electric wiring and electric elevator. A. J. Bellis, 615 Grear-Leslie Building, Kansas City, Mo., is architect.

OILTON, OKLA.—The Council has granted the Central Oklahoma Lighting & Power Company a franchise to furnish electricity in Oilton for commercial purposes.

SHATTUCK, OKLA.—Improvements to cost about \$20,000 are contemplated to the municipal electric light plant, and also to the waterworks, to cost about \$50,000. Burns & McDonnell, 402 Inter-State Building, Kansas City, Mo., are engineers.

TULSA, OKLA.—The Commerce Building Corporation, First National Bank Building, Tulsa, has awarded contract for construction of a bank and office building at 324 Main Street to the George A. Fuller Construction Company, Dwight Building, Kansas City, Mo. The plans provide for the installation of a private lighting plant. The cost is estimated at \$500,000. Rush, Endacott & Rush, 226 Unity Building, are architects.

AUSTIN, TEX.—Contract has been awarded by the War Department, Washington, D. C., for the construction of cantonment buildings at Camp Mabry, near Austin, for aviation field to J. F. Johnson of Austin, to cost about \$400,000.

KNIPPA, TEX.—Preliminary surveys have been made for the construction of a large hydroelectric power plant on the Frio River, near here, and a large irrigation

system. The site of the proposed dam is located about 14 miles north of Knippa, and will have a capacity of about 5000 acre ft., which will irrigate about 100,000 acres of valley land. Electricity generated at the proposed dam will be transmitted to San Antonio and a number of smaller towns. Charles A. Lindsey of Wichita, Kan., and associates have applied to the State Board of Water Engineers for authority to divert and utilize the water of the stream.

TOM BEAN, TEX.—A company has recently been organized for the purpose of installing and operating an electric-lighting plant in Tom Bean.

Pacific and Mountain States

CHEHALIS, WASH.—At an election held April 20 the proposal to grant C. E. Anderson and associates of Portland, Ore., a franchise to operate a second electric-lighting and power system in Chehalis was defeated. The North Coast Power & Light Company, which furnishes electrical service here, has recently (voluntarily) granted a reduction in its rates of approximately one-third.

EVERETT, WASH.—The City Council has engaged Burns & McDonnell of Kansas City, Mo., to make investigations and prepare estimates of the cost of establishing a power plant in the upper Sultana River district.

OLYMPIA, WASH.—Application has been filed with the state engineer by P. C. Kaylor for 9000 second ft. of water from the Spokane River, to be used for hydroelectric development.

SEATTLE, WASH.—Equipment is being installed by the Coast Engine Company of Seattle for the manufacture of small electric lighting plant to be operated by heavy oil engines of 2½ hp.

SPOKANE, WASH.—Application has been filed by the Washington Water Power Company of Spokane for permission to construct a reservoir and store unappropriated waters of the Baker River, to the amount of 30,000 acre ft., to be used for power development. The cost of the proposed project is estimated at about \$1,000,000.

ASTORIA, ORE.—The contract for the installation of electric wiring and equipment for the new bulk grain storage bins and workhouse has been awarded to the Ewart Electric Company of Astoria, at \$9,588.

GRANTS PASS, ORE.—The Crown-Willamette Paper Company of Grants Pass has been granted permission by State Engineer Lewis to appropriate 200 second ft. of water from Young River, near Astoria, for the development of 2273 hp. The cost of the proposed plant is estimated at \$150,000 and will include the construction of an 80-ft. dam, short pine line and power house.

PORTLAND, ORE.—An ordinance has been introduced to the City Council providing for an issue of \$4,000,000 for the purchase of a large tract of land as a site for a new power plant.

PORTLAND, ORE.—Application has been filed by the Valley Development Company of Portland with the State Engineer for a permit to divert waters of Lake Creek, Clear Fork, Johnson Creek and Glacier Creek for the purpose of generating electricity for transmission to cities and towns for manufacturing, mining and domestic purposes. The company has also asked for permission to construct a reservoir in Lake Creek and Clear Fork.

SALEM, ORE.—John R. Lewis, state engineer, has been advised that the federal government has withdrawn several thousand acres of public lands suitable for water power developments from the Oregon-California Railroad grant acreage. About 100 townships are affected along the Nehalem, Umpqua, Siuslaw, Siletz, Rogue and Smith Rivers and their tributaries.

TOLEDO, ORE.—The Thorsen-Hendricksen Mill Company has been reorganized and its name changed to the Lincoln County Light & Power Company. The plant now supplies electricity in the towns of Toledo and Newport. New equipment, including a 2000-hp. turbine and generator, will be installed. The additional power will be used to operate a large band sawmill which the company will erect in Toledo.

LOS ANGELES, CAL.—Plans are being considered by the City Council for the installation of an electric-lighting system in Fifty-fifth Street, from Budlong to Normandie Avenue. It is proposed to use marbelite standards.

LOS ANGELES, CAL.—The City Council has appropriated \$79,000 for extensions to the municipal distribution system to all parts of the harbor sections, including the extension of the power transmission lines

of Fish Harbor on Terminal Island, the latter to cost about \$34,000.

LOS ANGELES, CAL.—Negotiations are under way between the City Council and the Harbor Commissioners for the lease of property on the harbor boulevard as a site for the proposed new municipal substation which is to furnish energy in the West Basin and Wilmington districts.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Washington, D. C., until May 20 for furnishing and installing one 6000-lb. capacity freight elevator and supporting structure in the machine shop extension at the navy yard, Mare Island. Bids will also be received at same time at the navy yard, Mare Island. Drawings and specification No. 2936 may be obtained at the above bureau or the commandant of the navy yard named.

OROVILLE, CAL.—Negotiations are under way between the federal government and the Great Western Power Company of San Francisco for the construction of a hydroelectric plant to cost about \$5,000,000.

OROVILLE, CAL.—Plans for the construction of another large hydroelectric plant in the Feather River District have been announced by a group of Oroville men, providing for the conversion of the Great Bald Rock Canyon into a large impounding reservoir. This, it is said, can be accomplished by constructing a dam 1160 ft. in length and 650 ft. high. With this dam a total fall of 1750 ft. can be obtained, capable of developing 166,000 hp. Present plans provide for this development in three units, the first power plant to be located at the foot of the dam. A second power house is proposed for Canyon Creek, while a third plant would be situated near Bidwell Bar. The total cost of the project is estimated at \$7,500,000. Among the promoters are: Paul Reicker, civil engineer; W. L. Curran of Oroville; George C. Riley and A. J. Walsh, both of Sacramento.

SAN DIEGO, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., and at San Diego, Cal., until May 27 for constructing at San Diego, Cal., commandant's house, officers' quarters and barracks for 400 men.

STRATHMORE, CAL.—With the completion of the substation at Strathmore the San Joaquin Light & Power Company will receive energy from the plants of the Mount Whitney Power Company and the Southern California Company. The companies affected by the tie-in at Strathmore are the Mount Whitney Power & Electric, the San Joaquin Light & Power, the Southern California Edison and the San Diego Consolidated Gas & Electric Companies.

VERNAL, UTAH.—The Vernal Milling & Light Company has filed amendments to its charter increasing its capital stock from \$100,000 to \$150,000.

ARCO, IDAHO.—At an election held recently the proposal to issue \$10,000 for the installation of an electric light and power plant was defeated.

MALTA, MONT.—The new electric-lighting system will soon be placed in operation in Malta.

SNOWFLAKE, ARIZ.—Contract has been awarded by the Snowflake & Taylor Irrigation Company for the installation of an electric-light and power plant. As yet none of the equipment has been installed. The company contemplates beginning work on the construction of a hydroelectric plant about July 8. H. T. Lloyd of Wickenburg has the contract.

YUMA, ARIZ.—The Yuma Gas, Light & Power Company has begun work on the installation of a new transformer at its local substation.

Canada

NORTH VANCOUVER, B. C.—The City Council is considering an option on the property of the Nairn Falls Power Company with a view of developing hydroelectric power.

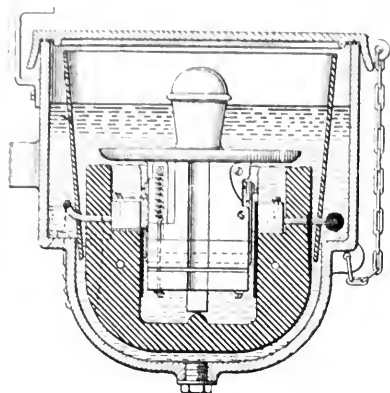
WHITE ROCK, B. C.—Arrangements have been made by the local water works company with the British Columbia Electric Railway, Power & Light Company to equip the local pumping station for electrical operation.

ST. JOHN, N. B.—A new 550-hp. steam power plant will be installed in connection with the new plant now being built by T. McAvity & Sons, Ltd. The company will need a total 1000 hp., of which only 450 hp. can be developed by the present plant.

BERWICK, N. S.—The installation of an electric-lighting and power plant to cost about \$50,000 is under consideration by the Town Council.

(Closed April 23, 1918.)

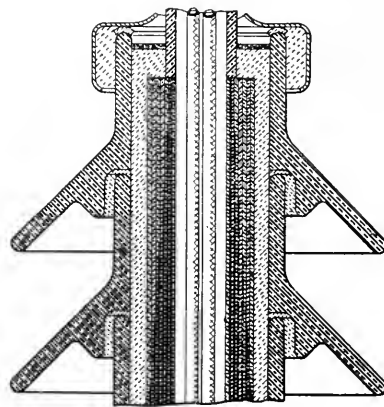
- 11,161 (11,150). TELEPHONE - EXCHANGE SYSTEM; Talbot G. Mathin, Chicago, Ill. App. filed March 21, 1916. Improvement.
- 11,161 (11,150). ELECTRICAL MEASURING INSTRUMENT; Harold E. Trent, Murraysville, Pa. App. filed Feb. 15, 1916. An ohmmeter having a relatively large range of deflection.
- 1,263,359. ELECTRICALLY HEATED COOKING DEVICE; Charles C. Armstrong, Marysville, Ohio. App. filed June 27, 1916. Adapted for performing various cooking



1,263,610—Circuit-Opening Device

operations such as broiling, toasting, boiling and frying.

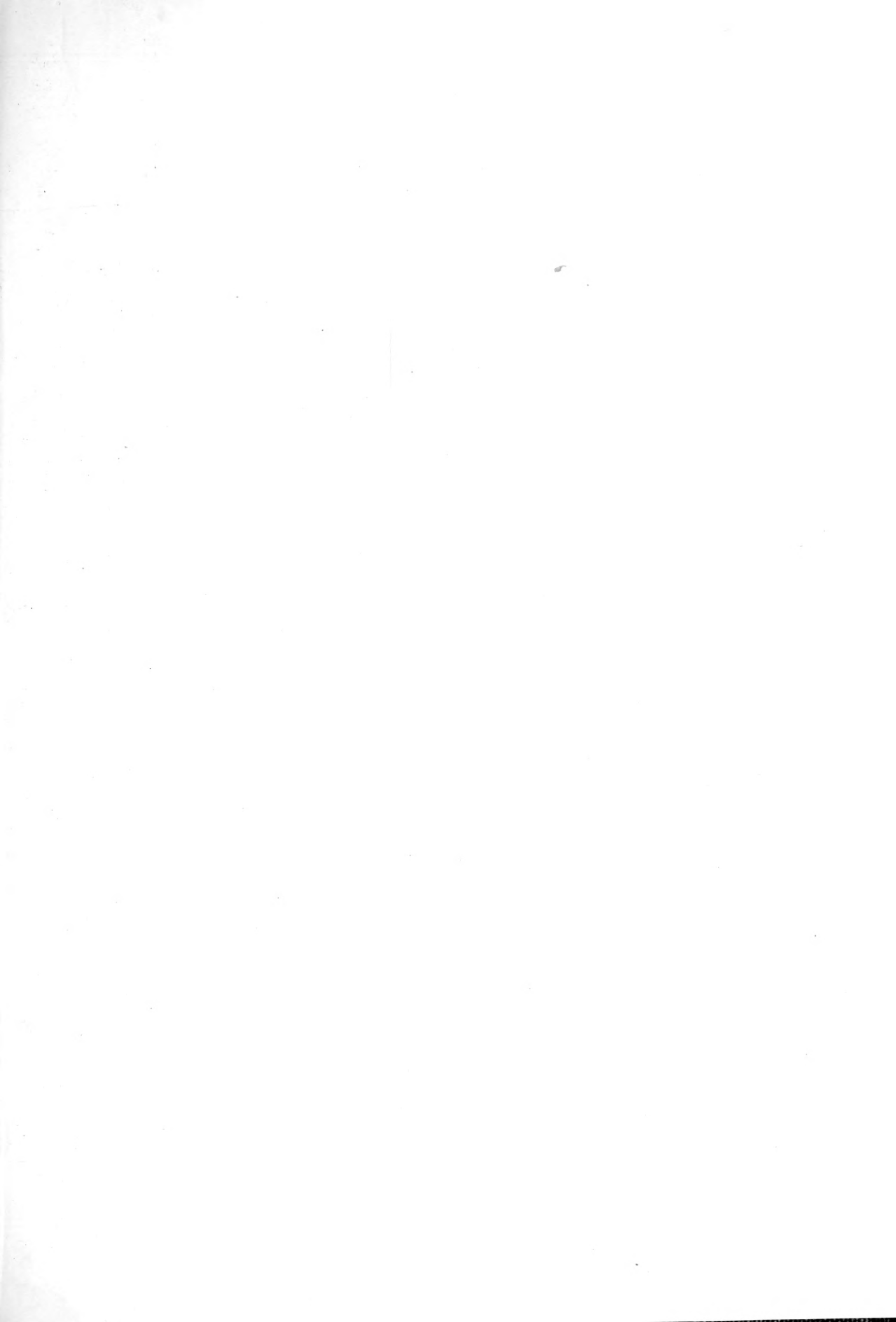
- 1,263,360. CONSTANT - CURRENT TRANSFORMER; Lyman Arnold, Lynn, Mass. App. filed Dec. 13, 1915. Improvements.
- 1,263,369. DEVICE FOR AUTOMATIC DISTRIBUTION OF A LIMITED ELECTRICAL EFFECT OR CURRENT INTENSITY BETWEEN LAMPS, ETC.; Ole S. Bragstad, Trondhjem, Norway. App. filed April 17, 1916. Improvements.
- 1,263,371. RAILROAD BLOCK - SIGNALING MEANS; Yorke Burgess, Chicago, Ill. App. filed Jan. 15, 1917. Improvements.
- 1,263,373. SERIES-PARALLEL SYSTEM OF CONTROL FOR TAPPED-FIELD MOTORS; Frank E. Case, Schenectady, N. Y. App. filed March 24, 1915. Plurality of motors may be operated and controlled.
- 1,263,376. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. and Charles L. Goodrum, Brooklyn, N. Y. App. filed Nov. 9, 1916. Time required for establishing connections between subscribers reduced.
- 1,263,377. ELECTRICAL TESTING SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Feb. 17, 1917. Means for automatically making routine tests of various parts of telephone systems.
- 1,263,383. ELECTROMAGNETIC DEVICE; Edward B. Craft, Hackensack, N. J. App. filed Nov. 15, 1915. Rapidly vibrating armature is employed for producing a signal.
- 1,263,389. TREATMENT OF GASES IN ELECTRIC FURNACES; Emil Edwin Christiania, Norway. App. filed Aug. 19, 1916. Improvements.
- 1,263,390. TREATMENT OF GASES IN ELECTRIC FURNACES; Emil Edwin Christiania, Norway. App. filed Aug. 29, 1916. Improvements.
- 1,263,393. ELECTRICAL MEASURING INSTRUMENT; Alvarado L. R. Ellis, Lynn, Mass. App. filed April 24, 1915. Movable element has a filar suspension.
- 1,263,402. TELEGRAPH INSTRUMENT; Oscar A. Garland, Hot Springs, Ark. App. filed Feb. 26, 1916. For instruction of beginners.
- 1,263,406. MAGNETIC SEPARATOR; Arthur L. Hadley, Fort Wayne, Ind. App. filed Oct. 7, 1916. For separating magnetic particles from liquids.
- 1,263,413. ELECTRIC GOVERNOR; Birger O. Holm-Hansen, Christiania, Norway. App. filed Aug. 9, 1915. For automatic regulation.
- 1,263,421. TELEPHONE SUBSTATION CIRCUIT; Kenneth S. Johnson, Jersey City, N. J. App. filed Sept. 7, 1915. Central-energy type.
- 1,263,424. ROTARY CONVERTER; Laurence D. Jones, Schenectady, N. Y. App. filed Oct. 17, 1917. Improvements.
- 1,263,429. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed July 3, 1917. Improvements.
- 1,263,431. ELECTROTHERAPEUTIC AND EXERCISING APPARATUS; John H. Kellogg, Battle Creek, Mich. App. filed March 22, 1917. Improvements.
- 1,263,436. ROTARY CONVERTER; William C. Korthals-Altes, Schenectady, N. Y. App. filed Nov. 6, 1917. Provided with commutating poles and operated in connection with variable voltage boosters.
- 1,263,437. DOUBLE-POLE ROTARY CONVERTER; Jens L. La Cour, Vesterås, Sweden. App. filed April 23, 1914. May be used to generate two different kinds of energy.
- 1,263,481. TELEPHONE ATTACHMENT; Albert H. Strock, Oakland, Cal. App. filed Dec. 7, 1915. Improvements.
- 1,263,500. STORAGE BATTERY; Theodore A. Willard, East Cleveland, Ohio. App. filed Oct. 8, 1917. Novel sealing means.
- 1,263,520. ELECTRIC COUPLING DEVICE; Thomas R. Brown, Sparkill, N. Y. App. filed Feb. 12, 1914. For automatically connecting the train-wire terminals when cars are coupled together.
- 1,263,521. ELECTRIC COUPLING DEVICE; Thomas R. Brown, Sparkill, N. Y. App. filed May 12, 1914. Electric train-line couplings.
- 1,263,533. APPARATUS FOR THE FIXATION OF NITROGEN; John A. Currie, Toronto, Ontario, Canada. Improvements. App. filed April 8, 1916.
- 1,263,537. TELEPHONE TRANSMITTERS; Aaron Dewinsky, Bethlehem, Pa. App. filed June 30, 1917. Improvements.
- 1,263,554. TIME-CONTROLLED MECHANISM; William H. Greenleaf, Hartford, Conn. App. filed Oct. 16, 1916. Small number of parts.
- 1,263,568. THERMOSTATIC ELECTRIC SWITCH; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Jan. 18, 1917. For use in connection with electrically heated warming pads.
- 1,263,578. VEHICLE DIRECTION INDICATOR; Israel L. Lowenthal, Minneapolis, Minn. App. filed June 7, 1916. Improvements.
- 1,263,598. TUNGSTEN-REDUCING FURNACE; Carl A. Pfanstiehl, Waukegan, Ill. App. filed Oct. 15, 1915. Improvements.
- 1,263,607. ALUMINOUS ABRASIVE; Lewis E. Saunders and Ray H. White, Niagara Falls, N. Y. App. filed Dec. 26, 1917. Improvements.
- 1,263,610. CIRCUIT-OPENING DEVICE; Edmund O. Schweitzer and Alfred Herz, Chicago, Ill. App. filed May 29, 1912. Certainty of action.
- 1,263,615. IGNITION AND LIGHTING SYSTEM FOR AUTOMOBILES; John C. Slager and Harry C. Anderton, Springfield, Ohio. App. filed Aug. 20, 1917. Improvements.
- 1,263,624. RAILWAY SIGNALING; William W. Talbert, Chicago, Ill. App. filed June 2, 1913. Improvements.
- 1,263,628. DEVICE FOR SHIFTING CURTAINS OR THE LIKE; Earl K. Vallen, Akron, Ohio. App. filed Jan. 3, 1916. Accomplished by closing of an electric switch.
- 1,263,642. STARTER; Dalmat T. Brownslee, Indianapolis, Ind. App. filed Feb. 15, 1917. For internal-combustion engine.
- 1,263,657. ELECTRICAL CONTACT DEVICE; Karl Fanta and Norbert Wessely, Vienna, Austria. App. filed May 7, 1914. For controlling the operation of textile machinery according to pattern cards.
- 1,263,674. POCKET FLASHLIGHT; Arnost Janovsky, Brooklyn, N. Y. App. filed Aug. 27, 1917. Improvements.
- 1,263,694. MAGNETIC FLYWHEEL; Christopher J. Meyer and Eugene P. Gleason, Milwaukee, Wis. App. filed March 1, 1915. Flywheel and rotary field magnet for a magneto-generator.
- 1,263,708. PRODUCT CONTAINING ALUMINA AND PROCESS OF PREPARING THE SAME; Lewis E. Saunders and Ray H. White, Niagara Falls, N. Y. App. filed March 2, 1917. Improvements.
- 1,263,709. ALUMINOUS ABRASIVE AND PROCESS OF MAKING THE SAME; Lewis E. Saunders and Ray H. White, Niagara Falls, N. Y. Improvements.
- 1,263,710. ALUMINOUS ABRASIVE AND PROCESS OF MAKING SAME; Lewis E. Saunders and Ray H. White, Niagara Falls, N. Y. App. filed Aug. 2, 1917. Improvements.
- 1,263,711. BUZZER; Carl J. Schwarze, Adrian, Mich. App. filed Aug. 23, 1917. Electrically operated.
- 1,263,746. INSULATOR; William H. Creamer, Leoma, Tenn. App. filed July 20, 1917. For use in stringing light, telegraph and telephone wires.
- 1,263,783. ADJUSTABLE LAMP SUPPORT; Frank X. Maler, Sterling, Ill. App. filed Nov. 11, 1916. Improvements.
- 1,263,855. WINDING MACHINE; Wilbur T. Childs, Akron, Ohio. App. filed Jan. 2, 1915. Capable of rapidly winding a strip helically about an object.
- 1,263,877. WATERPROOF ENTRANCE FITTING FOR SERVICE CONDUITS; Edgar H. Freeman, Trenton, N. J. App. filed Nov. 6, 1916. Improvements.
- 1,263,902. SAFETY SIGNAL FOR VEHICLES; Karl Z. Kiefer, Newark, N. J. App. filed July 2, 1917. Improvements.
- 1,263,923. TIRE-WRAPPING MACHINE; Frank M. Pierce, Chicago, Ill. App. filed Oct. 3, 1914. For use on automobiles.
- 1,263,924. DOUBLE-WRAPPER WRAPPING MACHINE; Frank M. Pierce, Chicago, Ill. App. filed Nov. 26, 1915. Improvements.
- 1,263,927. COMBINED ELECTRIC STOVE AND TOASTER; Harold A. Rice, New York, N. Y. App. filed Sept. 22, 1915. Improvements.
- 1,263,941. CONTROL OF ELECTRICAL DISCHARGES FROM ELECTRICAL CONDUCTORS; Walter A. Schmidt, Los Angeles, Cal. App. filed July 17, 1911. Improvements.
- 1,263,959. ANODE; Henry R. Swartley, Jr., Manhasset, N. Y. App. filed Feb. 25, 1916. Improvements.
- 1,263,961. ATTACHMENT - PLUG FITTING; George B. Thomas, Bridgeport, Conn. App. filed April 20, 1916. Barrier element serves to convert the receptacle into a polarized fitting.
- 1,263,976. ELECTRICAL APPARATUS; Frank P. Whitaker, Rugby, England. App. filed Nov. 10, 1916. Alternating-current generators and induction regulators.
- 1,263,992. MULTISPEED ALTERNATING - CURRENT MOTOR; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Dec. 17, 1915. Induction motors.
- 1,264,021. ELECTRICAL SYSTEM OF DISTRIBUTION; Gorham Crosby, Glen Ridge, N. J. App. filed March 7, 1916. Improvements.
- 1,264,058. PROCESS AND APPARATUS FOR PRODUCING LINE WELDS; Henry Geisenhoner, Schenectady, N. Y. App. filed Sept. 29, 1916. Improvements.
- 1,264,086. IMPULSE STARTER; Albert G. Karkau, Cleveland, Ohio. App. filed

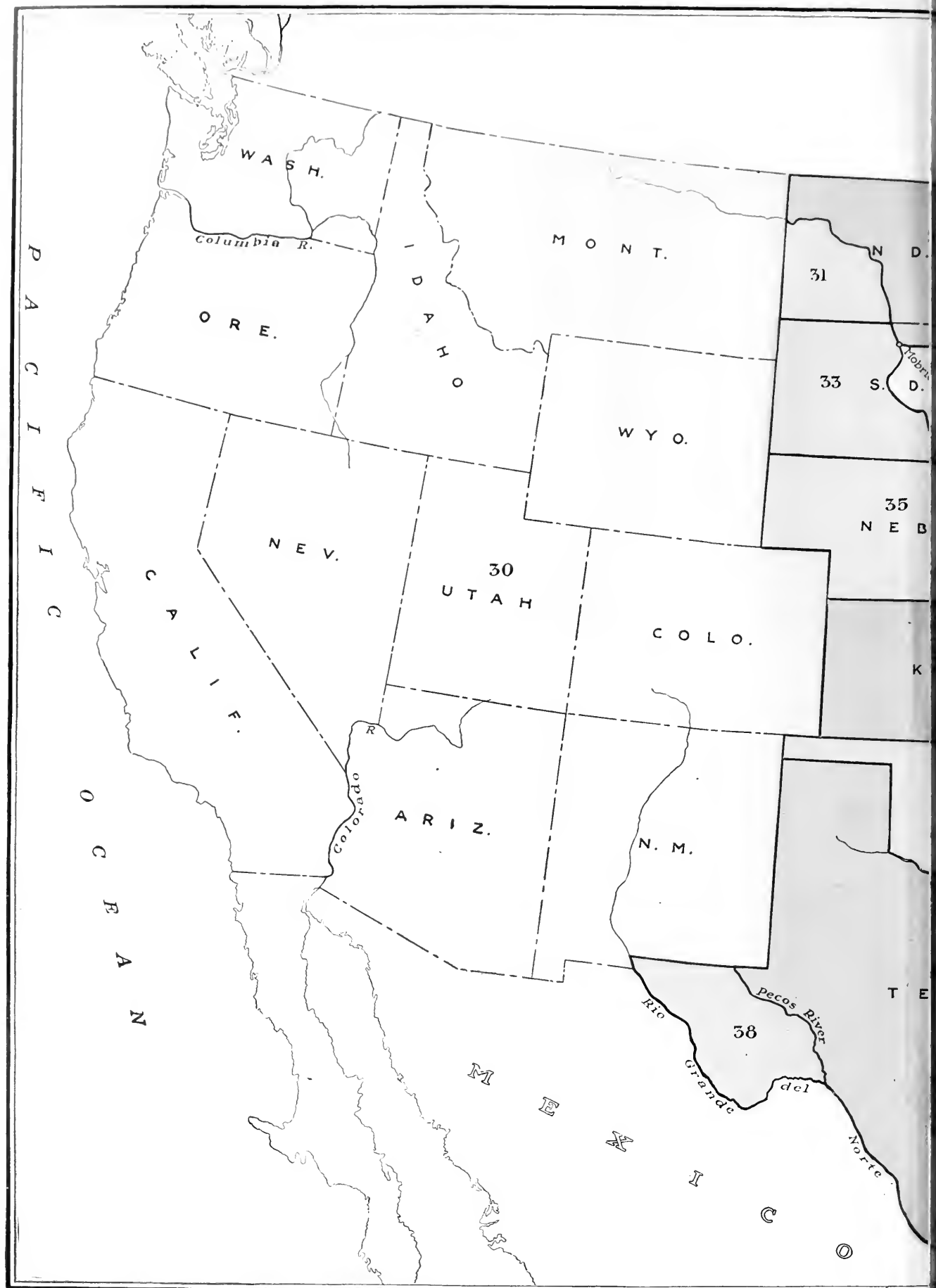


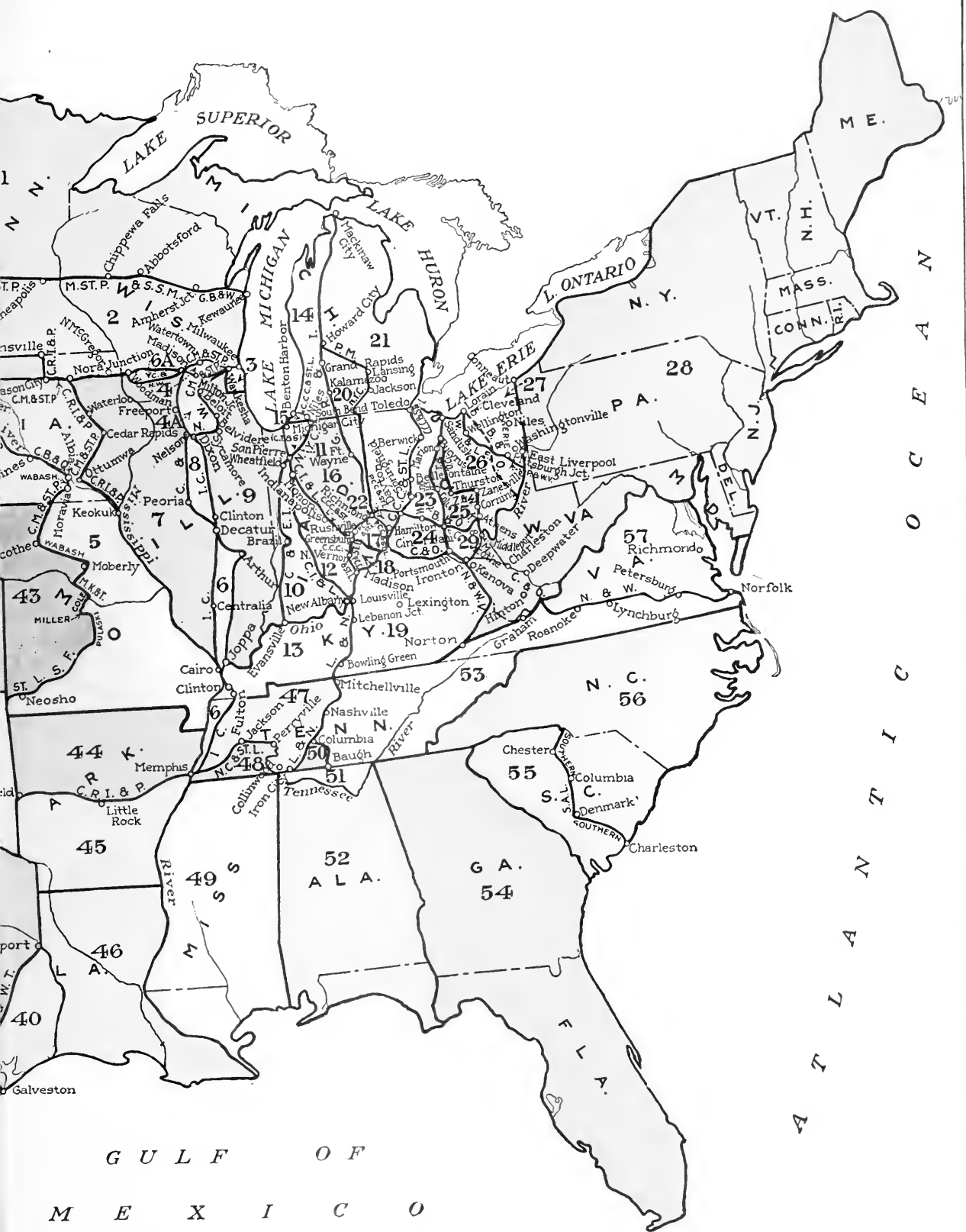
1,264,113—Condenser-Type Bushing

March 15, 1916. For use in connection with a magneto.

- 1,264,113. CONDENSER-TYPE BUSHING; Jesse E. Mateer, Wilkensburg, and Howard G. McDonald, Murraysville, Pa. App. filed June 8, 1917. Conducting layers terminate in superposed horizontal planes.
- 1,264,119. ELECTRIC HEATER FOR OIL WELLS; Charles A. Neal, Kansas City, Mo. App. filed Jan. 5, 1918. Improvements.







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Problems Involved in Interconnection

INCREASE in the size of transmission systems has been attended with a great amount of interconnection between auxiliary stations on the same initial system, between parts of a single network, and even between separate networks which have found it desirable to provide facilities for exchange of power. Speaking in broad terms, the practical working out of interconnections, involving the running of many scattered stations in parallel, has been solved very successfully. The length of the lines involved furnishes a sort of electrodynamic buffer which is very effective in preventing disturbing reactions between two stations. Important information on the results that are practically attainable is given in the current issue in the article by J. P. Jollyman, engineer of the Pacific Gas & Electric Company.

It appears that fairly long lines operating at voltages even 10 per cent apart can be interconnected without particular difficulty and that very little disturbance is created by additional lengths of line unless the charging current is exceptionally large. Sometimes in paralleling two lines of different total length at two common points trouble is caused by unequal distribution of load. The solution for this difficulty is to parallel the systems at one point only so that unequal distribution of load can be minimized.

Apparently the chief annoyance which has been found in practice is caused by connecting two fairly large systems with a long line having relatively small carrying capacity. In such instance the waterwheel governors may fail to work in harmony and establish a condition of hunting even up to the extent which will cause the systems to drop out of synchronism. With connections of large carrying capacity this is much less likely to occur. The same risk of going out of synchronism is encountered when energy is exchanged between two systems through a frequency changer, as now and then occurs. This case is somewhat similar to the hunting of synchronous converters, an occurrence that was unpleasantly familiar in the early days of their use.

Interconnection is the order of the day between great systems of the Pacific Coast. Some eight or ten interconnections with capacities up to 10,000 kw. are in daily use and excellent results are being obtained from every standpoint. A careful investigation was made last year of the situation. In a few instances it was found that considerable benefit could be realized by making additional interconnections. Other possible interconnections would have cost more than the bene-

fits would have warranted. The chief problem is to avoid conditions which will lead to hunting. These are now pretty well understood, and little serious trouble is to be expected from them.

The Large Joint Convention in California

THE Far West has consistently lived up to the policy that conventions in war time are even more necessary than before. This belief has led to extremely helpful meetings in which the paramount purpose has been the extension of "win the war" service. The joint convention held last week at Del Monte, Cal., was not only typical of this spirit but it was the more effective and made greater progress because of a similar meeting last year at Riverside. This year no preliminaries were necessary, and work was begun at once on a program in which "win the war" service was the underlying thought in every session. The trend toward consolidation of systems showed markedly in discussions in which representatives of the Railroad Commission, the Petroleum Administrator and others directly interested joined. Discussions showed how absolutely essential to the conduct of war industries the production of energy is.

It was also brought out that the producers of electrical energy are now wholly dependent upon government action. Government aid is being sought in financing further developments, the use of fuel will be subject to government refusal, priority orders must be secured for additional equipment, incomes can be maintained only if rate increases are permitted, and permission must be secured even now to refuse service beyond capacity. In short, war conditions are tending to make the government paternal in character. Labor alone, it was shown, is the one thing thus far uncontrolled, and some hold that it would be in much more stable condition were it too under government regulation.

Sessions of the jobbers' convention advanced the perfection of organization; central-station representatives discussed economies of various kinds and also means of meeting the increasing energy demands, while all joined with the dealers in furthering the co-operative commercial educational campaign that means so much to improved merchandising facilities. But, perhaps most important of all, the convention fostered more intimate acquaintance of the sort that begets confidence. Those in attendance carried away a generous portion of the enthusiasm so helpful in these times, the warm-hearted enthusiasm which seems so natural a feature of Western conventions.

Operation of the Fuel Zone System

WE PRESENT for our readers this week a map of the zone system established by the government authorities for bituminous coal, showing the districts into which the country is divided for the purposes of coal distribution, with suitable explanation of the available sources applying to these districts. Of course, our readers well understand the fundamental purpose of this specified distribution, to eliminate the unnecessarily long hauls which have characterized coal movements in the past. So long as there was no fuel shortage every one turned to some favorite sort of coal, whatever the length of the haul that brought it to him, unless the price was raised by transportation to an entirely prohibitive figure. Even so the favoring of long hauls in general increased the complexity of distribution until if one had marked out on a map the distribution lines from each source of coal the whole system would have reached amazing complexity. The general upsetting of ordinary conditions by the demands of the war rendered somewhat desperate measures necessary, and the zone system is the logical result.

We long ago passed out the general warning that the time was coming when the burning question would be not what kind of fuel but any kind of fuel, and that users of coal had better make up their minds to accustom themselves to that which could be obtained within comparatively easy reach. A great many experiments have been made in the utilization especially of low-grade fuels, and not a few large users have found it to their advantage that some easily available sources could be utilized quite irrespective of past custom. The present regulations will enforce more liberal views as to the possibilities of fuel, sometimes at considerable inconvenience to the individual user, but here as elsewhere those who have remembered that we are at war and have looked ahead toward some of the necessary results will find themselves in the best position to face the exigencies that arise as a result of the situation.

A Successful Change of Systems

THE brief account by M. C. Dean of the New York & Queens Electric Light & Power Company concerning the general change-over in that system ought to arouse interest. The situation to be met was a serious one. The distribution circuits had to be increased in rating something like 30 per cent. In one large district the current-carrying capacity of both feeders and regulators had been reached, and it was necessary to apply means for immediate relief. Of the three courses open—additional 2300-volt, two-phase feeders; high-tension feeders to relieve those operating at 2300 volts, and, finally, changing from a 2300-volt, two-phase, to a four-wire, three-phase system—the last mentioned was chosen. It was found that the necessary rating could be provided for less than half the expenditure required by other methods and that the feeders would have 50 per cent greater capacity as three-phase feeders than as two-phase feeders. Besides this, the line losses are reduced. The four-wire, three-phase system is one of

the most economical in the use of copper; wherever it has been used it has worked out admirably. The only reason that it has not been employed more extensively seems to be sheer timidity on the part of engineers.

The chief work that had to be done in making the change-over was in connection with the transformer banks serving power loads. Here old two-phase customers were allowed to remain, but new ones are furnished from the three-phase service. To permit this, one transformer from each power bank was replaced by two of half the rating, having 10 per cent taps giving the necessary phase relations. To simplify the changes this replacement was made in advance, leaving the two transformers simply in multiple, to be swung into the three-phase connection later. No change was made in the overhead circuits, which were already four-wire.

Since the change-over was made everything has been working smoothly, and as a result it has been unnecessary to install additional two-phase feeders. The line losses have been lessened by 200 kw., enough to pay full interest on the cost of the change-over, and the voltage regulation has been improved 100 per cent. Conversion of the rest of the company's distribution is likely to follow. The scheme is well worth the attention of other companies which find themselves short of feeder capacity.

Results from the Burning of Powdered Coal

THE coal crisis has driven engineers to extremities for a suitable supply of fuel. With the cost of liquid fuel rising rapidly, with wood at nearly prohibitive figures, and with the zone distribution ahead, compelling the use of fuel within easy reach, one is hard put to it for hope of economy. The conditions have caused reversion to several schemes which have been tried before with varying success. Briquetting has taken a new lease of life. Peat is coming again into notice, and the use of pulverized coal blown into the fire box by compressed air now seems to offer a fair chance for economical working. In the current issue A. E. MacInnis gives a very instructive account of some of the experiments with powdered coal made in the Northwest.

One of the most notable installations of this kind is in the plant of the Puget Sound Traction, Light & Power Company of Seattle, on which we commented last year. The final result of that preliminary work was so satisfactory that a new plant for an aggregate rating of 4100 boiler-hp. is now under construction. In the original test the powdered coal was prepared at a nearby briquetting plant where likewise pulverized coal is in use.

The advisable fineness of the finished product depends on the character of the coal. The higher the fixed carbon the further should pulverization be carried. With the local coal here employed it was ground until 85 per cent would pass through a 200-mesh machine and 95 per cent through a 100-mesh. This very finely ground fuel is fed to the boilers by compressed air. In some respects the burning of pulverized fuel is like that of some special coals in that large furnace space is necessary. In this instance a Dutch oven was built in front

of the boiler to give suitable combustion space. A large number of coals were tried. Some of them were fairly good, others particularly poor. All were, of course, thoroughly dried before pulverizing, some running very high in moisture in the raw state.

The net result showed that combustion of pulverized coal can be carried on at good efficiency even in the case of the low grade coals. The fire produced is easy to manage, smokeless and capable of being forced with great rapidity to carry peak loads.

In the new plant raw coal is to be delivered over street-railway tracks and dumped into a bunker which serves as a source of supply. Then it is crushed, dried, powdered coal being used for this purpose, and finally pulverized. From the grinding mills the coal goes over a system of conveyers to the steel bins over the front of the boilers. These have 15 tons capacity and feed the coal to the air blast. Slag pits are provided underneath the furnaces.

Besides this considerable plant for Seattle the Pacific Coast Coal Company is running at two of its own mines banks of boilers fired with pulverized coal, in each case aggregating more than 2000 boiler hp.

The general results thus far reached seem to indicate that under favorable conditions of fuel supply very excellent results can be obtained with powdered coal—good enough at least to encourage further work on a considerable scale. Certainly no subject is more vital to the central-station engineer, and the results which are reported in this case should serve to stimulate further research in other sections of the country.

Sudden Short Circuits of Alternators

WHEN an alternator is running steadily at synchronous speed it is well known that, in addition to its armature resistance, it possesses a certain reactance which is ordinarily considerably greater than the resistance. This apparent reactance is called its "synchronous reactance." It is much greater than would be accounted for by its self-inductance, owing to the effects of armature reaction. It is assumed in dealing with the subject that the changes in the electric circuit take place so slowly that the effects of armature reaction can fully develop. The synchronous reactance will then reveal itself. The synchronous impedance of the armatures will then likewise present itself as the vector sum of the resistance and synchronous reactance.

However, if the electric circuit of the running alternator be changed suddenly, the reactance presented

initially in the armature will be much less than the synchronous reactance and will approximate that due to the self-inductance of the armature alone. The initial impedance of the armature, being the vector sum of the resistance and initial reactance, will be much less than the synchronous impedance; so that the initial change of current in the circuit will be greater than that which the synchronous impedance would allow. After the lapse of a few seconds, the armature reaction has time to develop and to restore the armature impedance to its synchronous value. If, then, a sudden short circuit is applied to an alternator near its armature terminals, the initial short-circuit current tends to the value produced by the initial internal emf. divided by the initial vector impedance. This is commonly a much stronger current than flows after a few seconds, when the armature reaction has brought the reactance back to its synchronous value.

The characteristics referred to are unfortunately just the reverse of what a central-station manager would desire to see in force. He would like to have the initial armature reactance large, so that a sudden short circuit would come on gradually and give the time relays a chance to act before the mechanical stresses on the machine became excessive. On the other hand, he would prefer that the synchronous reactance should be small, so far as concerns the automatic regulation of terminal voltage in the machine under imposed changes of load.

With the facts as they are, a sudden short circuit tends to force an enormous initial current through the armature, with correspondingly enormous mechanical stresses in the machine. After a brief interval this current falls off to what may be called its synchronous value. In order to set a limit to the severity of the mechanical blow on the machine in the case of a short circuit just outside the power house, it has become common practice to install external reactors in the station. The fixed reactance of these devices takes the place of some of the lost synchronous reactance in the first stages of a sudden "short."

The belief is now generally accepted that the strength of the short-circuit current from an alternator falls off exponentially from the initial value to the synchronous value. It is not easy, however, to say how rapidly the descent will be made. In other words, the attenuation factors of the alternator field flux and of the armature current depend upon a variety of conditions, which are discussed in detail by N. S. Diamant this week in an extensive article upon the whole subject. In the case of large central-station alternators the matter is of great practical importance.

WAR has brought to every one in the electrical industry problems which are so different from those in the past that the only way they can be solved effectively is by the aid of a clearing house through which ideas can be exchanged freely. The ELECTRICAL WORLD recognizes its duty to serve as such a clearing house for the electrical industry and takes this opportunity to invite its readers to make use of it. Among problems which it sees the need of discussing particularly are the following: Shortage of materials, apparatus and labor and how to meet it, making existing equipment serve in-

The Coming Issues

creased loads, assuring reliability of service, increasing economy of operation, serving war industries, and guarding against fuel shortage next winter, either by assuring an ample supply of coal, adapting furnaces to low-grade coal or a substitute, or utilizing water power. In addition, all companies operating interconnected systems should give others the benefit of their experiences regarding the economies they have effected by interconnecting their plants. Articles in coming issues of the ELECTRICAL WORLD will cover a wide range of subjects along the lines mentioned above.

Operation of Interconnected Systems

Relative Importance of the Problems Which Are Encountered in This Connection—Swinging of Loads Must Be Considered in Connecting Systems, Especially in Those Cases Where Frequency Changers Are Used

BY J. P. JOLLYMAN

Engineer of Electrical Construction Pacific Gas & Electric Company

THE requirements of the times for more power and for the utmost utilization of all existing generating equipment have led to considerable extension of interconnected operation. In some cases the interconnecting lines may be long as compared with any other of the lines operated by either or both of the systems. Sometimes the capacity of the interconnecting line may be small relative to the capacity of the systems tied together. Occasionally the interconnection may be between systems of different frequency involving the use of frequency changers. Under any of these conditions or where a combination of them may be found new operating problems will arise. Some of the experiences in connection with one of the most extensive interconnected networks in this country may be of interest to those who are interested in rapidly expanding systems.

Unless the kva. required to charge the additional line seriously increases the load already carried by the generator or generators, no difficulty should be anticipated from making a considerable extension to an existing line. Even if the charging kva. is considerable, no harm can result

aside from that which may be caused by a sudden rise in voltage at the generator terminals when the line is charged.

As is quite generally understood, exact equality of voltage between systems is not necessary when synchronizing over a line of some length. In fact, no difficulty should be experienced with voltages 10 per cent apart or even more if the connecting line is quite long. The only result will be a small exchange of wattless current; the system with the higher voltage will supply some excitation to the other system.

In the development of an interconnected network cases sometimes arise where it becomes desirable to parallel two systems at two points and where the lines connecting these points are of quite different length. In such cases the shorter line or the line with the lowest impedance will naturally take on the most load. To keep both lines fully loaded it will therefore be

necessary to distribute the load between the lines and connect them in parallel at one point only. Paralleling of low-tension networks may be prevented by a difference in transformer connections in the parts to be connected, but this obstacle is not peculiar to interconnected operation.

One of the most troublesome situations which can be encountered in interconnecting two systems arises when each has considerable generating capacity and load of its own and the connecting line has considerable length and relatively small carrying capacity. If such a line is heavily loaded, there will be a decided tendency for the system to pull out of synchronism. This tendency arises from the nature of the speed control of transmission systems and may be explained as follows:

Consider two transmission systems A and B, each of which has generating facilities and a load of its own and which are interconnected by a line which transfers energy from system A to system B. Assume that a considerable load comes onto system B. The additional energy required will at first be drawn from the flywheels of all synchronously re-

volving apparatus, causing a reduction in speed. As the speed starts to decrease the governors will make the prime movers supply more energy to the generators and gradually bring their speeds back to normal. Momentarily, however, some of the energy required to carry the increased load on system B will be taken from the flywheels in system A and will flow over the interconnecting line. With increased load on the line an increased impedance voltage will be required between the two ends; hence there will be an increased difference in phase between systems A and B. The change in phase difference between two large systems may cause a swinging effect between the two systems which will overload the tie line and allow the systems to drop out of synchronism.

The action mentioned may be compared with that which would occur when two steam turbines each carrying a load of its own are coupled with a light shaft

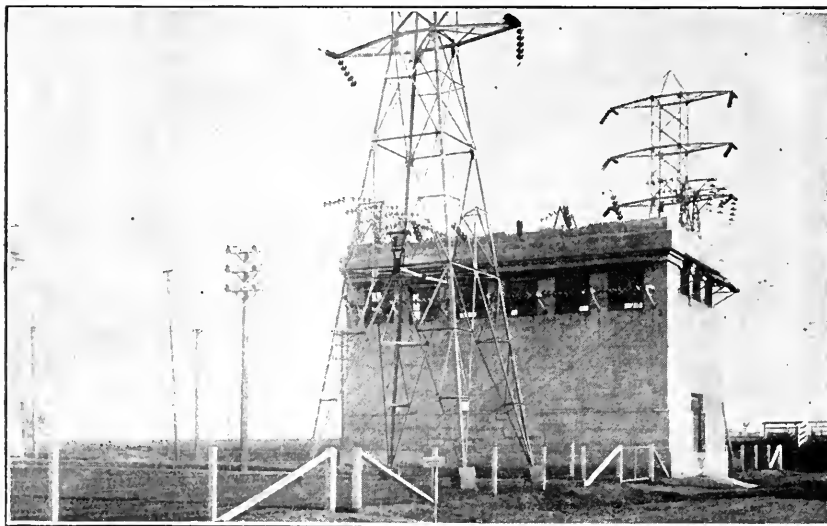


FIG. 1—SUBSTATION NEAR SACRAMENTO, CAL., WHICH SECTIONALIZES TRANSMISSION LINE OPERATING AT 100,000 VOLTS



the ultimate strength of which is much less than the rating of the turbines and a considerable load is thrown on one turbine. The energy required to carry the additional load must be drawn from the energy stored in the rotors of the turbines by a reduction of speed. The energy thus drawn from the first turbine must be transmitted over the light connecting shaft, which will thereby be subjected to torsional stresses that will cause a change in the angular position of the two turbines and may even cause the breaking of the shaft. Even if the shaft is not ruptured by the first load change, a torsional oscillation may be set up between the two turbines which will lead to a final rupture in the event of some load change coinciding with an oscillation.

Evidently the condition most likely to cause a "swing" will exist when energy is exchanged first in one direction and then in the other. The only remedy for this difficulty is to avoid overloading the interconnecting line, and especially to avoid establishing a condition that will cause rapid reversals in the flow of energy to take place. If the systems are large, the interconnect-

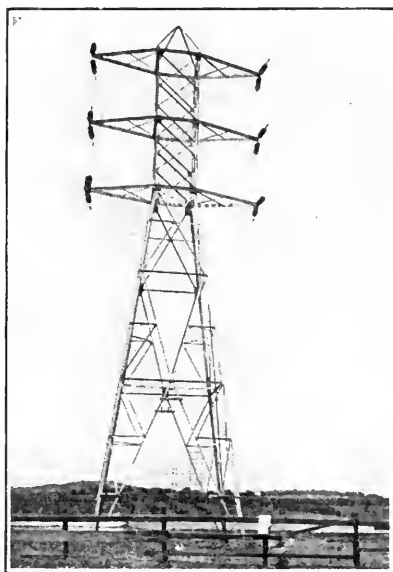


FIG. 3—TRANSMISSION LINE OF ONE OF THE PACIFIC COAST COMPANIES

ing line must have considerable carrying capacity over and above that required to carry the exchange power. This extra capacity must be sufficient to care for the rapid changes in load since the governors on the generators of the system on which a load increase has occurred may not act until after the governors of the other system have increased the supply of energy and thus supplied all the increased load over the interconnecting line.

An interconnection made through a frequency changer acts in a manner similar to a line of considerable length. From no load to full load the shaft of a synchronous motor will lag about 25 electrical degrees behind the phase of the impressed voltage. The same lag takes place between the shaft and the delivered voltage of the generator. In a fully loaded 25 60-cycle frequency changer the relative phase of the 60-cycle system will lag 85 deg. behind its phase for no load on the frequency changer. The difference in phase arises from the fact that the 25-deg. lag of the shaft of the frequency changer, due to full load on the

motor, is equal to 60 deg. lag on the 60-cycle generator. To this 60 deg. lag is added the 25-deg. lag of the generator under full load.

Swinging similar to that due to a long small tie line may thus take place between two systems interconnected with a frequency changer. The swinging will be greater in degree with the frequency changer than with the line. There is no way to overcome the difficulty due to the characteristics of a frequency changer unless the load transferred can be kept from fluctuating rapidly.

No difficulty need be anticipated from increased mileage of electrically connected network if the experience of the Western companies operating networks containing over 2000 miles (3218.6 km.) of high voltage circuits may be taken as a guide. In some cases these lines connect points over 400 miles (643.7 km.) apart.

Fuel Oil for State Electrical Plants

United States Consul William Dawson, Montevideo, Uruguay, writes that by a resolution the Uruguayan government has approved the action of the Administration General of State Electrical Plants in declaring that of the 7000 tons of fuel oil on hand in the deposits of the West India Oil Company 5000 tons be reserved for the state electrical plants and that the latter receive the preference in the distribution of cargoes arriving hereafter. The state electrical plants burn fuel oil which is supplied under contract by the West India Oil Company, and one of the clauses of the contract provides that if at any time the supply shall not suffice to meet all demands the state plants shall enjoy preferential treatment.

St. Louis Company Equipping Own Coal Mine

The management of the Union Electric Light & Power Company of St. Louis more than a year ago, appreciating the trend of conditions and anticipating the coal needs of the company, adopted a plan to guarantee as nearly as possible its future fuel requirements. This plan embraced the control and operation of a coal-producing property within a convenient distance of the generating station. In pursuance of it control had been acquired of 3143 acres (1271 hectares) of coal land in Jackson and Perry Counties, Ill., about 5 miles (8 km.) south of Du Quoin, 80 miles (128.7 km.) from St. Louis on the Illinois Central double-track line from St. Louis to New Orleans. On this track a mine is now being developed which will be equipped to screen and prepare 6000 tons of coal daily. Two seams of coal are available, one averaging 4 ft. to 5 ft. (1.2 m. to 1.5 m.) in thickness and the other ranging from 6 ft. to 14 ft. (1.8 m. to 4.2 m.), and the extractable tonnage is estimated at approximately 28,000,000 tons. If an annual production of 800,000 tons is maintained, this mine will last for nearly fifty years. All the coal will be removable through one shaft. The shaft and equipment are being completed as rapidly as possible and are of the most modern and efficient type obtainable. Underground the mine will be electrically equipped and thoroughly up to date in every respect. An adequate water supply is available.

SOUND-RANGE TELEPHONES ON THE FRONT IN FRANCE

Major-General Bell Describes Success of New System
for Ascertaining the Positions of Guns
of the Enemy

Major-General J. Franklin Bell, U. S. A., who has lately returned from an inspection trip on the front in France, where he viewed the British, French and American armies, has imparted to the Senate military committee the results of his observations, among which the Washington correspondent of the *ELECTRICAL WORLD* notes the success of the new sound-range telephone system for ascertaining the positions of enemy guns. The Germans captured one of the telephones and are now also using the system. General Bell says: "Probably the success of the sound-ranging system has been greater than that of any other scientific achievement in the war." General Bell said in part:

All armies now employ scientific methods of locating guns which have never been employed in warfare before. One is known as the sound-ranging method. Briefly, they have observers scattered along a curved line which has been accurately measured, and all of these observers, of whom there are usually six, utilize electrical sound-ranging apparatus by which they report instantaneously the moment they hear the sound of a gun explosion. At a central point another electrical apparatus records these sounds from the six different stations, and by a scientific method they combine the knowledge gained from these six points and succeed in locating with a remarkable degree of accuracy the position of the gun that made the explosion when it was fired.

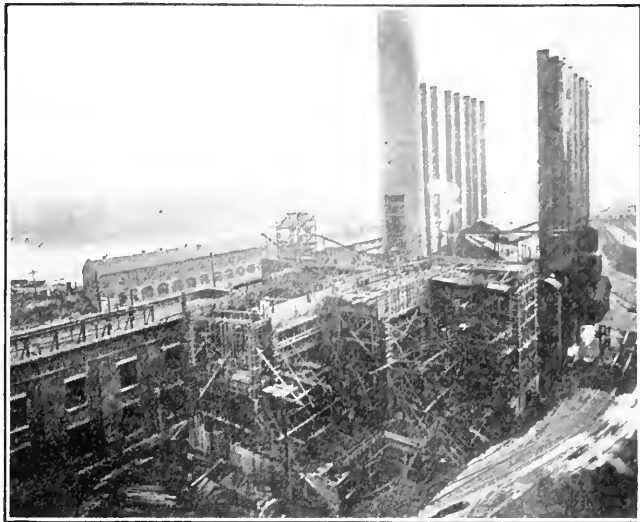
Each side has a type of telephone which is able to hear distinctly over very considerable distances conversations not intended for the listener, and for a long time the Allies employed this system of gaining information without the knowledge of the enemy; but the Germans captured one of these instruments and discovered that their conversations in the trenches had been listened to for quite a while and that the Allies had thus gained some information in a way which had long puzzled the Germans. New organizations had to be created in order to attend to the type of service which I have just been describing.

Transformers Mounted on Standing Timber



The construction shown herewith, while perhaps novel to distribution engineers in the thickly populated districts of the United States, is employed extensively in the Northwest lumber woods where central-station energy has to be supplied for camp needs.

Moline Plant of Tri-City Company



Since 1907 this station has hardly seen a day when some construction was not in progress. Arsenal and other government work in Rock Island, Davenport and Moline have grown to such an extent that a 200,000-kw. unit is now being installed.

FALLING OFF IN THE TOTAL OF ENGINEERING STUDENTS

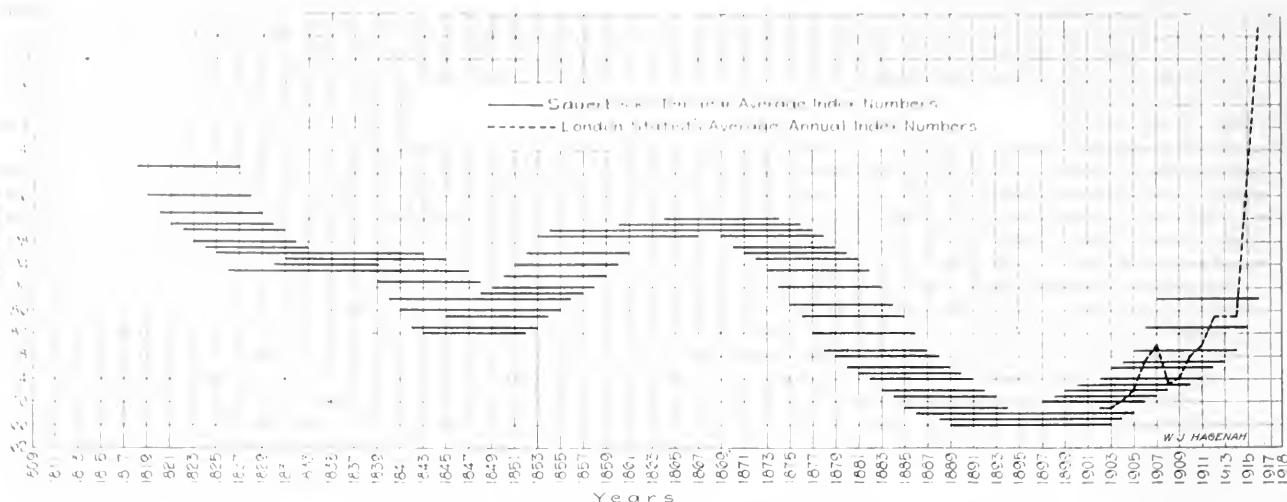
Letter of President Wilson Urging Importance of
Maintaining Engineering Studies — Attendance
Off 25 to 35 per Cent

A letter from President Wilson to Dean Mortimer E. Cooley of the College of Engineering of the University of Michigan, urging the importance of maintaining the number of engineering students, is receiving extended publicity.

The letter was written as a result of resolutions prepared by a committee consisting of Dean F. L. Bishop, University of Pittsburgh; Prof. C. R. Mann, Carnegie Foundation; Prof. A. E. Kennelly, Harvard University and Massachusetts Institute of Technology, and Dean Cooley, chairman. President Wilson expressed concern at the falling off in the number of engineering students because "it is not only immediately necessary that as many students as possible should prepare themselves for engineering duties in the army and navy, but it is also of the first consequence to the country that there should be an adequate supply of engineers for the period of reconstruction which must follow the war." Parents are urged to keep their sons in the schools.

Dean Cooley, in writing to the *ELECTRICAL WORLD*, says he believes that it is a fact that the attendance in engineering since this country entered the war has fallen off from 25 to 35 per cent. Hardly a day passes without calls from the army or navy for the more advanced students. Graduating classes this year, he expects, will not be more than half their usual size.

"The average age of engineering graduates," says Dean Cooley, "is nearly twenty-three years. Thus most of the juniors and seniors are eligible to the draft. Even our freshmen and sophomores, many of them, are keen to get into the war. The Engineer Enlisted Reserve Corps and the Naval Reserve Force, now that they have been established, will no doubt keep in college many who would otherwise go."



THE MOVEMENT IN COMMODITY PRICES IN ONE HUNDRED YEARS OF WAR AND PEACE

Commodity Prices and Public Utility Rates

Historical Precedents All Indicate that the Decline in Prices from Their Present High Level Will Be Very Slow Even After Cessation of War—Rate Increases Granted Only for Its Duration Will Be Inadequate

BY WILLIAM J. HAGENAH

Mr. Hagenah presented an extended discussion on this important subject before the Wisconsin Gas and Electrical Association at Milwaukee on March 27. These excerpts from his remarks emphasize the danger of failure to readjust electric rates.

WE ARE witnessing at the present time a most important development growing out of our disturbed economic and political conditions—one which is destined to have a most far-reaching effect on the operations of public utilities. Economists have for some time foreseen and predicted the condition which is now exerting such tremendous pressure on every form of activity, individual as well as corporate and public as well as private. There is hardly an individual or an enterprise that has not already felt this staggering force or is not destined to feel it in the near future, but among all forms of industry which are struggling to effect a readjustment none has suffered so acutely as have the public utilities. I refer to the steadily rising level of prices, to which such decided impetus has been given by our entry into the great European war.

For over fifteen years before the opening of the European war we witnessed in this country a gradually increasing price level. Coincident with this was our great industrial and commercial development.

The mine owner, the manufacturer, the farmer, the tradesman and the professional man met the rising level of prices by shifting the burden through increased charges for their product or his service, but not so with the utility. Its rates were fixed and could not be increased except by action of the proper public authority. So long, however, as the utility has not yet reached the reasonable limit of its technical development and while the territory which it served was still far from saturation, these increasing costs were largely offset by improvements in apparatus and methods. In fact, there are many instances where in spite of these conditions net earnings, because of especially favorable local con-

ditions, showed annual increases. Electric production units were each year becoming larger and more efficient. The art of distribution and transmission was making great strides. The investment per unit of capacity generally tended downward. At the same time the demand for utility service was growing, and what fifteen years ago was considered a luxury in a short time became a necessity. As long as this condition was present the economies growing out of increased efficiency and service development tended to offset the rise in labor and material prices, but when relatively high efficiency had been realized and the increases in the price level appeared to be gaining in momentum, the trend of net earnings in most instances turned definitely downward. With the reasonable limit of expansion reached, the crisis in the history of the utility industry approached. Between the pressure of increasing costs and the declining purchasing power of the dollar of income net earnings were threatened with extinction. This, in brief, was the condition of the utility industry when in 1914 the storm of the European war burst on the world—a war which each year has enveloped additional peoples and has gained in fury and destructiveness. And with the coming of this war the level of prices, which was already at the highest point reached in a generation, turned abruptly and violently upward, which tendency it has maintained to this time.

COMMODITY PRICES THAT GO BACK A HUNDRED YEARS

The diagram reproduced with this article shows Sauerbeck's ten-year average index prices for the years from 1817 to 1916, on which I have superimposed the annual index prices of the London *Statist* in order to show what has taken place beyond the period covered by the Sauerbeck data and what the extension of the Sauerbeck data for the next few years will reveal.

Just as the political history of the nineteenth century dates from the Congress of Vienna and the final

defeat of Napoleon, so the economic history of that century also begins with the conditions then broadly recorded. The year 1815 is one of those years in history which marks an epoch and the influences of which time extend for many decades. In the next few years we are likely to witness another such epoch-making date, when the world, bled white by war, will close a chapter of great social and economic forces in conflict, in the soil of which mighty political movements will have taken root.

Let me call attention to the fact that from the high-price level following the Napoleonic wars to the high level of the Civil War period was approximately fifty years. Also, following the low point reached in about 1846, it was again fifty years before the low level after the civil war was reached. Singularly, it is now just fifty years since the high level of prices in the Civil War period. In view of these events of the last century, covering two complete major economic cycles, in each case growing out of conditions similar to those with which the world is confronted at this time, can it be expected that following the declaration of peace in this war we shall see a quick decline in prices to the pre-war level or lower?

PREVAILING PROSPERITY IS LARGELY FALLACIOUS

In spite of prevailing conditions, we appear very prosperous at this time, but let us not be deceived. This is a war prosperity, and both England and Germany report the same kind of business activity. However, in view of what we know of conditions, it would be more correct to say that we are extremely busy rather than extremely prosperous, since we are not creating wealth. Our country, along with almost the entire world, is just now engaged under pressure of the greatest necessity in carrying on campaigns which are exhausting the man power and wealth of the world and from which all will emerge as peoples much poorer than before they entered. From this period of intense activity, of strained production and increasing consumption, we shall enter a period after the war when this destruction must be paid for by the hard labor and economies of the people. The reaction will be as great as was the action, but it will be extended over a much longer period of time. This does not mean that we shall at once have a serious depression. On the contrary, the necessity for urgent reconstruction and the accumulation of deferred work, together with the sentimental effect of the return of peace, will lead to considerable activity for a year or more after the close of the war; but the period of readjustment and of producing from the soil and other natural resources and by hard labor the wealth to pay for these struggles will cover many years, and during this time we shall undoubtedly experience a relatively high level of prices, but with a gradually declining tendency the world over.

Not only has our supply of gold been showing expanding tendencies, but our currency legislation for a number of years has operated to increase the supply of money and credits. Our currency laws, our Federal Reserve banking system, farm loan banks and the war credit machinery all operate strongly to encourage expansion which may even lead to inflation. These conditions will exert a powerful tendency to maintain prices at a high level and will offset many other influences which would otherwise operate for a decline. It

is even possible that the government will find it to the interest of the country at large to give stability to the price movement and to prevent any violent decline.

Based on the course of the price movement after periods of great world wars in the past and in view of the special conditions with respect to the currency and banking systems at the present time, we may look forward to a considerable period of high prices, a period of business readjustment and a period of new social legislation. What this means in its full significance to individuals, to business in general, and especially to public utilities, can be readily understood without attempt on my part either to generalize or to go into details.

However, reflect on what it will mean to business to be required to make extensions and to finance requirements on this level of prices while operating under a rate schedule determined five years ago if we should not return for fifteen or twenty years to the price level on which such rate schedule was based. What will it mean to business to have to purchase operating supplies on the price level of five years ago? The price level under which plants were built, under which franchise obligations were established and on which rate schedules were established may not again be reached in fifteen years or even longer. There are some who say that prices will decline quickly with the return of peace. Whether they will or not no one definitely knows, but when we stop to consider the extent and destructiveness of this world-wide war and remember the price movement after each of the other two great wars, it is not difficult to believe that many men in this room will not live to see the return to the price level of 1914.

As a result of this violent price movement which we are now witnessing the work of the utility commissions has not only been enormously increased but the character of their decisions reflects the really constructive purpose of such institutions. During the decade of commission activity extending from 1907 to 1917 the almost universal results of commission investigations were reductions in rates. For the larger part of this period the rise in prices was gradual but extremely moderate in comparison with the last two years; but these increases were in many instances offset by the increased efficiency in utility operations and the great extension in service. So elastic was the industry and so quick its response to reasonable rate reduction that these years, which represent an almost unbroken record of rate reductions, at the same time mark the golden years of utility growth—years during which public utilities reached a point of growth in size and stability comparing favorably with the greatest industries of history.

At the present time, however, the commissions, which were quick to take advantage for the public of every economy in operation or profit resulting from improvements, are now foremost in granting relief from the pressure of high prices. Nearly five hundred public utilities have received increases in rates or have been relieved from burdensome obligations by state utility commissions and by city councils within the last fifteen months, and among this number are companies operating in many of the large centers of population. If the present tendency among state commissions and city councils to permit increases in rates to offset rising costs continues, the year 1918 will witness a practical

cancellation of much of the work for rate reduction accomplished by these same authorities after many years of labor. It will also show that the original conception of a public utility commission as a continuing investigating body created to do justice to investor and public alike was correct, and that even in the midst of this great war, wherein every element of our national life is strained to the utmost, the desire for justice and fair play to all interests is still firmly grounded in the heart and mind of the great American public.

Standing out among the problems now before these commissions and growing out of the rapid increase in commodity prices are two facts which should be developed and properly presented to the regulatory authorities, the justice and necessity of which are apparent from a study of the price movement. These are, first, the necessity of departing from the use of the five-year and ten-year average prices as a basis for rate-making appraisals and, secondly, the necessity for a larger return on the fair value of the property.

Zone System for Bituminous Coal

Change in the Plan of Distribution Made by the Fuel Administration with the Intent of
Reducing the Burden on the Railroads, Facilitating Shipment of Fuel and
Keeping All Mines Working at Their Full Capacity

IN ORDER to reduce the burden on the railroads by the elimination of cross-hauling and the curtailment of railroad equipment in unnecessarily long hauls, the United States Fuel Administration in conjunction with the Director General of Railroads has devised a zone system for the control of bituminous-coal distribution for the year beginning April 1, 1918. Hereafter no cars or locomotives will be engaged in delivering coal to distant regions that can be served far more quickly from fields near by.

As shown by the map accompanying this article, the country is divided into a number of zones each of which will be supplied with coal from mines relatively near, thereby preventing abnormal and wasteful transportation movements and insuring more equal distribution of cars to the mines and more steady employment of mine labor. For example, Pocahontas coal will no longer find its way to Chicago and other Illinois points, but these latter will be compelled to substitute coal which can be obtained from Illinois mines with half as long a haul. Obviously, where the fuels possess different characteristics changes in boiler settings and methods of firing may have to be made. It is the hope of the Fuel Administrator, however, that unavoidable inconveniences will be borne gladly in view of the fact that the readjustment of the distribution of coal is made for the welfare of the nation.

The zone system does not affect bituminous coal for railroads, bituminous coal for movement on inland waterways or coal delivered to Canada. Moreover, there are certain exceptions to the conditions imposed. Where certain industries require coal of particular quality or characteristics, if that coal is not obtainable from the district in which the plant is situated, permits will be granted to bring in the fuel from other districts.

The zones are clearly indicated on the accompanying map and are marked with a key number. Definite boundaries are fixed for the zones such as state lines or railroad lines. A complete list of all the zones shown in the map is given in the key, which also enumerates the districts from which coal may be obtained. If, for instance, a consumer wishes to ascertain what coals are available for his use, he locates on the map the zone in which his plant is situated and notes its number. Under that zone number in the "Key

to Consuming Zones" is given the list of producing districts from which coal can be had. A wall map of large size showing the same zoning in fuller detail may be obtained from the Coal Zone Map Company, Glen Echo, Md.

KEY TO CONSUMING ZONES

Zone Number	Restricted to Coals Indicated
1	North Dakota, South Dakota, docks.
2	Illinois (summer only), docks, North Dakota, South Dakota, Iowa, (to points in Iowa only).
3	Illinois, Kentucky (Western), Indiana, docks.
4	Illinois, Kentucky (Western), docks.
4A	Illinois, docks.
5	Iowa, Kansas, Illinois, Missouri, Oklahoma, Arkansas.
6	Illinois, Kentucky (Western).
6A	Illinois, Kentucky (Western), docks.
7	Illinois, Iowa (to points in Iowa only).
8	Illinois, Indiana.
9	Illinois, Indiana, Kentucky (Western).
10	Indiana, Illinois (Danville district on Wabash Ry. only), Kentucky (Western, to Jeffersonville and New Albany only).
11	Virginia (L. & N. R. R.), Tennessee (M. R. R.), West Virginia (Southern), Illinois, Indiana, Kentucky (Eastern and Western).
12	Indiana, Illinois (Danville district on Wabash Ry. only).
13	Kentucky (Western).
14	Indiana, Kentucky (Eastern), West Virginia (Northern and Southern), Virginia (L. & N.), Tennessee (M. R. R.), Michigan, Ohio (on G. R. & I. Ry. only).
15	Illinois, Indiana, Kentucky (Eastern and Western), West Virginia (Northern and Southern), Virginia (L. & N.), Tennessee (M. R. R.), Michigan.
16	Indiana, Illinois (Danville district on Wabash Ry. only), Kentucky (Eastern), West Virginia (Southern).
17	Virginia (L. & N. R. R.), Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Southern).
18	Virginia (L. & N. R. R.), Kentucky (Southern), Tennessee (M. R. R.).
19	Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Southern, also Eastern, to points on C. & O. Ry. from Catlettsburg, Ky., to Cincinnati, Ohio).
20	Virginia (L. & N. R. R.), Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Northern and Southern), Indiana, Illinois (Danville district on Wabash Ry. to points in Indiana only), Ohio, Michigan.
21	Virginia (L. & N. R. R.), Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Northern and Southern), Ohio, Michigan.
22	Virginia (L. & N. R. R.), Kentucky (Eastern), Tennessee (M. R. R.), West Virginia (Southern), Ohio.

KEY TO CONSUMING ZONES (Continued)

Zone Number	Restricted to Ccals Indicated
23	Kentucky (Northeastern), West Virginia (Northern and Southern, also Eastern, along main lines of C. & O. Ry. and N. & W. Ry. to Columbus and Cincinnati, Ohio), Ohio.
24	Kentucky (Northeastern), West Virginia (Southern, also Eastern, along main lines of C. & O. Ry. and N. & W. Ry. to Columbus and Cincinnati, Ohio), Ohio.
25	West Virginia (Northern, also Eastern, along main lines of C. & O. Ry. and N. & W. Ry. to Columbus and Cincinnati, Ohio), Ohio.
26	Ohio.
27	Pennsylvania, Ohio.
28	No change contemplated in this plant except that low-volatile coal in the Pocahontas, Tug River and New River districts on the N. & W. R. R. and the C. & O. Ry. and the Virginian Ry., and Clinch Valley districts in Tazewell and eastern Russell Counties along the N. & W. R. R., also high-volatile east of Charleston, W. Va., on C. & O. Ry. and east of Iaeger, W. Va., on N. & W. R. R., will be restricted to the District of Columbia (except C. & O. Ry.), Virginia (including tide-water terminals), also points in West Virginia on the direct line of the C. & O. Ry. and N. & W. R. R. east and west bound and Virginia Ry. east bound.
29	Ohio, West Virginia (Northern, also Eastern, to points on the direct lines of the C. & O. Ry. and N. & W. Ry.).
30	No change.
31	North Dakota, Wyoming, Montana and other fields east of the Rocky Mountains, docks.
32	North Dakota, South Dakota, Wyoming, Montana, docks.
33	South Dakota, Wyoming, Montana and other fields east of the Rocky Mountains, North Dakota, docks.
34	North Dakota, South Dakota, Wyoming, Montana, Illinois (summer), docks.
35	Iowa, Kansas, Missouri, Arkansas, Oklahoma, Colorado and other fields east of the Rocky Mountains, Wyoming.
36	Kansas, Missouri, Iowa, Arkansas, Oklahoma, Colorado (Southern).
37	Oklahoma, Missouri, Arkansas, Kansas, Colorado, New Mexico, Texas.
38	New Mexico, Colorado, Texas.
39	Colorado, New Mexico, Arkansas, Oklahoma, Texas.
40	Kentucky (Western), Alabama, Texas.
41	Arkansas, Illinois (summer), Iowa, Kansas, Missouri, Oklahoma, docks.
42	Arkansas, Iowa, Kansas, Missouri, Oklahoma.
43	Iowa, Arkansas, Kansas, Missouri, Oklahoma.
44	Arkansas, Illinois, Kansas, Missouri, Oklahoma, Texas.
45	Alabama, Arkansas, Illinois (only on lines of St. L. S. W. Ry. and St. L., I. M. & S. Ry.), Kansas, Missouri, Oklahoma, Kentucky (Western), Texas.
46	Alabama, Arkansas, Illinois (only on lines of St. L. S. W. Ry. and St. L., I. M. & S. Ry.), Kentucky (Western), Texas.
47	Kentucky (Western).
48	Alabama.
49	Alabama, Kentucky (Western).
50	Kentucky (Southern), Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Kentucky (Western), Tennessee, Georgia.
51	Alabama, Kentucky (Southern), Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Tennessee, Georgia.
52	Alabama.
53	Kentucky (Southern, also Western, to points on N., C. & St. L. and T. C. R. R., Nashville to Old Hickory and Hermitage, Tenn., inclusive), Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise, and western Russell Counties of Virginia, also Clinch Valley district in eastern Russell and Tazewell Counties), West Virginia (Eastern, also Southern, on C. & O. Ry. east of Charleston and N. & W. Ry. east of Iaeger, W. Va.), Georgia, Tennessee.
54	Kentucky (Southern), Tennessee, Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Alabama, Georgia.
55	Kentucky (Southern), Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Tennessee, Georgia, West Virginia (Eastern).
56	Kentucky (Southern), Tennessee, Virginia (all Black Mountain and Stonega Districts in Lee, Dickenson, Wise and western Russell Counties of Virginia, and Clinch Valley districts in Tazewell and eastern Russell Counties along the N. & W. Ry.), West Virginia (Eastern, on C. & O. Ry. and N. & W. Ry. and Virginian Ry.).
57	No change contemplated. Coal to be supplied generally from low-volatile fields.

EXPLANATION OF TERMS USED

Summer.....	From April 1 to and including Sept. 30.
Winter.....	From Oct. 1 to and including March 31.
KENTUCKY	
Eastern.....	All mines in eastern Kentucky on Sou. Ry. (Q. & C.), L. & N., C. & O., N. & W. and L. F.
Northeastern.....	Sandy Valley & Elkhorn Ry., L. F., C. & O. and N. & W. in Thacker, Big Sandy and Elkhorn districts.
Northern.....	L. & N. in Hazard and Elkhorn districts.
Southern.....	Sou. Ry. (Q. & C.) and L. & N. in Harlan, Jellico and Southern Appalachian districts.
Western.....	L. & N. and I. C. west of Louisville, Ky.
WEST VIRGINIA	
Eastern.....	C. & O. and N. & W. in low-volatile fields of Pocahontas, Tug River and New River districts.
Northern.....	K. & M., K. & W. V. and C. & C. west of Dundon.
Southern.....	C. & O. and N. & W. in Kanawha, Kenova and Thacker districts.

KEY TO PRODUCING DISTRICTS

Location of District	Numbers of Consuming Zone to Which Restricted
Alabama.....	40, 45, 46, 48, 49, 51, 52, 54.
Arkansas.....	5, 35, 36, 37, 39, 41, 42, 43, 44, 45, 46.
California.....	30.
Colorado.....	30, 31, 33, 35, 36, 37, 38, 39.
Docks ¹	1, 2, 3, 4, 4A, 6A, 31, 32, 33, 34, 41.
Georgia.....	50, 51, 53, 54, 55.
Illinois (summer).....	2, 34, 41.
Illinois.....	3, 4, 4A, 5, 6, 6A, 7, 8, 9, 10 ² , 11, 12 ³ , 15, 16 ⁴ , 20 ⁴ , 44, 45 ⁴ , 46 ⁴ .
Indiana.....	3, 8, 9, 10, 11, 12, 14, 15, 16, 20.
Iowa.....	24, 5, 7 ⁴ , 35, 36, 41, 42, 43.
Kansas.....	5, 35, 36, 37, 41, 42, 43, 44, 45.
Kentucky:	
Eastern.....	11, 14, 15, 16, 17, 19, 20, 21, 22.
Northeastern.....	23, 24.
Southern.....	18, 50, 51, 53, 54, 55, 56.
Western.....	3, 4, 6, 6A, 9, 10, 11, 13, 15, 40, 45, 46, 47, 49, 50, 53 ⁴ .
Maryland.....	57.
Michigan.....	14, 15, 20, 21.
Missouri.....	5, 35, 36, 37, 41, 42, 43, 44, 45.
Montana.....	30, 31, 32, 33, 34, 35.
New Mexico.....	30, 35, 37, 38, 39.
North Dakota.....	1, 2, 31, 32, 33, 34.
Ohio.....	14 ⁶ , 20, 21, 22, 23, 24, 25, 26, 27, 28 ⁷ , 29.
Oklahoma.....	5, 35, 36, 37, 39, 41, 42, 43, 44, 45.
Oregon.....	30.
Pennsylvania.....	27, 28, 57.
South Dakota.....	1, 2, 32, 33, 34.
Tennessee (M. R. R.).....	11, 14, 15, 17, 18, 19, 20, 21, 22.
Tennessee.....	50, 51, 53, 54, 55, 56.
Texas.....	37, 38, 39, 40, 44, 45, 46.
Utah.....	30, 31, 33, 35, 36.
Virginia (L. & N.).....	11, 14, 15, 17, 18, 20, 21, 22.
Virginia ⁸	50, 51, 53, 54, 55, 56.
Virginia ⁹	53, 56.
West Virginia:	
Eastern.....	19, 23 ¹⁰ , 24 ¹⁰ , 25 ¹⁰ , 29 ¹⁰ , 53, 55, 56.
Northern.....	14, 15, 20, 21, 23, 25, 29.
Southern.....	11, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 53.
Wyoming.....	30, 31, 32, 33, 34, 35.

¹South bank Lake Superior and west bank Lake Michigan.
²From Danville district on Wabash Ry. only.
³Only on lines of St. L., I. M. & S. and St. L. S. W. Rys.
⁴To points in Iowa only.
⁵To points on N., C. & St. L. and T. C., Nashville to Hermitage and Old Hickory, Tenn., inclusive.
⁶On G. R. & I. only.
⁷From mines in Columbiana County, Ohio, only.
⁸All Black Mountain and Stonega districts in Lee, Wise, Dickenson and western Russell Counties.
⁹Clinch Valley districts in Tazewell and eastern Russell Counties.
¹⁰Along lines of C. & O. and N. & W. to Cincinnati and Columbus, Ohio.

Sudden Short Circuits of Alternators

Thorough and Critical Exposition of Electromagnetic Phenomena Attending Sudden Short Circuits of Alternators in the Light of Recent Experimental Results—
Practical Methods of Calculating Characteristics

BY N. S. DIAMANT, RICE INSTITUTE, HOUSTON, TEX.

IN THIS article it is proposed to give a thorough, complete and the simplest possible exposition of the electromagnetic actions which take place when an alternator, or a system connected to it, is suddenly short-circuited. At the outset the author does not hesitate to state that the article is non-mathematical. However, it must be conceded that in engineering the most useful and practical knowledge is the quantitative knowledge; thus an attempt will be made to serve the

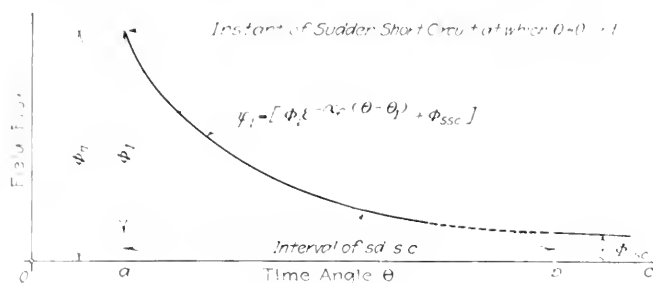


FIG. 1—ATTENUATION OF FIELD FLUX

majority who may desire only qualitative information without neglecting the minority who can use only quantitative knowledge.

It is apparently the opinion of some engineers that "an exact solution of the problem seems quite impossible," or that "it is well nigh impossible to estimate with a reasonable degree of accuracy the rate of decay of the current."¹ However, the writer is inclined to believe that with a thorough and clear understanding of the electromagnetic phenomena involved in the sudden short-circuit² of alternators, and through the proper interpretation and check of the theories proposed, it will be possible to solve and answer many practical problems and questions.

ANALYSIS OF THE ELECTROMAGNETIC PHENOMENA

To establish a concrete basis from which to work consider an n -phase, non-salient pole alternator operating light at full speed and normal excitation. Before the occurrence of a sudden short circuit the field mmf., acting alone, produces a certain flux $\Phi_{normal} = \Phi_n$ which links with the armature. If the machine is suddenly short-circuited, there is a great rush of current which sets up enormous stresses varying as the square of the current. This is followed (in about one or two to seven seconds in case of turbo-alternators without and with external reactors) by the "steady" condition of sustained short circuit,³ in which the strong demagnetizing armature currents combine with the field mmf. to produce the resultant flux, $\Phi_{ssc} = \Phi_{sustained\ sh\ circ}$. It is well known that Φ_{ssc} is a small fraction of Φ_n ; thus the flux in the machine, somehow or other, dies

down from Φ_n to Φ_{ssc} . E. J. Berg, to whom this theory is due, assumes that the flux decays according to the attenuation factor of the field in the manner indicated in Fig. 1.

Under sustained short-circuit or normal operation the armature conductors cutting the constant fluxes Φ_{ssc} and Φ_n produce an alternating emf., say sinusoidal in shape as indicated in Figs. 2a and 2b, where the maximum values E_{ssc} and E_i are proportional to Φ_{ssc} and Φ_n respectively. The transient or decaying flux which lasts during the interval ab (Fig. 1) produces an emf. as illustrated in Fig. 2c, where E_i is proportional to $(\Phi_n - \Phi_{ssc})$, and the rate of decay is assumed to depend upon α_f , the attenuation factor of the field.

Knowing the quantitative expressions for the emf. acting under sudden short circuit and the sustained short circuit, it is a simple matter to find the current due to them. According to Kirchhoff's second law, the sum of the emfs. e_i and e_{ssc} (see Fig. 2, page 1029) is equal at every instant to the sum of the armature resistance and reactance drops. The equivalent mathematical expression which involves r_a and x_a , the armature resistance and reactance per phase, and also z_a and α_f reduces to

$$i_a = I_{ssc} \left[\left(k \frac{X}{Z} \right) e^{-\alpha_f(\theta - \theta_1)} \sin(\theta - \beta) + \sin(\theta - \beta_1) \right] - e^{-\alpha_a(\theta - \theta_1)} \times \left\{ k \frac{X}{Z} \cdot \sin(\theta_1 - \beta) + \sin(\theta_1 - \beta_1) \right\} \quad (1)$$

Where I_{ssc} = the ssc, armature current = (E_{ssc}/z_a) ; $(E_i/z_a) = (kE_{ssc}/x_a)$; or $E_i = kE_{ssc}$; $z_a = \sqrt{r_a^2 + x_a^2}$ = armature impedance; $\alpha_a = (r_a/x_a)$ = armature attenuation factor; $R/X = (\alpha_a - \alpha_f)$. $Z = \sqrt{R^2 + X^2}$; $\beta = \tan^{-1}(X/R)$; $\beta_1 = \tan^{-1}(x_a/r_a)$. Equation (1) may be simplified by assuming $\beta = \beta_1 = 90$ deg.⁴ Until it is known exactly what these quantities stand for and what the assumptions involved are, however, mathematics will only shield ignorance. Considering the complexity of the subject, however, it will be best, before taking up its physical interpretation, to look at the problem from another viewpoint based on the excellent work of P. Boucherot.⁵

THREE-PHASE SUDDEN SHORT CIRCUITS

Consider one of the phases of a three-phase alternator and suppose that phase No. 1 is at the position indicated in Fig. 3, when the three phases are suddenly and simultaneously short-circuited. Assuming a sinu-

¹See, for example, *Transactions A. I. E. E.*, Vol. 34, 1915, p. 2275; also the *Electrician*, London, August, 1906, p. 765, etc.

²Where referred to by symbols it is indicated by s.d. s.c.

³Where referred to by symbols it is indicated by ssc.

⁴See Berg's "First Course in Electrical Engineering," p. 301.

⁵*Transactions International Electrical Congress*, 1911, Turin, Italy; also, *Bulletin Société Internationale des Electriciens*, Paris, December, 1911.

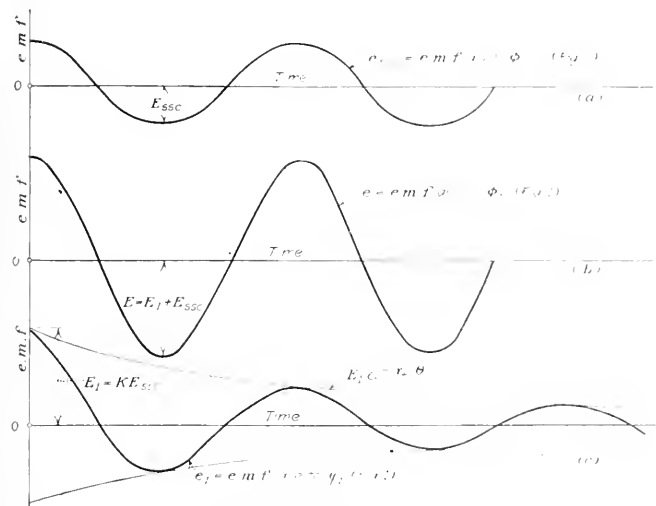
soidal flux distribution, the flux inclosed by phase No. 1 at the instant of the short circuit will be:

$$N_a \Phi_a \sin \omega t_1 = N_a \Phi_a \sin \theta_1$$

where $N_a \Phi_a$ = maximum flux inclosed by the N_a turns of any given phase. The flux inclosed by phase No. 2 at the instant of the sudden short circuit will be $N_a \Phi_a \sin(\theta_1 + 2\pi/3)$, and similarly for the third phase.

As is well known, the flux inclosed by any given phase under sustained short circuit is a very small fraction of $N_a \Phi_a$. Therefore, if it is assumed* that the sustained short-circuit armature reaction (a) is wholly demagnetizing (b) and sinusoidally distributed like the field flux, and that (c) the armature resistance drop is negligible compared to the reactance drop; then a little consideration will show that the armature flux under sustained short circuit will be zero. Thus the flux linking with phase No. 1 is $N_a \Phi_a \sin \theta_1$, at the instant of the sudden short circuit when $t = t_1$; it is reduced to zero at the end of the short circuit when $t = \infty$, and it is $(N_a \Phi_a \sin \omega t) e^{-\alpha_a(t-t_1)}$ at any time t during the interval of sudden short circuit, α_a being the attenuation factor of the armature. Under normal or transient conditions the flux linking phase No. 1 is equal at every instant to the mutually inductive flux coming from the field plus the self-inductive flux of phase No. 1 itself. The corresponding condition holds true for the other phases.

The field flux, which is $N_f \Phi_f$ under normal conditions, dies down to Φ_{fssc} at the end of the sudden short circuit or at the beginning of the sustained short cir-



FIGS. 2a, 2b AND 2c—EMFS. PRODUCED BY CONDUCTORS CUTTING Φ_{ssc} , Φ_n AND $(\Phi_n - \Phi_{ssc})$

cuit; at any time after the sudden short circuit it is equal to

$$\Phi_f = \Phi_{fssc} + (\Phi_f - \Phi_{fssc}) e^{-\alpha_f(t-t_1)}$$

where α_f is the attenuation factor of the field. Under normal or transient conditions this flux is equal at every instant to the mutually inductive flux coming from the three phases plus the self-inductive flux of the field itself.

Having the fundamental sudden short-circuit equations, the next step is to solve them for the field and

armature currents. The procedure followed by Boucherot (see footnote 5) is rather long and involves some almost "formidable mathematics." He obtains approximate theoretical expressions (Table I) for the damping factors α_f and α_a in terms of L_a , λ_a , L_f and λ_f (L is self-inductance and λ leakage inductance), for single-phase and two-phase short circuits, when the machine is equipped with perfect or ideal amortisseur windings and when it is not. Substituting in these the experimental values of L_a , λ_a , L_f and λ_f given in Table II, columns 4 and 5 are obtained. From these it is seen that the theoretical effect of amortisseur windings is to increase the damping factor of the armature about 33 per cent and that of the field about 16 per cent. This, of course, is very beneficial, especially from the point of view of the circuit-opening devices.

Interesting as these results may be, it seems to the writer that it is well at present not to rely too much on these theoretical or ideal results. This attitude seems justifiable in the light of some extensive sudden-short-circuit tests made several years ago by C. M. Davis⁷, which indicate that the "amortisseur winding has little or no influence." However, it may be added here that the experience of some operating companies seems to be contrary to this.

If instead of getting α_f and α_a mathematically, they are obtained experimentally by means of the rise of direct current⁸ in the armature and field respectively or by some other method⁹, expressions can be readily obtained for the transient armature and field currents. The sudden-short-circuit field current of a three-phase alternator is given by

$$i_f = I_f [1 + D e^{-\alpha_f(\theta - \theta_1)} - D e^{-\alpha_a(\theta - \theta_1)} \cos(\theta - \theta_1)] \quad (2)$$

where I_f = permanent field current, i_f = transient field current, $\theta = \omega t$, $D = (L_f - \lambda_f) / \lambda_f$, $\lambda_f = (L_a - \lambda_a) / \lambda_a$; α_a and α_f are the attenuation factors of the armature and the field. The armature current for phase No. 1 is:

$$i_a = I_{ssc} \left[(\cos \theta_1) \left(1 + \frac{D}{2} \right) e^{-\alpha_a(\theta - \theta_1)} - \cos \theta - \left(D \cos \theta \right) e^{-\alpha_f(\theta - \theta_1)} + \frac{D}{2} \left(\cos(2\theta - \theta_1) \right) e^{-\alpha_a(\theta - \theta_1)} \right] \quad (3)$$

and the currents i_2 and i_3 for the other phases are similar except that instead of $(\theta$ and $\theta_1)$ the expressions $(\theta - 2\pi/3)$, $(\theta_1 - 2\pi/3)$, $(\theta - 4\pi/3)$ and $(\theta_1 - 4\pi/3)$ are used respectively.

CRITICAL ANALYSIS OF THE EQUATIONS

In framing the theory of sudden short circuit and deriving quantitative expressions for the field and armature currents certain assumptions have been made or, strictly speaking, an ideal alternator has been considered having sinusoidal flux distributions, constant resistances, reactances, etc. However, all these equations and definitions of r_a , λ_a , α_a , etc., apply to ordinary commercial machines, in so far as they approximate the ideal machine for which all the theories in general are made. Thus it should be clear that the resistances r_a and r_a are not the ohmic or direct-current resistances

* (a) assumes the angle $\psi = 90$ deg. Assumptions (a) and (c) are ordinarily quite permissible, but the second assumption as to the distribution of armature reaction is very far from being true according to extensive investigations some of the results of which will be presented shortly before the A. I. E. E. Still, (b) may be taken as a permissible assumption, as far as theory is concerned, in order to simplify matters.

⁷General Electric Review, August, 1914, p. 816.

⁸See Transactions A. I. E. E., Vol. 31, 1915, p. 2211, Section II.

⁹See Transactions A. I. E. E., Vol. 31, p. 2260, and p. 2266, Sections IV and VII. See also second installment of this article.

of the field and armature conductors, but they are the alternating-current resistances corresponding to the actual non-uniform flux distribution under short-circuit conditions. Furthermore, it may be easily seen that the different quantities r , L , λ , etc., are and have to be assumed as constant, though actually they are neither constant nor is the law according to which they

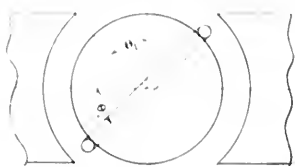


FIG. 3—CONDITION ASSUMED FOR DISCUSSION STARTED AT BOTTOM OF PAGE 1028

vary usually known. It is fortunate, however, that, as experience indicates, satisfactory results can be obtained by using certain average values or by introducing certain empirical or semi-empirical factors.¹⁰

The extent to which the preceding theory can be applied to actual machines may be answered qualitatively as follows: Consider, for example, the damping factor of the field, $\alpha_f = r_f/x_f$; here r_f is not the direct-current resistance of the field spools but it includes any eddy-current or energy-consuming effects which help to damp out the field transients. Furthermore, as just stated, the reactances and even the resistances involved in (2), (3), etc., do not remain invariable during the short circuit. In fact, the writer has noticed that the damping factors are considerably and consistently¹¹ larger during the first cycle or so of the sudden short circuit than toward the end of it. This is especially true of α_f , which has high values at first and then remains constant for the rest of the sudden short circuit. For example,¹² in case of a 700-kva., 4000-volt, 60-cycle machine the following values were obtained from a sudden-short-circuit oscillogram:

$$\begin{aligned} \epsilon^{2\pi\alpha_f} &= 1.127, \text{ or } \alpha_f = 0.019 \text{ for first two cycles.} \\ \epsilon^{2\pi\alpha_f} &= 1.039, \text{ or } \alpha_f = 0.0061 \text{ for succeeding five cycles.} \\ \epsilon^{2\pi\alpha_f} &= 1.065, \text{ or } \alpha_f = 0.10 \text{ mean for all seven cycles.} \end{aligned}$$

Similarly,

$$\begin{aligned} \epsilon^{2\pi\alpha_a} &= 1.426, \text{ or } \alpha_a = 0.0564 \text{ for first two cycles.} \\ \epsilon^{2\pi\alpha_a} &= 1.575, \text{ or } \alpha_a = 0.0722 \text{ for succeeding five cycles.} \\ \epsilon^{2\pi\alpha_a} &= 1.532, \text{ or } \alpha_a = 0.0677 \text{ mean for all seven cycles.} \end{aligned}$$

A quantitative answer, however, to the question is extremely difficult, since so much depends upon the flux distribution, the flux oscillations and the eddy-current paths in the pole faces, the armature teeth, etc. Furthermore, a great deal depends upon the design and construction details of a given machine or a given type of machine. For example, it is conceded that the sudden short circuit of large turbo-alternators having a cylindrical field of two or four poles is very much more serious than that of salient-pole alternators. However, the writer knows of cases where salient-pole alternators with a comparatively large number of poles had a ratio of sudden-short-circuit current to full-load current 20 to 40 per cent higher than large turbo-gen-

erators five to ten times the kva. rating of the salient-pole machines. Fortunately, here, as in many engineering problems, a definite quantitative answer is not necessary, and it is safe to state that at present, guided by the rational theories developed above, the sudden-short-circuit characteristics of a machine or a system can be calculated with the accuracy required in ordinary practice, in most cases and for most problems, without subjecting the machine to unreasonably dangerous or expensive tests.

PHYSICAL INTERPRETATION¹³ OF SUDDEN-SHORT-CIRCUIT PHENOMENA

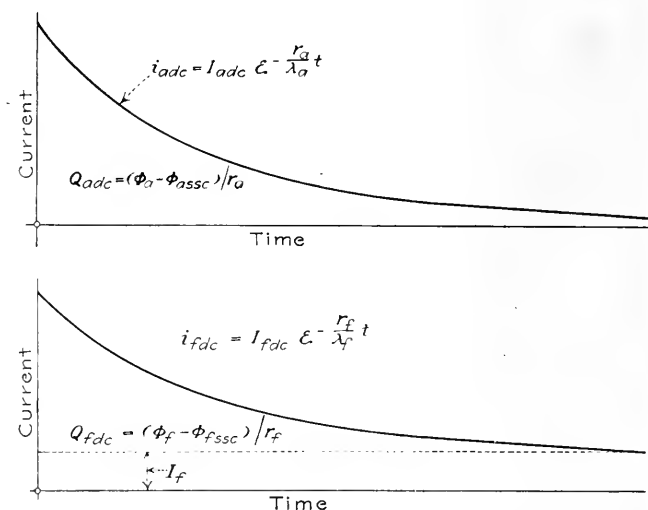
This has really, explicitly or implicitly, been given in the foregoing quantitative exposition. Still, it may be well to consider further some of the physical aspects of the subject, which is admittedly very complex. To begin with, it is known that:

(a) The comparatively large flux existing under normal operating conditions is reduced to practically zero under sustained short circuit.

(b) The rate of decay in mutually inductive circuits depends upon the total or equivalent leakage inductance and not the inductance L .¹⁴

(c) The fundamental fact true of any electromagnetic circuit, that any change of the flux inclosed by a circuit gives rise to, and is equal to, a quantity of electricity q times the total resistance of the circuit.¹⁵

Upon these fundamentals are based the most important interactions between the armature and field during sudden short circuit. In Fig. 4, Q_{adc} represents the quantity of electricity due to the change of flux in the phase under consideration. This quantity gives rise to i_{adc} in the armature, and it is clear that its value depends upon the amount of flux inclosed by the phase at the instant of sudden short circuit; i.e., $Q_{adc} = (N_a \Phi_a \sin \theta_1) / r_a$. It is a maximum when $\theta_1 = 90$ deg. or when the emf. wave is zero, and it is zero when



FIGS. 4a AND 4b—QUANTITY OF ELECTRICITY DUE TO CHANGE OF FLUX IN ARMATURE AND FIELD CIRCUITS

¹³See footnote, page 11.

¹⁴Throughout this article the definitions of L , λ and M given before are strictly adhered to.

¹⁵A method based on this principle is used to determine the apparent resistance of a ballistic galvanometer on closed circuit. The method consists in connecting the galvanometer to a secondary whose primary is supplied with direct current. From the deflections of the galvanometer for different resistances of the secondary the apparent resistance of the instrument can be calculated, or if desired the mutual inductance of the two circuits may also be obtained.

¹⁰These remarks apply to standard theories of all alternating-current or direct-current machines.

¹¹See *Transactions A. I. E. E.*, Vol. 34, 1915, p. 2266, where attention was called to this.

¹²Based on data given in *General Electric Review*, February, 1917, p. 125, Table I. The method of calculation of α_a and α_f is described later in this article.

$\theta_1 = 0$ or the emf. is maximum. Similarly $Q_{fde} = (\Phi_f - \Phi_{fssc})/r_f$ is due to the change of flux in the field and gives rise to i_{fde} (in the field). This, of course, is independent of θ_1 or the point of the emf. wave at which the short circuit occurs.

Referring to the equations, it will be found that in case of the armature current:

The first term in (3) and the third term in (1) represent i_{adc} of Fig. 4a, and according to either term

TABLE I—THEORETICAL ATTENUATION FACTORS WITH VALUES FROM TABLE II SUBSTITUTED TO GIVE COLUMNS 4 AND 5

Kind of Sudden Short Circuit	THEORETICAL ATTENUATION FACTORS DERIVED MATHEMATICALLY		Column 2 in per Cent of (r_f/L_f)	Column 3 in per Cent of (r_a/L_a)	Field Equipped or Not with Perfect Amortisseur
	a_f of the Field	a_a of the Armature	Based on Experimental Results Given in Table II		
(1)	(2)	(3)	(4)	(5)	(6)
Two-phase..	$\left(\frac{r_f}{\lambda}\right)^*$	$\frac{r_a}{L_a}\left(\frac{D}{2}+1\right)^{**}$	$3.04\left(\frac{r_f}{L_f}\right)$	$1.50\left(\frac{r_a}{L_a}\right)$	Not equipped
Two-phase..	$\left(\frac{r_f}{\lambda_f}\right)$	$\left(\frac{r_a}{\lambda_a}\right)$	$3.04\left(\frac{r_f}{L_f}\right)$	$2.01\left(\frac{r_a}{L_a}\right)$	Equipped
Single-phase.	$\frac{r_f}{\sqrt{L_f \lambda_f}}$	$\frac{r_a}{\sqrt{L_a \lambda_a}}$	$1.74\left(\frac{r_f}{L_f}\right)$	$1.41\left(\frac{r_a}{L_a}\right)$	Not equipped
Single-phase.	$\frac{r_f}{L_f}\left(\frac{D}{2}+1\right)^{**}$	$\frac{r_a}{\lambda_a}$	$2.02\left(\frac{r_f}{L_f}\right)$	$2.01\left(\frac{r_a}{L_a}\right)$	Equipped

* λ = Leakage inductance. ** $D = (L_f - \lambda_f)/\lambda_f = (L_a - \lambda_a)/\lambda_a$.

i_{adc} is a decaying direct current and is a function of θ_1 as just explained.

The second term in (3) and the second term in (1) represent the sustained short-circuit armature current due to Φ_{fssc} , Fig. 2a.

The third term in (3) and the first term in (1) represent the decaying alternating current due to i_{fde} induced in the field, Fig. 4b.

In the case of the field current:

The first term in (2) represents the steady direct-current exciting current.

The second term in (2) represents i_{fde} of Fig. 4b, due to the change of flux in the field.

The third term in (2) represents an alternating decaying current induced in the field by the decaying direct current i_{adc} in the armature (see Fig. 4a).

There is a fourth term in (3) which represents a double frequency current in the armature decaying according to α_a . A little consideration will show that this is due to the alternating current in the field, which is of fundamental frequency and decays according to α_a , as indicated by the third term of (2). If all the interactions between the field and armature were to be taken into account, it would be found that:

1. The direct-current decaying current in the armature represented by Fig. 4a and third term of equation (1) or first term of (3) produces an alternating current of fundamental frequency in the field, represented by the third term of (2).

2. This decaying alternating current in the field induces a double-frequency decaying current in the armature as represented by the fourth term of (3).

3. The decaying double-frequency current in the armature produces a triple-frequency decaying alternating current in the field, etc.

Hence there may be the second, fourth, sixth, etc., even harmonics in the armature and the first, third, fifth, etc., odd harmonics in the field, all decaying according to the armature damping factor α_a . Besides the above harmonics, due to i_{adc} , it can be shown that unbalanced three-phase currents in case of an unbalanced sudden short circuit or balanced three-phase odd harmonics of the armature current will produce armature reactions of double, quadruple, sextuple, etc., fre-

TABLE II—ATTENUATION FACTORS* OF THE FIELD AND ARMATURE OF ONE MACHINE AS OBTAINED FROM THE RISE OF DIRECT CURRENT IN THE FIELD AND ARMATURE RESPECTIVELY

Test No.	Manner in Which Field or Armature Were Connected	Machine at Rest or Running	ATTENUATION FACTORS			INDUCTANCE IN PER CENT	
			Of Field of in per Cent	Of Armature		Field	Armature
				a_a in per Cent	Actual Values		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I	Armature open circuit	At rest	100	....	....	100	....
II	Armature dead short circuit.....	At rest	107	....	....	93	....
III	High R across armature.....	Full speed	117	....	....	85	....
IV	Armature dead short circuit.....	Full speed	304	....	....	33	....
V	Field open circuit ..	At rest	....	100	0.070	....	100
VI	Field dead short circuit.....	At rest	....	139	0.097	....	72
VII	Field open circuit ..	Near. full speed	....	185	0.130	....	54
VIII	Field dead short circuit.....	Full speed	....	201	0.140	....	50

*Transactions A. I. E. E., Sept., 1915, p. 2271.

quency, which in turn will produce emfs. and currents of third, fifth, seventh, etc., frequency in the armature. However, experience shows that in most practical cases the higher harmonics in the field and armature may without important consequence be neglected.¹⁶

Wireless Signal Lamp for War Work

Engineers of the National Lamp Works of the General Electric Company, working in conjunction with experts from the federal ordnance department, have developed a wireless signal lamp for airplane service and other war work. It can be flashed at a great distance by means of energy transmitted to it through wireless extensions now in use. The advantage of this lamp is in the elimination of wires which can be cut or tampered with by the enemy. It can be used between stations on the ground at the battle front or between ground stations and airplanes flying over the enemy's territory. To John Randall, advisory head of the lamp department at Nela Park, credit is given for the development of the lamp. He has spent years in experimental work with lamps.

It is stated that an absorbent gas for use in fighting poisonous gases thrown by the enemy is being perfected at Nela Park.

¹⁶See also the ELECTRICAL WORLD, Dec. 29, 1917, p. 1251, where by means of curves and oscillograms the interactions between field and armature are illustrated and their combined effect in producing the complex transient field and armature currents is explained qualitatively or non-mathematically.

Experience with Powdered Coal

Fuel in This Form Considered Especially Desirable as Low-Grade Coal Can Be Burned at High Efficiency—Method of Preparing and Burning Fuel—Results of Tests

BY A. E. MACINNIS

WITH the experience of the past winter in mind and the possibility of a worse fuel scarcity and the new problems imposed by the recent order of the Fuel Administration regarding zone distribution ahead, every coal-consuming plant will do well to ascertain what methods are being employed to burn coal more economically, especially the lower grades. Experience in the Northwest may shed some light on the subject, and for this reason a brief account of the situation there and of what is being done to improve it will be given in this article.

More than a year ago the price of fuel oil began to advance rapidly, and there was a prospect that crude oil might be withdrawn from the market. This caused an increased demand for coal, which threatened to overtax the mine and transportation facilities. Three possible ways of meeting this situation were considered—first, utilizing grades and kinds of coal previously wasted; second, securing higher efficiency from the coal burned; third, substituting wood to make up the shortage.

One of the first men in the Northwest to attempt the solution of the fuel problem was W. J. Santmyer, advisory engineer and superintendent of steam heat for the Puget Sound Traction, Light & Power Company, Seattle. From previous experiments he was inclined to favor pulverized coal, as by its use low grades of coal can be burned at relatively high efficiency. In theory this form of combustion is ideal since it provides an intimate, even and thorough mixture of coal and air, which allows complete combustion with a minimum of excess air. On Mr. Santmyer's recommendation the company conducted a series of experiments* with powdered coal in a 300-hp. Babcock & Wilcox boiler which lasted from February to June. The results obtained were so favorable that the company authorized the erection of a complete pulverized coal plant for ten boilers, aggregating 4100 boiler-hp. This installation is now in progress, but before describing the new plant a résumé of the experiments will be given.

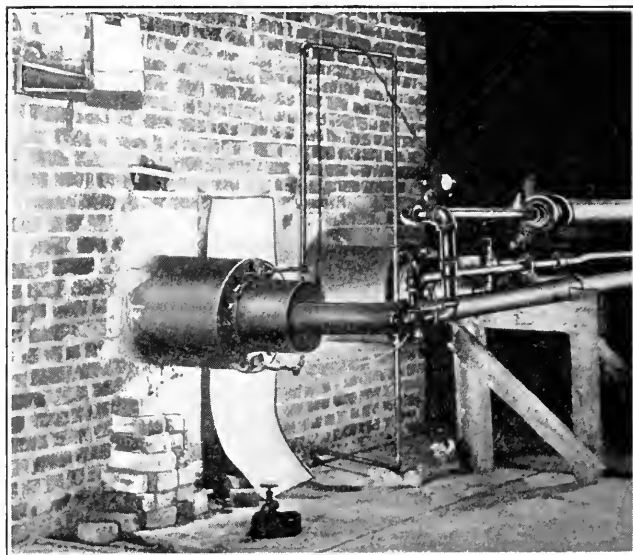
PREPARATION OF THE COAL

The powdered coal was prepared at the briquetting plant of the Pacific Coast Coal Company, about 12 miles (19.3 km.) from Seattle. This plant is in continual operation, its boilers and driers being fired with its own pulverized coal. The preparation process is as follows: If not already to size, the coal is crushed to $\frac{3}{4}$ in. (19 mm.) and then fed into a Ruggles drier, which consists of two nearly horizontal steel cylinders, one within the other. The furnace is installed at the higher end, and the hot gases pass through the inner cylinder to the lower end and then back between the two shells in contact with the coal. Both cylinders rotate slowly so that the coal is continually agitated as it passes down to the

lower end of the drier. Drying of the coal is necessary to prevent cohesion of the particles which would interfere with pulverization. The degree of drying necessary varies according to the form in which the moisture occurs in the coal, ranging from 1 to 6 per cent.

The grinding is done in a Raymond mill. The degree of fineness necessary is that which will allow complete combustion while the fuel is still suspended. With lignites having a high volatile content and ash with a high fusing point coarser pulverization is permissible than with coals having a greater proportion of fixed carbon. With the local coal available the best results are obtained when 95 per cent will pass through a 100-mesh screen and 85 per cent through a 200-mesh screen.

The powdered coal was transported to Seattle in a



APPARATUS THROUGH WHICH POWDERED COAL IS DISCHARGED INTO FURNACE

box car equipped with a metal-lined hopper, so as to be air-tight and prevent the absorption of moisture. From this it was discharged into an inclosed conveyor which elevated and dumped it into the bunker. The coal was fed into the boiler supply pipes by two motor-driven screws and conveyed about 30 ft. (9.1 m.) horizontally to the boiler front by compressed air.

As it is imperative that there be sufficient space in the furnace for complete combustion to take place without contact with the boiler tubes and to avoid damage to the brickwork due to the blasting effect of the flame, an extended or "Dutch" oven was built out about 5 ft. (1.5 m.) in front of the boiler. After considerable experimenting Mr. Santmyer devised a burner and feeder that gave a thorough mixture of coal and air and just the discharge velocity to keep the fuel suspended until completely burned.

It was found that certain coals would slag at com-

*See ELECTRICAL WORLD, June 9, 1917, p. 1105.

paratively low temperatures, but by constructing a slag pit underneath the furnace with sides sloping sharply away from the top opening it was found that the slag would drop off in small chunks which could be readily removed through a clean-out door.

Boiler trial records were kept of fifteen test runs made with many different kinds of coal, among which

TABLE I—TEST OF 300-HP. B. & W. BOILER BURNING FOUR GRADES OF POWDERED COAL (See Table II)

	A	B	C	D
Elapsed time (hr., min.)	14-30	12-30	21-30	14-38
Water by Venturi meter (lb.)	156,000	177,800	179,500	169,500
Temperature of water (deg. Fahr.)	186	190	192	186
Water evaporated, actual (lb.)	153,600	175,000	176,630	166,960
Temperature of steam (deg. Fahr.)	407	405	401	408
Steam pressure, gage (lb.)	110	106	108	116
Temperature corresponding to pressure (deg. Fahr.)	344	332	343	347
Superheat (deg. Fahr.)	63	73	58	61
Factor of evaporation	1.1	1.1	1.09	1.1
Weight of coal (lb.)	21,220	22,020	22,980	21,820
Evaporation per pound of coal, as fired from and at 212 deg. Fahr.	7.24 8.0	7.95 8.77	7.68 8.37	7.64 8.42
Draft in uptake, in inches water	0.27	0.35	0.31	0.27
CO ₂ (per cent)		13	13	13½
B.t.u. per pound of coal, dry powdered	10,000	11,368	10,985	10,967
B.t.u. per pound of coal, raw	8,677		9,952	9,449
Efficiency (per cent)	77	75	74	75
Kind of coal	Newcastle*	Newcastle	Mendota mine run	Renton buckwheat

*Under water for several years.

were South Prairie, Black Diamond, Renton, including sludge, which in raw state analyzed over 21 per cent ash and 30 per cent moisture; Tono, which runs only about 8000 B.t.u.'s per pound; Newcastle screenings, which had lain for years under water in Lake Washington; Mendota; Nanaimo (B. C.) slack; and coal from Rock Creek, Cal. The results of some representative tests are given in Table I.

The experiments indicated the following advantages for pulverized coal:

Different kinds and grades of coal can be prepared,

pendable. It is smokeless, even under heavy overload. It is remarkably flexible, it having been possible to force the 300-hp. boiler to 600 boiler-hp. in a few minutes without injury to the heating surface or brick-work.

The increased capacity of boilers means less investment and hence a saving through lower fixed charges additional to that due to greater efficiency.

Because of these advantages the company decided to change its Western Avenue station to a powdered-coal plant. Before describing this installation, the writer wishes to impress on the reader that it is not being pointed out as necessarily the best installation. To his knowledge, however, it is the *first* large stationary boiler plant to be operated on powdered coal as a commercial undertaking. Because it is a pioneer in this field it does warrant particular notice. At present it is only in the course of construction and will likely not be ready to try out until August and not in full operation until Sept. 1. Therefore comment on its efficiency, cost and in general its success must be delayed until a demonstration is made under actual operating conditions.

DESCRIPTION OF POWDERED COAL PLANT

Raw coal will be delivered over the company's street-car tracks and dumped into a 500-ton bunker across the street from the station. This bunker can be enlarged to 1500 tons capacity. The coal will pass through a single-roll crusher rated at 75 tons per hour, which will reduce the coal to 1-in. (2.54-cm.) size, if not already of that fineness. A belt conveyor will carry the coal under the street to a 300-ton raw-coal bunker in the station. From this bunker the coal will pass over an apron conveyor, designed to empty the storage bin completely into either or both of the two Fuller driers. The driers have a capacity of 15 tons per hour each, are 55 ft. (16.8 m.) long and consist of single-shell steel cylinders, one 5 ft. (1.5 m.) in diameter and the other

TABLE II—COAL ANALYSIS (IN PERCENTAGE)

	NEWCASTLE COAL*, RAW		NEWCASTLE COAL*, DRIER		NEWCASTLE COAL*, POWDERED		MENDOTA, MINE RUN		RENTON BUCKWHEAT			NEWCASTLE	
	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis	Raw	Dry Powdered	Raw	Drier	Powdered	Powdered as Fired	Dry Bins
Water	14.22	.....	2.80	.....	3.04	.....	21.85	7.50	15.20	7.11	5.44	4.43	.....
Volatile	38.54	44.92	41.01	42.19	42.04	43.35	34.38	43.88	39.11	12.68	15.32	42.09	41.01
Fixed carbon	34.17	39.83	42.20	43.41	39.26	40.19	32.50	37.13	32.10	37.32	35.57	40.55	42.12
Ash	13.07	15.23	13.99	14.39	15.66	16.15	11.80	11.49	13.56	12.89	13.67	12.93	13.53
Total	100.0	98.00	100.00	99.00	100.00	99.00	100.53	100.00	100.00	100.00	100.00	100.00	99.00
Sulphur	0.03	0.16	0.38	0.40	0.37	0.40	.....	.....	0.37	0.12	0.39	0.31	0.36
B.t.u.	9,952	11,602	11,515	11,847	10,985	11,329	.....	.....	9,449	10,862	10,967	11,368	11,895

*Years under water.

transported, stored and burned with the same equipment without physical difficulty.

Higher efficiency can be obtained than with any other means of combustion.

Powdered coal is not (contrary to a rather prevalent opinion) dangerous to handle.

Low-grade coals that cannot be burned efficiently in any other manner give good results in the powdered form.

The powdered-coal fire is easy to operate and de-

6 ft. (1.8 m.). A brick furnace covers more than half the shell, firing being accomplished from the side. Powdered coal will be used for firing both driers in burners designed by Mr. Santmyer.

The dry coal will be elevated in buckets to a bin holding 100 tons, from which it will be fed by gravity onto an apron conveyor leading to four Fuller pulverizers. Each of these mills measures 42 in. (106 cm.) and is designed to grind 5 tons of coal per hour fine enough so that 95 per cent will pass through a 100-

mesh screen and 85 per cent through a 200-mesh screen. In this type of mill the grinding is done by large cast-iron balls propelled around a race so as to press the coal against a wearing ring.

From the mills screw conveyors will carry the coal to a bucket conveyor, which will elevate it to the top of the building and deliver it into other screw conveyors that will take it to the steel bins over the front of each boiler. These bins will hold 15 tons each and will drop the powdered coal in front of the boilers, where it will be picked up by air at perhaps 6 oz. (26 gm. per cm.) pressure and carried to the bunker. This air will be furnished by two centrifugal fans, one on each side of the boiler room, driven by steam turbines exhausting into the steam heating mains.

Of the ten boilers, four are to be rated at 300 boiler-hp., three at 400 hp., one at 500 hp. and two at 600 hp. In the 300-hp. and 400-hp. boilers two burners will be used and in the larger boilers three burners. Three different burners will be tried out—Santmyer's, Muhlfield's and Fuller's. Mr. Santmyer's feeder and burner will be similar to that which gave good results in the experiments referred to before.

All the boilers will be equipped with Dutch ovens extending 5 ft. (1.5 m.) out in front, stretching the full width of the boiler, and standing 7 ft. (2.1 m.) high. Each boiler will also have a slag pit underneath. The slag pits will be of different design, according to the requirements of the feeder and burner, but each pit will have a clean-out door for the removal of slag.

OTHER POWDERED COAL DEVELOPMENTS

In addition to the Briquetteville plant the Pacific Coast Coal Company has powdered coal plants operating successfully at both its Black Diamond and Newcastle mines. At Black Diamond there are two 300-hp. Wickes water tubular boilers and ten 150-hp. horizontal return-tubular boilers, all fired by burners and feeders designed by Messrs. Santmyer and Ralph Galt. The coal is dried in a 10-ton Ruggles drier, fired with powdered coal and pulverized in a 5-ton Raymond mill. The unique thing with this installation is the absence of slag pits. The size of the boiler plant being sufficient to avoid forcing the boilers beyond 125 per cent rating, the furnace temperatures are low enough to prevent slagging.

The Newcastle plant is practically a duplicate of that at Black Diamond except that there a Fulton mill does the grinding instead of a Raymond.

In Seattle Messrs. Santmyer and Galt are changing the oil-burning plant in the Crystal Pool natatorium to powdered coal. The same boiler setting will be used without a slag pit as the two 150-hp. horizontal return-tubular boilers will make enough steam without undue forcing. A 10-ton steel bunker is being built to receive the powdered coal from a specially constructed auto truck which will haul the prepared coal from the Pacific Coast Coal Company's plant at Briquetteville.

As the Western Avenue plant will be the first large station to use powdered coal, so the Crystal Pool will be the first small isolated plant to burn pulverized fuel, delivered by auto truck. Should the actual results realize the expectations based on the experiments already made, present methods of burning low-grade coal will be altered considerably.

A WAR-TIME EXPEDIENT AND MEASURE OF ECONOMY

Growth of Load Cared for by Means of Change from
Two-Phase to Three-Phase Four-Wire
—Considerations That Governed

BY H. C. DEAN

General Superintendent New York & Queens Electric Light & Power Company

TO PROVIDE for growth in load the New York & Queens Electric Light & Power Company, Long Island City, N. Y., was confronted, not long ago, with the problem of increasing the rating of its distribution circuits about 30 per cent. In some districts it was possible to postpone the installation of additional copper in the feeders and obtain the increase merely by replacing 100-amp. regulators in the substations with 150-amp. or 200-amp. regulators. In the case of the Long Island City district, however, the current-carrying capacity of both feeders and regulators had been reached, and all regulators were of the maximum size (200 amp.) which the company considers it desirable to use.

CHOICE OF SYSTEMS

Three methods of solving the problem were open: (1) To install additional two-phase feeders (2300 volts, four-wire); (2) to install high-tension feeders and relieve the 2300-volt feeders of the larger consumers; (3) to change the 2300-volt, two-phase system to 2300/4000-Y volts, three-phase.

The chief question at first was whether or not it would be as cheap to change from two-phase to three-phase as to leave the two-phase system and transfer the larger consumers to lines operating at transmission voltage. A number of consumers are so supplied at the present time, and the company is looking forward to increasing such services to a large extent from now on. With the existing geographical layout of the lines and large consumers, the arguments were two to one in favor of changing the two-phase distribution system. However, this was due to local conditions, and it is possible that for other companies the advantages would be materially different, either greater or less.

Careful estimates showed that the third alternative would provide the necessary rating for less than half the expenditure required by the other methods, owing chiefly to the high cost of copper. It had the additional advantage that any future feeders would have 50 per cent greater capacity as three-phase feeders than as two-phase feeders, while the per cent line loss and voltage drop would be only half as great. To determine the relative advantages of three-phase over two-phase, it was therefore only necessary to determine the valuation of the existing distribution system (less the poles) and to balance 50 per cent of this cost against the cost necessary to change to three-phase.

In the Long Island City district the power load is about four times as large as the lighting load, consequently considerable work had to be done in making changes in the transformer banks. Although new consumers are provided with three-phase service, it was decided to continue two-phase, 230-volt service to existing consumers. This made it necessary to replace one transformer of each power bank with two of half the rating having 10 per cent taps. The connections and

the voltages obtained are shown in the accompanying diagram. There are no theoretical disadvantages in this method, as far as the writer can see, and it has given entire satisfaction for the past seven months.

METHOD OF MAKING CHANGE-OVER

To facilitate the work on the day when each feeder had to be changed from two-phase to three-phase

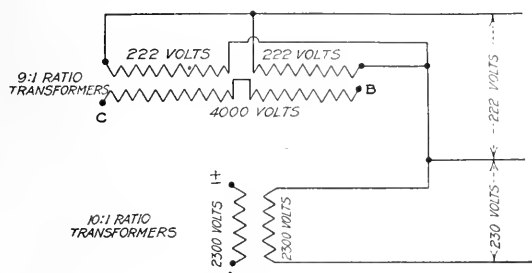


FIG. 1—METHOD OF SECURING CONVERTING FROM TWO TO THREE-PHASE WITH STANDARD TRANSFORMER

(which in every case was Sunday), the replacement of one transformer in each power bank with two of half capacity was made in advance, the two smaller transformers being connected in multiple temporarily. The testing of all underground 2300-volt services, the replacement of certain cable not safe enough for operation at 4000 volts, and the installation of pot-heads on all cable ends, constituted the only other preliminary work on the feeders themselves.

In the substation it was necessary to install a spare panel complete with equipment and three regulators for a three-phase feeder and to provide for maintaining one of the 2300-volt buses at three phase. This spare panel and equipment was used for the first feeder changed over to three-phase, which thus released a two-phase panel and the corresponding equip-

the fuse plugs of all power transformers were disconnected. The feeder was then switched from the two-phase bus to the three-phase bus and the power consumers were given service in the order of their needs. The change did not require rearrangement of the overhead circuits.

ECONOMIC ADVANTAGES

The change from two-phase to three-phase distribution in Long Island City district has resulted in a decided war economy, since it has made unnecessary the installation of additional two-phase feeders, the expense of which would have been five times the cost of making the feeder changes to obtain three phase. Furthermore, it has decreased the line losses by approximately 200 kw., which alone would pay interest charges on the cost of making the change. In addition, it has improved the voltage regulation 100 per cent, which means that better service is given and that loads at great distances from the substation can be more economically handled than heretofore, thereby delaying the day when additional substations may be required.

The company is now planning to change over the distribution system in the rest of its territory, which lies in the borough of Queens, comprising over one-third of the area of New York City. The population served is small compared with Manhattan's, but is about equal to that of Minneapolis.

The borough of Queens, which covers 117 square miles (30,000 hectares) of territory on Long Island, is considered to be growing more rapidly than any other section of New York City.

INTERNATIONAL TRADE-MARK REGISTRATION BEGINS IN CUBA

Bureau Opened at Havana as Result of Fourth Conference of American States at Buenos Aires in 1910

The International Trade Mark Bureau, for registration of trade marks of producers and manufacturers in the eleven northern countries of North America, Central America and the West Indies, has been opened at Havana, Cuba, under the direction of Dr. Mario Diaz Irizar, who will arrive in Washington shortly for conferences with United States Patent Office officials and the State Department, as a result of which regulations for the conduct of the bureau will be worked out. It may be decided to issue a monthly bulletin in English and Spanish, recording work of the bureau.

The Havana bureau and another to be opened at Rio de Janeiro result from the fourth conference of American states at Buenos Aires in 1910, at which an international trade-mark agreement was reached. The Rio de Janeiro bureau, which will provide for registration of trade-marks in the southern countries of South America, as the Havana bureau does for the northern countries, cannot be opened until three more countries have ratified the 1910 agreement at Buenos Aires. It was provided that two-thirds of the countries involved must ratify. Of the ten countries in South America only four—Brazil, Ecuador, Paraguay and Bolivia—have ratified so far. It is expected that some time during the coming year Peru will ratify and that eventually other South American countries will do so.

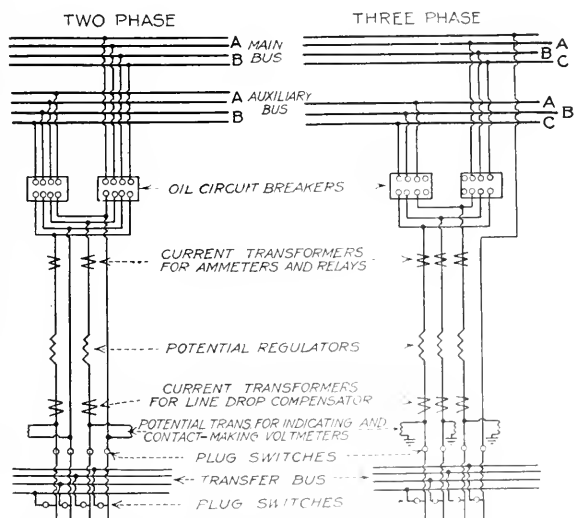


FIG. 2—METHOD OF ARRANGING FOR CHANGE-OVER FROM TWO-PHASE TO THREE-PHASE

ment. The panel in turn was built over to provide for the second three-phase feeder, etc.

On the day of actual change over of a feeder it was only necessary to change the connections of certain transformers and to transfer the feeder connections from the two-phase bus to the three-phase bus. Any power consumer who had to have service Sunday morning was permitted to use it until noon, by which time

Great Electrical War Convention in California

Central Stations, Manufacturers, Jobbers, Contractors and Dealers Discuss War Problems at the Annual Convention of the Pacific Coast N. E. L. A.
Section—Co-operation of the Industries

WAR problems were the chief topics discussed by representatives of all branches of the electrical industry at Del Monte, Cal., last week. In session with the annual convention of the Pacific Coast Section of the National Electric Light Association were the Pacific division of the Electrical Supply Jobbers' Association, the California Association of Electrical Contractors and Dealers, manufacturers' representatives and others, totaling more than 400 delegates. Even more than in the case of previous California conventions was this gathering notable for the variety of interests represented and the spirit of co-operation manifest. The advantage was not only in promoting closer relations and better understanding, but also in expediting action on matters where conference and agreement between the several branches of the industry were required.

President H. F. Jackson, Sierra & San Francisco Power Company, opened the meeting Thursday morning with a patriotic address, urging that all efforts be bent toward extending the usefulness of the electrical industry in war service and that closer co-operation in all branches be cultivated.

THURSDAY'S ENGINEERING SESSION

Thursday afternoon the engineering session was opened with J. E. Woodbridge, Sierra & San Francisco Power Company, in the chair. He reported that subcommittees working jointly with state and federal officials have rendered service in work on conservation and war measures.

F. D. Nims, Washington Coast Utilities, Seattle, and H. H. Schoolfield, Pacific Power & Light Company, represented the Northwestern Electric Light and Power Association. Mr. Nims said the use of powdered coal and sawmill refuse in the Northwest is helping to solve the fuel problem. Large industrial consumers have been induced to shift working hours so as to relieve peak conditions. Mr. Schoolfield described Portland's endeavor to conserve resources rather than energy and said that interconnection is receiving careful attention.

Fred H. Fowler, district engineer for the United States Forest Service, read a paper on the possibility of water-power development in California, Nevada, Arizona and New Mexico. The characteristics of the several drainage systems and their power sites were discussed and attention was directed to the large ratio of steam to water power. The small amount of hydroelectric development in recent years was noted and the need for a change in this regard was emphasized. Three prospective sources for increased power stand out, Mr. Fowler thought, as more notable than others in California. These are the Big Bend of the Pitt River, the combination of an increase in Great Western capacity on the Feather River with adjacent developments of the Pacific Gas & Electric Company, and the increase of capacity on the Big Creek system. On the Pitt River two alternatives are considered. One, promising 175,-

000 hp., would require a seven-mile (11.2-km.) tunnel, while the other, though of only about half the capacity, could be built in much less time. The Feather River project would afford about 195,000 hp. It involves two miles (3.2 km.) of tunnel. The Big Creek system could be increased about 300,000 hp. by adding to its drainage area. Because of the oil shortage and abundance of water power the electrification of mountain divisions of the railroads was urged. With the railroads now using three times as much oil as the next largest consumer, electrification must be studied in a new light.

Other papers presented at this session were: "Power Resources in Southern California," by H. A. Barre, Southern California Edison Company, and "Joint Operation of Power Companies," by J. P. Jollyman, Pacific Gas & Electric Company, San Francisco.

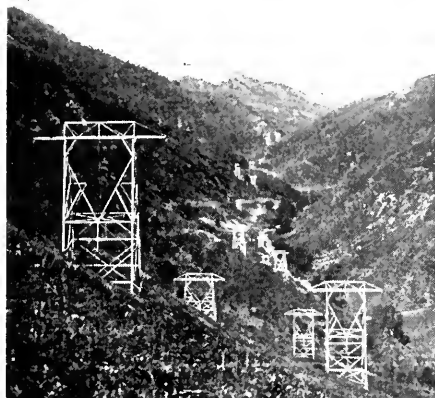
GOVERNMENT ANNOUNCES ITS FUEL-OIL PLAN

D. M. Folsom of the Pacific Coast Petroleum Administration announced by letter that fuel-oil users will be listed and classified probably within six months, and only those industries entitled to priority rating will be allowed to have oil. Public utilities will receive such rating only where industries served are entitled to priority, and the burden of proof of such priority shall rest upon the power companies. The oil supply will be exhausted within a year at the present rate, Mr. Folsom said, even with great economy. Drilling operations this year thus far show a 40 per cent decline as compared with last year.

L. S. Ready, Railroad Commission of California, reviewed the progress made in interconnecting transmission systems, pointed out that the State is two or three years behind in its hydraulic development and suggested developing small additional sources of energy wherever possible rather than concentrating solely on larger developments.

R. H. Ballard, Southern California Edison Company, suggested the desirability of securing financial aid from the War Finance Corporation in developing needed hydroelectric power. Without some such plan financing on the large scale necessary would be impossible. Prospects for such aid are improved by the amount of energy used on the Pacific Coast for irrigation pumping, because of the 800,000-hp. shortage on the Atlantic Coast found by the War Industries Board, and because of the extent to which hydroelectric development will release oil for the navy and the merchant marine.

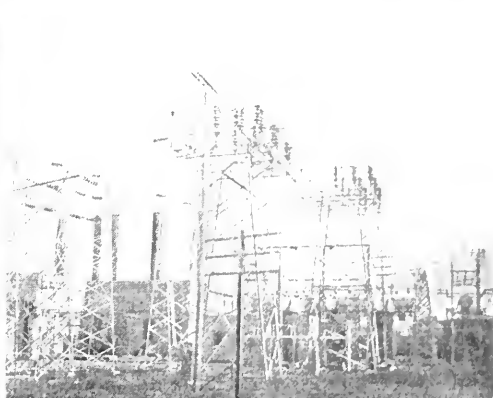
P. M. Downing, Pacific Gas & Electric Company, said that the chief problem is how to finance the additional hydroelectric development which is urgently needed. With the completion of interconnections now under way the available energy will be utilized. This means that when the curtailment of oil comes load must be correspondingly dropped. John Hood, General Electric Company, San Francisco, drew a parallel between the unpreparedness of this country at the outbreak of the war and the present lack of definite plans



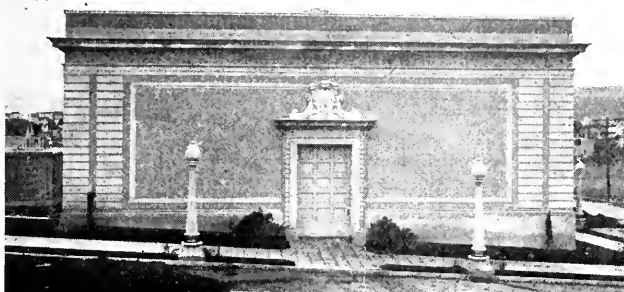
BIG CREEK TRANSMISSION LINE
SOUTHERN CALIFORNIA



STANISLAUS HYDROELECTRIC
STATION, SIERRA & SAN FRANCISCO
POWER CO.



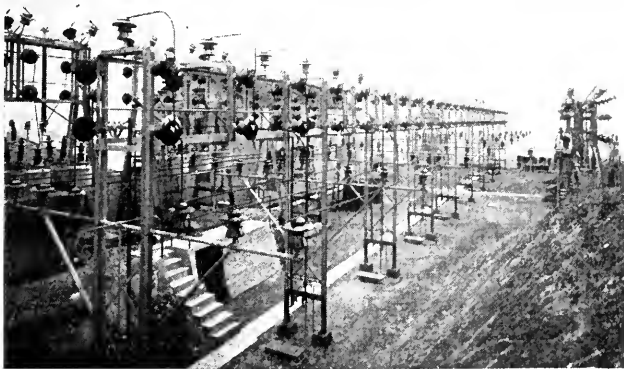
TERMINAL OF TRANSMISSION LINE,
SOUTHERN SIERRAS POWER CO.



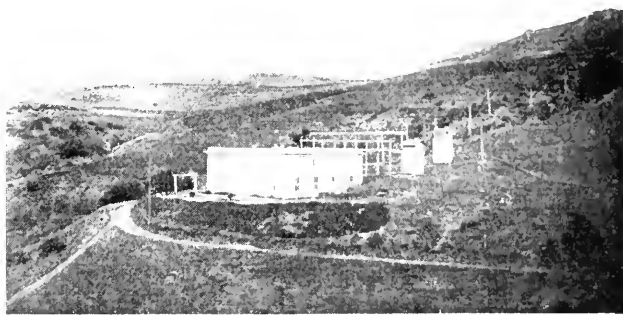
ATTRACTIVE SUBSTATION
PACIFIC GAS & ELECTRIC CO.



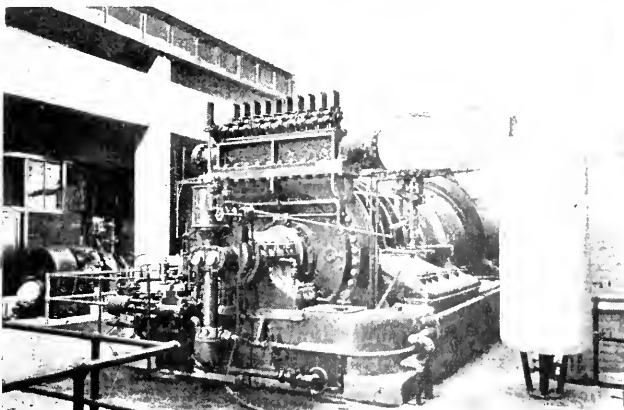
DEL MONTE HOTEL,
WHERE THE CONVENTION WAS HELD



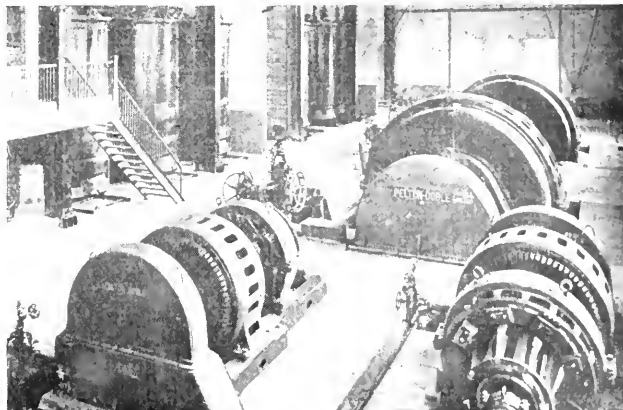
SWITCHES AT SOUTH TOWER, CARQUINEZ STRAIT CROSSING,
PACIFIC GAS & ELECTRIC CO.



PACIFIC GAS & ELECTRIC SUBSTATION AT
BERKELEY



IN THE RIVER STATION, SACRAMENTO
PACIFIC GAS & ELECTRIC CO.



IN THE DRUM POWER HOUSE
PACIFIC GAS & ELECTRIC CO.

for electrifying mountain divisions. Because railroads are by far the largest consumers of oil and because locomotives burn oil at three times the rate normal in highly economical stations where equivalent energy could be generated preparation for electrification should be begun now.

S. J. Lisberger, Pacific Gas & Electric Company, San Francisco, stated that neither large hydroelectric developments nor electrification of railroads could be effected immediately and that our greatest problem is how to meet energy demands during the next eighteen months. To help in this he urged attention to the multitude of minor economies all can make, such as boiler-wall insulation, the use of economizers, efficient combustion and decreasing waste of energy at every point.

Mr. Barre stated that fuel consumption would always be necessary on electric generating systems. Not only is fuel properly used to carry peaks but it should also carry a part of the load in low-water years, thereby making economical larger hydroelectric installations. Two sources of electrical power in southern California can be made available very quickly, Mr. Barre stated. The Los Angeles Aqueduct can be made to produce annually an additional 100,000,000 kw.-hr., and the capacity of the Kern River plant No. 3 can be increased by 180,000,000 kw.-hr. These extensions would supply demand increases for about two years. The larger developments should also be begun now in order to be ready for further demand increases in two years.

Others who participated in the discussion were Max Thelen, president California Railroad Commission; C. O. Poole, Southern Sierras Power Company, Riverside; Edward Whaley, Northern California Power Company; W. M. Shepard, California-Oregon Power Company; E. A. Quinn, San Joaquin Light & Power Corporation, and E. R. Northmore, Los Angeles Gas & Electric Corporation.

WOMEN'S WAR SERVICE SESSION

On Thursday evening a war service session was held for ladies of the convention. Mrs. H. F. Jackson effectively outlined the purpose of conferences of women of the electrical industry and the great possibilities they give.

Miss Gertrude Tucker, secretary to the president of the Southern California Edison Company, explained how women employees have come to be recognized as worthy of training such as that given to the men, holding that the modern woman has genuine service ideals and a stronger spirit of loyalty than the men. Women employees in her company have increased from 50 to 250 and the employment of women station and switch-board operators is being contemplated.

Mrs. Frank A. Gibson spoke on the making of a loyal citizen, outlining work to be done for our foreign population.

FRIDAY'S ENGINEERING SESSION

At the Friday morning engineering session economies in operation of generating and transmission systems were discussed.

J. A. Koontz, Great Western Power Company, San Francisco, maintained that wearing bands shrunk on water-wheel runners and scroll cases have greatly increased the life and efficiency of units. The efficiency of worn runners can sometimes be improved by electric welding, he said.

Mr. Nims reported increased efficiency by carefully keeping tailwater elevation at the lowest level consistent with the seal on the draft tube.

G. R. Milford, Northern California Power Company, San Francisco, reported relieving hammering and vibration in a draft tube by tapping a faucet into it and opening it slightly.

Mr. Schoolfield described a 1900-hp. plant installed to utilize power from a 60-ft. (18.2-m.) drop in a canal system previously wasted. This plant has an induction motor running as a generator. It is entirely automatic and has been running four years without trouble. Although it will not synchronize itself when relieved of load, a gate control scheme has been proposed for shutting off power until speed drops down to synchronism. At present an attendant must be sent to the plant to resynchronize it. It is thrown back on the system at 5 per cent under or over speed. Substation and line losses were discussed in detail.

Mr. Lisberger disapproved of keeping the rate of line transformer burn-outs too low. Higher economy is secured by working them well up to capacity, expecting to replace burn-outs occasionally.

L. M. Klauber, San Diego Consolidated Gas & Electric Company, reported over-all losses of 22 per cent. For the Southern Sierras system Mr. Poole reported over-all losses in stations and lines of about 37 per cent. Discussion on lower rates under less strict guarantees on continuity of service failed to develop a feasible plan.

Economies in the boiler room was a live topic. There was agreement that automatic burner and damper control afford important savings, but where men must control fuel feeding a bonus for economy was urged. Mr. Klauber described a home-made automatic steam-pressure regulator for oil burners. He has found automatic boiler tube cleaners or soot blowers to be so productive of higher efficiency as to rate them as a necessity. Under war conditions more frequent cleaning of oil burners, condensers and all apparatus subject to clogging was urged.

Mr. Lisberger described a home-made device used to determine salt content in boiler water. Where more than 50 grains per cubic centimeter is found a remedy is applied.

Mr. Nims reported that powdered coal is often of superior grade when made of a poor-grade coal. It was suggested that California poor-grade coal deposits might thus be utilized. R. S. Masson, Arizona Power Company, Prescott, reported that his company recently completed a steam plant which produced 354 kw.-hr. per barrel of oil under test or 1 kw.-hr. per pound of oil. The plant averages 256 kw. per barrel in monthly records. High economy is attributed largely to automatic control. The oil is the same used as elsewhere and under test showed 18,650 B.t.u. per pound.

Mr. Klauber spoke of increasing preference for steel over copper for conductors. His company has more than 300 miles (482.8 km.) of steel conductors in service. Even where salt spray strikes the lines double-galvanized cable is expected to last fifteen years. The economy is not only in the price but also in poles, for spans are doubled when steel replaces copper, and in reduced erection costs. Standard steel spans are 700 ft. (213 m.) for 40-ft. (12.9-m.) poles. Mr. Downing urged that, in buying insulators, in addition to specify-

ing line voltage the conditions to which the line will be subjected should be mentioned.

Confidence was expressed in the economy and safety of reinforced-concrete stubbing of decayed wood poles. A pole that would cost \$50 to replace at present prices can be made safe in this way for less than \$8.

COMMERCIAL SECTION MEETINGS

The Commercial Section convened on Friday morning, with Chairman R. M. Alvord, General Electric Company, presiding. The session was devoted chiefly to discussion on the general subject of retail selling practice. This brought out agreement that data on accounting methods in retail electrical stores must be collected for the use of the co-operative campaign committee. The percentage of gross income that should be used on advertising, for example, has been fairly well established in other lines of business, and such data in the retail electrical business are urgently needed. Discussion was taken part in by J. C. Rendler, Southern California Electrical Company; Glen Arbogast, F. E. Newberry Company, Los Angeles; H. L. Kimball, Oakland, and Louis Levy, Levy Electric Company, San Francisco.

At the Friday afternoon session a paper by Mr. Bibbins on development of the community of interest was fully discussed. Mr. Ballard urged endeavor toward improving public relations and interesting employees, consumers and the public generally in investing in utility securities. This, he held, is the most effective and complete answer to the municipal ownership tendency.

Much of the Commercial Section discussion dealt with ways and means of aiding the commercial co-operative campaign. It was decided that further meetings be held from time to time in various parts of the State to promote further co-operation on the part of all branches of the industry interested. W. L. Goodwin, General Electric Company, New York, outlined the Goodwin plan and explained its advantages. He dwelt particularly on the danger in the Western field of allowing sectional views and interests to hamper progress. The industry is too closely interrelated to permit of any but a national viewpoint.

John A. Britton, as chairman of the public policy committee, read a report summarizing the present position of the public utilities and reviewing some of their problems and progress toward still greater war service. A policy that would engender public confidence was urged, and the great need for passing the pending water-power laws was emphasized. Ample funds are in the banks for power development if the safety and profit of the investment are assured. Meantime, though no water power is being developed and fuel is scarce, energy demand is increasing in California at the rate of 10 per cent per year. The report concluded with a resolution that Congress be urged to pass legislation directed toward discontinuing the waste of water power so that fuel may be conserved. The convention adopted the resolution and ordered copies sent to all congressmen.

A resolution was also adopted instructing the incoming officers to appoint a bureau of publicity to the end that the daily press may properly report events in the electrical industry.

Among other resolutions adopted were those provid-

ing that effort be made toward Americanization of foreign-born residents, that endeavor be made to secure aid of governmental bureaus in providing sufficient energy for maintaining service to war industries, that further study and extension be made on interconnecting systems, that effort be made to conserve energy resources, that an effort be made to ascertain the amount of fuel oil available so that business of the companies may be adjusted accordingly, that the commercial co-operative campaign be extended for an additional six months, and that jobbers' and dealers' associations be invited to meet again with the Pacific Coast Section of the N. E. L. A.

ELECTION OF OFFICERS

Officers of the Pacific Coast Section, N. E. L. A., for the ensuing year were elected unanimously as follows: President, Samuel Kahn, Western States Gas & Electric Company, Stockton; vice-presidents, E. R. Davis, Southern California Edison Company, Los Angeles, and A. G. Wishon, San Joaquin Light & Power Company, Fresno; secretary, A. H. Halloran, *Journal of Electricity*, San Francisco; treasurer, J. F. Pollard, Sierra & San Francisco Power Company; executive committee, H. F. Jackson, H. A. Bostwick, J. B. Black, William Bauerhyte, George A. Campbell, D. E. Harris, Frank Somers, C. M. Einhart, S. Aller, H. E. Van Kuran, H. H. Jones and A. E. West.

JOBBERS' ASSOCIATION MEETING

The quarterly meeting of the Pacific division of the Electrical Supply Jobbers' Association was held at Del Monte just preceding the joint convention. Two open sessions were held, in which J. J. Gibson, Westinghouse Electric & Manufacturing Company, and W. L. Goodwin, General Electric Company, discussed laws for stabilizing trade conditions. Mr. Gibson had gone to the Pacific Coast from the East especially to discuss at this meeting his plan outlined in the March issue of *Electrical Merchandising*. The plan of basing discounts on each order on the quantity of that order was approved. The sense of the meeting was that, although adjustments must still be made, the Goodwin plan, which is the Pacific Coast plan, and the Gibson plan could be worked together. The next meeting of the jobbers' association was set for the middle of August at Paradise Valley, in Rainier National Park.

CONTRACTORS' AND DEALERS' MEETINGS

The California Association of Electrical Contractors and Dealers in its separate sessions decided unanimously to join the national association. Its sessions took on a broader tone because of the attendance of jobbers and manufacturers' representatives, who frequently participated. Two sessions devoted exclusively to the interests of motor men proved so helpful that a permanent motor section was proposed. Papers on motor sales were presented by F. W. Buzzell, San Francisco; C. E. Ingalls, San Francisco; H. H. Courtwright, Fresno, and E. Boyd, General Electric Company, San Francisco. The chief topics were the relations between manufacturer and agent and how to build up motor business.

In answer to the complaint that the motor business does not pay, Mr. Boyd affirmed that it does pay if properly managed. The study of motors, in order to analyze customers' needs and render service after the

sale, was urged upon dealers. The question of who is entitled to motor agencies was discussed at length, and all were in accord with the point that only those able to make sales intelligently and to render service should be so recognized. W. H. Gribble, Chico, suggested that one of the subjects of frequent controversy could be settled by making discounts only to motor agents.

COMMITTEES TO GET TOGETHER

T. E. Bibbins, Pacific States Electric Company, San Francisco, urged that dealers get together and agree on improvements desired in the present plan. Manufacturers would welcome a uniform plan, he said, but while all sections of the Pacific Coast demand different action no changes whatever could be expected. These were the sentiments of the meeting. The dealers appointed a committee of three, and the manufacturers were asked also to appoint a representative committee in order that uniform plans might be agreed upon and steps taken to put them into effect.

The manufacturers' margin is small; so methods whereby the dealer can increase his profits on the present basis were considered. Study of the means of increasing rate of turnover and volume of business was suggested. Investigating the requirements in special lines, such as the printing trade, woodworking shops, etc., was advised. Purchasers will prefer dealing with local men rather than with manufacturers if the former render the desired service. Motors should not be sold to get wiring jobs, and the awarding of agencies to unscrupulous dealers was also condemned.

Chairman Frank J. Somers, San José, went on record as opposed to any more closed meetings of the association.

Among others who spoke were R. A. Balzari, Westinghouse company, San Francisco; W. S. Berry, Western Electric Company, San Francisco; A. J. Myers, Wagner Electric Company, San Francisco; P. H. Affolter, Garland-Affolter Engineering Company, San Francisco; F. S. Thomas, Valley Electrical Supply Company, Fresno; C. L. Lamoree, Westinghouse company, Los Angeles; C. F. Butte, Butte Engineering & Electric Company, San Francisco; C. S. Renwick, Richmond, and Frank E. Doerr, San José.

ENTERTAINMENT FEATURES

The joint entertainment features proved most effective in facilitating closer relationships, and at the Friday evening banquet a stirring patriotic address by Prof. Charles Mills Gayley, dean of the faculty of the University of California, brought home to all the importance of enlisting every resource and individual in win-the-war service.

Kingston, Jamaica, Reports Good Year

In the annual report of the West India Electric Company, Ltd., for the year ended Dec. 31, 1917, James Hutchinson, the president, says: "In consequence of a plentiful rainfall throughout the year the hydraulic station has been able to supply the necessary power for operating, with only occasional assistance from the auxiliary steam station; therefore the consumption of coal has been small. The company has been very fortunate in this respect during the last three years, especially as coal in Kingston has more than trebled in value."

Selling the War Savings Stamps as Steps Toward Liberty Bonds

NOTICE TO EMPLOYEES

We have no sympathy with workmen we have heard of who willfully slow down during regular working hours and days so as to make overtime necessary; and if any of these appear on our force they will be the first to get laid off. We are only too glad to pay tribute to all of our men who have worked for us steadily, and to say that no such criticism has ever been directed against them.

Sometimes, particularly on urgent work for the Government, overtime is absolutely necessary. If, under these circumstances, our employees earn overtime, we strongly urge them to put it, or in any event, a large part of it, into War Savings Stamps.

The virtues of U.S.S. are too well known to be dwelt upon here; but we remind you that every stamp you buy helps to shorten the war and is the safest and best way to save. When January 1, 1923, comes around, work may not be as plentiful as it now is, and you may be very glad to have War Savings Certificates to cash in.

You will find in each pay envelope a form to be filled out, indicating the amount of your pay you will be willing to take in war stamps, we having been appointed an authorized agent of the Treasury Department to sell stamps at cost.

F. W. LORD,
President.

"While a great many workmen may not be able to subscribe for Liberty bonds, there is no one who cannot buy war savings stamps," says F. W. Lord, president Lord Electric Company, New York. "In order to inculcate the thrift habit, we have caused this notice to be posted up wherever our men are at work.

"There is no question but that the war savings habit makes a strong and solid foundation for investments of the larger order, such as Liberty loan bonds, and we are encouraging all our workmen to save as much as they can afford, believing that it will not only be to their own benefit but to the benefit of the country."

WAR TENDENCIES NOTED BY UNDERWRITERS' LABORATORIES

Dana Pierce Speaks to Electric Club-Jovian League of Chicago on the Work of the Underwriters' Laboratories and the War

Speaking before the Electric Club-Jovian League of Chicago on May 9, Dana Pierce of the Underwriters' Laboratories, New York, told of the large amounts of wire and conduit which are being inspected by the regular forces of the laboratories, thus relieving, through systematized inspection, many men for other war work who would otherwise be required in an organization built up especially for such inspection purposes.

In commenting upon the tendencies which have been noted by the Underwriters' Laboratories in the development of electrical material during the war, Mr. Pierce stated that appliances to assure greater safety were decidedly in the ascendency. These are of two classes, namely, arrangements for grounding and arrangements for effecting inclosures of current-carrying parts. He dwelt at some length on the complications entering into problems of inclosing electrical equipment.

It was the prediction of Mr. Pierce that after the war there would be a marked advance in the field of electrical signaling growing out of work that has been done in the war. He also stated that there is at the present time a pressing need for the development of devices which will afford slightly, safe and inexpensive methods of extending light and power outlets from completed jobs. The now common flexible-cord method of carrying on this work met his severe criticism.

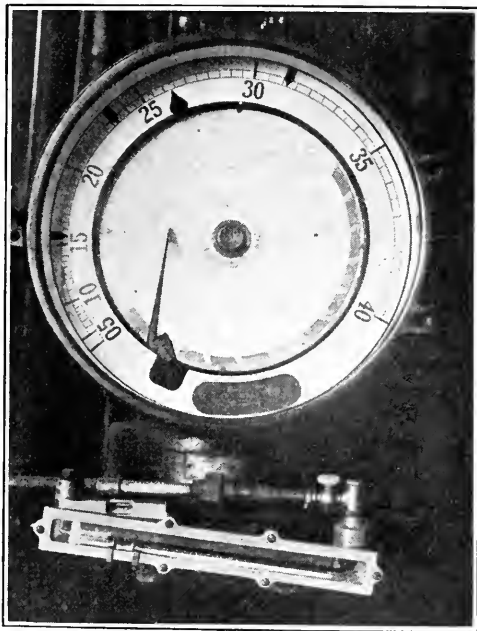
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SPECIAL CALIBRATION OF STEAM-FLOW METERS

Full-Load, Load and One-Half and Double-Load Points for Units on Which Meters Are Used Are Shown by Red Markers

Additional markings are sometimes desirable on steam-flow meters used on individual boilers to indicate the full-load, load-and-one-half and double-load points. A meter calibrated in this manner is shown in the ac-



100, 150 AND 200 PER CENT LOAD POINTS INDICATED ON SCALE

companying illustration, the points mentioned being indicated by pieces of red paper pasted on the white dial. They may be easily removed if desired.

SHOP VERSUS FIELD TESTING OF NEW WATT-HOUR METERS

Minneapolis General Electric Company Favors Testing in the Field Exclusively—New Meters Are Set Without Testing After Rigid Inspection

Many central stations, according to George W. Hewitt, meter foreman of the Minneapolis General Electric Company, are actually wasting time and money testing new meters just received from the factory. Virtually all factories ship meters which are guaranteed to be accurate within 2 per cent. Testing the meters in the shop, carting them around all day in a vehicle, often installing them wrongly and not testing again for a year or so induces much "lost motion." "A shop test as compared with a service test, especially on direct-current meters, is not worth the money expended on it," says Mr. Hewitt.

In his opinion, the only test worth consideration is that made under actual service conditions. When the commutator of a direct-current meter, for instance, is polished and the meter adjusted it will be found that aging due to the oxidation of the silver commutator affects the meter and that a test made from thirty to sixty days after installation will show different results from a shop test or that made at the date of installation. Then, again, local and earth magnetic fields affect meters to a large extent, depending on the position of the meter. Errors of 5 to 10 per cent sometimes result from this cause.

The Minneapolis General Electric Company meter department does 90 per cent of its testing in service, holding its shop testing to a minimum. Meters which are repaired in the shop are adjusted within 2 per cent of complete accuracy, and new meters are not tested at all. They are thoroughly inspected and then tested within thirty days after the installation and adjusted to within 0.5 per cent of accuracy. The fact that 95.7 per cent of the installations tested are within the legal limit of 2.5 per cent accuracy seems to bear out the contention that this method of testing is satisfactory. According to the records, only eighteen meters out of 4309 recently installed failed to register. This plan of testing meters after installation has the further advantage of being a check on the men who install the meters.

FLEXIBLE DISTRIBUTION AS USED IN CLEVELAND

Emergency Connection Boxes Arranged So that Service Can Be Maintained in Case Transformers Feeding Any Section Break Down

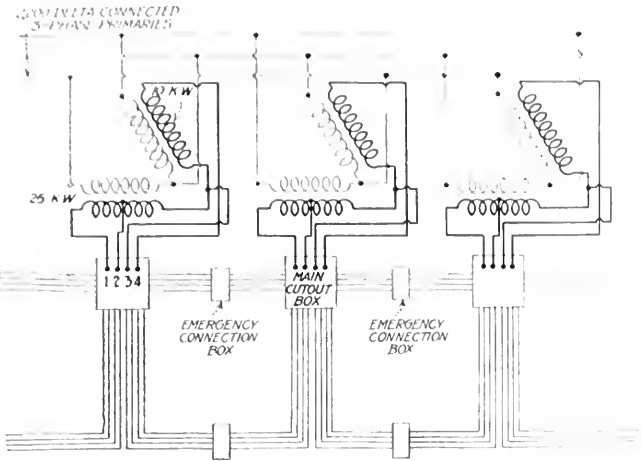
By employing the arrangement represented in the accompanying illustration the Cleveland (Ohio) Electric Illuminating Company prevents the spread of any disturbances and also makes it possible to maintain service in case transformers feeding any section break down. The corresponding terminals of the transformers are connected with different phases so that a practically balanced load is maintained on the three-phase primary circuit.

The secondary system is primarily for 220-110-volt lighting circuits, but three-phase power loads can be carried by the open-delta connection provided. The lighting circuit is connected across terminals 1, 2 and 3, 220 volts existing between the outside wires and 110 volts between the outside conductors and intermediate wire.

The secondary mains are arranged in rectangles, provision being made for connecting adjacent sections through the emergency connection boxes. The circuits at these points are normally left open to prevent the spread of any disturbances which may occur in any section. When the emergency connections are made

they cannot be run straight through, as the phase relations differ in adjacent sections.

If the transformer bank in the middle section, for instance, cannot be used, it is disconnected from its particular section of the secondary system and the corresponding phases are joined in the emergency connec-



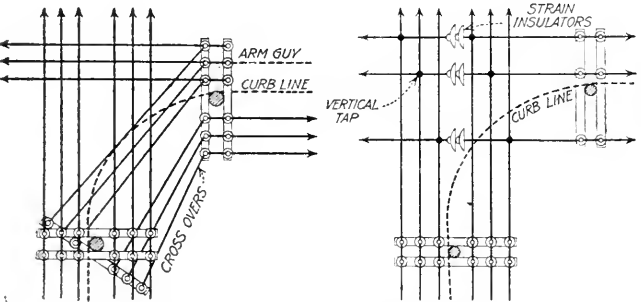
EMERGENCY BOXES SECTIONALIZE SYSTEM BUT PERMIT CONNECTION WHEN NECESSARY

tion boxes between this section and the adjacent ones. With this arrangement the transformers on each side of the section will each be required to carry 50 per cent of the load in the intermediate section.

VERTICAL TAPS SIMPLIFY THE TURNING OF CORNERS

Method of Construction Which May Be Employed at Street Intersections Where There Are Wide Curbs and Rounded Corners

Corner work is often complicated and difficult to install with adequate clearance between wires in cities having wide curbs with rounded corners at street intersections. Single-pole buck-arm corners are generally impracticable even when side or alley arms are used, since the wires are brought too close to buildings thereby. Therefore a double-pole corner must be installed with connecting cross-overs run between poles.



FIGS. 1 AND 2—OLD AND IMPROVED METHODS OF CONNECTING LINES RUNNING AT RIGHT ANGLES

Vertical taps are sometimes employed rather than cross-overs as they give a neater installation. They are, however, more difficult to place, particularly where the poles are so high that the taps cannot be made from tower wagons.

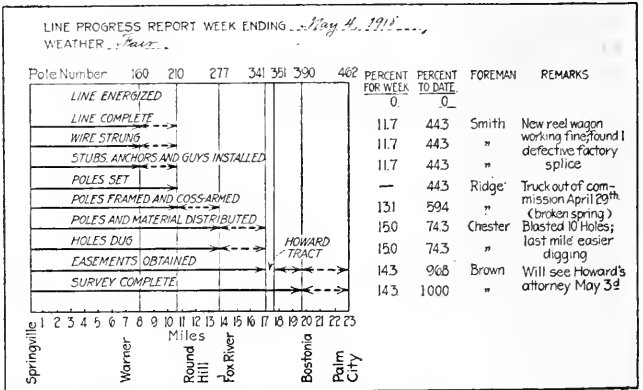
A special installation in which considerable saving in first cost with added safety and simplicity was se-

cured by means of vertical taps and special line insulators is illustrated in the accompanying figures. In this case two independent 11-kv. circuits passed by a street intersection where it was desired to provide a branch from each circuit, one to the right, the other to the left. The usual method of installing cross-overs would have required the construction shown in Fig. 1. Owing to the relatively high voltage of the circuits a 45-deg. buck-arm would have been required on the higher pole in order to secure proper clearances. However, by installing vertical taps and strain insulators as shown in Fig. 2, the construction was greatly simplified, both as to dead-ending and guying. Strain insulators were installed in pairs to secure an added factor of safety, although single units were sufficient for the voltage here employed. The insulators and taps are so placed that under normal operating conditions with both lines energized there is no potential across the insulators. The taps were installed by a lineman working from a temporary steel cable swung across the span.

GRAPHIC METHOD OF MAKING REPORTS OF PROGRESS

Adapted Especially to Transmission and Distribution Construction—Saves Clerical Labor and Still Is Complete

A form of graphic and tabular progress report adapted to transmission or distribution line construction is illustrated herewith. Field construction parties are not ordinarily well fitted for clerical work, and this form of report, which may be blueprinted or mimeographed in advance, will save considerable labor without sacrificing completeness. The lines showing progress for the current week may be dotted, as shown in the diagram, or entered in a different color from the rest of the completed work. If a background of cross-section paper is used with a scale of one hundred spaces to the entire distance, the percentages may be read directly. Vertical lines are drawn and pole num-



PROGRESS OF DIFFERENT LINE INSTALLATION OPERATIONS INDICATED BY LENGTH OF LINES

bers entered only at significant points. Obviously every pole cannot be indicated, but indicating the exact pole at which work began or stopped adds definiteness to the report. The proportion of the work done up to date and for the week, the foreman's name and other pertinent information are given at one side of the chart, as shown above.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

ELECTRIC PROCESS IN THE MELTING OF BRASS

H. M. St. John of Commonwealth Edison Company
Gives Present Status of Electric Brass Melting
and Discusses Central-Station Point of View

Important advances in the art of melting brass by electricity have recently been made, and the present outlook warrants a considerable degree of optimism, says H. M. St. John of the Commonwealth Edison Company, speaking before commercial members of the Ohio Electric Light Association at Cleveland on May 8. "So far as yellow brass is concerned, it cannot be said that an entirely satisfactory furnace has yet been produced," said the speaker, "but the field has been partially covered, and the prospects for future advancement in the art are good. In 1914 it was estimated by H. W. Gillett of the United States Bureau of Mines that there were 3600 plants engaged to some extent in melting brass and bronze. It was further estimated that the value of the metal annually melted by these plants was in the neighborhood of \$120,000,000. Of this amount the metal lost beyond recovery during the melting operation was not less than \$3,000,000." Mr. St. John continued:

If all the brass and bronze produced in the United States could be melted in electric furnaces, the annual consumption of electric energy for this purpose would be in the neighborhood of 200,000,000 kw.-hr. and the generating capacity required to supply the necessary power would be about 75,000 kw. There is little reason to expect the complete electrification of this industry either now or in the future, but the expansion in this field which may reasonably be expected is sufficiently large to be interesting to the central-station companies.

A central station not only has an object in promoting the satisfactory progress of this development but has at stake interests which can only be protected by a constant oversight of such features of development as directly concern itself. For example, all furnaces are not equally satisfactory from the standpoint of economical power supply, and the power company which expects to furnish power for an electric furnace installation should, for its own sake, be familiar with the electrical and operating characteristics of the furnace.

Not all electric furnaces are good. Good electric furnaces can be misapplied. Such misapplications have been made and are now being made. Good electric furnaces properly applied may result in failure because of faulty operation. This, too, has happened. When such a failure occurs three parties suffer. The user of the furnace has lost some money, but he can go back to his old practice and use a fuel-fired furnace. The seller of the furnace has lost a customer, but he can find another, a few hundred miles away, who has never heard of the failure. The central station has lost an opportunity to extend a profitable phase of its business. Every such failure becomes town talk, in an industrial sense, in the community in which it has occurred, and makes it increasingly difficult to promote the use of electric furnaces in that locality. The business of the central station is generally limited to a relatively small territory, and its loss of possible future profits is correspondingly greater because more concentrated than that of the seller of electric furnaces.

The central-station industry has something to gain by the successful development and use of electric furnaces. It has something to lose by their failure. It is in a position to protect this interest and should do so by informing itself quite fully concerning the possibilities of electric furnace application within its territory.

METHODS OF ASSESSMENT FOR ORNAMENTAL LIGHTING

A Discussion of the Existing Situation in Syracuse,
N. Y., Defending the Equal Division Be-
tween the City and the Abutters

The question of who shall pay for an ornamental lighting system, and in what amounts and according to what conditions, keeps continually coming to the front. The situation in Syracuse, N. Y., in this connection is discussed by A. R. Acheson, consulting engineer, in the following paragraphs, which were addressed to the Commissioner of Public Safety:

The ornamental lamps were installed and are maintained as an advertising proposition. If this be conceded, then citizens who recognize, with us, that the system is not economical from a lighting standpoint, should ask the question whether the system has been effective as an advertiser of Syracuse and whether such advertising has been of the kind to help Syracuse. In our judgment, the answer must be a decided yes. Consideration of a future system of ornamental lighting should include the advertising feature. Further, if the advertising feature be conceded, then it follows that the cost of maintaining the system should be borne by those benefited by the advertising. The city at large is benefited, but the abutting property owners more especially. If the exact value of the advertising to the abutters and to the city were known, the cost of the ornamental lamps could be equitably assessed. Such advertising value cannot be definitely known, and so an arbitrary division of the cost was established by law, whereby the city at large pays not more than 50 per cent of the cost of the ornamental lighting, the other 50 per cent being assessed on the abutting property owners "in the same manner as are ordinary taxes," i.e., "according to valuation" of the abutting property. As you have shown, the legal authorities now agree that the present law compels assessment "pro rata according to the valuation of abutting property" and does not permit of assessment according to foot frontage or any other method.

When ornamental lamps are installed in any new district of low valuation the burden of the cost of such lighting falls on the high valuation district; hence we have the queer case of the outlying district getting something at the expense of the center district and at the same time getting advertising which attracts trade away from the center district. This is manifestly unfair and has led the city administration to consider having the law changed to permit other methods of assessment. Other methods proposed are these:

1. Assess according to front footage.
2. Assess half of the abutters' cost according to valuation and half according to foot frontage.
3. Assess according to the land valuation only.

Those who advocate retaining some portion of the assessment "according to valuation" do so on the theory that the large department store, for instance, gets more advertising than does the small store with same frontage. This is

debatable. Objectors to foot-frontage assessment say that vacant lots are unduly assessed. It is noticeable, however, that the demand for extension of the system comes from locations where vacant or poorly developed sites predominate. Please note the proof of the advertising feature.

Some contend that the advertising should be paid for as other advertising is—every one pays the same amount for the same quantity of printed matter. Hence ornamental lamp advertising should be according to the foot.

Some say the streets are being used for advertising, and so the cost of such use should be in proportion to the traffic, and hence approximately in proportion to the valuation.

An arbitrary decision must be made. The writer favors assessing 50 per cent on the city at large and the remaining 50 per cent on the abutters according to the front footage, after a deduction has been made for any lighting that is eliminated when such ornamental system is installed.

It may be well to call attention to the fact that if the law is changed and assessments are made according to foot frontage or some similar method, there will be a considerable readjustment of the burden of the cost on abutters. The owners in districts of low valuation will have their assessments increased. This may lead to an agitation for having the city pay the whole cost; in fact, some are raising that issue already. In our judgment, it would be a mistake for the city to assume all the cost of the ornamental system, as that would be discrimination in favor of the center district and would open the way to unwarranted demands upon the city for extensions of the system, the 50 per cent deterrent having been lost.

EXISTING LEGAL STATUS OF CONTRACTS FOR POWER

A Public Utility May Publish Rates for All Classes of Service, but Is Not Permitted to Alter Them by Contract or Otherwise

The often-discussed subject of whether certain deviations from the published schedule of rates invalidate contracts for service was dealt with by Leroy E. Eastman at a recent meeting of the new-business co-operations committee of the Ohio Electric Light Association under the title "The Legal Status of Power Contracts."

He went into the status of a contract which provides that electricity shall be furnished to a certain customer during a term of years at a rate different from the published rate; of a contract which contains a published rate when made and where during the term of the contract the published rate is changed; of a contract whereby the company agrees not to change existing schedules, and of a contract which places a consumer in a class other than that in which his actual physical condition would naturally place him.

The author pointed out that the courts of every state have consistently condemned every special contract or private arrangement which differed from the regular published schedules and which in effect created a preference, or which tended to discriminate in favor of an individual consumer. The intention of the parties, he stated, is of no consequence, and the only consideration is the question whether or not the situation in which the court finds the parties is one which will lead to an evasion of the statute and will open the door to unequal rates.

This is upon the general principle that ignorance of the law is no excuse, and if the direct object of the parties is to do an illegal act, the agreement is void, and it is immaterial that either or both did not know that the object was illegal, and also upon what is perhaps the more sound view that the published schedules are open

for public inspection at all times and the consumer is charged with knowledge of their contents.

Thus, it was stated, a contract specifying rates less than those named in the schedule is wholly illegal and will not be enforced though there was no intention to violate the act. Furthermore, contracts fixing rates for a series of years are of no force, it was shown, against subsequent lawful change in rate within the period covered by the contract. Such contracts have been condemned in many cases. The courts adopt the view that the law is a part of every contract, and the parties to such a contract take it subject to any change which may thereafter be made in the rate.

It was also stated that contracts which attempt to place a customer in a certain class are held to be invalid.

In considering each of these situations actual cases were cited, and in every one the only point in which the courts seem to be interested, according to the author, is whether or not the contract or arrangement amounts to discrimination or produces any of the results forbidden by the statute.

No distinction, it is stated, has been made between contracts made before and those made subsequent to the passage of the public utility acts. It would seem that the various state statutes would not have the effect of abrogating pre-existing contracts because of the provision of the federal constitution that the state shall not pass laws impairing the obligation of contracts; but the courts hold that such acts are properly within the police power of the state and may be enforced even against pre-existing contracts.

"It seems clear," the author said in conclusion, "that the duty of the utility is to publish a tariff for every class of service which it has to sell, and that it has no power to alter or vary the rates fixed by those schedules by any contract, arrangement or device whatsoever. A complete remedy is afforded by the statute to both the utility and the consumer by complaint filed with the commission for relief both against insufficient and against unreasonable rates."

METER ACCURACY OF ONE COMPANY AFFECTS OTHERS

Good Practice for Large Companies to Check Standard Meters of Smaller Neighboring Utilities if Requested to Do So

It is the policy of the Minneapolis General Electric Company to calibrate the rotating standards of the smaller neighboring utilities at cost. This plan is adhered to regardless of any amicable relations that may have been established between the larger company and its smaller neighbors by underlying financial relations or by cordial relations among the personnel of the organizations. It is thought to be good policy purely in the interest of keeping all nearby standard instruments in accurate running condition. This accuracy in turn is reflected in the meters of individual customers. Hence, when the Minneapolis company gets a new customer who has been living in one of the surrounding towns it does not get from him a complaint arising from the fact that his meter at his old home was slow while the meter in his Minneapolis home registers correctly. Such a condition was entirely likely under the older methods of handling meters.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Relative Advantages of Three-Phase-Monophase Current Converters.—CESARE DELLA SALDA.—The synchronous type of converter, besides being able to function simultaneously as a synchronous condenser, has the possibility of being used with more than three phases. The series type, in its varied forms, is simpler, does not require automatic apparatus and is more economical. This type is advantageous if it is desired to derive current from a single phase of a three-phase network. It does not, however, permit correction of power factor. The different types of asynchronous converters have the advantage of improving the power factor.—*L'Elettrotecnica*, March 25, 1918.

Generation, Transmission and Distribution

Fuels and Their Efficiency for Central Stations.—NEWTON HARRISON.—Good and bad fuels, heat value and composition of fuels, free-burning fuels, caking, coking, difference between anthracite and bituminous coal, the amount of air required, low-grade fuels and the amount of heat required to evaporate water are subjects discussed in this article.—*The Central Station*, April, 1918.

Improvements in Waterwheel Efficiency.—E. C. HUTCHINSON.—The subject is divided into three parts: (1) Improvement in power output by the installation of modern waterwheel runners, the rest of the equipment remaining the same; (2) improvement of power output through decreasing the size of the water-economizing nozzle; (3) general improvement of the entire unit by installing both modern waterwheel runners and water-economizing nozzles.—*Journal of Electricity*, April 15, 1918.

Electric-Power Supply at Buenos Aires.—This article deals with the equipment and various classes of apparatus used in the installation and is copiously illustrated with instructive diagrams.—*London Engineering*, March 1, 1918.

Joint Operation of Power Companies.—J. P. JOLLYMAN.—The results of operating power companies jointly, made possible by the interconnection of their power lines, are embodied in an appendix to the article.—*Journal of Electricity*, April 15, 1918.

Linking Up Rural Communities in Iowa.—How the inefficiency attending the independent operation of comparatively small electric light properties in Ohio has been avoided by interconnecting their systems is discussed in this article.—*Chicago Electrical Review*, April 6, 1918.

Use of Pulverized Fuel and Its Possibilities in the War.—F. P. COFFIN.—The first section briefly summarizes the advantages of pulverized coal, treats of the suitability of its use as fuel for stationary boilers, locomotives, steamships and metallurgical furnaces, and recommends its adoption to conserve our coal resources and to release for military use the fuel oil

now burned for industrial purposes. Following a description of the indispensable part that electric power plays in the preparation, handling and burning of pulverized fuel, the second section of the article presents an impressive list of the American users of pulverized fuel.—*General Electric Review*, May, 1918.

Interconnected Power Systems of the South.—This article deals with the hydroelectric systems of independent companies operating in five Southern states which are interconnected into one vast transmission system, permitting considerable economies in operation. The layout of the different plants and statistical data regarding their ratings, loads, power factors and yearly output are given in the article, which is illustrated by a map showing the high-tension network considered.—*Metallurgical and Chemical Engineering*, May 1, 1918.

Secretary Lane Urges Water-Power Development.—An interview with Secretary of the Interior Lane, who is quoted as saying: "The electrochemical industries of the United States have been found particularly essential to the conduct of the war, and yet they have not had adequate power. If these industries are to be fostered in this country and their extension made possible, it will be necessary to provide more power; otherwise we are confronted with the expatriation to more favorable localities of those industries which should be established here. More power should be developed at Niagara, and I believe that the United States and Canada should enter into an agreement for a large international development there that will make 1,000,000 hp. available to both countries. It is not at Niagara alone, however, that we need to develop water power. Our program should encourage development throughout the country wherever there seems to be a necessity for it and wherever we have mineral resources contributory to electrometallurgical industries."—*Metallurgical and Chemical Engineering*, May 1, 1918.

Hydroelectric Economies.—J. P. JOLLYMAN.—As much as 77 per cent in over-all efficiency has been obtained in the hydroelectric plants of one Pacific Coast company by replacement of obsolete equipment and other improvements in combination with an effective system of testing and checking performance. The best efficiency obtained with impulse wheels was about 82 per cent and with Francis turbines from 85 to 87 per cent. The value of accurate continuous records of the amount of water supplied to the hydroelectric plants has justified the installation of Venturi meters in the pipe lines of their most recent plants. Automatic nozzle control is not used on any of the impulse units. All of the high-head Francis turbine units are equipped with relief valves adjusted to close automatically when desired. "Improvements in efficiency may be expected," says Mr. Jollyman, "from a change in buckets, (a) if the form of the original buckets does not approximate closely to the best modern types, (b) if the buckets have become pitted or waved, (c) if the buckets have

so worn at the entrance as to permit the spilling of live water, or (d) if the buckets have holes worn through them to a material extent." Data showing the pipe line, waterwheel, generator and transformer efficiencies of three hydroelectric plants are given.—*Journal of Electricity*, April 15, 1918.

Traction

Railway Substation for Paris Railway.—LUCIEN PAHIN.—Description of the substation erected in 1914 at Bagneux on the electrified railway line extending from Paris to Anthony, a distance of 8.3 km. (5.18 miles). This substation is rated at 1300 kw., two six-phase commutators of 425 kw. each having been installed, with provision for a third. Three-phase current at 50 cycles and 15,000 volts is furnished by the central station at Issy-les-Moulineaux and stepped down to 450 volts.—*L'Industrie Electrique*, March 25, 1918.

Installations, Systems and Appliances

The Radioscope in the Treatment of Wounded Men.—A new radiosopic method of discovering projectiles in the bodies of the wounded. The apparatus requires only a disk and two wires, and it necessitates no calculation, no tracing on the screen and no removal of the patient. The location of the foreign body is shown by a simple reading.—*Revue Générale de l'Electricité*, March 30, 1918.

Steel Plant Applications.—F. B. CROSBY.—The article is devoted to a description of the process of manufacture of steel wire at the plant of the Keystone Steel & Wire Company, starting from the raw materials with which the open-hearth furnaces are charged and ending with the finished product. Interspersed between the sections describing the process are descriptions of the electric equipment which vitally contributes to the successful operation of the plant. The layout of the plant is illustrated by diagrams, and curves are presented showing the speed-horsepower and speed-torque for reversing blooming mill drive.—*General Electric Review*, May, 1918.

Electric Furnaces for Melting Brass (Editorial Comment).—The main reasons underlying the economic change, now taking place, from fuel-fired to electric brass furnaces are to be found in the conservation of time, metal and fuel, improvement in the sanitary conditions of the foundry, and the higher strength and uniformity produced. The metallic loss, especially of zinc, is said to be reduced to at least one-half. With thermal efficiency averaging perhaps seven times that of a fuel-fired furnace, the electric furnace affords a great saving even when using energy from a steam-electric plant. With hydroelectric current the saving is considerably increased. The saving of time and labor per unit of production is of special importance, especially under present industrial conditions. There are on the market to-day over a dozen different electric furnaces for non-ferrous metallurgy, representing five different types, namely, induction, radiating-arc, direct-arc, resistance and high-frequency. These are used for the production of a variety of metallic alloys which may be classified substantially as follows: (a) yellow brass with less than 3 per cent lead; (b) red brass and bearing-metal irrespective of the lead content; (c) red brass with low lead content, and (d) the aluminum mixtures. The induction furnace is the type hitherto

found most suitable for melting yellow brass with a spelter loss of 1 per cent or less. This is due to that characteristic of the induction furnace which permits accurate heat control, with consequent uniform temperature throughout the bath of metal. The advantage is obvious if it is desired to keep the volatilization of zinc at a minimum.—*Metallurgical and Chemical Engineering*, May 1, 1918.

Miscellaneous

Eliminating Corrosion Caused by the Carbonic Acid Contained in Steam.—CH. CHOROWER.—In an article previously published (*Revue Générale de l'Electricité*, Nov. 17, 1917) the author attributed the corrosion of boilers and steam-driven machinery to the action of the carbonic acid contained in steam and advocated ridding the feed water of this gas. In the present article he gives the result of seven years' work along this line and claims to have demonstrated scientifically, as the outcome of experiments in the central station of Lisbon, Portugal, that by preliminary chemical treatment of the water and subsequent watchfulness corrosion can be eliminated.—*Revue Générale de l'Electricité*, April 6, 1918.

The Rivetless Ship a Possibility.—Electric welding as a substitute for riveting is being tested by the government at four shipbuilding yards, and so far the work is proving highly satisfactory. According to recent data, the process will increase the strength of the joint at least 25 per cent and decrease the time to get out a hull nearly 50 per cent. Eminent marine engineers claim that there will be a saving in labor of 60 to 70 per cent. The machine employed is the Wilson welder. At present the plates are being lap-welded, the plates being overlapped at least 2 in. (5.1 cm.), sometimes more, and each edge welded down. In the future it is the intention to butt-weld the plates, in which case they will be beveled so that when placed edge to edge V-shaped grooves will be formed, into which the welding metal will flow, leaving a welt over the top of the V. The reverse side, the one exposed to the sea, will be left perfectly smooth. By this method considerable steel will be saved which otherwise is wasted by overlapping, and at the same time the weight of the ship will be reduced. Plates 3½ in. (8.9 cm.) in thickness have been welded, this being the maximum thickness used on the particular jobs where observations are being made. The advisability of casting entire steel sections and then welding them together is also under consideration. While electric welding will eliminate the use of rivets to a large extent, there is at present a certain amount of riveting to be done in attaching the plates to the frames. Repair work can be done without removing the broken parts from a ship. When a vessel comes into port with a broken cylinder the repair can be made on board. No preheating or annealing is necessary. A novice can be developed into a satisfactory electric welding operator in thirty days, and from available data it is estimated that thirty welders can do the work of 125 riveters. The Wilson welding outfit operates on what is known as the arc principle and consists of a motor-generator set, the generator of which is wound for 35 volts. The welding metal serves as one electrode, while the ship plates constitute the other electrode.—*Marine Review*, May, 1918.

Scientific and Industrial Research

A Department Devoted to Interchange of Ideas, Investigations Contemplated, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Apparatus Available*

LAMPS, ACCURATE LIFE TEST.

Booster transformers are used in the individual lines to life-test racks for incandescent lamps, in order to maintain the exact voltages required, irrespective of the load. There are forty voltage steps, covering a total range of less than two volts.—Clayton H. Sharp, *Electrical Testing Laboratories, New York City.*

Suggestions for Research*

ARC RECTIFICATION.

A systematic study of very short arcs or sparks displaying themselves between two electrodes of different material is urged as a means of developing rectification methods. Water-cooled copper as the anode and carbon as the cathode seem to be quite suitable for this work. The arc gap ought to have large cooling flanges which tend to enhance the de-ionization and to reduce the temperature of the path of the arc at the time when the arc is supposed to be extinguished. A careful study of a quenched spark gap would be a good introduction to any one who should care to attack this rectifier problem.—August Hund, *Berkeley, Cal.*

CABLES, TEMPERATURE RISE IN.

The temperature that ducts and conductors will attain when laid in duct systems in different kinds of earth would be interesting; also the relation of surface temperatures and of the ambient earth temperature to those in the ducts. Research along this line should comprise tests on duct systems having different numbers of ducts well filled with cables which are operating under light, normal and heavy loads. The radiating power of duct structures, surrounded by different kinds of earth or sand, should also be studied at different times of the year. Careful consideration should also be given to the rate at which the temperature drops from the duct structure outward and what effect the street covering has on this gradient. Recently one company lost several cables because the streets were covered with asphalt pavement. On taking up the pavement it was found that the soil around the duct structure was absolutely dry from excessive heat, the asphalt paving having prevented the water from entering the soil around the ducts.—H. W. Fisher, *Standard Underground Cable Company, Perth Amboy, N. J.*

CONDUCTORS, MECHANICAL STRENGTH.

A method of determining the mechanical characteristics of composite strands of cables made up of steel and copper wires of various percentages of the two metals would be valuable. Perhaps the greatest experimental difficulty in testing the samples of cable to be examined would be in providing terminal attachments. They must be such as to avoid having one or more loose wires in a strand when the load is first applied. This would naturally be more difficult the shorter the sample.—H. H. Cochrane, *Montana Power Company, Butte, Mont.*

CONDUCTORS, SKIN EFFECT.

It would be of interest to know the skin effect in a composite strand about 0.4 in. (1 cm.) in diameter, made up of a central steel wire surrounded by three steel wires and three copper wires arranged alternately around the center. This conductor would be used for high-voltage lines of small or medium power capacity, in which the size indicated would be required to avoid corona, but only the copper indicated would be required for conductivity.—H. H. Cochrane, *Montana Power Company, Butte, Mont.*

CONDUITS, HEAT TRANSMISSION.

The thermal resistance of duct lines to dissipation of heat is of considerable importance in determining the temperature rise of cables. Since a study of actual conduits is rather difficult because of the many variables involved, the following method is suggested: Make up from sheet metal small unit-length models of a conduit line and place in a glass vessel filled with an electrolyte to represent the soil around the ducts. Measure the resistance between the duct and surface of the electrolyte which corresponds to the earth's surface. In this way the effect of duct arrangements and conduit depths can be studied and certain constants obtained which would be applicable to actual conduit lines.—Richard C. Powell, *San Francisco, Cal.*

CONSTANTAN.

Relation between the composition of constantan and the stability of its thermal emf. with use under various conditions of oxidizing and reducing gases.—M. E. Leeds, *Philadelphia, Pa.*

CORONA.

The influence of temperature and air pressure on the electric breakdown of air should be known in connection with the use of the corona voltmeter.—J. B. Whitehead, *Johns Hopkins University, Baltimore, Md.*

*The names of individuals given after each institution reporting investigations are those of persons with whom others interested should communicate. All institutions reporting research work should give such names.

GENERATORS, DIRECT-CURRENT.

It would be very desirable if direct-current generators up to 500 kw. or thereabout could be successfully built to operate at 3600 r.p.m. in order to allow direct connection to a steam turbine.—M. D. Church, *Terry Steam Turbine Company, Hartford, Conn.*

INDUCTION GENERATOR, HIGH-FREQUENCY.

A high-frequency generator could probably be built by using an asynchronous machine with a set of condensers. The nature of this device is entirely different from that of the Goldschmidt alternator, since the latter builds upon the reflection principle while in the induction generator an oscillating mutual induction is probably utilized.—August Hund, *Berkeley, Cal.*

LIGHTNING PROTECTION WITH BARBED WIRE.

In place of the ordinary grounding arrangement consisting of heavy copper or iron plates embedded in carbon in damp soil, the author recommends using about 10 m. of ordinary galvanized barbed wire wrapped into a coil about 1.5 m. in circumference. The turns must be placed close to each other so that an electrical discharge could readily jump across. The wire should be placed in vegetable earth, or where some vegetation is planted on top, so that moisture will be assured. The advantages of such an arrangement are large surface, favorable discharge characteristics due to the points, and the absence of a soldered joint. Limited experience seems to indicate that such protection is quite satisfactory, but further and more elaborate tests are recommended.—H. M. Levyier, *Escuela Industrial de la Nación, Buenos Aires, Argentina.*

MAGNETS, PERMANENT.

The influence of heat treatment and of chemical composition of steel upon the characteristics of permanent magnets offers a field for investigation.—M. E. Leeds, *Philadelphia, Pa.*

MALLEABLE IRON, MAGNETIC PROPERTIES OF.

Malleable iron has been used by the writer in the construction of small generators and motors, and, while the permeability is much lower than that of cast steel, being apparently about one-half, yet nearly the same flux density can be used. The material is much cheaper and lends itself much better to machine-shop operations. Malleable iron has been substituted for cast steel in the field frame of a number of starting motors for starting automobile engines without any apparent difference in the characteristics. The writer has never been able to find any considerable amount of data bearing upon this material, and yet the subject seems to be of great commercial importance.—Benjamin F. Bailey, *University of Michigan, Ann Arbor.*

PROTECTIVE DEVICES.

The form of electrostatic field which would break down in the shortest time and over the greatest area would be interesting in connection with the design of protective apparatus. The greater protective value of a sphere gap against over-voltages as compared to a needle gap is due to the fact that the sphere gap has a smaller time lag. An umbrella gap probably has a still smaller time lag because the electrostatic field is more uniform.—Editorial Suggestion.

SURGES IN CABLES AND OVERHEAD LINES.

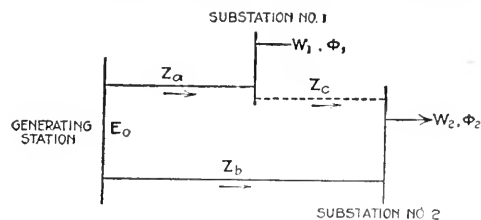
The following experimental arrangement affords a simple means for laboratory investigation of traveling surges with a steep wave front. Take a single-phase cable or overhead line, a few hundred feet long, and connect one end of it to a source of moderately high direct voltage. Connect to the cable the measuring devices and apparatus upon which it is desired to investigate the action of a surge. Keep the other end of the line open and then suddenly short-circuit it. This will produce a steep wave surge, from the generator out, with all its characteristic phenomena. For example, a wave will jump a spark-gap in series with the conductor rather than go through a low resistance loop shunted across the spark-gap.—Editorial Suggestion.

TELEPHONE, LOUD-SPEAKING.

There is still a wide field for further improvement of loud-speaking telephones and for a scientific study of the best conditions. The hot-cathode amplifier might easily prove to be a useful adjunct in such devices. (The development of corrective devices for the deaf is of particularly practical and humanitarian importance now that many soldiers will soon be returning from the war with their hearing rendered defective on account of the hardships encountered at the front.—Editorial Suggestion.)

TIE-LINE PROBLEM.

The following problem is of interest to operating companies, and it is desired to obtain a solution, analytical, graphical or combined, in such a form that even one not well versed in the intricacies of alternating-current vectors or complex quantities could apply it to his own case. Referring to the accompanying diagram, two substations are fed each with polyphase power



from a station bus through one or more lines in parallel. The combined impedance of the feeders to substation No. 1 is Z_a , of those to No. 2 is Z_b . The loads W_1 and W_2 as well as the phase angles ϕ_1 and ϕ_2 at both substations are given. The feeders to substation No. 2 are overloaded, and it is desired to add a tie-line marked Z_c . The problem is to find the new electrical conditions when the tie-line Z_c is of a given size in operation, or to find the size that would bring about the desired relief. Of particular interest are the currents in Z_b and Z_c . Readers are invited to contribute solutions to this problem.—Editorial Suggestion.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

CHARLES A. COFFIN

HONORED BY FRANCE

Chairman of Board of Directors of General Electric Company Given High Rank of Officer of the Legion of Honor

The French government has conferred on Charles A. Coffin, chairman of the board of directors of the General Electric Company, the rank of Officer of the Legion of Honor. This was done through Justin Godart, formerly Assistant Secretary of War of France, who is in this country on a special mission.

The honor given to Mr. Coffin is in recognition of his services as a member of the executive committee of the War Relief Clearing House for France and as a member of a committee of prominent Americans promoting the establishment of scholarships in French universities for American students after the war.

Mr. Coffin is the only Officer of the Legion of Honor in America.

As is generally known in the electrical industry, Mr. Coffin has given devoted service to the great work of war relief.

ANNUAL MEETING OF SOCIETY FOR ELECTRICAL DEVELOPMENT

Work of the Society to Be Continued for Another Year on Present Basis—"Convenience Outlet" Campaign Planned

The annual meeting of the Society for Electrical Development, Inc., was held on May 14 at the offices in New York. James R. Strong presided.

James M. Wakeman, general manager, read his annual report, reviewing the work during the year and suggesting activities for the coming year. The report of the treasurer, James Smieton, Jr., was read and accepted, together with the auditor's report.

The election of directors resulted:

Representing central stations—J. E. Montague, four years; W. W. Freeman, two years; E. N. Sanderson, one year.

Representing manufacturers—L. P. Sawyer, four years; W. D. Steele, one year.

Representing jobbers—Fred Bissell, four years.

Representing contractors—G. M. Sanborn, four years.

At the directors' meeting which followed, with J. E. Montague presiding, it was decided to continue the work of the society for another year upon the present basis and to conduct a "convenience outlet" campaign as suggested by the general manager. An appropriation was made to carry on the campaign along national lines, similar to the "Wire Your Home" and "America's Electrical Christmas" campaigns.

The society will issue broadsides, booklets, folders, lithographed posters, etc., and will ask local committees to procure the co-operation of the entire electrical industry in educating the public to an appreciation of

"convenience outlets" of all kinds, such outlets to be preferably on a separate circuit from the lighting. It is felt that the time is opportune for such a campaign inasmuch as domestic servants are scarce and people have money to spend upon appliances, the proper use of which plays an important part in fuel conservation.

Henry L. Doherty was again elected president. Joseph E. Montague was elected to succeed W. H. Johnson as vice-president and as a member of the executive committee. Gerard Swope was elected chairman of the executive committee. James M. Wakeman was reappointed general manager and James Smieton, Jr., secretary-treasurer for the ensuing year.

I. E. S. DISCUSSES VALUE OF PROTECTIVE LIGHTING

Chief of Federal Plant Protection Bureau Outlines Its Work and Shows Relation of Illumination to Watch System Used

Some very practical hints regarding the best methods of utilizing artificial illumination to help in the protection of industrial plants against marauders were outlined by Edmund Leigh, chief of plant protection, Military Intelligence Bureau, at the May 9 meeting of the Illuminating Engineering Society held in New York. In discussing the subject of protective lighting he pointed out that very few industrial plant managers know the value of illumination in preventing crime and that they have to be educated as to its proper use. This the plant protection bureau is doing, but illuminating engineers and engineers connected with electric service companies and manufacturers of lighting equipment can help considerably.

Floodlighting produces beneficial results in many cases, but if not properly used it will blind the watchman and defeat its purpose. In many cases considerably better results can be obtained with localized lighting, using deep-bowl reflectors. The best results can be obtained by studying the watch system employed and adapting the lighting system to it rather than vice versa as it is usually done. Silhouette lighting is also very effective, the speaker declared, since long tracts can be guarded in this way without disclosing the position of the watchman. To give an example of how this form of lighting can be used, he referred to experience he had many years ago in guarding the Bowery in lower New York. By standing where he could see a light at the far end of the tract which he had to watch he could see marauders if they stepped between him and the light.

At the McCook aviation test ground very effective protective illumination in the form of searchlamps mounted on sentry towers is employed. Several of these towers are used, the lamps being arranged so they can be easily directed by sentries in the towers.

Mr. Leigh said that whenever the plant protection

branch of the Military Intelligence Bureau cannot cope with a protective lighting problem he calls in illuminating experts.

In the discussion which followed Mr. Leigh's talk the following men took part: George H. Stickney, Mr. Porter, Preston S. Millar and Mr. McGuire.

Mr. Stickney emphasized the need of designing protective lighting systems to fit the method of watch service employed. He also pointed out that lighting mains are often too accessible to persons who might tamper with them.

Mr. Porter had pictures cast on a screen showing different methods of protective lighting. He said that most of these are shown in the booklet which the Illuminating Engineering Society has prepared for the government. One of the principal methods of lighting shown was by means of floodlamps giving a relatively narrow dispersion of rays placed so that the light illuminated a tract parallel to the place that had to be protected. The speaker pointed out that if the dispersion is too narrow a marauder can cross the illuminated space easily and escape in the darkness.

Mr. Millar also referred to the booklet on protective lighting which the Illuminating Engineering Society has prepared for the government.

Mr. McGuire described a protective scheme which he had found very effective. An unclimbable fence was stretched around the building to be protected and the most vicious dogs that could be obtained were turned loose in the space between the fence and the building. Watchmen are stationed at the four corners of the building, and time clocks must be rung one-half minute apart. Thus no watchman can ring for another.

Another speaker called attention to the undesirable use of high-intensity small-spread lamps too close to the ground, saying that lamps of smaller intensity equipped with stippled glass screens to reduce the intrinsic brilliancy of the source are much better. He expressed the belief that the best lighting for railroad yards can be obtained by using deep-bowl reflectors. Flame-arc or incandescent lamps are suitable under such conditions.

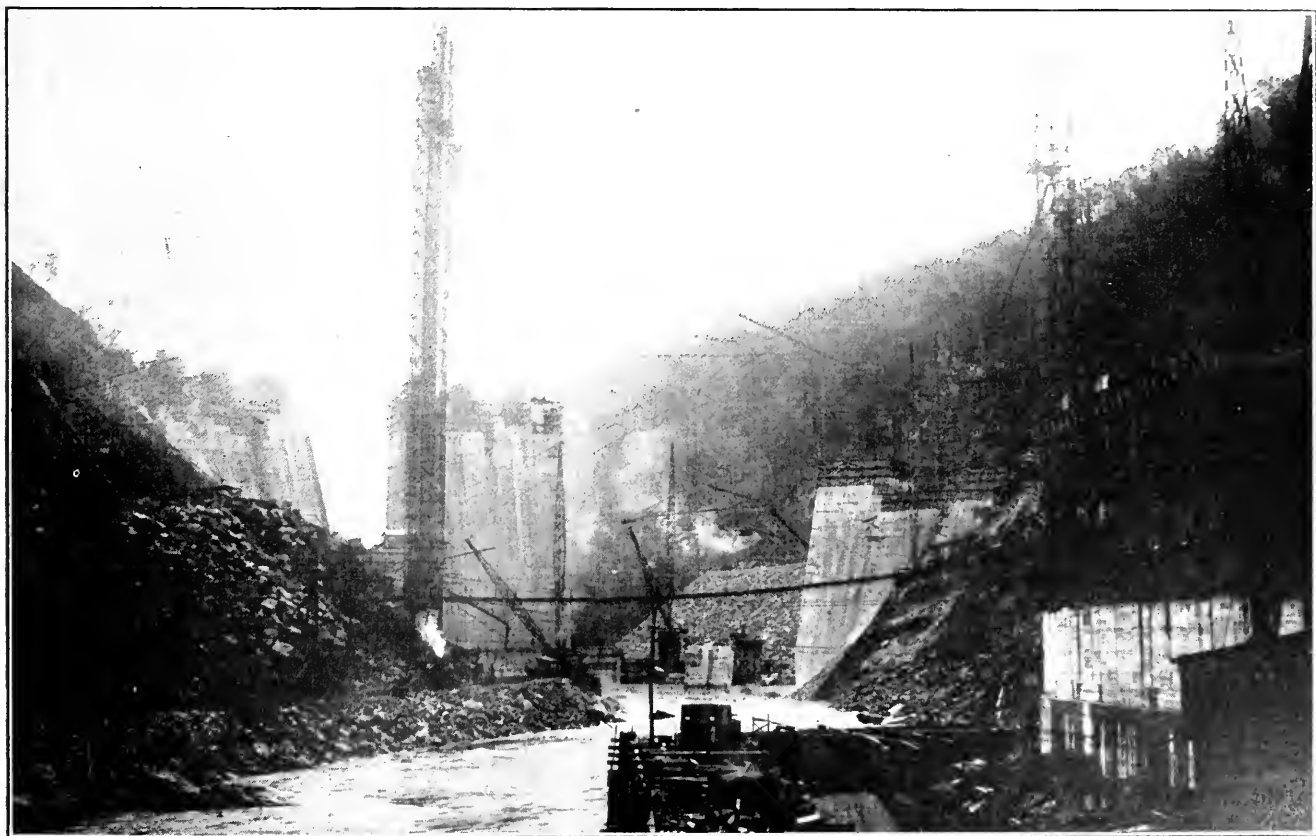
Bassett Jones, Jr., also presented a paper entitled "An Instance of Industrial Lighting," in which he explained how to lay out a flexible distribution system for interior lighting.

SECTION FOR HEATING AND CURRENT-CONSUMING DEVICES

Meeting to Be Held on May 28 to Form New Section
of the Associated Manufacturers of
Electrical Supplies

By request of many of the leading manufacturers, a meeting has been called for Tuesday, May 28, at 2 p. m., at the offices of the Associated Manufacturers of Electrical Supplies, New York, to consider the advisability of forming a section in the association to include manufacturers of the various forms of heating and current-consuming appliances for household and industrial purposes.

Such a section has been under contemplation for some time, says Charles E. Dustin, general secretary of the association, and the conditions now seem opportune for accomplishing what it is conceded must be of lasting value to the industry.



HARNESSING THE SOUTHERN RIVERS FOR INDUSTRIAL PURPOSES

The 80,000-hp. development of the Aluminum Company of America at Cheoah, on the Little Tennessee River. The first of a number of hydroelectric stations to be built along that river.

Water-Power Hearings at Washington Concluded

It Is the Expectation that the Special Committee of the House of Representatives
Will Report a Satisfactory Water-Power Bill to the
Present Session of Congress

HAVING heard the various Cabinet members who will constitute the commission on water power proposed in the "administration" bill, and also engineers, financiers and others interested in water-power legislation, the special committee of the House of Representatives will conclude the hearing this week and discuss the matter further in executive session with a view to reporting a workable bill at the present session of Congress.

The Secretaries of War and of Agriculture appeared before the committee on Wednesday and elucidated that portion of the bill dealing with recapture and particularly the part defining net investment. Otherwise they added nothing of importance to the measure, which already embodies their ideas as well as those of the Secretary of the Interior. Senator Thomas J. Walsh of Montana also appeared before the committee on Wednesday to offer two minor amendments, and Representative at Large Frank W. Mondell of Wyoming discussed the various provisions of the bill on Monday. Mrs. H. W. R. Strong of Los Angeles, Cal., asked the committee on Tuesday to exclude from present development the Colorado River in the Grand Canyon of Arizona, preferring that that be made a government reservation until such time as the government itself may choose to dam the canyon and use the electricity for irrigation and other purposes.

STATEMENT OF SECRETARY OF WAR BAKER

Secretary Baker commented on the bill as originally submitted by the three secretaries and also on the effect of the proposed amendments subsequently offered. The latter he said were introduced for the purpose of clarity. His own view is that the terms of the franchises provided for in the "administration" water-power bill shall be definitely limited to fifty years. On this point his testimony was as follows:

"As the bill was originally introduced it was drawn by Secretary Lane, Secretary Houston and myself and represented the consensus of opinion as to what would be desirable in a bill that would meet the views of the legislators who had been considering the subject up to that time. The substitution of the phrase 'net investment,' with a concise and inclusive definition of that phrase, was for the purpose of enabling the committee to consider a bill which had a repetition of that phrase throughout, carrying with it always the identical definition and not requiring the extraction from the body of the bill, in various places, of limitations to be used in determining the recapture price. I thought when I went over it that the phrase 'net investment' as defined here was a clearer definition of exactly the same intention as had been expressed in the original phrases. I do not feel, however, that the adoption of that phrase or that method is at all essential to our concurrence in the bill as originally drafted.

"We have to decide at the outset whether a fixed term

is to be used, at the end of which there is an end of the rights of the licensee, or whether we are going to spread the investment of any licensee over an indefinitely prolonged period under proper safeguards. If it be determined that a single term of fifty years is to be the principle of the bill, then any investor must, whether you provide it in the bill or not, amortize the investment in fifty years. That means that the consumers during the fifty years will have to pay by that much a higher rate than they would have to pay if they covered in their rates merely obsolescence and replacements and did not sink the entire original cost during the period of the grant. If the primary object is to secure a minimum rate to the consumer, the course of having consecutive terms would be the proper course.

"The purpose of this bill was to have a fifty-year term, and at the end of the fifty-year term the government was to have the three options of either taking over the property, granting it to a new licensee or regranting it to the original licensee or his successors in interest. The intention of the bill was to make those three options identical, so far as the financial obligation was concerned. If the government took it over, it would pay *X* dollars; if it granted it to a new licensee, the new licensee would pay *X* dollars; if it regranted it to the original licensee, it would ascertain and fix, as a new starting point for his net investment, *X* dollars, the same number of dollars in each instance. The purpose of the bill, as originally drawn, I think—and certainly as clearly shown by the amendment—was not to sink and amortize the original cost during the first term, but to carry that investment—depreciate it so that at any particular period of renewal it represented the actual value—to carry that forward as a continuing asset in the licensee, either to be repaid to him by any other licensee or by the government or to be regarded as his investment at the beginning of the new license period.

"Now, my own judgment, my very strong preference, is for the first of those courses, to fix an absolute term and to allow the government not to have a system of equities built up against it at the end of that term. If that were done, it would cost more to the consumer clearly, but if it is intended to do that, it ought to be so clearly done that when the first term or first license does expire, there will not be any doubt that the government has a right to expect the licensee to have protected himself by amortization during the period.

GOVERNMENT CONTROL OF INTRASTATE RATES

"Now, there is one other point that has been raised here upon which I want to say a word, and that is the question as to whether or not it would be possible to put in this bill the control of rates by the federal government on *intrastate* business of such a character as to assure the building up of an amortization fund. I am not prepared to express an opinion on that subject

as a lawyer, but I remember a somewhat similar case to which I would call attention.

"In the State of Ohio a telephone company made a contract with the city of Toledo whereby the company got a franchise to operate telephones in that city and agreed to charge a stipulated rate for domestic and business telephones. After it had constructed its plant it started to charge a much higher rate for both business and domestic telephones. A suit was brought, I think, in quo warranto, for abuse of franchise, and it was decided in the Circuit Court in Ohio that the power of the city of Toledo in the matter of the granting of a telephone franchise was not to make a contract with regard to rates but merely to determine whether in the public interest the public highways might properly be used for the erection of telephone poles and wires, and that therefore the subject of rates was outside of the purview of the contracting power of the city and the telephone company; that it must be assumed that the subordinate governmental agency had correctly decided the convenience of the government in allowing the erection of these facilities, and that its attempt to inject into that decision a contractual relation with regard to a subject matter where it was not authorized to contract was ultra vires and entirely nugatory, and that the company could continue to enjoy the grant of the right to occupy the streets without being bound by the obligation as to rates. That is the case of McMahon against the Home Telephone Company, and it is the Circuit Court's decision, but it was afterward affirmed by the Supreme Court.

"Now, if the federal government dealing with public lands and the public forests has a different kind of right from that which it has in dealing with navigable rivers, and its contract with a licensee proceeds in the one case from a proprietary interest which might be made the basis of a contract, where in the other case it is exercising a governmental power of regulation, it might well be that a provision in this act authorizing the fixing of rates in intrastate business would be upheld with regard to the public lands and the public forests, where it rested upon a proprietary interest in the government as a contracting party, and not upheld with regard to navigable streams, where the basis of the power is the regulation of the streams in the interest of navigation. I simply cite that as being a difference which may arise. In my own judgment, if the term is fixed definitely at fifty years and there be either an explicit statement or so plain an inference in the bill that the rights of the licensee then terminate, you will force both upon the licensee and upon any local regulating body the obligation of including in the rate a sum which will provide for amortization. In other words, I think the courts would enjoin, as confiscatory, any rate which was sought to be imposed upon a public utility living under the definite and fixed term 'grant,' with no equities of renewal, a rate which did not authorize it to collect enough to pay its running expenses and amortize the investment during the period of the grant."

WHAT CONSTITUTES FAIR VALUE

Secretary of Agriculture Houston, in discussing net investment as defined in the amended measure, said

that the original draft of the bill provided for recapture of the water-power development at fair value. In suggesting the term "net investment" as the basis for payment it was thought it would not be susceptible to any misunderstanding or misinterpretation inasmuch as the term was specifically defined. However, it is inconceivable that there should be any unappropriated surplus to deduct from the original cost as required in the measure (see ELECTRICAL WORLD, March 16, page 581), and for that reason he suggested the following amendment to the clause on "net investment" as defined in the amended measure or to "fair value" as understood in the original draft:

"That out of surplus earnings, if any, accumulated in excess of a specified rate of return upon the net investment of the licensee in any project or projects under license the licensee shall establish and maintain amortization reserves, which reserves shall, in the discretion of the commission, be held until the termination of the license or be applied from time to time in reduction of the net investment. Such specified rate of return and the proportion of such surplus earnings to be paid into and held in such reserves shall be set forth in the license."

Should the government at the end of the fifty-year period take over the project that sum would be deducted from the original cost. Whether or not to make amortization within the fifty-year period compulsory was a question of policy for the committee to decide. To do so would mean higher rates for the electric service during the life of the franchise, which the utility has a perfect right to exact.

OPINIONS OF CONGRESSMEN

Representative Ferris gave as his opinion that the term of the lease should be definitely fixed at fifty years and that the government should not be required to pay back every cent put into a project. Secretary Houston was, however, in favor of succeeding terms under proper regulations and safeguards and on terms which would be reasonable under the conditions then existing. He also was of the opinion that one body should treat all water-power matters including boundary waters covered by treaty.

It was the opinion of Representative Mondell of Wyoming that a good right-of-way measure would be preferable to the present water-power bills since most of the water powers are on non-navigable streams. He was not in favor of a recapture by the government because it fixed a time at which investment values would be disturbed, and this had to be taken into consideration in fixing a rate. What is needed, he said, is the largest possible development under the best economic conditions, best management and lowest rates. He was glad to note the change of attitude on the part of the government toward electrical developments. Monopoly was now sought where a few years ago reports were issued against combinations and monopolies in water powers. The business, he said, was now recognized as being essentially monopolistic and all the government should do is to hold electrical enterprises in absolute public control as to rates and practices. Without a recapture clause the federal charge can be adjusted from time to time. The government, he maintained, has no values to give to any one in connection with water-power developments.

The return allowed can be secured by any one without the least effort by merely buying a bond.

The amendments offered by Senator Walsh called for the advertising of one's intention to apply for a license, giving the location of the works and the public lands to be occupied, and provided that preference be given to the applicant offering the best terms to the public.

The final hearings in the closing days of the present week were held after this issue of the ELECTRICAL WORLD had gone to press. A further report will be published in next week's issue.

"MAXIMUM PRODUCTION WITH MINIMUM WASTE"

Large Scope of the Fuel Administration Plan for Conservation in Power Plants Through Personal Inspection of Every Plant

Announcement of the appointment by the United States Fuel Administration of an administrative engineer for the Pittsburgh district as part of a general plan for fuel conservation in power plants was made in the ELECTRICAL WORLD of May 11, 1918, page 992. Thomas R. Brown is appointed administrative engineer for the Pittsburgh district and C. P. Billings special staff assistant.

This plan is the result of conferences with the federal fuel administrators and their committees for the group of states which together consume about 70 per cent of all the coal used in the United States, exclusive of railroads. The plan has received the indorsement of the fuel administrators of all these states, as well as approval of the United States Bureau of Mines and a committee representing the Engineering Council of the four national engineering societies.

The slogan of the campaign is "Maximum production with minimum waste." In other words, the object is to operate all industries at full capacity, but at the same time to make a pound of fuel perform its maximum service in power, light and heat.

In laying the foundations for the organization it has been anticipated that this work should become a permanent service of the government.

The expectation of the Fuel Administration is that from 10 to 20 per cent—that is, from 25,000,000 tons to 50,000,000 tons of coal per year—can be saved by the correct operation of steam-power plants, using their present equipment, in the industries, in office buildings, hotels, apartment houses, etc.

It is considered most important that all existing fuel-conservation committees, committees of chambers of commerce and national defense, manufacturers' associations and other bodies be continued in full force, and that the work of such organizations be consolidated with the national program, which comprises certain fundamentals, as follows:

1. Personal inspection of every power plant in the country.
2. Classification and rating of every power plant, based upon the thoroughness with which owner of said plant conforms to recommendations.
3. Responsibility of rating the plants will fall upon an engineer in each district, the rating to be based upon reports of inspectors, who will not express opinions, but will col-

lect definite information. The state fuel administrator, in his judgment, may entirely or partially shut off the consumption of coal to any needlessly wasteful plant in his territory.

4. Inspectors are to be furnished from one or more of the following sources: (a) Inspectors of the steam-boiler insurance companies; (b) state factory inspectors; (c) engineering students from technical colleges; (d) volunteers.

The ratings will be based upon recorded answers to questions, each of which will be given a value depending upon its relative importance to the other questions. Depending upon the efficiency of methods in use in any plant, it may be rated in class 1, 2, 3 or 4.

The ratings will be based upon existing equipment. The difficulty, delay and expense involved in the installation at this time of improved power equipment is fully recognized, but experience has proved, in the judgment of the Fuel Administration, that 10 to 20 per cent of fuel now used in power plants can be saved by improvements in operation alone.

In advance of the first inspection a questionnaire will be sent to every power plant in each district, with notice to the owner that within sixty or ninety days his plant will be inspected personally and the questionnaire will be checked up by the inspector upon his visit. This action will tend to prepare the minds of plant owners for what will follow. It will operate to induce proper care in furnishing information and will also tend to produce a desire to improve their plants, if necessary, so that they may be rated in a high class by the time the inspector calls upon them.

COLLECTING WAR DATA FOR N. E. L. A. CONVENTION

Information Sought from the Companies as to Employees in Service, War Loans, War Savings Stamp Activities, Etc.

Secretary T. C. Martin of the National Electric Light Association, writing to electric light and power companies, says that in connection with the thirty-fourth annual meeting of the association, to be held at Atlantic City on June 13 and 14, it is desired to present definite data bearing upon the direct relations of the electric light and power industry to national service in the various forms that represent contribution toward winning the war. It is known in a general way, he says, that, "as was to be expected, the response of our group of public utilities to all patriotic and philanthropic appeals has been both prompt and generous, but no details exist as to present conditions and results.

"The value and need of such information is obvious, and I have been instructed by President Lieb to make this effort to secure it, with the request that you will immediately co-operate with us. The belief is entertained that each company has in its possession already information of the kind sought, as proved by the inquiry made by us at the time of the first draft in regard to its effect on the man power of the industry."

Data are specifically requested as to four main items: (1) Number of employees in all the armed forces of the nation; (2) contributions to war loans; (3) war savings stamp activities; (4) Red Cross work and allied patriotic philanthropy.

Already returns are being received at the association offices, and some of them are surprisingly large.

SEEKS TO POSTPONE RATE CASE UNTIL TERMINATION OF WAR

**Edison Electric Illuminating Company of Boston
Makes Earnest Effort to Convince Commis-
sion that This Would Be Right**

A vigorous plea on behalf of postponement until the end of the war of the pending general inquiry by the Massachusetts Gas and Electric Light Commission into the rates of the Edison Electric Illuminating Company of Boston was made May 9 by F. M. Ives, counsel for the company. The board was hearing the petition of Granville S. MacFarland of the Hearst publications for a rate investigation on the Boston system, when Mr. Ives requested that the whole matter be tabled without prejudice during the remainder of the war. After listening to the company's side and reserving an opportunity for President C. L. Edgar to make a statement later, the commission adjourned the hearing to May 13, when the petitioners were to reply to the suggested postponement.

THE REASONS FOR POSTPONEMENT

The company assigns as grounds for its motion three reasons:

The improbability of the commission's recommending a general decrease in rates or a revision of schedules at this time, and the much greater probability of the necessity of an increase in rates if the company is to continue an efficient servant of the public.

The fact that the company has neither the time nor the funds necessary for a proper preparation of the case, either in getting at the facts which the petitioners desire or for a proper presentation of its own case.

The futility of an investigation of the facts upon which a proper measure of the rates should be based when the facts are changing daily.

The Boston Edison company finds itself in the same predicament as other companies in the same field. It has already felt obliged to add to its rate a coal clause designed to collect from all its customers the exact increase of the cost of coal above the cost in normal times. So far this coal clause has not been applied to the maximum rate, with the result that the company is not collecting anything like the increased cost of coal. The company foresees the time when the coal clause must be applied to the maximum rate, and if conditions do not change for the better, it seems inevitable that a general increase in rates will be necessary. The amount written off for replacements last year exceeded \$200,000 transferred to the reserve fund for that purpose.

As a result of the street-lighting decision the company has been obliged to pay back to the city of Boston for the period from December, 1914, to February, 1918, both inclusive, almost \$150,000. By agreement with the city the company is paying this in ten monthly installments, paying interest on the installments from March 1. The new street-lighting rates have been made effective all over the system, with a reduced income of from \$50,000 to \$60,000 per year. Lightless nights during January, February and March and heatless and workless days during the same period still further reduced the income by some thousands of dollars. The Boston company now estimates that daylight saving will reduce its income at least \$250,000 a year.

Last week a general increase of 10 per cent was

granted in the wages of all employees earning \$3,000 or less, a concession which will cost the company at least \$200,000 a year. Increases in the cost of coal, a small percentage of which is compensated by the coal clause, amount now to \$1.65 per ton (55 cents on the coal price and \$1.10 on the transportation) above the price paid in the fiscal year 1917, and the company burned 225,000 tons in that year. The consumption has since increased and further advances in coal cost may be expected, together with higher prices on materials for repairs and renewals. The \$875,000 available in 1917 for depreciation and surplus looks small in the face of 1918 requirements and will virtually disappear in 1919 if the war continues and rates are not increased.

Mr. Ives pointed out that there is a severe shortage of the men needed to prepare a rate case properly. Prof. D. C. Jackson, who has been at work on this case for the company for several months, has been summoned by General Pershing to France, and the government has commissioned W. B. Jackson, his partner, withdrawing him from private practice. The company's own officers are so occupied with work of public concern that little time is available for other than routine business. President Edgar's service on committees, important not only to the industry but to the government, requires his attendance in New York or Washington two or three days in every week, leaving him little time for other than routine affairs, many of which are unusual in scope.

Conditions are far from ordinary. Costs are changing daily, and the only inference which can be drawn from past costs is that they will be higher to-morrow if the war continues, Mr. Ives states.

THE SERIOUS FUEL SITUATION

The company has a contract for transporting coal from Hampton Roads to the boiler room at South Boston at 95 cents per ton. This has already been increased to \$2.05, and the company has conceded that a further increase not yet settled is to be met. If the government should withdraw the boats it has already requisitioned, there is a probability of having to pay the government rate, which is \$3.23 for freight alone from Hampton Roads to South Boston. It is said that this rate has now been raised to \$3.50. In February, when the supply was low, the company paid about \$9 per ton for a cargo of coal at the wharf bought outside the contract. If the coal shortage continues, as seems more than likely, there will be more than a few months of lightless nights and heatless and workless days next winter, with a resulting loss of income. If the government continues giving in to the ever-increasing demands of labor, the company will be forced to make further increases in wages. To-day 310 employees are with the colors.

In closing, Mr. Ives said: "The company has to face the very serious problems caused by the existing ever-changing conditions, due to the most stupendous war in the history of the world—problems which are the most serious in the experience of the company. It asks that it be permitted to attend to their solution, untrammelled and unimpeded by proceedings to reduce its rates instituted when conditions were normal and before a war in which the United States might take so important a part was thought of."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Engineers' Club of Columbus.—At a recent meeting of the Engineers' Club of Columbus, Ohio, E. G. Bradbury was chosen president and E. G. Morris secretary.

Engineers' Club of Trenton.—On May 9 J. B. Scott of Day & Zimmermann, Inc., addressed the Engineers' Club of Trenton, N. J., on the new power plant of the Erie Lighting Company, at Erie, Pa.

Louisiana Engineering Society.—T. F. Carlisle, British Consul, delivered an address on "Britain and the War—The Last Twelve Months," before a meeting of the Louisiana Engineering Society, New Orleans, on May 13.

A. I. and S. E. E., Cleveland Section.—The Cleveland Section of the Association of Iron and Steel Electrical Engineers will hold its next meeting on May 25 at the Hotel Statler. A. E. Hogrebe will deliver an address on "Electric Cranes."

A. I. E. E., Schenectady Section.—"The Romance of the Pictures" was the subject of an address by C. Francis Jenkins, president of the Society of Motion Picture Engineers, before the May 10 meeting of the Schenectady Section of the American Institute of Electrical Engineers.

Detroit Engineering Society.—At a recent meeting of the Detroit Engineering Society Charles Dixon was elected president. At the May 3 meeting of the society Robert H. Kuss, consulting engineer, Chicago, spoke on the subject of "Coal Conservation as Applied to Boiler-Room Operation."

Society for the Promotion of Engineering Education.—"The Engineering School and the War" will be the subject of a discussion at the twenty-sixth annual meeting of the Society for the Promotion of Engineering Education, to be held at Northwestern University, Evanston, Ill., June 26-29.

Engineering Club of Des Moines, Iowa.—Engineers have banded together in Des Moines, Iowa, and have formed the Engineering Club. The membership includes practicing engineers, graduate engineers and non-graduates who are engaged in engineering work. The first officers are A. W. Lee, president, and Monroe L. Patrick, secretary.

I. E. S., Philadelphia Section.—"The Relation of Light to Health" was the subject of a paper read by Dr. C. E. de M. Sajous before a joint meeting of the Philadelphia Section of the Illuminating Engineering Society and the Philadelphia Safety Council on May 17. Howard Lyon also gave a short talk on "Methods of Calculation."

Jovian League, Atlantic City, N. J.—A chapter of the Jovian League has been established at Atlantic City, N. J., with A. J. Purinton as president and H. C. Stockinger as secretary. The league will hold meetings on the first and third Mondays of each month.

N. E. L. A., Iowa Section.—The date of the convention of the Iowa Section of the National Electric Light Association has been changed from May 22 and 23 to May 31 and June 1. The program is as follows: Discussion of the labor situation by T. Crawford, Clinton, Iowa; discussion on isolated plants by Austin Burt, Waterloo, Iowa; discussion on rate increase by F. A. Warfield, Peoria, Ill.; discussion on the coal situation by F. W. Linebaugh, Boone, Iowa; discussion on boiler-room economy by E. S. Hight, Peoria, Ill.

Missouri Association of Public Utilities.—The annual convention of the Missouri Association of Public Utilities is meeting at St. Joseph, Mo., May 17 and 18. The program is as follows: P. J. Kealy on "Work of National Utilities Association"; H. Wurdack, "How War Conditions Have Affected the Utilities of the State and the Nation"; J. S. Tritle, "Problem of Manufacturing Under War Conditions"; H. Spoehrer, "Taxes Affecting Public Utilities." According to an announcement of the convention issued by F. D. Beardslee, St. Louis, secretary-treasurer, the Fuel Administrator of Missouri will also address the convention.

National Electrical Credit Association.—The nineteenth annual meeting of the National Electrical Credit Association will be held at the La Salle Hotel in Chicago on June 17 and 18. The National Association of Credit Men will also hold its annual meeting at the Hotel La Salle June 18 to 21 inclusive. President W. T. Pringle of the Pringle Electric Manufacturing Company of Philadelphia will preside at the electrical credit men's meeting, and the program will be conducted under the supervision of M. A. Curran, Western Electric Company, New York, as chairman of the committee on arrangements, and H. E. Wilkins of the Belden Manufacturing Company, Chicago, chairman of the local committee of entertainment.

Arkansas Association of Public Utility Operators.—The important papers to be presented at the eleventh annual convention of the Arkansas Association of Public Utility Operators at the Arlington Hotel, Hot Springs, on May 21 and 23 inclusive, will be as follows: William Crooks, engineer Arkansas Light & Power Company, "Transmission Line Construction"; J. F. Christy, manager Jonesboro Water & Light Company, "Present-Day Fuel Situation"; A. Patterson, superintendent electric department Southwestern Gas & Electric Company, "War-Time Costs Versus Rates"; W. R. Herstein, Electric Supply Company, Memphis, Tenn., "Courteous Attention to Traveling Salesmen." W. N. Gladson, dean of the College of Engineering, Arkansas State University, will also deliver an address.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

To Improve Trade Statistics for War Work.—With the immediate object of furnishing more detailed and accurate information for the war boards engaged in licensing imports and exports and conserving tonnage, foodstuffs and raw materials, a radical revision and extension of the government's foreign trade statistical classification has been undertaken by the Bureau of Foreign and Domestic Commerce, Department of Commerce. To this end the business public is urged to make immediate suggestions as to new classes of goods that ought to be shown in the trade statistics or new subdivisions of the present classes. Although the present need for more specific statistics is largely brought about by the war, the bureau desires to make the statistics of the largest possible permanent value in its work of promoting foreign commerce after the war. The Tariff Commission, the Food Administration, the War Trade Board, the Shipping Board and other war organizations are co-operating with the bureau in the effort to obtain a more detailed classification and will take measures to insure compliance with the officially issued regulations.

Higher Rates Sought in Kansas City, Mo.—The Kansas City Light & Power Company is preparing to make application to the Missouri Public Service Commission for readjustment of schedules. The commission is now securing material on the company's costs of operation and revenue, in view of the fact that the schedule indorsed by it in 1917 was to be operative only until April 30 this year. The Kansas City Railways Company has asked the commission to increase the rate charged by it to the Kansas City Light & Power Company for energy from around 1 cent per kilowatt-hour to a figure that will provide at least for cost. It is expected, according to Kansas City advices, that the commission will grant such an increase, possibly of four-tenths of a cent or thereabouts, which would involve an additional annual expense to the light company of about \$350,000. It is also possible that the commission may make the increase retroactive or may require the payment of a lump sum. If the increased rate is granted, effective from Jan. 1 this year, and a lump sum of \$100,000 or more is granted for making up deficiencies of the rate during 1917 and previously, these costs, with the increased expense of wages and coal, would mean a burden of around \$700,000 on the light company this year, which the schedules would have to take care of, at least in part.

Arthur E. Smith has resigned as commercial manager of the Little Rock (Ark.) Railway & Electric Company to enter the automobile business in Little Rock.

P. W. Campbell has been transferred from the Henryetta (Okla.) Electric Light Company to act as manager of the Stamford (Tex.) Gas & Electric Company.

D. F. Radsloff, chief engineer of the Northern States Power Company, Grand Forks (N. D.) division, has entered the Thirty-fourth Engineering Regiment at Wrightstown, N. J.

Robert A. Wood has resigned as new-business manager of the Brush Electric Company, Galveston, Tex., to take charge of the Christian Science army camp work in Texas.

A. L. Martin, manager of the Oregon Power Company, Marshfield division, has been elected a member of the board of directors of the Marshfield Chamber of Commerce for the ensuing year.

J. C. Breeding has been transferred from the Stamford (Tex.) Gas & Electric Company to the Longview (Tex.) Ice & Light Company to act in the capacity of manager, succeeding W. B. McNaughton, resigned.

Paul J. Hayes, formerly manager of the Texas Public Service Company of Vernon, Tex., has been appointed manager of the Henryetta (Okla.) Electric Light Company and the Henryetta Ice & Cold Storage Company.

G. C. Marshall has been transferred by the American Gas & Electric Company from the Newark office of the Ohio Light & Power Company to the Steubenville (Ohio) office of the Ohio River Power Company as commercial manager.

George M. Keenan has been appointed superintendent of the railway power plant of the Little Rock Railway & Electric Company. This appointment was called for by the resignation of A. W. Russell, formerly chief engineer of the power house.

V. L. Blanchard, who has been a special representative of the new-business department of the Toledo Railway & Light Company, has returned to the Brush Electric Company at Galveston, Tex., as new-business manager, succeeding Robert A. Wood, resigned.

A. P. C. Schramm, who for the last five years has been the chief engineer of the Klaxon Company, Newark, N. J. has established himself as a consulting engineer at 276 Canal Street, New York City. His work embraces electrical, industrial and efficiency engineering.

J. C. Chestnut has resigned as superintendent of the New Castle (Pa.) Electric Company, a subsidiary of the Mahoning & Shenango Railway & Light Company, to become general manager of the Choctaw Power & Light Company, McAlester, Okla. Mr. Chestnut has been superintendent at New Castle for the past four years, prior to that having been superintendent of the Shenango Valley Electric Light Company at Sharon, Pa.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

A. G. Carson has resigned from the managership of the Eastern Wisconsin Electric Company at Fond du Lac to become associated with the C. C. Smith interests in Wisconsin.

F. E. McKenna, formerly superintendent of the Oregon Power Company at Coquille, has been transferred to Marshfield as general superintendent for the Coos Bay division of the Oregon Power Company.

C. J. Cooper, Jr., who until recently has been assistant general manager of the Merchants' Heat & Light Company, Indianapolis, Ind., has been made general manager of the Mineral Point Public Service Company, Mineral Point, Wis.

M. H. Frank has been appointed manager of the Eastern Wisconsin Electric Company at Fond du Lac, succeeding A. G. Carson, resigned. Mr. Frank, who is a graduate of Purdue, was previously with the Galesburg (Ill.) Railway, Lighting & Power Company.

F. T. Morrissey has been appointed electrical engineer for the Indiana Railways & Light Company, Kokomo, Ind., to fill the vacancy made by the resignation of George H. Losey. Mr. Morrissey was formerly manager of the Eldorado (Ill.) group of properties owned and operated by the Southern Illinois Light & Power Company.

H. W. Derry has resigned as contract agent of the Pittsfield (Mass.) Electric Company to take charge of the motor sales department of the Hartford (Conn.) Electric Light Company. Mr. Derry has been associated with the Pittsfield company for the last five years, having been in the employ of the Westinghouse Electric & Manufacturing Company previously.

L. R. Dutton, manager of the Jenkintown division of the Philadelphia Suburban Gas & Electric Company, has been granted leave of absence by the company from May 1, to engage in war welfare work in connection with the military training camps. Mr. Dutton has been appointed to a secretaryship of the Y. M. C. A. at the base hospital at Camp Dix, Wrightstown, N. J.

Dr. Addams S. McAllister has gone to Washington, D. C., as assistant to Major Thompson in the progress section of the Control Board of the Ordnance Department. Prior to going to Washington Dr. McAllister had been very active in New York in engineering society committee work relative to war matters—among other things, obtaining for the government engineers with qualifications required for particular war operations.

E. G. Holzer, who for fifteen years has been manager of the Easton Gas Works, has been appointed manager of the Jenkintown division of the Philadelphia Suburban Gas & Electric Company during the absence of L. R. Dutton, who has gone into war welfare work with the Y. M. C. A.

M. W. Arthur has resigned from the Westinghouse Electric & Manufacturing Company to accept a position as superintendent of sales for the Northern Ohio Traction & Light Company of Akron. Mr. Arthur for seven years has been connected with the railway and power department of the Westinghouse company at Cincinnati.

C. L. Proctor, who has been new-business manager of the Empire District Electric Company at Joplin, Mo., has been made general manager of the Danbury (Conn.) & Bethel Gas & Electric Light Company, succeeding the late Charles H. Merritt. Mr. Proctor before going to Joplin three years ago was for six years general superintendent and purchasing agent for the Athens (Ga.) Railway & Electric Company.

C. M. Brewer, manager of the Richmond (Cal.) division of the Western States Gas & Electric Company, has been appointed a member of a committee organized for the purpose of assisting the Industrial Commission in effecting a suitable building and loan plan to increase the residences in Richmond. Mr. Brewer has also been made a member of the executive board of a newly organized war body to be called "Community Council for War Work."

Ralph W. E. Donges, president of the Board of Public Utility Commissioners of New Jersey, has been commissioned a lieutenant-colonel in the National Army. Governor Edge of New Jersey has requested Secretary of War Baker to permit the continuance of Mr. Donges' commissionership until pending important rate cases are decided. Lieutenant-Colonel Donges has been a commissioned officer in the New Jersey National Guard for the last seventeen years. He has been a member of the State board since 1913, when he was appointed by Woodrow Wilson, then Governor.

Obituary

Arnold von Siemens of Siemens & Halske died last week at the age of sixty-five years, according to a press dispatch from Berlin.

Frank E. Getts, general manager of the Electrical Engineers' Equipment Company, Chicago, died May 7 in Los Angeles, as the result of overexertion, which caused an artery near his heart to burst. Mr. Getts had become well known in the electrical industry through his connection with the Siemens-Halske company for five years and the General Electric Company in the turbine department for fifteen years. At one time Mr. Getts was in charge of the turbine business of the General Electric Company in the Chicago district.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

STANDARD PACKAGES IN CERTAIN LINES OF ELECTRICAL GOODS

The Advantages and Convenience of the New System
—Various Branches of the Trade Are
Now Considering the Change

For some months there has been considerable attention given to the matter of the number of pieces in standard packages. There is now no general system. Some members of the trade incline toward the dozen system, while others are in favor of the tens system.

The former argue largely from the ease with which the dozen lends itself to packing. It has the four and three combination. Those in favor of the tens method point out the ease of thinking in units of ten. Where ten will make packing difficult they use a multiple of ten. This is their way out. Furthermore, that the inclination of American trade is more and more toward the use of the metric system is an argument made in favor of the tens system.

In this connection one company, the Bryant Electric Company, has already established new standard packages. The following quantities now prevail in standard packages in the Bryant line: 250 keyless socket body, 250 pendent cap, 100 $\frac{1}{8}$ -in. cap, 100 $\frac{1}{4}$ -in. cap, 100 $\frac{3}{8}$ -in. cap, 100 $\frac{1}{2}$ -in. cap, 100 $\frac{3}{4}$ -in. angle cap, 100 $\frac{1}{2}$ -in. angle cap, 100 molding base, 100 $3\frac{1}{4}$ -in. box base, 100 4-in. box base.

MANUFACTURERS AND JOBBERS REPORT INCREASING BUSINESS

Southeastern Trade's Volume of Buying Indicates
Value per Order on Higher Level—
Status of Trade Acceptance

For the last two years, and during 1917 and up to the present time especially, the manufacturers represented in the Southeast, together with the jobbers, have enjoyed a large volume of business; and underlying indications point to a continuance of these conditions, with the possible exception of a marked cessation in central-station purchases. The latter are more than offset, however, by substantial buying for government account. Previous to 1917 the dealers and jobbers bought, in a measure, from hand to mouth, and along the entire line the value per order was small compared with the same value to-day. While sporadic large orders created spotty increases in these values, nevertheless the general average was comparatively low. Data at hand indicate that the value per order is increasing daily.

Utilizing 100 as a base or index figure representing the value per order for 1916, the indices for 1917 are 140 for manufacturers and 125 for jobbers. The last three months of 1917 indexed 180 for manufacturers' sales and 150 for jobbers'. From meager information the index figures for 1918 to date are: Manufacturers, 184; jobbers, 156. The greater portion of increase in these index figures is due to the fact that prices enhanced rapidly in many lines during 1917, but there are several other potent factors that have tended to boost these figures.

Dealers are buying larger quantities through the jobbers, because a smaller number of salesmen are traveling. Salesmen do not call as frequently, and then, too, dealers realize that the man with the goods secures the business. This feature alone makes for larger individual orders, which in part precludes future difficulties in transportation. Moreover, the same reasons for increased index figures are applicable to the manufacturers, as the jobbers are buying in large lots, being actuated by the same motives that influence

the dealers and retailers, combined with some pressure and wholesome advice from manufacturers.

It can hardly be said that the adoption of the trade acceptance has affected the index figures, but it may be of interest along this line to state that the acceptance is being received with more favor throughout the industry. A preliminary canvass shows that while a few manufacturers are suggesting this class of paper to jobbers, others are "staying off" awaiting the trend of activity in this channel. For a time the jobbers were paying very little attention to the acceptance, but of late it has come into wider use. At the present time there is slight opportunity for the contractor to utilize this paper, owing to the fact that his accounts are harder to take care of in this manner.

SELLING TRADEMARKED GOODS IN LATIN-AMERICAN COUNTRIES

Director Appointed by Treasury Department at
Havana—Long-Established Abuses in Connection
with American Brands to Be Eliminated

Manufacturers and exporters selling trademarked electrical goods in foreign countries, particularly South America, may be interested in these few important facts: (1) In Argentina, Bolivia, Chile, Costa Rica, Cuba, Guatemala, Paraguay, Peru and Venezuela trademark titles absolutely depend upon priority of registration. Furthermore, any one may lawfully register a United States trademark (registered or unregistered) and thus prevent entry of the goods into the country. (2) In Brazil, Cuba, Guatemala and Panama the trademark must be registered in the United States Patent Office before it can be registered in these countries. (3) In Ecuador, Mexico and Nicaragua no suit may be brought for infringement of a trademark without registration. (4) It is said on good authority that enemy belligerents are now registering United States trademarks in countries mentioned in clause (1) through "dummies." The result is obvious: manufacturers who anticipate exporting trademarked products will find themselves blocked in their effort to do so.

At the fourth Pan-American Conference, held in Buenos Aires in 1910, a convention was adopted which provides that "any mark duly registered in one of the signatory states shall be considered as registered also in the other states of the union, without prejudice to the rights of third persons and to the provisions of the laws of each state governing the same. In order to enjoy the benefit of the foregoing, the manufacturer or merchant interested in the registry of the mark must pay, in addition to the fees or charges fixed by the laws of the state in which application for registration is first made, the sum of \$50 gold, which sum shall cover all the expenses of both bureaus for the international registration in all the signatory states."

In the administration of this provision two bureaus for the registration of trademarks were to be established. The twenty-one republics forming the Pan-American Union are divided into two groups, with Havana as the center for the countries of North and Central America and the West Indies, and Rio de Janeiro as the center for the South American countries. Either bureau may be established upon the ratification of the convention by two-thirds of the countries of the respective groups. The necessary number for the establishment of the bureau at Havana were secured in August, 1916. At present Mexico, Salvador and Haiti are the only countries of the northern group that have failed to ratify the convention. Dr. Mario Diaz Yrizar has been appointed director of the bureau at Havana.

LEADING FAN MANUFACTURERS NOW POSITIVE OF SHORTAGE

Government Requirements Are Exceeding All Calculations—Selling Season Is Well Advanced and Business Is in Full Swing

So far it now seems certain that in the Eastern section of the country a shortage of fans is unavoidable. This is the opinion expressed by several leading manufacturers in reviewing current conditions and immediate prospects. Following what was stated in the ELECTRICAL WORLD of April 27, page 900, and with the premature opening of the retail selling season, two months earlier than usual, producers are more positive than ever that a shortage is in sight.

One manufacturer, conspicuous for his company's large output and important distributing connections, stated this week as an instance of the unusual, if not unprecedented, demand for fans that his concern had just received inquiry for 2000 to 3000 fans from a United States medical base and another from the government concerning the equipment of one of the biggest cantonments. Further, he said that if all the cantonments ordered on similar specifications, which is more than likely, these requirements alone would be sufficient to absorb the entire stock of fans in the country.

Shell-loading plants, a new source of distribution, are in the market for liberal quantities of fans. These buildings are hastily constructed in connection with powder and explosive factories, and if other establishments of this kind, complete and in course of construction, make similar requirements, the supply will be again heavily drawn upon. If government orders so far received are followed by others of the same proportion, it seems likely that fans must necessarily be rated as essential war merchandise.

The manufacturers are of one mind. They are equally emphatic regarding the threatened scarcity. One of the Western producers with important Eastern connections stated that up to date his sales to the close of April were equal to what were usually reached in June. Of course, it was stated, prices are fixed and will not be disturbed, but they in no way are binding on the dealer.

METAL MARKET SITUATION

Official Price of Copper Still in Abeyance—Scarcity of Tin Causing Concern

Some manufacturers and jobbers of electrical staples and wire products are positive that copper will be placed on a higher official price level June 1. With this belief increases in the cost of finished goods are spoken of as assured. Nevertheless, the War Industries Board has come to no decision, though a number of conferences have been held to discuss the matter. Metal market authorities are equally certain no change will be made. Tin is occupying more attention than copper, its scarcity inducing the government to inquire into conditions. The increasing shortage and high prices are causing acute concern in the electrical trade.

NEW YORK METAL MARKET PRICES

	May 6			May 13		
	f	s	d	f	s	d
Copper:						
London, standard spot....	110	0	0	110	0	0
Prime Lake	Govt. price 23.50			Govt. price 23.50		
Electrolytic	Govt. price 23.50			Govt. price 23.50		
Casting	Govt. price 23.50			Govt. price 23.50		
Wire base	26.25 to 26.75			26.25 to 26.75		
Lead, trust price	7.00			7.00		
Nickel, ingot	40.00			40.00		
Sheet zinc, f.o.b. smelter....	Govt. price 15.00			Govt. price 15.00		
Spelter, spot	7.10 to 7.12½			7.45 to 7.57½		
Tin, Chinese*	\$1.00			1.05		
Aluminum, 98 to 99 per cent.	Govt. price ‡32.10			Govt. price ‡32.00		

OLD METALS

	Cents per Pound		Cents per Pound	
Heavy copper and wire....	21.50	to 22.00	21.50	to 22.00
Brass, heavy	13.50	to 13.75	13.50	to 13.75
Brass, light	10.50	to 11.50	10.50	to 11.00
Lead, heavy	5.75	to 6.00	5.75	to 6.00
Zinc, old scrap.....	5.50	to 5.62½	5.00	to 5.50

*No Straits offering. †In 50-ton lots: carload, 32.10 cents per lb.; 10-ton to 14-ton lots, 32.20 cents per lb.

THE WEEK IN TRADE

NO UNFAVORABLE reports concerning general business in the electrical trade have been received in the past week. On the contrary, sales have increased in volume and value, and, on the whole, a more cheerful aspect is noticeable in every section. Jobbers' stocks are in better shape, far-sighted buying, predicated on a belief in the underlying soundness of commercial affairs, being responsible. Dealers are also anticipating their requirements and making needful preparations for future demands by the consumer. In some parts of the country it is estimated that the volume of trade is 50 per cent ahead of last year, and would be still greater if the shortage of labor had not curtailed production and hampered work in which electrical equipment would have entered largely.

Price advances of a substantial nature are said to be about ready for announcement in schedule material, porcelain goods, etc. Lamp stocks are now well distributed, and even an accumulation is mentioned in some places heretofore complaining of a shortage. Conduit is yet difficult to obtain in quantity. Domestic items, such as sewing and washing machines, ironers, flatirons, etc., are selling 25 per cent ahead of last year at this period.

Collections are somewhat slow, especially with the contractor-dealer class, which is inclined to overbuy. Accounts are carefully watched, particularly on new business.

NEW YORK

No falling off in the demand for electrical goods is reported. On the contrary, manufacturers are having a full quota of orders from distributors and jobbers, with the dealers absorbing whatever is obtainable in staples and specialties. Some price changes have been announced on insulation where cotton, linseed oil, etc., figure, and advances are said to be imminent in lines in which copper and brass are basic materials.

Deliveries improve not uniformly, but unevenly, the embargoes occasionally lifting temporarily and permitting the shipping and arrival of goods sometimes delayed for weeks en route. Labor is causing anxiety at the factories, shortage of skilled workers interfering seriously at times with their productive capacity.

Collections are reported as slowing up within a week or two. Credits were never so carefully watched.

SCHEDULE MATERIALS.—An advance of a substantial character on schedule materials—outlet boxes, standard sockets and receptacles, rosettes, shade holders, etc.—is about ready to be made by manufacturers whose lines are handled by almost the entire jobbing trade. The last increase was announced in November, when the discounts were lowered from 47 to 40 per cent. The impending change is credited to the difficulty of obtaining material, shortage of labor, the large investment required to carry on business and other considerations. On these goods buyers are advised to place orders early if reasonable deliveries are desired. Several carload shipments, held up for weeks en route, were received last week, easing the supply.

COLLECTIONS AND CREDITS.—Reports are to the effect that collections have fallen off about 5 per cent recently. No special cause is assigned.

FRACTIONAL MOTORS.—Small motors for sewing and washing machines, ironers, etc., are still coming through slowly. The demand exceeds all previous records.

LIGHTING FIXTURES.—Trade is quiet and has been for some time, owing to the slump in building operations. Some jobbers and dealers are having clearance sales to stimulate business, using discontinued styles as a price lever, shading prices to meet the varying circumstances presented. Such

other sides as are recorded are for replacements and improvements.

WIRING DEVICES.—Of the great variety scheduled the dominating orders are coming through governmental departments for war industries, material and equipment. These requirements are so large that only the manufacturers are thought to be able to handle them successfully, making deliveries in accordance with specifications. The orders are divided or distributed by a government representative in the electrical field, so that the different factories are treated on a capacity basis.

CONDUIT.—Distributors state that conduit is somewhat easier in all sizes for commercial demands. Freight embargoes are still hampering deliveries from the mills, which are reported to have an ample stock. Substitutes, made with less steel and having other claims to the trade's attention, are appearing in the market and being generously exploited. Prices remain firm on the regular lines.

CHICAGO

The volume of business in the Chicago territory continues to be fairly good, but evidence of the spotty characteristics formerly mentioned are still present. The week's news carries indications of improvement in future business. The Chicago Telephone Company has gone before the City Council asking a rate increase. With the People's Gas Light & Coke Company already asking for increased rates, this makes two out of Chicago's four important utilities applying for more revenue. The position of the Commonwealth Edison Company remains unchanged. It is buying resale merchandise for its electric shops and is making purchases of such materials as meters but there is no general buying movement or buying for construction.

In the industrial field the news that the United States Steel Company will build a great gun plant in the Middle West is taken to mean real business. Following such an enterprise there are always allied activities that provide orders for the entire trade. Not much electrical business is expected to result from the freight-car orders that have been placed in this territory, because freight cars carry no electrical equipment and the building of them is largely done outdoors so that very little factory electrical material is needed. There have been no price changes during the week, but certain changes, it is expected, will be announced soon.

PORCELAIN.—Contracts for porcelain are now being written with a provision for a price revision on July 1. This applies to the so-called standard lines and special products. It does not appear likely that it will affect high-tension insulators. That the price revision will be a revision upward, if it is made, appears unquestionable in the light of the labor and fuel situation in the porcelain production fields.

CONDUIT.—There is no improvement in the conduit delivery situation. Jobbers report that they are obliged to fight for every dollar's worth of conduit they get. The government is taking more and more of this product, and the situation appears likely to become worse.

COPPER WIRE.—The increase in the price of weather-proof wire has made no appreciable change in the business situation. Surprise is expressed that it did not go higher, and the belief has been put forward that manufacturers who have not raised their prices will very soon be obliged to do so.

METERS.—Two important meter factories in the Middle Western territory report that their business is holding up well as to volume. While this is somewhat surprising in view of the curtailment in residential building activities, it can be accounted for by the exceptional activity in industrial building.

INDUSTRIAL LIGHTING EQUIPMENT.—In spite of the daylight-saving law this class of apparatus is moving actively.

SPECIAL WIRE.—Local manufacturers of enameled and other special wire report that the factories have practically all the work that they can handle, but that fairly good deliveries are being made.

ELECTRIC RANGES.—Sales so far in 1918 are just about equal to what they were in 1917 at this date.

RESALE MERCHANDISE.—The business in resale merchandise continues good and gives promise of getting better. Jobbers report the volume in this class of goods to be far ahead of what it was this time last year. Not enough washing machines are available to meet the demand.

BOSTON

Trade holds up well, with the usual government basis of activity in evidence everywhere. Despite widespread complaints of poor railroad deliveries, due to embargoes and congestion, jobbers' stocks are, on the whole, in good shape to meet present requirements. There has been a great deal of far-sighted buying in past months predicated on a firm belief in the underlying soundness of the business situation in this part of the country. Governmental scrutiny of the expansion of public utility facilities is very close, and the deflection of equipment for central-station use into other channels is rather disquieting, as in the case of the Boston Edison company, which, it is said, must let go of a turbo-generator of some 35,000 kw. rating, ordered some time since, and now destined for government service.

Such events do not mean disaster to the central stations, but they indicate that everything is to be run close-hauled for the immediate future, with a sharp control of new business developments. Readjustments are constantly taking place as the war progresses, but there is no reason to expect the electrical buying power of New England to shrink to the starvation point because of these changes. Large orders for electrical material are going into the army and navy base work in this part of the country, and more are to follow. Competition is keen, and there is some complaint that these large orders are not so widely distributed as is desirable under present conditions.

SOCKETS AND SWITCHES.—An advance of from 10 to 15 per cent in prices on P. & S., Bryant, Hubbell, etc., schedule B and schedule S material, was expected on Monday and is likely to be in effect by this time.

COLLECTIONS.—These are fairly good, although somewhat slow among the contractor-dealer class, which seems to be laboring under a slight tendency toward overstocking. Accounts are carefully watched in these days, especially in connection with new business.

FANS.—Everything is ready for a record-breaking business in fans. Shipments are still coming into the jobbers' stockrooms, and even central stations which are pursuing a very conservative policy commercially are now ordering fans. The mill trade in fans, both for office and departmental service, looks unusually promising, and many industrial managers appear to realize to-day that the humble electric fan is a factor in hot-weather production not to be neglected.

FUSES.—A steady market is reported, with substantial sales to mill customers. Prices hold firm on various types.

ELECTRICAL SUPPLIES FOR AUTOMOBILES.—Business is very active. One jobber sold more than \$500,000 worth of automobile accessories, including much electrical material, last year. Stocks are in good condition and the outlook is excellent for the season.

FLASHLAMPS AND DRY CELLS.—A steady business is reported in the former, with a heavy absorption of product by cantonments and naval stations. Dry cells are in much demand by the garage trade.

ELECTROMAGNETS.—Large magnets for lifting service are in steady demand after a distinct "peak load" in sales last year, due to an apparent sudden realization of their economic value. A new field of service appears to be marine reclamation.

HEATING EQUIPMENT.—To offset a present quiet spell in domestic heating demand a very active period in specialized industrial electric heating applications is reported under way. The saving of time and insurance of high-quality production are strong points of interest under war conditions, and a broadening market is expected to develop. Prices are remarkably steady, considering changes in other lines.

ATLANTA

With the government operating in practically every essential line, general trade, while still heavy, has been subjected to further repression. The recent pledge of leading manufacturers to subordinate all other demands to government requirements makes for closer application to war business in the steel industry than at any previous period. It has been suggested that a continuous sixty days' run on government orders would make it feasible to give commercial needs more attention later. This idea has not received much encouragement, however, as summer operations must provide against any possible fuel and car shortage next winter.

Numerically orders are less than this time last year, but on the other hand the amounts are much greater, which indicates that the general volume so far is holding up, with big increases in some lines. The concrete ship is meeting with more favor, and it is reported that the United States Shipping Board will establish several additional plants at Southeastern or Gulf ports where the all-around climatic conditions are more favorable for this class of construction. The Bon Air Coal & Iron Corporation will erect a plant costing \$1,300,000 at Lyles, Tenn., for the extraction of methyl alcohol and acetate of lime, machinery alone to cost \$500,000.

LAMPS.—Stocks are well distributed and accumulating at certain points. The latter feature is due to the fact that manufacturers and jobbers are stocking up, anticipating the fall trade. The demand for lamps is excellent for this season and considerably over the same period of past years. The call appears to be general from all sections, mostly through small dealers. Industrial requirements have fallen off.

CABLE.—Factory stocks are reported to be in better shape. Local stocks, however, are in fair condition only, owing to embargoes and general transportation difficulties. The demand for heavy sizes has dropped off perceptibly at the same time that a sag in rubber is noted.

BELL-RINGING TRANSFORMERS.—Viewed through the eyes of the manufacturer the call for these is spotty, but jobbers and dealers report a steady demand. Shipments are coming in in sufficient volume to handle the volume of trade.

INSULATING MATERIALS.—A good market exists for varnished cambric, cloth and varnish. On the surface it would appear that less of this material is being used, but large quantities are utilized by repair shops and for manufacturers opening up shops for the repair of their own products. Mica and asbestos are the only materials slow in arriving.

FANS.—The arrival of seasonal weather has stimulated the movement of fans. The greater part of the shipments are being made to extreme Southeastern points. Stocks are ample.

SEATTLE

Northwest jobbers and dealers report a steady volume of sales during the past week, which is not unusual. There was no startling increase along any particular line. The past month's volumes were sustained. Labor shortage still defies solution and is hampering greatly. Shortages of conduit, rubber-covered wire and larger-sized lamps still prevail. This condition is practically conceded to be chronic. Domestic appliance sales are keeping up well. Government and shipyard sales show a very slight decrease.

Several of the largest Seattle electrical retailers report that domestic business for April exceeded in volume that of the same month last year by more than 50 per cent. The volume would be 100 per cent greater if mechanics could have been secured to build houses. Business in fixtures, wiring devices, lamps, bells, etc., has been exceptionally heavy in the past month with no let-up in sight until the summer camping season starts.

Domestic sales in vacuum cleaners, washing machines, sewing machines, irons and smaller appliances exceed those of last year at this period by more than 25 per cent. Central stations and larger retailers report sales of ranges very

satisfactory. Retailers report that commercial sales to other business houses show a heavy decrease over last year. This is due to the small amount of remodeling and new work in the business district. Wholesalers and jobbers report that sales of the larger size motors and power apparatus have decreased noticeably in the past two weeks. In fact, the supply is practically equal to the demand.

Wholesalers and jobbers at this time are realizing on heavy orders placed some time back. The past week's volume was gratifying, being somewhat heavier than for several weeks. Stocks are fairly well filled, although they are not pre-war stocks. Prices are holding steady, and shipments from the East are coming through in satisfactory shape, everything considered. One lesson has been thoroughly learned apparently by the Pacific Northwest jobbers and wholesalers, and that is anticipating future needs and demands and making preparations to care for them. Heretofore sales depended more or less on the question of deliveries. This factor is being eliminated by the dealers' foresight when possible.

A majority of the jobbing houses report lamp stocks in fair shape, although larger sizes are hard to obtain. The demand is steady and prices are firm. The diversion of thousands of cars from the East to the Pacific Northwest has overcome the shortage of equipment. There is now a surplus of cars for shippers' needs in Oregon and Washington, due to the inability of the lumber mills to load as fast as cars can be delivered.

SAN FRANCISCO

Country orders continue normal. They are composed of articles of staple call. City business, however, has been very quiet for the past week because of the National Electric Light Association convention at Del Monte. The real estate market records a number of sales of lots in San Francisco for industrial purposes. Several de luxe trains are to be taken off the Western sections of transcontinental lines. This will relieve needed hauling stock and trackage for freight shipments. That shipping conditions are being gradually improved is indicated by the resumption of twenty-day and thirty-day service between the Pacific Coast and Eastern points. Some factories are apprehensive of the government's declaration that it will shut off fuel oil from non-essentials, but California would be little affected by this order. Oil is to be diverted from the Pacific Northwest for California power companies.

The government is to construct a large number of new buildings in Camp Fremont to increase the camp's capacity to handle a second division. Thirteen acres of land have been purchased near San José on which to erect a vegetable and fruit cannery. Its cost is estimated at \$250,000, and it is said that it will be the largest of its kind in the United States. Fresno reports the construction of thirty-one bungalows at an estimated value of \$2,000 each. The Union Oil Company is to construct a large group of workmen's houses near Oleum. San Francisco building permits for April total 355 (of which 284 are alterations), totaling \$694,000. For the same period Oakland reports 240 (76 being alterations) at an estimated value of \$593,000.

The San Joaquin Light & Power Corporation is building fifty new lines to supply pumping plants with power. At present there are 225 plants connected up, and there is a heavier load at present on the substation than at any time last year. There is no assurance of power being supplied under the new applications for contracts, owing to the difficulty in securing transformers and the scarcity of labor.

GUARDS.—There were several industrial demands for low-priced portable guards during the past week. Vapor-proof and watertight guards are sold as fast as they are received from the East. The heavy duty demands and character of help supplied in the new war work factories, especially shipyards, demands absolute protection of all lamps.

CARBON LAMPS.—There was an export inquiry for 10,000 moving picture carbons to be the first shipment of a far larger quantity.

SCHEDULE MATERIAL.—Is still advancing in price. Plug cutouts, entrance switches and fuse plugs have just advanced about 10 per cent. Demand is below normal.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor	
No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
Less than coil.....	No. 14 Solid List
Coil to 1000 ft.....	10% to 57.25
Less than coil.....	No. 12 Solid List
Coil to 1000 ft.....	10% to 66.75

Twin-Conductor	
Less than coil.....	No. 14 Solid List
Coil to 1000 ft.....	10% to \$97.75
Less than coil.....	No. 12 Solid List
Coil to 1000 ft.....	10% to \$126.80

DISCOUNT—CHICAGO

Single-Conductor	
Less than coil.....	No. 14 Solid 15% to + 10%
Coil to 1000 ft.....	10% to 20%
Less than coil.....	No. 12 Solid 15% to + 10%
Coil to 1000 ft.....	10% to 20%

Twin-Conductor	
Less than coil.....	No. 14 Solid 15% to + 10%
Coil to 1000 ft.....	10% to 20%
Less than coil.....	No. 12 Solid 15% to + 10%
Coil to 1000 ft.....	10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10% to 24 cents
1/5 to std. pkg.....	20% to 19 cents
Std. pkg.....	34% to 18 cents

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	12% to + 20%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.285	.295

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175-.3195	.3275-.3295
Barrel lots.....	.2875-.2895	.2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 100 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.....	List 15% to \$69.75
3/8-in. d. stp.+10% to 75.00	List to 72.00
1/2-in. s. stp.....	List 15% to 93.00
1/2-in. d. stp.+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	\$75.00 \$63.75
3/8-in. double strip.....	78.25-78.75 71.25-71.75
1/2-in. single strip.....	100.00 85.00
1/2-in. double strip.....	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	2.....	.47
3/4.....	.15	2 1/2.....	.55
1.....	.18	3.....	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.00-\$21.50
1/4-in.—	\$28.00-\$60.00	\$22.50-\$27.00
		\$22.00-\$23.50

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.00-\$55.00	\$25.00 \$22.50
1/4-in.—	\$40.00-\$60.00	\$27.00 \$25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Cards No. 38 and 39

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37 1/2
2 1/2.....	.58 1/2
3.....	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Couplings, List		Elbows, List	
1/4.....	\$0.05	1/4.....	\$0.19
3/8.....	.06	3/8.....	.19
1/2.....	.07	1/2.....	.19
3/4.....	.10	3/4.....	.25
1.....	.13	1.....	.37
1 1/4.....	.17	1 1/4.....	.45
1 1/2.....	.21	1 1/2.....	.50
2.....	.28	2.....	1.10
2 1/2.....	.40	2 1/2.....	1.80
3.....	.60	3.....	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.....	1/4 in. to 1/2 in. 4% to 12%	3/4 in. to 3 in. 7% to 15%
2500 to 5000 lb.....	6% to 14%	9% to 17%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

Less than 2500 lb.....	1/4 in. to 1/2 in. 5.3% to 8.9%	3/4 in. to 3 in. 8.3% to 11.9%
2500-5000 lb.....	7.3% to 10.9%	10.3% to 13.9%
(For galvanized deduct six points from above discounts.)		

FLATIRONS

NEW YORK

List price.....	\$6.00
Discount.....	30%

CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	\$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	\$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	30%
1/5 to std. pkg.....	40% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28% to 30%
1/5 to std. pkg.....	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Less than 1/5 std. pkg.....	Per 100 Net
1/5 to std. pkg.....	\$5.00
Standard packages, 500.	List, each \$0.07.

CHICAGO

Less than 1/5 std. pkg.....	Per 100 Net
1/5 to std. pkg.....	\$6.25
Standard packages, 500.	List, each \$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
16 to 40-watt—B.....	100	\$0.30
60-watt—B.....	100	.35
100-watt—B.....	24	.70
75-watt—C.....	50	.70
100-watt—C.....	24	1.10
200-watt—C.....	24	2.20
300-watt—C.....	24	3.25
Round bulbs, 3 1/4-in., frosted:		
15-watt—G.....	50	.53
25-watt—G.....	50	.55
40-watt—G.....	50	.55
Round bulbs, 3 1/2-in., frosted:		
60-watt—G.....	24	.77
Round bulbs, 4 1/2-in., frosted:		
100-watt—G.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.....	List
Std. pkg.....	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	List
Std. pkg.....	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

Per 1000 Ft. Net	
Less than coil (250 ft.).....	\$31.00 to \$34.90
Coil to 1000 ft.....	26.20 to 27.90

CHICAGO

Per 1000 Ft. Net	
Less than coil (250 ft.).....	\$29.00 to \$30.00
Coil to 1000 ft.....	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100.....	\$24.00
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CHICAGO

Net per 100.....	\$21.75 to \$25.75
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200, S.E., 300, A.X., 1 1/2 4 S.....	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.....	25%	20%
\$10.00 to \$50.00 list.....	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.....	40%	35%
\$10.00 to \$50.00 list.....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

Per 1000 Net	
Less than 1/5 std. pkg.....	\$20.00 to \$38.00
1/5 to std. pkg.....	19.00 to 26.00
Standard package, 2200. List per 1000,	\$20.

CHICAGO

Per 1000 Net	
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$27.50 to \$29.00	\$30.75
1/5 to std. pkg.....	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85	\$30.75
1/5 to std. pkg.....	11.10 to \$11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets.....	500	\$0.33
1/4-in. cap keyless socket.....	500	.30
1/4-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List
1/5 to std. pkg.....	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.....	24% to 25 cents
1/5 std. pkg.....	30% to 23 cents

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:			
30-amp. S. P. S. T.....			\$0.80
60-amp. S. P. S. T.....			1.20
100-amp. S. P. S. T.....			2.25
200-amp. S. P. S. T.....			3.48
300-amp. S. P. S. T.....			5.34
30-amp. D. P. S. T.....			1.20
60-amp. D. P. S. T.....			1.78
100-amp. D. P. S. T.....			3.38
200-amp. D. P. S. T.....			5.20
300-amp. D. P. S. T.....			8.00
30-amp. 3 P. S. T.....			1.80
60-amp. 3 P. S. T.....			2.68
100-amp. 3 P. S. T.....			5.08
200-amp. 3 P. S. T.....			7.80
300-amp. 3 P. S. T.....			12.00
Low Grade:			
30-amp. S. P. S. T.....			0.42
60-amp. S. P. S. T.....			0.74
100-amp. S. P. S. T.....			1.50
200-amp. S. P. S. T.....			2.70
30-amp. D. P. S. T.....			0.68
60-amp. D. P. S. T.....			1.22
100 amp. D. P. S. T.....			2.50
200-amp. D. P. S. T.....			4.50
30-amp. 3 P. S. T.....			1.02
60-amp. 3 P. S. T.....			1.84
100-amp. 3 P. S. T.....			3.76
200-amp. 3 P. S. T.....			6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.....	List to + 5%
\$10 to \$25 list.....	11%
\$25 to \$50 net.....	14% to 15%
	Low-Grade
Less than \$10 list.....	5% to 10%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.....	+ 5%
\$10 to \$25 list.....	10% to 11%
\$25 to \$50 list.....	14%
	Low-Grade
Less than \$10 list.....	5%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List
1/5 to std. pkg.....	15%
Std. pkg.....	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	List to + 20%
1/5 to std. pkg.....	List to 15%
Std. pkg.....	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....	List to 40%	List to 30%
\$2.00 to \$10.00 list.....	10% to 50%	5% to 40%
\$10.00 to \$50.00 list.....	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25%	20%
\$2.00 to \$10.00 list.....	25%	20%
\$10.00 to \$50.00 list.....	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price.....	\$6.00
Discount.....	30%

CHICAGO

List price.....	\$4.50 to \$6.00
Discount.....	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.....	\$0.41 1/4 - \$0.44 1/4
No. 18, full spools.....	0.36 1/4 - 0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.....	\$0.57 1/2 to \$0.65
No. 18, full spools.....	0.50 1/2 to 0.56

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	5000 Ft.
No. 14.....	\$15.00-\$18.00	\$12.50-\$13.00	\$9.85-\$11.50	
12.....	23.25-25.40	21.30-21.80	15.95-19.35	
10.....	32.40-35.20	29.70-30.20	22.10-27.00	
8.....	45.70-49.15	41.90-42.10	30.85-38.00	
6.....	72.40-77.85	66.35-66.75	48.95-60.30	

CHICAGO

	Price per 1000 Ft. Net			
	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.	5000 Ft.
No. 14.....	\$18.00	\$13.00	\$11.50	
12.....	25.33-\$26.28	22.02-\$25.33	18.55-\$20.93	
10.....	30.49-36.54	27.94-31.26	22.86-29.23	
8.....	42.54-51.57	38.99-44.13	31.90-41.36	
6.....	61.46-88.38	56.15-75.61	50.53-70.70	

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$35.25 to \$36.40
25 to 50 lb.....	34.40
50 to 100 lb.....	30.40 to 34.25

CHICAGO

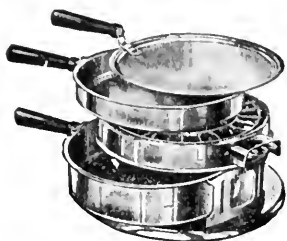
	Per 100 Lb. Net
Less than 25 lb.....	\$35.42 to \$40.35
25 to 50 lb.....	34.42 to 39.35
50 to 100 lb.....	33.42 to 38.25

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Grill with Rust-Proof Pan

A four-heat round grill equipped with rust-proof aluminum pans instead of nickel-plated steel pans is being marketed by Landers, Frary & Clark of New Britain, Conn. The device is known as E986 and is the same as type E984 with the exception of the



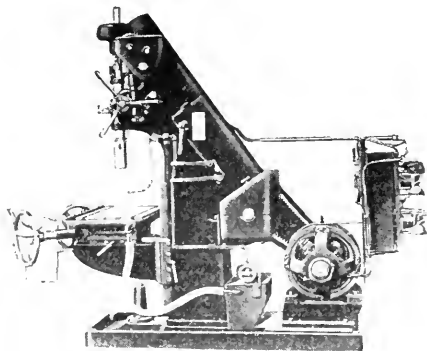
PANS ARE DETACHABLE AND MAY BE USED SEPARATELY

aluminum equipment. The manufacturers claim that these pans will withstand long boiling and soaking in water without damage because they are made of seamless aluminum. The pans may also be purchased separately.

Motor-Driven Drill and Tapper

A heavy-duty drill and tapper that eliminates the use of belts has been placed upon the market by the Barnes Drill Company, Inc., 830 Chestnut Street, Rockford, Ill. With the exception of a spindle sleeve and cross-arms all bearings and all gears are continuously lubricated by an automatic self-oiling system. The oil for this purpose is pumped from the reservoir at the base of the machine by geared pumps.

Eight changes of speed are provided



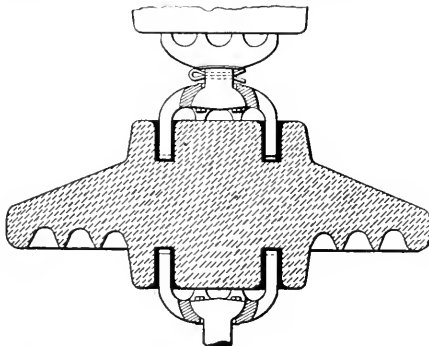
BEARINGS AND GEARS LUBRICATED BY AUTOMATIC SYSTEM

with control levers within easy reach of the operator from his position in front of the drill. For tapping the machine may be equipped with an automatic reversing mechanism which is

very desirable, especially for depth tapping. The trip on this mechanism can be set so that the instant the tap reaches the depth required the spindle will automatically reverse. These machines are driven by Westinghouse Electric & Manufacturing Company 10-hp. direct-current motors by means of a silent chain. A Westinghouse automatic starting panel, which may be entirely inclosed in a metal case, is also provided with this machine.

High-Tension Disk Insulator

A high-tension porcelain disk insulator that is said to be free from internal defects is shown in the accompanying illustration. The electrodes of the insulator are separated by 2.25 in. (5.7 cm.) of homogeneous porcelain, which is somewhat more than in the case of the ordinary insulator. A metal alloy is used to fasten the electrode to the porcelain instead of cement. The manufacturers claim that



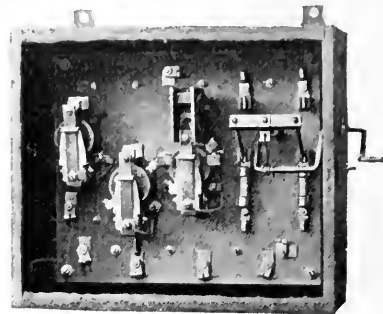
METAL ALLOY FASTENS ELECTRODE TO PORCELAIN DISK

this alloy has a flexibility sufficient to withstand all temperatures, and that it will not crack the porcelain in hot weather. The quality of porcelain is said to be of the best, and porosity is entirely eliminated from the product as far as any test will detect. The insulator is known as the J-D insulator and is manufactured by the Jeffery-Dewitt Company of Detroit, Mich.

Automatic Starter for Industrial Motors

The advantages of automatic control for machine tools have been so persistently preached by the motor and control manufacturers that it is doubtful if there remain many operators who are not fully convinced that this type of control is both economical and productive. The complete controller shown herewith is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is en-

tirely inclosed in a dust-proof case, 15 in. high by 17 in. long by 10 in. deep (38 cm. by 43 cm. by 25 cm.), and may be locked to prevent unauthorized persons from tampering with the switches. The knife line switch is operated from the outside of the case by a crank handle extending



AUTOMATIC CONTROL INCLOSED IN STEEL BOX

through one end, thus isolating the operator from current-carrying parts. The counter-emf. method of acceleration is used, and as the time of acceleration is dependent on the motor load, positive protection against too rapid acceleration is assured. Provision is made for either conduit or open wiring through the top, bottom and end of the case opposite the switch handle. These starters are provided with protection against the failure of power and may be so arranged that either the motor will be started again when the power returns or will require the service of the operator to start it. By using pressure gages or other automatic devices in connection with these starters automatic service may be obtained.

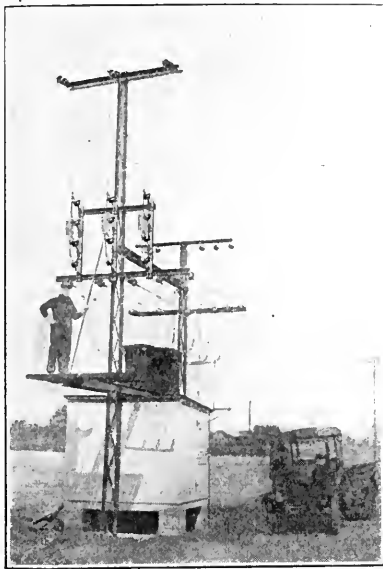
Unit Shade Connector

A unit shade connector that allows a convenient method of installation of a two-piece lighting fixture is being marketed by the J. H. White Manufacturing Company, 111 North Third Street, Brooklyn, N. Y. The connector consists of a chain with a rosette attached to each end. It is designed for units having $\frac{3}{8}$ -in. (0.95-cm.) slip holes. Three connectors are usually needed for attaching each unit, and they can be installed without the use of tools.

Ready-Made Outdoor Substation

Transmission-line companies selling small amounts of power from high-tension lines are often confronted with the necessity of designing small substations of such cost that the revenue obtained therefrom will justify the in-

stallation. To eliminate the usual drafting-room expense that has to be assumed by operating companies, the Delta-Star Electric Company, 2433 Fulton Street, Chicago, has placed upon the market a ready-made outdoor steel-frame substation that can be shipped complete for immediate erec-



STANDARDIZED STEEL SUBSTATION
SHIPPED COMPLETE

tion. These standardized substations are primarily designed for voltages up to and including 33,000 and are made in various kva. ratings. When small transformers are used they are mounted on a platform, but larger ones are mounted on the ground level. High-tension switching, fusing and choke-coil equipment consists of self-contained units with channel bases for bolting to the steel frame. Lightning arresters can be mounted upon the same structure or on the next line pole ahead of the station. The type "VB" form 18 substation is shown in the accompanying illustration.

Electric Washing Machine

An electric washer is being manufactured by the Richmond Cedar Works, Richmond, Va., of the dolly type and made of seasoned hardwood. It is equipped with a reversing wringer with a safety release device. The moving parts of the machine, such as gears, are inclosed in steel covers for protection from dirt and against accidents. It is driven by an Emerson motor.

Receptacle Clusters for Table Use

Receptacle clusters that can be set on the dining-room table and used for supplying energy for cooking utensils are being marketed by the Anderson Electric Specialty Company, 118 South Clinton Street, Chicago, Ill. They are constructed by using a Benjamin wireless cluster that is inverted and set upon the table. The plug at the top is connected to the dining-room lighting

fixture, and the energy supply is distributed from the receptacle to toaster, chafing dish or percolators that are used on tables. These devices are made in two styles, with either the two outlet or the three-outlet receptacle.

Unit-Type Safety Switchboard

Absolute safety to workmen operating switches, renewing fuses or working around switchboards is provided in an auto-lock switchboard which has recently been placed upon the market by the Krantz Manufacturing Company of Brooklyn, N. Y. The switchboard is interesting in the fact that each switch is in a separate compartment. Each of the smaller sections represents a switch unit, and each of the larger sections represents a compartment for busbars, wiring gutters and pull box. Nothing is mounted on the front of the switchboard except the switch handle and a card holder to indicate the circuits controlled by the switch. Since the switch handle is not connected with any current-carrying part, the front of the board is absolutely safe. On the back of the board, too, no live parts are exposed. If all the switches are closed so that the fuses are alive, all



FUSE DOOR MUST BE CLOSED BEFORE
SWITCH IS ENERGIZED

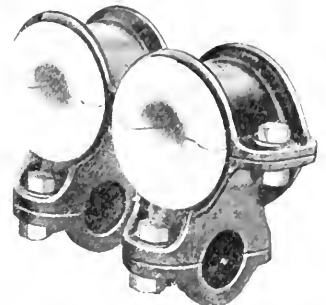
the fuse doors are automatically locked. If it becomes necessary to remove a fuse, the switch affected is thrown off when the switch door is open. It is also impossible for one man to close a switch when another is renewing the fuses. The door must be closed tightly before the switch can be thrown off and the fuses energized.

Cabinet Bushings That Snap into Place

A metal bushing for use in knock-outs, gutter linings of cabinets, meter loops, drop-cord covers and signs has been developed and will be soon placed on the market by J. J. Duck, 432 St. Clair Street, Toledo, Ohio. No spring or locking device is necessary as the bushing snaps into place like a glove fastener. Metal bushings are said to be more efficient than porcelain.

Heavy-Clamp Insulator Supports

A line of insulator supports of considerable strength has recently been brought out by the General Devices & Fittings Company, Mid-City Bank Building, Chicago. The line of supports has a great number of mounting arrangements and almost unlimited size ranges. They are of the split-clamp type and may be mounted on flat or round pipe surfaces. The standard pipe-mounted bases are listed for a

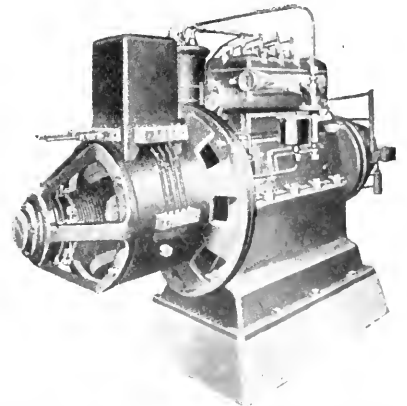


CLAMP INSULATOR THAT MAY BE EASILY
INSTALLED

1.25-in. (3.18-cm.) support, as this size is used almost universally, but bases of any size can be obtained if desired. The insulators may be used for bare or insulated conductors.

Farm Lighting Plant Without Battery Equipment

A farm lighting plant that is not equipped with a battery has been brought out by the Electromatic System Company, 2136 Michigan Avenue, Chicago. It is entirely automatic and is designed for use on the farm or in the suburban home, in public garages, stores or theaters, or in any place where light and power are needed. It delivers 115 volts direct current from the generator and is started by the turning of the switch at the point where electricity is to be used. It will remain in operation until the entire load has been removed. The plant is made in two sizes. The 1-kw. plant



OPERATION OF OUTFIT AUTOMATICALLY
DEPENDS UPON LOAD

is equipped with a two-cylinder engine and weighs 375 lb. (170 kg.) packed complete for shipping. The 3-kw. plant has a four-cylinder engine and weighs, packed for shipping, 175 lb. (215 kg.)

Farm Lighting Plants

The Gile Tractor & Engine Company of Ludington, Mich., is now marketing through the Consolidated Utilities Corporation, 221 Lake Street, Chicago, a 600-watt farm lighting plant. The engine is a 2.6-in. by 3.5-in. (6.7-cm. by 8.9-cm.) valve-in-head, four-cycle, water-

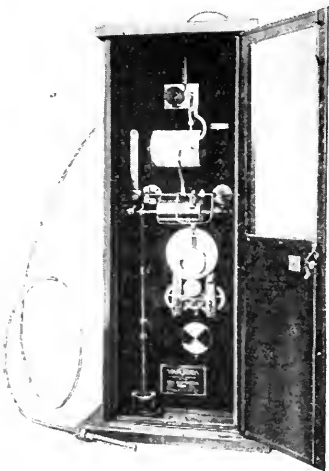


SET USES KEROSENE OR GASOLINE

cooled, 1600-r.p.m. unit. The generator operates at 32 volts to 40 volts. The plant is fully equipped, including a special governor and an arrangement to use kerosene if desired. The Consolidated Utilities Corporation has stated that the marketing of this plant will in no way interfere with the sale of its 1-kw., 2-kw., 5-kw. and 15-kw. Matthews automatic plants.

Feed-Water Weight and Temperature Recorder

The feed-water weight recorder manufactured by the Yarnall-Waring Company, Chestnut Hill, Philadelphia, which was described in the July 4, 1914, issue of the *ELECTRICAL WORLD*, is now being equipped with a temperature recorder. The recording-chart roll is arranged so that the temperature and the weight of the feed water are recorded



TEMPERATURE AND WEIGHT OF FEED-WATER RECORDED ON SAME CHART

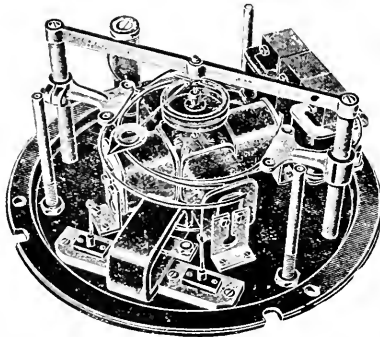
on the same sheet, and both of these values can be obtained for any time during the twenty-four hours. This chart is also convenient for filing, and a large book is furnished with the

meter for permanent records. The outfit is furnished complete with a 5-in. (12.7-cm.) sensitive bulb, a separable 0.75-cm. (1.9-cm.) connection and 10 ft. (3 m.) of flexible insulated tubing. The instrument heretofore went under the name of the Lea V-notch meter, but it is now known as the Yarway V-notch meter with Lea recorder.

Rotary Synchronizers

Brushes for leading current to and from the moving coil are dispensed with and frictional effects are overcome in a rotary synchronizer that has been placed upon the market by Nalder Bros. & Thompson, Ltd., London, Eng. This is accomplished by the use of a small transformer in the instrument which is provided with a circular secondary coil. The secondary coil is electrically connected to the moving coil of the instrument and is rigidly attached to the spindle so that it is free to revolve in a narrow air gap without touching either the primary coil or the iron core of the transformer.

Surrounding the moving coil are four fixed coils. Two of these are connected in series with a resistance wound on a porcelain bobbin, and the other two are connected in series with a choking coil



INTERIOR WITH TRANSFORMER PRIMARY COIL AND CORE REMOVED

which is shown to the right behind the fixed coil. These two circuits are connected in parallel across the terminals of the incoming alternator. A magnetic field rotating with a frequency equal to that of the incoming alternator is thus produced. Similarly, the primary coil of the instrument transformer is connected to the busbar terminals of the meter, the moving coil thus receiving current of busbar frequency and setting up a pulsating magnetic field. The interaction between this and the rotating field causes the pointer to revolve in one direction or the other according to whether the frequency of the incoming alternator is greater or less than the busbar frequency. The number of revolutions per second made by the pointer is equal to the difference of these two frequencies. When the incoming alternator is running at synchronous speed the pointer comes to rest, but its position on the dial then gives a direct indication of the phase displacement between the busbar electromotive force and that of the incoming alternator. By slightly adjusting the speed of the latter the pointer can be caused to move slowly

around until it coincides with the bold mark at the top of the dial. Assuming the voltage of the incoming alternator and the busbars to be equal, the synchronizing switch may be closed and the excitation of the alternator adjusted until it takes its due share of the load.

Adapter for Portable Lamps

An adapter for portable lamps that permits the use of a great variety of lamp shades has recently been brought out by the National X-Ray Reflector



LAMP ADAPTER SMALL AT TOP

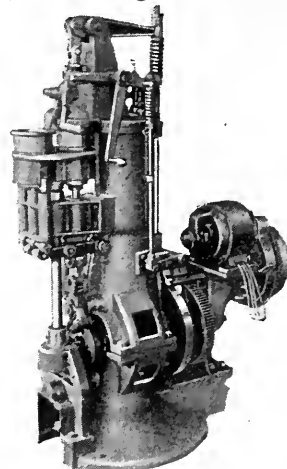
Company of Chicago. This adapter is listed as the "Curtis" and contains the X-ray mirror reflector which fills the room with a mellow, glareless light.

Semi-Indirect Lighting Fixture

A semi-indirect lighting fixture that is designed for use with a gas-filled lamp is being marketed by the Daylite Fixture Company, 416 South Dearborn Street, Chicago. This fixture is known as the Bel-Ko-Lite. The manufacturers claim that it can be easily cleaned and gives perfect diffusion.

Piston Vacuum Machine

The piston vacuum machine used by canners and preservers shown in the accompanying illustration combines a tumbler-sealing machine and a vacuum pump in one single unit. The amount of vacuum desired in each package can be regulated instantly and



SEALING AND VACUUM PUMP

the receptacle sealed immediately. The machine is made by the Anchor Cap & Closure Company, Brooklyn, N. Y., and is operated by a Westinghouse 0.75-hp. motor.

Trade Notes

SCHNEIDER ET CIE removed their offices on April 25 to 21 East Fortieth Street, New York City.

SUSSMAN & SUSSMAN, electricians, have removed their factory and offices to 8 and 10 East Thirty-first Street, New York City.

THE H. W. JOHNS-MANVILLE COMPANY of New York City will have its office at Houston, Tex., at 424-426 Washington Avenue after July 1.

THE WAR TRADE BOARD of Washington, D. C., has issued supplement No. 1, a revision of the "Enemy Trading List," containing additions, revisions, removals and corrections to April 1.

THE ELECTRIC SERVICE SUPPLIES COMPANY has secured larger quarters in the Hudson Terminal Building, 50 Church Street, New York City, and is now occupying rooms 1771 and 1773.

MCCARTHY BROTHERS & FORD of Olean, N. Y., manufacturers of electrical power, lighting and heating supplies, have moved into their new five-story concrete building at 75 to 79 West Mohawk Street.

H. O. BOURKARD will succeed F. Ernest Lauderbach as representative of the National X-Ray Reflector Company in its Southern territory. The company's St. Louis office has been closed, and Mr. Bourkard will make his headquarters at some central point in the territory.

THE ELECTRICAL SUPPLY & REPAIR COMPANY of Hazard, Ky., is reported as a new enterprise. L. B. Trumbull is president, and associated with him are C. E. Carlin and R. L. Cornell. The latter was formerly general manager of the Kentucky River Power Company.

JOHN A. DIENNER has been made a member of the firm of Brown, Hanson & Boettcher, 1550 Monadnock Block, Chicago. Mr. Diener has been associated with this firm of patent attorneys for four years, prior to which time he was an assistant examiner in the United States Patent Office at Washington, D. C.

THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE, Department of Commerce, Washington, D. C., has published "Foreign Tariff Notes No. 27," reprinted from "Commerce Reports October-December, 1917." Copies may be obtained by forwarding 10 cents to the superintendent of documents, Washington.

F. T. BANGS, formerly of the advertising and sales department of the George Cutter Company of South Bend, Ind., has been made advertising manager of the Belden Manufacturing Company of Chicago. Prior to his connection with the George Cutter Company Mr. Bangs was for one and a half years associate editor of the *Electrical Review*.

THE MERCURY MANUFACTURING COMPANY of Chicago is issuing a sixteen-page monthly newspaper entitled *The Trackless Train*, illustrated, and devoted to the description and exploitation of its "Mercury tractors." In other words, the tractor is aimed to meet the need for better and more modern trucking methods adaptable to factory purposes.

CHESTER H. PENNOYER on April 7 became general sales manager of the National Conduit & Cable Company of New York City. He will devote much of his time to traveling in the Eastern States. Mr. Pennoyer is from Oakland, Cal., where he was physical superintendent of the Great Western Power Company during the construction of the big hydroelectric plant.

THE LIBERTY MANUFACTURING COMPANY, just formed, has acquired a plant at Carrollton Avenue and Oleander Street, New Orleans, La., it is reported, to manufacture electrical, foundry and other products. Eph. Rosenberg is president, P. Sefton Schneidau vice-president, and B. B. Hans secretary-treasurer. Operation of the plant has begun. The property measures 318 ft. by 310 ft. and is a "daylight" plant, equipped along modern lines.

THE DEPARTMENT OF COMMERCE of Washington, D. C., has issued, through the Bureau of Foreign and Domestic Commerce, a report entitled "German Trade and the War." It is the work of Chauncey D. Snow, assistant chief of the bureau, in collaboration with J. J. Kral. The part that Germany is planning to play in after-the-war trade is described thoroughly and authoritatively. A copy may be had by addressing the bureau or its co-operative offices.

E. E. MAHER has been appointed by the Terry Steam Turbine Company of Hartford, Conn., manager for the Chicago district, with offices at 1328-29 McCormick Building, 322 South Michigan Avenue. John D. Stout has become manager of the New York office of the Terry company in charge of that district, with the exception of navy and marine installations. Mr. Stout has been assisting Mr. Herbert, formerly in complete charge of the New York district, who will now devote his entire time to navy and marine requirements.

Trade Publications

OIL.—Turbo machine oil is advertised in a circular being distributed by the Borne Scrymser Company, 80 South Street, New York.

WIRE-HOLDERS.—Hubbard & Company, Pittsburgh, Pa., is distributing a circular describing the Peirce wire-holder for open wiring.

ELECTRIC FORGES.—The Buffalo Forge Company of Buffalo, N. Y., is distributing an illustrated catalog describing its portable forges.

ELECTRIC FANS.—A dealer circular has been issued by the Carleton Company, 170 Summer Street, Boston, Mass., describing the "Liberty" fan.

BULLETIN INDEX.—The General Electric Company, Schenectady, N. Y., has issued indexes to descriptive bulletins and sheets and also index of supply part bulletins.

FLOOR SWEEPERS.—William Firth, 200 Devonshire Street, Boston, has issued a folder describing the Firth broomless floor sweeper for cotton mills. This device sweeps floors by air suction.

SOCKETS.—"Harmony in Fixtures" is the title of a two-page circular being distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, describing its porcelain sockets.

MAZDA LAMPS.—The new Westinghouse Mazda carton in orange and black is illustrated in a folder being distributed by the Westinghouse Lamp Company, 165 Broadway, New York City.

STEAM TRAPS.—The Sterling direct-return steam trap is described and illustrated in a circular issued by the Templeton Manufacturing Company, Parkway and Sterling Streets, Cambridge, Mass.

HIGH-TENSION INDOOR EQUIPMENT.—Switches, fuses and choke coils are illustrated and described in bulletin No. 33, being issued by the Delta Star Electric Company, 2433 Fulton Street, Chicago.

FIRE ALARM SYSTEMS.—W. R. Osterlander & Company, 371 Broadway, New York City, have issued a bulletin describing their fire-alarm system for factories, hotels, department stores and public institutions.

STORAGE BATTERIES.—The General Lead Batteries Company, Chapel Street and Lister Avenue, Newark, N. J., is distributing bulletins Nos. 25, 26 and 27, describing its storage batteries for starting and lighting automobiles.

ELECTRICAL SPECIALTIES.—Harvey Hubbell, Inc., Bridgeport, Conn., has issued a catalog on electrical specialties, containing illustrations of the newest Hubbell specialties, with charts, indexes, price lists, etc., for the same.

ELECTRICAL SPECIALTIES.—The Hamilton-Beach Manufacturing Company, Racine, Wis., has issued a booklet for its salesmen entitled "Electric Labor-Saving Devices." It shows not only the company's product but also its sales help.

BALL BEARINGS.—The SKF Ball Bearing Company, Hartford, Conn., has issued an illustrated booklet entitled "Woodworking Precision at High Speed." The bulletin deals with the application of ball bearings to electric motors for woodworking.

SILENT CHAINS.—Book No. 312 has been issued by the Link-Belt Company, Philadelphia, describing the Link-Belt silent chain drive for operating machine tools. The bulletin is profusely illustrated with machines showing actual installations.

RHEOSTATS.—The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing a circular entitled "Universal Charging Rheostat for Charging of Starting, Lighting and Ignition Batteries." This device can be used to charge any number of cells from one to the maximum that can be connected in series and charged from 40 volts.

New Incorporations

THE KENNEDY-WEBSTER ELECTRIC COMPANY of Chicago, Ill., has been incorporated with a capital stock of \$30,000 by Harry M. Kennedy, William H. Webster and Kenneth G. Kennie.

THE GENERAL SUPPLY & LIGHT COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of \$10,000 by J. B. Goldenberg, H. A. Rocker, J. Schnuerer and Arthur Krause.

THE CONTINENTAL ELECTRIC COMPANY of Detroit, Mich., has been chartered with a capital stock of \$10,000. The incorporators are: M. R. Bryant, Henry Burdeno, W. J. Moore of Detroit.

THE WHOLESALE ELECTRICAL SUPPLY COMPANY of Tulsa, Okla., has been incorporated with a capital stock of \$30,000 to deal in electrical supplies. Albert H. Bell is president and Ray S. Fellows secretary.

THE STORAGE BATTERY & APPLIANCE COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of \$150,000. The incorporators are: Donald G. Scott, William Knoblock and William J. Graham.

THE BELYEA-GRANT ELECTRIC MACHINERY COMPANY of New York, N. Y., has been incorporated by R. Grant, B. M. and T. S. Belyea, 48 East Eighth Street, New York City. The company is capitalized at \$5,000.

THE UNITED ELECTRIC COMPANY of Marlboro, Mass., has filed articles of incorporation with a capital stock of \$10,000. The directors are: H. J. Rougeau, president; Arthur J. Rougeau of Marlboro, treasurer, and E. M. Rougeau.

THE HARRY S. ORR COMPANY of Boston, Mass., has been incorporated by Harry S. Orr, George M. Heathcote of Newton and George L. Ellsworth of Boston, Mass. The company is capitalized at \$50,000 and proposes to deal in electrical goods.

THE ELECTRIC TYPE DAIRY COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$500,000. The incorporators are: M. I. Perty, F. L. Buck and K. E. Longfield of Wilmington, Del.

THE OHIO MECHANICAL & ELECTRICAL MAINTENANCE COMPANY of Mansfield, Ohio, has been incorporated with a capital stock of \$1,000 by William H. Thompson, Guy E. Thompson, Ellsworth G. Clark, Harry Calhoun and Frank Schwartz.

THE R. V. G. COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of \$25,000 to manufacture electrical specialties. The incorporators are: F. Goldberg, R. Goldberg, Great Kills, S. I., and L. J. Cohen, 52 Broadway, New York City.

THE BANNISTER HYDROELECTRIC COMPANY of Los Angeles, Cal., has been incorporated with a capital stock of \$200,000 by George R. and Robert B. Bannister and Perry H. Brown. The company proposes to manufacture an electric gage and similar products.

THE PHILADELPHIA ELECTRIC STEEL COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$70,000 to do a general steel business. The incorporators are: C. L. Rimplinger, M. M. Clancy and F. A. Armstrong of Wilmington, Del.

THE DILWORTH MANUFACTURING COMPANY of Hoboken, N. J., has been incorporated by Ernest E. Davies of Hoboken; N. P. Hill of Montclair, and George C. Sprague of Englewood Heights, N. J. The company is capitalized at \$50,000 and proposes to manufacture wireless and electrical equipment.

THE JOHN C. SERVICE COMPANY of New York, N. Y., has been incorporated by J. C. Williams, Lake View Avenue, Brightwaters; A. Stemmermann, 417 Brevoort, Richmond Hill, and W. S. Ross, 64 Montague Street, Brooklyn. The company is capitalized at \$25,000 and proposes to do a general contracting and electrical engineering business, etc.

THE SINGLAND POWER COMPANY OF NEW JERSEY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at \$250,000 and proposes to acquire patent rights to develop power by air. The incorporators are: Leonard Singland, Frank P. Venable, John H. Mussner and Louis J. Patmost of Paterson, N. J.

New England States

CONTOCOOK, N. H.—The Contocook Electric Light Company is extending its electric transmission line through the town south of Willow Hollow to connect with the Boston and Maine lines.

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has completed its dam on the Piscataquog River at Gregg's Falls. Two generators of 1500 kw. each will be installed in the new power station. Electricity will be transmitted at 33,000 volts to the Kelley's Falls station. The main generating room of the power station, not yet completed, will be 85 ft. by 40 ft.; the transformer room will be 25 ft. by 74 ft., and will be equipped with three transformers each having a rating of 1250 kva.

LUDLOW, VT.—Arrangements have been made by the commissioners of the municipal electric light plant with the Colonial Power & Light Company of Cavendish for furnishing 200 kw. additional, which is to be used by woolen mills working on government orders.

CANTON, MASS.—Plans have been prepared by A. H. Wright, 53 State Street, Boston, for the construction of an addition to the engine house of the plant of the Springdale Finishing Company.

MILLBURY, MASS.—The New England Power Company of Worcester has petitioned the Selectmen for permission to erect a high-tension transmission line across the Providence Railroad and South Main Street, near the Sutton line. The proposed line will extend from Worcester to Webster.

SPRINGFIELD, MASS.—The United Electric Light Company will remodel its building at State and Water Streets for an electrical switching station. The cost is estimated at \$102,000. Contract, it is understood, has been awarded for the work.

DANBURY, CONN.—The property of the National Electric Utilities Corporation of Danbury has been purchased by Landers, Frary & Clark of New Britain. The purchasing company, it is understood, will continue the business of the Utilities corporation in its present building and plan extensions to same.

NORWICH, CONN.—Contract has been awarded by the Eastern Connecticut Power Company to Fred T. Ley & Company, Springfield, Mass., for the construction of its proposed steam power station in Norwich.

PUTNAM, CONN.—Plans have been prepared by the Cochrane Manufacturing Company, 56 Barrett Avenue, Malden, Mass., for the construction of a new power house, transmission system, and dam in Putnam. Erastus Worthingham, of Dedham, Mass., is engineer.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received by the Board of Contract and Supply, Albany, until June 17 for electric-lighting fixtures for the city hall. Drawings and specifications, etc., may be seen at the office of the associate architects, C. G. Ogden and Joseph J. Gander, 61 State Street, Albany, or at the office of the Board of Contract and Supply, City Hall.

ALBION, N. Y.—The contract for the construction of the proposed addition to the boiler plant at the Western House of Refuge has been awarded to Henry C. Belson of Albion.

BINGHAMTON, N. Y.—The Ansco Company has awarded a contract to the Binghamton Light, Heat & Power Company for furnishing electricity to operate its plant at Johnson City. About 100 hp. will be required in small motors.

BROOKLYN, N. Y.—Plans have been filed and contract awarded to John H. Deeves & Brother, 103 Park Avenue, New York City, by the Arabol Manufacturing Company, 100 William Street, New York, for the erection of an addition to the boiler plant at its local works.

BROOKLYN, N. Y.—Contracts have been awarded by the E. W. Bliss Company of Brooklyn to the Hedden Construction Company, 52 Vanderbilt Avenue, New York City, and W. H. and F. W. Cane, Woolworth Building, for the construction of an addition (seven stories) to its projectile works on Fifty-third Street, near First Avenue. 200 ft. by 300 ft., to be supplemented by a pier, 60 ft. by 575 ft.

BUFFALO, N. Y.—Plans are being prepared for the construction of a new power house, about 40 ft. by 40 ft., in connection with the new plant of the Buffalo Cereal Company.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

CENTRAL ISLIP, N. Y.—Plans are being considered by the State Hospital Commission for the installation of new boilers and other equipment at the State Hospital at Central Islip. The installation of a new heating plant at the institution is also contemplated. E. S. Elwood is secretary of the commission.

GLENS FALLS, N. Y.—The construction of a new transformer station at Canastota is under consideration by the Adirondack Electric Power Corporation. H. J. Hunsicker is chief engineer.

NEW YORK, N. Y.—Plans have been prepared for the construction of a new transformer station for the Gryphon Rubber & Tire Company on Bailey Avenue near 192d Street.

NEW YORK, N. Y.—The United Electric Light & Power Company, 130 East Fifteenth Street, New York, has purchased a site, 47 ft. by 100 ft., on which it proposes to erect an electric power station.

NEW YORK, N. Y.—Work has begun on the erection of a new power house to be built by Kenneth Stevenson, 25 Broad Street, at 172-80 Water Street. The proposed building will be 105 ft. by 115 ft., five stories, and will cost about \$350,000.

OLEAN, N. Y.—The Olean Electric Light & Power Company is contemplating the purchase of additional equipment.

CAPE MAY COURTHOUSE, N. J.—The contract for installing electric lighting fixtures for the Middle Township high school at Cape May Courthouse has been awarded to the L. L. Jones Company, 1019 Atlantic Avenue, Atlantic City.

SOUTH PLAINFIELD, N. J.—Plans are being considered by the Spicer Manufacturing Company for the construction of a new power house at its works here.

TRENTON, N. J.—Preliminary plans are being prepared by J. O. Hunt, 114 Montgomery Street, architect, for the construction of a new power plant at the works of John E. Thropp & Sons, Lewis Street.

TRENTON, N. J.—The City Commission has granted the Trenton & Mercer County Traction Corporation permission to erect wires on the poles on South Broad Street between Liberty Street and Cedar Lane, owned by the Public Service Corporation and the Bell Telephone Company. The company is making improvements to its street car line in the West State Street section, as well as on the Princeton, Lawrenceville, Pennington, Hopewell and Yardville divisions.

BETHLEHEM, PA.—The Bethlehem Electric Company has filed notice with the Public Service Commission of an issue of \$50,000 in bonds, the proceeds to be used for extensions and improvements.

ELWOOD CITY, PA.—The Pennsylvania Power Company, which recently purchased considerable water-front property in the Turkey Hill section, about 5 miles south of Wrightsville, is reported to be planning the construction of a dam.

ERIE, PA.—The Burke Electric Company is reported to be planning an addition to its local plant. Another small plant, it is said, will be established in Conneautville in the near future by the company for the manufacture of a new line of electrical work.

HARRISBURG, PA.—The Harrisburg Light & Power Company has filed notice with the Public Service Commission of an issue of \$50,000 in bonds, the proceeds to be used for extensions and improvements.

LANCASTER, PA.—The Edison Electric Company has filed notice with the Public Service Commission of an issue of \$115,000 in bonds, the proceeds to be used for extensions and improvements to its system.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 20 under specification 2952 for construction of power house and two transformer stations at Philadelphia, to cost about \$188,000.

PITTSBURGH, PA.—Plans are being prepared for the construction of a new power plant for the Pittsburgh Modern Laundry Company in connection with its proposed new plant. The cost of the entire work is estimated at about \$60,000. Paul W. Irwin, Renshaw Building, Pittsburgh, is architect.

WESCOESVILLE, PA.—The construction of an addition to the local boiler plant is under consideration by the Commissioners of Lehigh County for which plans are now being prepared by Tilghman Moyer, architect, 824 Hamilton Street, Allentown.

LINTHICUM HEIGHTS, MD.—Work has begun on the erection of the proposed new power house of the Consolidated Gas & Electric Company in Linthicum Heights, to cost about \$7,000. The Cogswell-Roecher Company, 406 Park Avenue, Baltimore, has contract for building.

ST. HELENA, MD.—Contract has been awarded by the United States Shipping Board to the Consolidated Engineering Company, Calvert Building, Baltimore, for construction of bakery, power house, 302 convertible houses, etc., at St. Helena, to cost about \$800,000.

ALEXANDRIA, VA.—Contracts have been awarded by the Virginia Shipbuilding Corporation of Alexandria for the construction of a shipbuilding plant on the Potomac River, to cost about \$5,000,000, to Frederick T. Ley & Company, 19 West Forty-fourth Street, New York, N. Y., and the Raymond Concrete Pipe Company, 90 West Street, New York. The initial works will consist of 12 one and two-story buildings, including a machine shop and a foundry.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, until May 20, for installing at the navy yard, Philadelphia, Pa., coal and ash-handling equipment for aircraft factory, to cost approximately \$35,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 27 for constructing an eight-way tile duct system with manholes, complete for break-down service between the frequency changer building, Navy Yard, and the Capitol power plant, Garfield Park, Washington. Drawings and specification No. 2959 may be obtained upon application to the above bureau or to the commandant of the navy yard named.

North Central States

BELLAIRE, MICH.—At an election held recently the proposal to issue \$6,000 in bonds for improvements to the municipal electric-light plant was carried.

AKRON, OHIO.—A permit has been granted the Wellman-Seaver-Morgan Company for the erection of a fireproof power house on Kenmore Boulevard.

CALEDONIA, OHIO.—The County Commissioners have granted the Delaware & Marion Railway Company a franchise to erect transmission lines from Marion to Caledonia, a distance of 10 miles, to furnish electricity here. The local electric plant was recently closed down on account of the high cost of fuel and labor.

CINCINNATI, OHIO.—The Union Gas & Electric Company is reported to be contemplating the installation of a third electric generating unit.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until May 24, for steel smoke breeching for the division of light and heat.

CLEVELAND, OHIO.—The France Manufacturing Company, 1434 West Seventy-fifth Street, is planning to build a new plant at Berea Road. The company manufactures magnetic rectifiers, ammeters, electric meters, carbon rheostats and rotary strippers.

DILLES BOTTOM, OHIO.—The power plant of the Fort Pitt coal mines in Dilles Bottom was destroyed by fire recently, causing a loss of about \$25,000.

EATON, OHIO.—The County Commissioners have granted the Twin Valley Light & Power Company a franchise to erect and maintain electric transmission lines to transmit electricity for a distance of about 9 miles, in the southeast part of Preble County for a period of 25 years. The company proposes to supply electricity to farmhouses along the line, which it will purchase from a traction company. J. E. Flora, William Knopp and others are interested.

HAMILTON, OHIO.—Bids will be received at the office of the County Commissioners, Hamilton, Ohio, until May 25 for the installation of a lighting system for bridge and viaduct over the Miami River between Middletown and West Middletown, including furnishing and placing of conduits, glassware, metal globe holders, sockets, etc. Plans and specifications

are on file in the office of the county auditor and County Commission, Hamilton.

HURON, OHIO.—The City Council is considering an issue of \$4,500 in bonds for improvements to the municipal electric-light plant and water-works system, including the installation of two electric motor-driven water pumps, equipping the water department with meters and providing equipment for unloading coal at the railroad station.

MANSFIELD, OHIO.—Preparations are being made by the Farmers' Dairy & Produce Company for enlarging and remodeling its plant on East Third Street. It is proposed to equip the plant to purify the milk by the electrical process. The name of the company has been changed to the Electro Pure Process Company.

SANDUSKY, OHIO.—Preparations are being made by the Hinde & Dauck Paper Company to move into its new factory. The power requirements of the new plant will be considerably in excess of the old factory. All direct-current motors will be eliminated. Power for operating the plant will be supplied by the Sandusky Gas & Electric Company.

TOLEDO, OHIO.—The City Council has authorized the installation of 50 additional arc lamps in the streets of the city.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Railway & Light Company has applied to the Public Utilities Commission for permission to issue \$600,000 in bonds to be sold at 90, and \$200,000 in preferred stock. The Interstate Commerce Commission has approved an application by the company to issue these securities.

LEXINGTON, KY.—The American Metallic Packing Company, it is reported, would like to receive prices on a 300-kw., 250-volt, second-hand (must be in first-class condition), direct-current generator directly connected to steam engine.

DANVILLE, IND.—The Merchants' Heat & Light Company of Indianapolis has applied to the Public Service Commission for permission to issue \$140,000 in bonds and \$60,000 in capital stock, the proceeds to be used to purchase the property of the Danville Light, Heat & Power Company. The local company purchases energy from the Merchants' company and distributes it in Danville, Plainfield, Brownsburg, Clermont, Avon and rural districts adjacent.

CHICAGO, ILL.—Contracts, it is reported, have been awarded by the Illinois Central Railroad Company for the construction of a new electric power plant at Ninety-eighth Street and Cottage Grove Avenue to Joseph E. Nelson & Sons, 118 LaSalle Street, Chicago. The cost of the proposed plant is estimated at about \$60,000.

CLINTON, ILL.—Preparations are being made by the Illinois Central Railroad Company, it is reported, for improvements to its local shops. The proposed work will include rebuilding the machine shop, enlarging the erecting shop, the construction of a new power house, installation of new boilers and other work, for which contracts, it is understood, have been awarded.

NORTH CHICAGO, ILL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 27 under specification 2993 for installing an electric distributing system at the Great Lakes Training Station. Further information may be obtained on application to the chief of bureau.

ST. JOSEPH, ILL.—Plans have been prepared for rebuilding the plant of the Berry Iron & Steel Company, which was recently destroyed by fire. It is proposed to replace the two buildings burned with five, designed for railroad foundry work. The main foundry room will be 50 ft. by 260 ft., and will be equipped with two cranes.

PRESTON, MINN.—The Root River Power & Light Company, it is reported, is planning to extend its electric system from Caledonia to Houston during the coming summer.

DES MOINES, IOWA.—All bids submitted for the electroliners (259) for lighting the Capitol extension have been rejected. The lowest bid was \$30,000, which was considered too high by the Council. It has been decided to postpone indefinitely the installation of ornamental lamps and to reduce the number of lamps to be installed at this time to a number sufficient to make the grounds safe.

NEW ENGLAND, N. D.—The Asby Light & Power Company is reported to have purchased the property and equipment of the Gardner Electric plant. As soon as the necessary changes in connection with the consolidation can be made, a 24-hour service will be established.

BRADLEY, S. D.—The Dakota Northern Power Company, it is reported, is con-

templating the construction of a power station and the purchase of equipment. E. L. Lewis is secretary.

ATWOOD, KAN.—The municipal electric-light plant has recently been changed over from direct to alternating current. New electric lines are being erected in the city limits. The plant is driven by Fairbanks-Morse oil engines. S. F. Snyder is superintendent.

Southern States

GLIDEN, N. C.—R. O. Blanchard, of Gliden, it was reported, would like to communicate with manufacturers and dealers of electrical and water-power machinery.

ATLANTA, GA.—Contract has been awarded to the Bailey Oliver Electric Company, 73 Walton Street, Atlanta, for furnishing addition to main switchboard, power tablet and electric feeders for lamps and motors in the United States penitentiary at Atlanta, at \$3,300.

COLUMBIA, TENN.—Arrangements have been completed by the Southern Cities Power Company for the construction of a power plant on Duck River, to cost about \$100,000. The work will include the construction of a crib dam, 12 ft. high, a power house and a 15-mile transmission line to Mount Pleasant, at a cost of \$25,000. The initial installation will provide for a development of 450 hp. for transmission to Mount Pleasant. Contracts have been placed for equipment and construction work. M. R. Stern is general manager.

RUTHERFORD, TENN.—At an election held recently bonds to the amount of \$10,000 were voted for the installation of an electric-light plant in Rutherford.

DE QUEEN, ARK.—The De Queen Lumber Company is planning to equip its mill, having a daily capacity of 100,000 ft., with motor-driven machinery. W. O. Creason is manager.

GUEYDAN, LA.—The city has taken over the electric-light plant and water-works system, to be owned and operated by the municipality. Improvements involving an expenditure of \$15,000 will be made to the electric plant, and \$20,000 will be expended on the water works. An ice factory of 10 tons capacity will be built at a cost of about \$10,000. It is proposed to house the three plants in one building. New equipment, including crude-oil engine, to develop from 50 to 100 hp., will be installed in the electric plant; plans for the water works include a 6-in. deep well, 60,000-gal. tank, 100-ft. elevation, pumps, mains, etc. The J. B. McCrary Company of Atlanta, Ga., has charge of the engineering work.

JENNINGS, OKLA.—Bonds to the amount of \$25,000 have been voted for the installation of an electric-light plant in Jennings.

OKLAHOMA CITY, OKLA.—Final plans have been prepared for the construction of the Chickasaw hosiery mills, which will include a 150-hp. steam and electric power plant and dyeing machinery. The plant will be equipped with electric-driven motor machinery. The cost of the entire plant is estimated at about \$60,000. T. E. Cullen, Colcord Building, is secretary and treasurer.

DEL RIO, TEX.—Steps have been taken by the City Council for the installation of a municipal electric-lighting plant.

MERCEDES, TEX.—The Mercedes Water, Light & Power Company is planning to install a new 100-hp. engine and generator. When improvements are completed a 24-hour service will be established in Mercedes.

RUSK, TEX.—Improvements are contemplated by the Texas Steel Company involving an expenditure of about \$75,000, and will include the installation of a large pump, for water circulating, improvements to blast furnace and pipe foundry, replacing motors and overhauling cranes, etc. Work is already under way.

Pacific and Mountain States

SEATTLE, WASH.—The Board of Public Works has selected the Skagit River power site for immediate development for additional power for the city. All other offers have been rejected. The board has suggested to the Council that new detailed plans and specifications be prepared in accordance with the physical condition encountered on the Skagit River, conditional upon the approval of the site by the City Council.

SPOKANE, WASH.—The Westinghouse Electric & Manufacturing Company of

Pittsburgh, Pa., it is reported, has acquired the controlling interest in the Spokane Heat, Light & Power Company, which operates a central heating, lighting and power plant, furnishing service to the central district of Spokane.

TACOMA, WASH.—The City Lighting Department is considering a contract with the Tacoma Railway & Power Company, under which the company will install, maintain and operate the large generator which the city has purchased and for which no space has been provided. The Tacoma company has offered for \$1,800 per year to install and operate the generator and hook it up with its own switchboard, so that if the peak load were exceeded the company could cut in the city line on its own current. Hamilton Groner, commissioner of light, estimates that it would cost the city \$10,000 to build a substation on the tidelands and \$4,500 for salaries to operate the plant.

ASTORIA, ORE.—The Hammond Lumber Company, it is reported, has placed contracts for an additional turbine and generator of 2000 hp. and for four 600-hp. water-tube boilers.

PORTLAND, ORE.—The contract for the electrical equipment in the new municipal grain elevator in Portland has been awarded to the Ne Page-McKinney Company of this city.

PORTLAND, ORE.—The Liberty Foundry, Inc., recently incorporated, has leased the plant of the Lister Sash Weight Company, which it proposes to equip for a foundry and machine shop. The company contemplates adding electric welding and brass and bronze casting departments. William Cornfoot, shipbuilder, is among the incorporators.

GRIDLEY, CAL.—Contracts, it is reported, have been placed by Rosenberg Brothers & Company of Gridley for equipment for an entire new power plant to operate their rice mill here. The capacity of the new plant will be 40 per cent more than the present plant. Arrangements are also being made by the company to build a new two-story mill, 100 ft. by 240 ft., to be equipped with all new labor-saving devices. The company is reported to be planning the erection of two additional mills in the Sacramento Valley at points yet to be designated.

HOLLISTER, CAL.—The installation of an electrolier lighting system in the business district of the town is under consideration.

MODESTO, CAL.—Plans are being considered by the Sierra & San Francisco Power Company for extensive improvements, including the construction of a hydroelectric power plant on the Middle Fork of the Stanislaus River.

SAN FRANCISCO, CAL.—Plans of the Bethlehem Steel Company for the construction of a large steel ship repair plant at Hunter's Point, San Francisco, have been accepted by the United States government. The work includes the erection of machine shops, fabricating plants, marine railroad and other equipment. Three floating docks, with a capacity of 8000, 4000 and 3500 tons, respectively, are to be moved to the new location, and two additional docks built. The cost of the entire project is estimated at \$2,000,000.

NOGALES, ARIZ.—The Arizona Gas & Electric Company of Nogales has petitioned the State Corporation Commission for permission to issue \$100,000 in bonds, the proceeds to be used to pay for outstanding indebtedness and for an additional generating unit, to cost \$30,000.

CALIENTE, NEV.—The installation of an electric-lighting system in Caliente is reported to be under consideration.

Canada

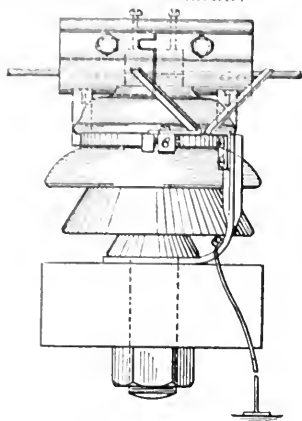
VANCOUVER, B. C.—The Jarvis Electric Company of Vancouver has been awarded the contract for electrical machinery to be installed on the three auxiliary sailing ships under construction by the William Lyall Shipbuilding Company, including three generators, directly connected to gasoline engines, electrically driven sail hoists and motor equipment for air-compressors and bilge pumps.

BROCKVILLE, ONT.—Arrangements are being made by the Cedar Rapids Transmission Company to supply electricity generated at Mille Roches to the towns along the St. Lawrence River. Brockville, it is understood, will be the chief distribution center.

HAMILTON, ONT.—The installation of a private power plant in the City Hospital is under consideration by the board of governors. Dr. W. A. Langrill is medical superintendent.

(Closed April 30, 1918.)

- 1,263,197. APPARATUS FOR REGULATING HEATING SYSTEMS; Everett H. White, St. Paul, Minn. App. filed Feb. 17, 1915. Dampers of a heating furnace, hot water, steam or otherwise, may be suitably controlled.
- 1,261,137. MEASURED-SERVICE TELEPHONE SYSTEM; Albert Andersen, Chicago, Ill. App. filed Dec. 5, 1913. Improvements.
- 1,264,158. TELEPHONE SYSTEM; Henry P. Clau-chen, Mount Vernon, N. Y. App. filed July 2, 1917. Improvements.



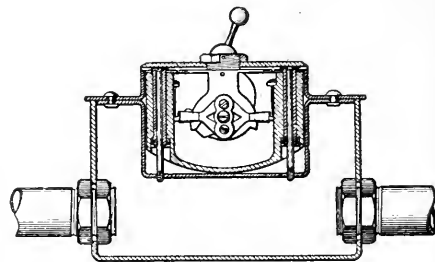
1,264,396—Lightning Arrester

- 1,264,174. KNIFE AND WAX HEATER; Frederick M. Furber, Revere, Mass. App. filed Nov. 4, 1914. For manufacture of shoes.
- 1,264,176. TELEPHONE-CALL RECORDER; Rupert H. Greenlaw, Lawrence, Mass. App. filed April 15, 1916. May be readily attached to a portable telephone instrument.
- 1,264,183. MEASURED-SERVICE TELEPHONE SYSTEM; Harry E. Hershey, White Water, Kan. App. filed Nov. 28, 1913. Improvements.
- 1,264,204. APPARATUS FOR TRANSMITTING AND DISPLAYING SIGNALS AND THE LIKE; Archibald R. Mitchell, London, England. App. filed March 23, 1915. For displaying announcements in hotels.
- 1,264,255. ELECTRICAL SOCKET FITTING; William F. Anklam, Detroit, Mich. App. filed April 18, 1917. For connecting the incandescent lamps of a vehicle lighting system.
- 1,264,270. ELECTRODE - SHIELDING DEVICE; David F. Carpenter, Wilkensburg, Pa. App. filed July 6, 1915. Improvements.
- 1,264,272. ELECTRICAL WINDING; Lewis W. Churb, Pittsburgh, Pa. App. filed July 12, 1917. Energy of a structurally discontinuous winding may be uniformly distributed throughout.
- 1,264,276. VAPOR-ARC RECTIFIER; Frank Conrad, Swissvale, Pa. App. filed May 11, 1914. Relates to metallic containing receptacles for vapor-arc rectifiers.
- 1,264,280. ARC LAMP; William A. Darrah, Wilkensburg, Pa. App. filed Jan. 24, 1914. Provision made for withdrawing the fumes and vapors from the arc chamber.
- 1,264,297. SYSTEM OF CONTROL; Arthur J. Hall, Wilkensburg, Pa. App. filed Feb. 10, 1916. Regenerative control of electric railway motors.
- 1,264,298. SYSTEM OF DISTRIBUTION AND CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Feb. 19, 1914. Control of polyphase induction motors.
- 1,264,299. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 10, 1914. Improvements.
- 1,264,300. STREET-TRAFFIC-SIGNAL APPARATUS; Harry D. Heuer, St. Louis, Mo. App. filed May 23, 1914. Improvements.
- 1,264,326. ELECTRIC WELDING APPARATUS; John P. Nikonow, Dayton, Ohio. App. filed Sept. 7, 1917. Manually controlled electric arc.
- 1,264,333. CIRCUIT INTERRUPTER; Carl C. Randall, Edgewood Park, Pa. App. filed Aug. 2, 1913. Knife-blade switch of the quick-break type.
- 1,264,335. CONTROL SYSTEM; Lynn G. Riley, Wilkensburg, Pa. App. filed May 3, 1915. For controlling dynamo-electric machines.
- 1,264,340. REVERSING MECHANISM FOR WASHING MACHINES; George Simon and Fritz Balzer, Chicago, Ill. App. filed Feb. 8, 1915. Actuated by the movement of the reversible parts.
- 1,264,354. CONTROL SYSTEM; Charles C. Whitaker, Wilkensburg, Pa. App. filed Aug. 10, 1915. For pantograph trolleys.
- 1,264,366. CALLING DEVICE; Henry P. Clau-chen, Mount Vernon, N. Y. App. filed Oct. 13, 1916. Impulse transmitters for automatic and semi-automatic telephone systems.
- 1,264,378. CONTROLLING SYSTEM; Amos F. Dixon, Newark, N. J. App. filed March 16, 1914. Arranged to control the feed of a paper tape such as is used in automatic telegraphy.
- 1,264,388. TELEPHONE SYSTEM; Olof M. Guthe, East Orange, N. J. App. filed Aug. 20, 1917. Improvements.
- 1,264,396. LIGHTNING ARRESTER; Frederick W. Hays, Pittsburgh, Pa. App. filed June 15, 1916. Improvements.
- 1,264,402. METERING SYSTEM FOR AUTOMATIC TELEPHONE EXCHANGES; Jacob W. Lattig, Glenside, Pa., and Charles L. Goodrum, New York, N. Y. App. filed Sept. 24, 1915. Subscribers are charged for calls as originated in accordance with the services rendered.
- 1,264,404. KNIFE-BLADE SWITCH; Ronald Lister, Chorlton-cum-Hardy, England. App. filed June 27, 1917. Hinge and contact members formed entirely of strip metal.
- 1,264,405. ARC-LAMP GLOBE; George M. Little, Pittsburgh, Pa. App. filed Aug. 11, 1913. Arc lamps.
- 1,264,406. POST-TYPE ARC LAMP; George M. Little, Pittsburgh, Pa. App. filed Dec. 4, 1913. Permits inspection of lamps and the necessary replacements to be readily made, and will allow of a weatherproof design.
- 1,264,413. SIGNAL DEVICE; Jesse F. MacDonald, Billings, Mont. App. filed April 30, 1917. Adapted for use on motor vehicles.
- 1,264,414. DISCONNECTING SWITCH; Joseph H. Mahoney, Wilkensburg, Pa. App. filed April 24, 1913. Will open and close with a minimum pull or twist on the insulators forming the pillars of the switch.
- 1,264,415. ELECTRICAL PROTECTIVE DEVICE; Joseph N. Mahoney, Wilkensburg, Pa. App. filed April 3, 1914. For reverse-current and underload tripping devices for circuit interrupters.
- 1,264,420. MEANS FOR PRODUCING ALTERNATING CURRENTS; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. Inverted rectifiers of the vapor type.
- 1,264,421. ELECTRIC SWITCH; Charles H. Miller, Milwaukee, Wis. App. filed Oct. 28, 1913. For automatic motor starters.
- 1,264,444. INDUCTION MOTOR; George J. Schmidt, Wilkensburg, Pa. App. filed Dec. 4, 1914. Method of controlling motors.
- 1,264,450. OUTLET BOX WITH KNOCK-OUT SECTIONS; Oliver T. Sweet, St. Louis, Mo. App. filed June 28, 1916. Easily and quickly removed at the time the box is installed.
- 1,264,465. AUTOMATIC CIRCUIT-CLOSER ATTACHMENT FOR TELEGRAPH KEYS; James L. White, Buffalo, Tex. App. filed July 19, 1917. Automatically closing the line circuit to the next station immediately upon release of the key by the operator.
- 1,264,473. COMBINATION SWITCH; Howard H. Baker, Buffalo, N. Y. App. filed July 24, 1915. Can be partly dismantled or taken apart for inspection or repairs without disclosing the combination.
- 1,264,482. ELECTRIC CONNECTOR FOR DASH LAMPS, ETC.; John Berg, Chicago, Ill. App. filed July 20, 1917. Means for securely mounting a dash lamp on an automobile.
- 1,264,507. MULTI-UNIT TELEPHONE TRANSMITTER; William W. Hanscom, San Francisco, Cal. App. filed Feb. 27, 1917. Adapted for wireless telephony.
- 1,264,517. ELECTRIC IMPULSE SENDER; Henry J. Herink, London, England. App. filed Dec. 23, 1916. Improvements.

Record of Electrical Patents

Notes on United States Patents

- 1,264,520. FLASHLIGHT BATTERY; Major E. Holmes, Lakewood, Ohio. App. filed March 2, 1914. Combination of a flashlight battery with a rheostat.
- 1,264,525. PORTABLE ELECTRIC LIGHT; Walter D. Kahn, New York, N. Y. App. filed Aug. 16, 1917. Flashlight.
- 1,264,529. SNAP-SWITCH DEVICE; Henry Kocourck, Jersey City, N. J. App. filed Jan. 22, 1917. For use with a solenoid.
- 1,264,535. ELECTROLYSIS OF CHLORIDES; Karl P. McElroy, Washington, D. C. App. filed Dec. 9, 1915. Improvements.
- 1,264,536. MANUFACTURE OF ALKALIS; Karl P. McElroy, Washington, D. C. App. filed June 22, 1915. By electrolysis.
- 1,264,544. SIGNAL-ACTUATING DEVICE FOR MOTOR VEHICLES; Charles Nevin, Buffalo, N. Y. App. filed Sept. 9, 1915. Arranged on the steering wheel of a motor vehicle.
- 1,264,545. SIGNAL-ACTUATING DEVICE FOR VEHICLES; Charles Nevin, Buffalo, N. Y. App. filed May 29, 1916. Arranged on the steering wheel of a motor vehicle.
- 1,264,546. SUPPORTING MEANS FOR ELECTRIC SWITCHES; William J. Newton, Lynbrook, N. Y. App. filed May 25, 1915. Adapted for the control of the ordinary lighting circuits of buildings.
- 1,264,560. SPARKING MEANS FOR MOTOR VEHICLES; Andrew L. Iker, Short Hills, N. J. App. filed July 16, 1902. For igniting the combustible in the engine cylinders.
- 1,264,593. ELECTRIC WATER PURIFIER; Edward M. Barnes, Hastings, Mich. App. filed June 30, 1917. Improvements.
- 1,264,596. AUTOMOBILE SIGNAL; Joseph Basil and Emilio Stocchi, Detroit, Mich. App. filed April 30, 1917. Improvements.
- 1,264,611. METHOD OF ELECTRIC WELDING; William B. Cleveland, Cleveland, Ohio. App. filed June 11, 1915. Improvement on "Herrick" process of making a homogeneous mechanical juncture.
- 1,264,628. DISTILLING PROCESS FOR RECOVERING METALS FROM ORES AND METAL-BEARING MATERIALS; Charles H. Fulton, St. Louis, Mo. App. filed April 21, 1917. Improvements.
- 1,264,629. PROCESS FOR RECOVERING MERCURY; Charles H. Fulton, St. Louis, Mo. App. filed April 21, 1917. Improvement.
- 1,264,671. SIGNAL BOX; Jacob F. Mehren, Chicago, Ill. App. filed Dec. 14, 1914. Readily accessible to the public to enable fire and police alarms to be sent in.
- 1,264,674. INSULATION OF ELECTRICITY; Erwin Moller, Brackwede, Germany. App. filed Aug. 10, 1909. Improvements.
- 1,264,685. METHOD OF MAKING ELECTRICAL CONTACTS; Giuseppe A. Rignon, Genoa, Italy. App. filed Sept. 30, 1916. For the ignition of the explosive mixture in internal-combustion engines.
- 1,264,724. ELECTRICAL FUEL VAPORIZER; William Wheeler, Brooklyn, N. Y. App. filed June 26, 1917. For use in internal-combustion motors.
- 1,264,749. METHOD OF BUILDING ARMATURES; Vincent G. Apple, Dayton, Ohio. App. filed Jan. 29, 1917. To secure inseparably the bar conductors within openings in the core of armatures so that holding bands become unnecessary.
- 1,264,799. ELECTRIC CONTACT DEVICE; Gottlob Honold, Stuttgart, Germany. App. filed July 21, 1917. Mechanically controlled



1,264,546—Supporting Means for Electrical Switch

trolled interrupters for use with the ignition devices of internal-combustion motors.

- 1,264,802. ELECTROLYSIS OF SULPHATE OF CADMIUM SOLUTION; Edwin J. Hunt and William T. Gidden, Warley, England. App. filed June 24, 1916. Improvements.
- 1,264,813. CURRENT AMPLIFIER; August J. Kloneck, New York, N. Y. App. filed May 29, 1914. For amplifying oscillatory currents between signaling stations.

Electrical World

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Number 21

Co-operative Compensation Insurance

WHEN the workmen's compensation act became effective in New York State the public utilities were vitally interested. This, like other acts, was of rather uncertain portent. To a considerable extent it has worked to the advantage of the workman and also to the advantage of the insurance companies, which take no chance on a somewhat unfamiliar type of risk. As the situation developed the Utilities Mutual Insurance Company was organized as a measure of self-defense, and it has now more than a hundred electric and gas companies in its membership. The plan was to work on a thoroughly businesslike basis, forming a genuine mutual compensation company, working directly along this line without any side issues. It pursued the policy of charging the ordinary company premiums and then, after establishing adequate reserves and paying losses, distributing part of the surplus as a dividend to its members.

In this way the insurance was obtained on a basis at least no more disadvantageous than if it had been obtained in the open market, and, as in many cases of mutual organizations, it has proved that the actual net cost of insurance was very much below market rates. Part of this saving, 20 per cent or more, has been returned in the form of dividends for the last four years, besides leaving a substantial surplus. This success was undoubtedly due in a measure to the fact that the receipts were on the whole better than the average, and still more to the sound conservative management which furnished insurance at cost instead of at premiums exaggerated by enormous loads for the benefit of the stock company. These loads have in general to represent, not favorable conditions, but the worst which can possibly be encountered in the company's business, so that the advantage of co-operative working in a class of rather favorable risks is particularly obvious.

Not a little of the good result obtained is due to the instinctive feeling among all the participating companies that inspections and precautions to avert accidents would be directly to their benefit. The inspecting force was known to all participants as having for its fundamental motive, not blind adherence to a group of specifications intended to meet the worst possible conditions, but genuine interest in endeavoring to cut down the risks to which the member companies were exposed. Each company was examined at least twice a year, never twice in succession by the same man, and the recommendations made by the inspectors were directed closely to the lessening of danger. The scheme

entered into in a tentative way to try out a remedy for a difficult situation has "made good" on the face of the returns, and there is no reason to suppose that an extension of the activities of similar enterprise elsewhere will not likewise find a most encouraging reward.

Edison Medal Presented to Colonel Carty

THE presentation of the Edison medal last week to Col. John J. Carty met with universal acclaim, and the event is sure to be noted with satisfaction by all our readers. Colonel Carty, as the chief engineer of the American Telephone & Telegraph Company and as a junior past-president of the American Institute of Electrical Engineers, is known to electrical men all over the world. His contributions to telephone engineering have been numerous. As an organizer and administrator he has revealed great ability. His discernment, foresight and intuition in telephone engineering have been remarkable. Moreover, as a man he unites in an extraordinary degree the patient, persistent working power of the designing engineer with the sympathies and artistic instincts of the poet. He is the eighth on the list of eminent electrical men to receive the award of the Edison medal.

The occasion and ceremonies at the Institute meeting were brilliant and memorable. As our readers are informed, the results of the annual election for A. I. E. E. officers were announced. The president-elect, Prof. C. A. Adams, received a cordial welcome, and his brief address of acceptance and response met much applause. When Colonel Carty was escorted to the platform by Dr. Carl Hering, the chairman of the Edison medal committee, it was before a distinguished audience of ladies and gentlemen, among whom were many well-known telephone engineers, that the formal presentation was made. This was preceded by a eulogistic speech by Dr. Pupin, describing some of the recipient's well-known qualifications. E. W. Rice, Jr., the retiring president, delivered the medal and diploma. Colonel Carty's speech of acceptance displayed at once his characteristic modesty and his clear breadth of vision. He pointed out the great forces which telephony and telegraphy exert, and the yet greater forces which they are capable of exerting, for the world at large; also how much science and art, study, discipline and co-operation were needed in order to improve and maintain the service of telephony.

By good fortune both Dr. Alexander Graham Bell and General Squier were on the platform. Allusions to these well-known men and to their work drew repeated

applause. Dr. Bell was prevailed upon to make a short speech, which closed the proceedings very happily. The committee on arrangements deserved great praise for the excellence and precision of the function.

Electrical Transportation Can Help Win the War

AT OUR railway terminals, on our city streets, in our factory yards, we have got to handle and haul goods faster and cheaper. The central station has a vital part in this. It doesn't have to sell trucks; it doesn't have to sell conveyors; it doesn't have to spend money. All that is necessary is that every man from top to bottom shall see that electricity for power for transportation is to-day economically as sound as electricity for light and for motor drive, for domestic devices and electric furnaces; that the trucks and batteries of to-day are not the trucks and batteries of ten years ago; that gasoline and skilled men are getting scarcer except for primary war purposes, and that the self-propelled electric motor vehicle is succeeding on sheer intrinsic merit as the cheapest and simplest method of handling short-haul, many-stop deliveries.

Faster and cheaper methods of transportation will help win the war. The railroads are but one link in the transportation system that begins at the shipping platform of the factory and ends at the business warehouse and the customer's door. Our transportation system to-day needs help—real help—first, to make more efficient our present systems; second, to replace outgrown systems with newer and more economical methods.

The self-propelled vehicle is being demanded as an aid to rail transportation in government work, in munitions plants and in other essential war-time industries. The gas truck is called upon for actual army needs for long, rough transportation. The electric truck is needed for short-haul city transportation. The industrial storage-battery truck makers are swamped with business for this specialized transportation in mines, warehouses and factories. The short-haul, many-stop delivery systems are being analyzed by government boards and by individual business men, and the opportunity for heavy 5-ton electric trucks to-day has outstripped factory production. The specialized tractor field—the tractor for hauling wagons—is being developed, and fleets of light electric trucks for mail, express and merchandise deliveries have proved their economy over and over again.

The central stations are furnishing electricity for power and lighting for war work under many extraordinary conditions. They must furnish energy for transportation at a near date. As a load, it is well known, the battery charging meets war-time conditions. It is off-peak. Besides being good business to-day to promote electrical transportation methods, it is patriotic. Electricity is helping to win the war, in air photography, in wireless, in telephony, in big-gun firing on land and sea, and in the economical furnishing of energy for power, light and heat from a central station. To this we add, with peculiar importance at this time, the supply of energy for transportation. The electric trolley, the battery-driven industrial truck, the heavy-duty truck and the light delivery wagon are needed.

Self-Inductance of Short Reactance Coils

WHEN a coil has a core of non-magnetic material, such as wood or air, its self-inductance becomes a definite quantity and one which often assumes considerable practical importance. For example, in radio engineering the coils which carry high-frequency currents are ordinarily non-ferrous or have non-magnetic cores. It is often requisite to know their inductances. Again, large reactors with non-magnetic cores are now commonly installed in large central stations to limit short-circuit currents. Their inductances have to be predetermined during design, within reasonable limits of error. The inductance of any coil may be regarded as expressing the sum total of linkages of magnetic flux with that coil when it is excited by unit current.

Not long ago H. B. Dwight published in our columns a useful set of engineering formulas for deriving the inductance of a long coil. A coil may be defined as long for the present discussion when its axial length exceeds its mean winding diameter. Per contra, a coil whose axial length is less than its mean winding diameter becomes defined as a short coil. In this number Mr. Dwight contributes a similar set of useful engineering formulas for finding the inductance of a short coil. Three formulas are given, as well as a convenient curve sheet for approximate evaluation by inspection.

It may be noted that, as usual, the calculation can be simplified if the mechanical measurements of the coil are expressed in centimeters instead of in inches, because the numerical factor 0.3937 in the denominator of each formula then becomes replaced by unity, and if, further, the result is looked for in abhenries, instead of in henries, the denominator outside the main bracket in each formula disappears or is replaced by unity. This is merely another way of saying that since the henry, like all the international electromagnetic units, is a metric unit, it is simpler and swifter to use the metric system than the English system of units in electrical engineering calculations.

Great Market for Low-Priced Appliances

THERE has been a very large development of small motors for the application of electricity to small devices and appliances. To enumerate a few of the scores of devices now on the market is to suggest this tremendous growth. The fan, the hair drier, the vacuum cleaner, the washing machine, the ironer, the floor polisher are typical of home labor-saving appliances; the adding and calculating machine, the ventilating fan, the duplicating machine are samples of office and business devices; the coffee mill, the cash carrier, window display racks, intermittent signs are contrivances sold in increasing numbers in stores; and the industrial and specialized applications of small motors for tools in factories are as varied as industry itself. The universal motor, the motor that operates on both alternating and direct current, has been developed for these uses. But the field of application is barely scratched because these applications, with perhaps the exception of the fan, are relative luxuries to the average buyer.

The proportionate numbers of buyers for any com-

modity may be represented as a pyramid. At the apex are the few wealthy buyers to whom price makes relatively small difference in purchases. At the base are the utility buyers who have to match pennies with their wants of food, shelter and clothing. In between these extremes is a great middle class tapering in income toward the very rich at the top of the pyramid and toward the very poor at the base. The bulk of the merchandise that makes any pretense of having convenience as well as utility value is sold to this middle-class group. Very few electrical contrivances are priced in this field, for two reasons—first, because the first market has been in the relative luxury class; second, because the small volume of sales has made costs high.

All this is background for the small-motor designer. In our industry electrical design is linked very closely with merchandising demand, because electrical design gets at the root of costs, costs have definite relation to price, and price has a definite relation to sales volume. So we complete the circle and get back to design. We need to-day, and will need increasingly, good small motors that can be built and sold more cheaply, not because costs are too high for present markets, but because if we are to get down into the bulk utility markets we must have five-dollar, ten-dollar and fifteen-dollar motor-driven appliances. In many of these devices the motor is 50 per cent or more of the assembled factory cost. Our small-motor designers have done some remarkable things. There are certain irreducible relations between copper and iron to get output. There are definite limits of efficiency. But our designers have the problem of scaling efficiency and cost in such proportions that, given quantity production, a good small motor can be produced which will put the small power appliances in the great middle-class buying group.

Precautions to Insure Safety in Switching

THE article by M. M. Samuels and F. N. Bechoff in the current issue is full of practical ideas for the assurance of safety in performing various switching operations and of plans for interlocking the various devices so that they cannot be mishandled. The diagrams of safety and interlocking devices which the authors give will be found very suggestive by those who are dealing with switchboard design. The fact is that switchboard design is a fine art rather than a science and one which even now is in anything but its final stage of development. There are plenty of standard panels for ordinary purposes which leave little to be desired in completeness; but a standard panel

is not a switchboard, neither is it a simple proportional part of the switchboard, and when it comes to laying out the various interconnections for a considerable station there is room for exercise of indefinite ingenuity. It is in the organization of a complete switching system that practical hints like those in the present article will prove of a good deal of service, not only in themselves, but in suggesting still further possibilities of lessening risks and providing a more easily worked switchboard equipment. The interlocking idea in particular is worth development. For example, it is perfectly practicable to use for certain purposes simple and cheap auxiliary switches provided that they are not expected to open the circuit under heavy load. If interlocked so that this particular thing cannot be done, the cost of an expensive oil switch may be saved to the plant.

The only danger lies in carrying the elaboration of safety devices so far that the entire system gets more complicated instead of less so. One cannot entirely eliminate human intelligence in the operation of a switchboard, and it sometimes seems to us a question as to whether an attempt to do so is not likely to lead to too much blind confidence in things going right even if the operator does not think. In certain cases—for instance, the operation of an automatic substation—the working of the switching apparatus must be completely automatic. The distant operator pushes a button, and the motor it controls does the rest. If one tries to reduce an entire switchboard to this condition, there is still left the chance of the operator pushing the wrong button and starting the wrong irrevocable train of operations into action, losing time if nothing worse. Here, as everywhere else, the human equation cannot be eliminated, and a sense of personal responsibility may be a more valuable factor in safe and successful operation than mechanical contrivances of too complicated a nature.

We are quite disposed, therefore, to believe that in the long run the best policy is to work assiduously in the direction of extreme simplicity in the general layout of the switchboard, thereby decreasing not only the labor of the operator but the chances of his doing the wrong thing. These chances may be still further diminished by intelligent use of safety devices and by employing fully automatic switching apparatus when, and only when, it really makes for simplicity instead of complication. In old stations grown by a process of aggregation complication cannot be avoided and there is free scope for the exercise of much ingenuity in providing for safe operation. In new stations the watch dog of the treasury ought to be on guard over the switchboard designer, ready to show his teeth at the first symptom of unneeded intricacy.

IF ALL of the brass and bronze in the United States were to be melted in electric furnaces, the annual consumption of energy would be about 200,000,000 kw.-hr. and the generating capacity required would be about 75,000 kw. These figures give some idea of the importance to user, manufacturer and central station of knowing the fundamental principles which govern the success of electric brass melting. These will be outlined in a coming issue in which the relative merits of different types of

The Coming Issues

furnaces will be discussed and the central-station viewpoint presented. Among other articles that will appear shortly will be one telling what types of lighting units or layouts are best suited for protective lighting purposes and another describing some interesting long-span construction leading up the side of a mountain broken by ravines and covered with tall trees. The second and concluding installment of Prof. N. S. Diamant's article on "Sudden Short Circuits of Alternators" will appear in the next issue.

Determination of Economical Power Circuits

Method of Deriving Curves Which Show the Most Economical Wire Size When the Cost of Copper Wire, the Cost of Energy at the Switchboard, the Equivalent Hours During Which Load Is on Circuit and the Maximum Current Are Known

BY P. O. REYNEAU

Distribution Engineer, Detroit Edison Company

IN AN article* previously published an attempt was made to determine the economical size of feeders for a load consisting of residence and store lighting. These feeders were single-phase and carried a uniform load throughout their length, being the link between the substation and the distribution center. The analysis was made on the basis of the peak load intended to be carried on these feeders and what was called the "equivalent" hours that the load was carried on them. The equivalent hours times the maximum current squared is approximately equal to the actual I^2r loss due to the varying current throughout the day.

Here the same general method will be used for three-phase circuits carrying power load and a very small amount of factory lighting. As previously established, the most economical size of wire is that for which the sum of the fixed charges and the energy losses at the switchboard cost is a minimum. This sum represents the annual charges.

The current that can be carried on these circuits is limited by the current-carrying capacity of the cables feeding out of the substations, which are 200,000-circ. mil three-wire cables. Various sizes of wire are considered, No. 0000 being taken as the largest size that can be handled on existing pole lines without special

D = distance of transmission in thousands of feet.
If

g = per cent interest and depreciation,

W = weight per foot of wire,

C_c = price of copper wire per pound,

H = cost of stringing 1000 ft. of line,

I = maximum current carried,

ρ = resistivity of wire in ohms per mil-foot,

A = area of wire in circular mils,

t = equivalent hours per day peak load is on,

C_e = cost of energy per kilowatt-hour,

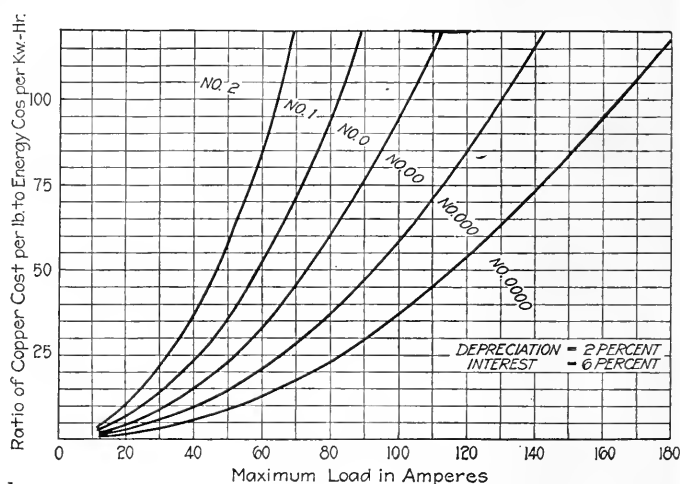
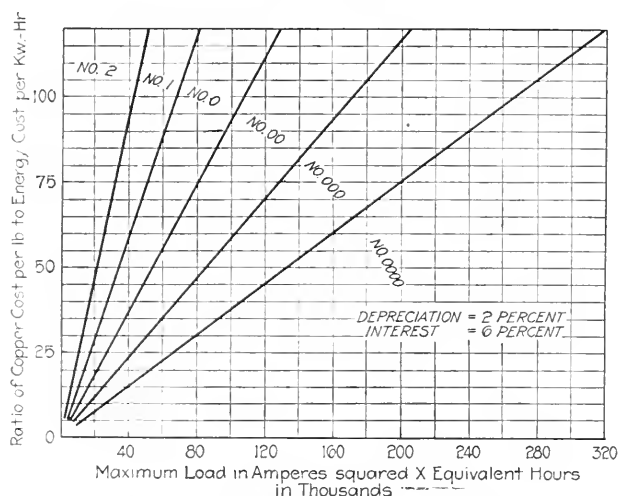
and working days are taken as three hundred per year.

The formula for annual charges becomes:

$$\begin{aligned} \text{Annual charges} &= [(g/100)(3000 \times W \times C_c + H) + \\ &\quad I^2 \times (\rho/A) \times 3000 \times t \times 300 \times \\ &\quad (C_e/1000)]D \\ &= [30gWC_c + (gH/100) + \\ &\quad 900I^2(\rho/A) \times t \times C_e]D. \end{aligned}$$

Assuming that for one size of wire $W = W_1$ and $A = A_1$, and for the next larger size $W = W_2$ and $A = A_2$, then:

$$\text{Annual charges (1)} = [30gW_1C_c + (gH/100) + 900I^2(\rho/A_1)t \times C_e]D.$$



FIGS. 1 AND 2—ECONOMICAL SIZE OF CONDUCTOR FOR THREE-PHASE POWER CIRCUITS WITH ANY RATIO BETWEEN COPPER AND ENERGY COST. FIG. 1 HOLDS FOR ANY VALUE OF EQUIVALENT HOURS, FIG. 2 APPLIES WHEN EQUIVALENT HOURS EQUAL 9.69

reinforcement. In this manner the pole-line cost is considered the same for all sizes of wire and could be eliminated in the calculations.

The annual charges may be represented as follows:

$$\text{Annual charges} = (K_1 + K_2)D.$$

Where K_1 = annual fixed charge per 1000 ft. of line
 $= (g/100)(3000 \times W \times C_c + H)$

K_2 = annual copper loss per 1000 ft. of line
 $= I^2(\rho/A) \times 3000 \times t \times 300 \times C_e / 1000$

$$\text{Annual charges (2)} = [30gW_2C_c + (gH/100) + 900I^2(\rho/A_2)t \times C_e]D.$$

If these two quantities are equated, a point is obtained where it is as economical to use either wire size, considering the same C_c , C_e , I and t .

$$\begin{aligned} \text{Annual charges (1)} &= \text{annual charges (2)} \\ [30gW_1C_c + (gH/100) + 900I^2(\rho/A_1)t \times C_e]D &= \\ [30gW_2C_c + (gH/100) + 900I^2(\rho/A_2)t \times C_e]D \end{aligned} \quad (1)$$

Since C_c and C_e are not constant and I and t depend on the load, it is advisable in order to make the equa-

*See ELECTRICAL WORLD, Dec. 15, 1917, p. 1142.

tion most usable to solve equation (1) for the ratio of C_e/C_c , thus leaving two troublesome variables in a convenient form for substitutions.

Then:

$$30gC_e(W_1 - W_2) + 900I^2 \times C_c \varphi [(1/A_1) - (1/A_2)] = 0;$$

or

$$C_e/C_c = \frac{900 \times \varphi \times [(1/A_1) - (1/A_2)] \times I^2}{30g \times (W_1 - W_2)}$$

$$= \frac{30\varphi(A_1 - A_2)}{g \times A_1 A_2 (W_1 - W_2)} \times I^2,$$

or, equating the expressions

$$K = \frac{30\varphi(A_1 - A_2)}{g \times A_1 A_2 (W_1 - W_2)}$$

A constant for each size of wire under consideration can be obtained, leaving only the four main variables to be considered $C_e/C_c = KI^2t$, as follows:

$$K_1 = \frac{30 \times 10.8 \times (211,600 - 167,800)}{8 \times 211,600 \times 167,800 (0.6405 - 0.5079)} = 0.000378 \text{ (No. 000 to No. 0000).}$$

$$K_2 = \frac{30 \times 10.8 \times (167,800 - 133,100)}{8 \times 167,800 \times 133,100 (0.5079 - 0.4028)} = 0.000596 \text{ (No. 00 to No. 000).}$$

$$K_3 = \frac{30 \times 10.8 \times (133,100 - 105,500)}{8 \times 105,500 \times 133,100 (0.4028 - 0.3195)} = 0.000955 \text{ (No. 0 to No. 00).}$$

$$K_4 = \frac{30 \times 10.8 \times (105,500 - 83,690)}{8 \times 105,500 \times 83,690 (0.3195 - 0.2533)} = 0.00151 \text{ (No. 1 to No. 0).}$$

$$K_5 = \frac{30 \times 10.8 \times (83,690 - 66,370)}{8 \times 83,690 \times 66,370 (0.2533 - 0.2009)} = 0.002415 \text{ (No. 2 to No. 1).}$$

With the equation in the above form it is possible to substitute for all the variables with the exception of t , which still remains to be determined. It is naturally assumed that a careful analysis has been made to ascertain the best cost of copper and of energy at the substation switchboard, or better still at the cable pole to be used in the substitution.

There are two courses open with regard to the equivalent hours or t to be used: First, an analysis of the power load on the system in question may be made to determine an average t to be used in the design of all power circuits. This was done here by analyzing the power load curve of the system, taking two typical days in each month of one year. If t_e = equivalent hours, I = average current for each hour, I_m = maximum current for the day, then the equivalent hours for one day can be represented as follows:

$$t_e = (\Sigma I^2 R) / (I_m^2 R) = (\Sigma I^2) / (I_m^2) \text{ or } = [\Sigma (\text{kva.})^2] / [(\text{kva.}_{max})^2],$$

these two quantities being proportional to one another. Then, having the equivalent hours for each one of the twenty-four typical days of the year, an average can be obtained for the equivalent hours for the year. Fig. 3 gives a graphical representation of this process. By the preceding method 9.69 hours was found to be the equivalent hours for the various circuits of the system in question. Fig. 1 gives the means of finding the economical size of wire on that basis.

Secondly, to make the proposition absolutely general,

curves can be plotted (Fig. 2) with C_c , C_e as abscissas and the quantity I^2t as ordinates, thus giving all possible combinations of the four variables C_c , C_e , I and t for the conditions previously described. The equation this time is a straight line.

The first set of curves serves as a general guide for average power circuits. It is best to use them on circuits where the character of the load is uncertain or when it is liable to change from time to time. The second set of curves allows of more refinement of design. In this case each power circuit can be designed separately if definite information or if plausible assumptions are available for determining the actual values of the equivalent hours. To do this it would be necessary to know the kind of load carried, its variation during the working hours and the working hours per day or the number of shifts. Serious error might result from assuming 9.69 as the average equivalent hours for a variable load, such as welders, or for a factory load running normally two or three shifts a day, such as furnace load, etc. Therefore the curve would be of service wherever a special analysis is possible, and the over-all efficiency of the system of power circuits would be greatly increased by separate study of each one.

So far only power circuits carrying the same load throughout have been considered, such as would exist with one large customer on the circuit. If the power circuit has several customers on it, and if it has

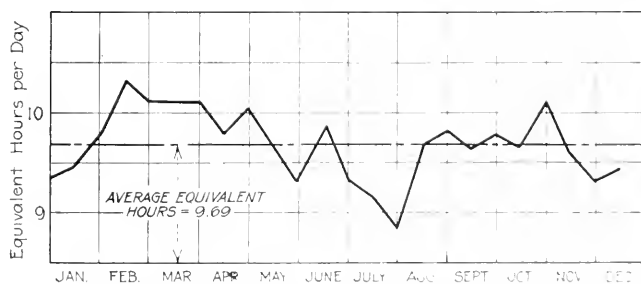


FIG. 3—EQUIVALENT HOURS PER DAY TAKEN FROM SYSTEM LOAD CURVES FOR ONE YEAR

branches, the load carried on each section of the circuit and on each branch should be analyzed and the most economical size of wire determined for each one of these parts. It is also possible to determine or make a plausible assumption of the equivalent hours for each part or branch.

Finally, it should be brought out that these curves only furnish a basis for obtaining the best economies in a system of circuits. They are sufficient in themselves for each circuit if the four variables C_c , C_e , t and I are known. They can only assist and guide in the design of a system of power circuits. The reasons are obvious and dictated by the quality of service to be furnished. In present-day practice, switching facilities and throw-over facilities are absolutely necessary in case of trouble and in many cases would demand wide divergence from the data obtained from the curves. However, if the correct relations between all the elements of power-circuit design that can be measured in tangible quantities can be established, the engineer is freer to work out his combinations and more apt to choose correctly the other elements, such as quality of service, etc., that cannot be measured in such exact sets of units.

ECONOMY OF CROSS-CONNECTED REVERSE-POWER RELAYS

Little Control Wiring Is Necessary—Practically Instantaneous Action Obtained—Relays Operate on Small Currents

WHEN the balanced system of relay protection is too expensive to employ on a network of feeders, cross-connected reverse-power relays may be used as shown in Figs. 1 and 2. In the particular example shown the relays are applied to a system consisting of a generating station and a substation connected by four parallel feeders. By referring to the diagrams mentioned it may be noted that all of the current transformers in the generating station and substation are connected in series and that each relay, which must be a reverse-power (unidirectional) relay, is shunted across its current transformer. This arrangement can be used with equal success in any part of a complicated network if the feeders are in parallel. While the cables in parallel should be alike in characteristics, any differences in their impedance can be easily compensated.

Under normal conditions the load in each of the cables

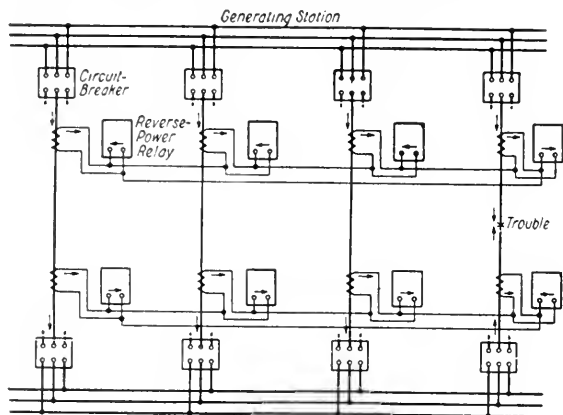


FIG. 1—SCHEMATIC DIAGRAM OF CROSS-CONNECTED SYSTEM SHOWING ONLY ONE PHASE OF EACH FEEDER

will be the same. Since the relays have a higher impedance than the current transformers, the current from the latter will therefore circulate through all of them in series without any flowing through the relays. If trouble occurs at any point outside the section protected by the cross-connected relays, the current through the cables will still be balanced; consequently there is no force tending to operate the relays. On the other hand, if trouble occurs on a cable within the section, the current through the defective cable will be higher than that in the others; therefore the excess current from the current transformers must pass through the relays. While under this unbalanced condition current will flow through all the relays, the current is in the proper direction to cause the opening action to occur only in the relays at each end of the defective cables.

The pallet switches shown connected in the transformer secondary circuit are also connected mechanically to the operating mechanism of the circuit breaker so that when the breaker opens the current transformers on the circuit controlled thereby will be short-circuited. Consequently a cable can be cut out of service without interfering with the electrical balance.

By referring to Fig. 1 it may be noted that when the cross-connected scheme is used on only two cables the two sets of relays are actually in parallel and will

operate in the opposite directions. The expense of the two-cable cross-connected system can be reduced by using, in place of the two sets of reverse-power relays as shown in Fig. 3, one set of special relays having two contacts, one to close when power flows in one direction, and the other in the reverse direction.

Among the advantages of cross-connected reverse-

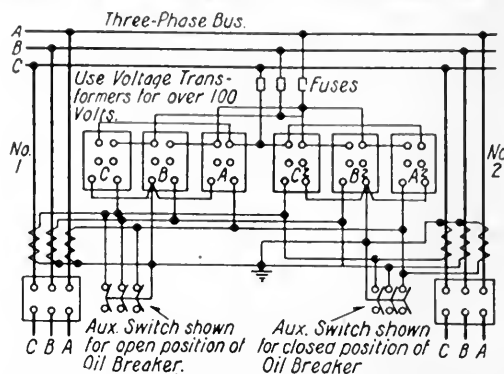


FIG. 2—THREE-PHASE CONNECTIONS WITH AUXILIARY SWITCH ATTACHED TO CIRCUIT BREAKER

power relays are the following: Practically instantaneous action is obtained; they can be set to operate on smaller currents than the full load current of each feeder, and they do not require change of adjustments each time generating systems are cut in or out.

The use of cross-connected relays or double-contact reverse power relays does have some of the disadvantages of balanced systems in that if trouble occurs on the busbars or on all of the feeders simultaneously it cannot be automatically cleared. In addition, some difficulty may be encountered when it is attempted to cut in a new feeder. When the feeders are heavily loaded and an attempt is made to close the switch in the substation end first, the new feeder will be tripped out, whereas if it is closed in the generating end first the feeders carrying the load will be tripped out.

However, the difficulty mentioned may be overcome if the overload elements are given so high a setting that the normal load current cannot possibly operate them. Such a change would, of course, eliminate the advantage

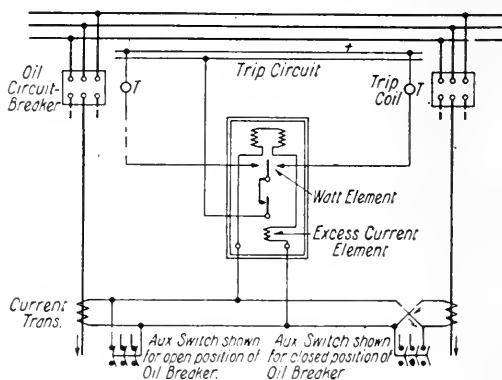


FIG. 3—DOUBLE-CONTACT REVERSE-POWER RELAY APPLIED TO DUPLICATE FEEDERS

that the system can operate on small currents. The possibility of the breaker being tripped out when in a new feeder can be overcome by mechanically or electrically holding the substation relay while "cutting in" first at the substation and then at the generating station.

This scheme has been worked out by engineers of the Westinghouse Electric & Manufacturing Company.

Safety Features in Switching Installations

Interlocking of Disconnecting Switches, Circuit Breakers and Synchronizing Plugs Recommended—Best Locations for Pilot Lamps and Preferred Construction—Weaknesses of Auxiliary Switches and Relays

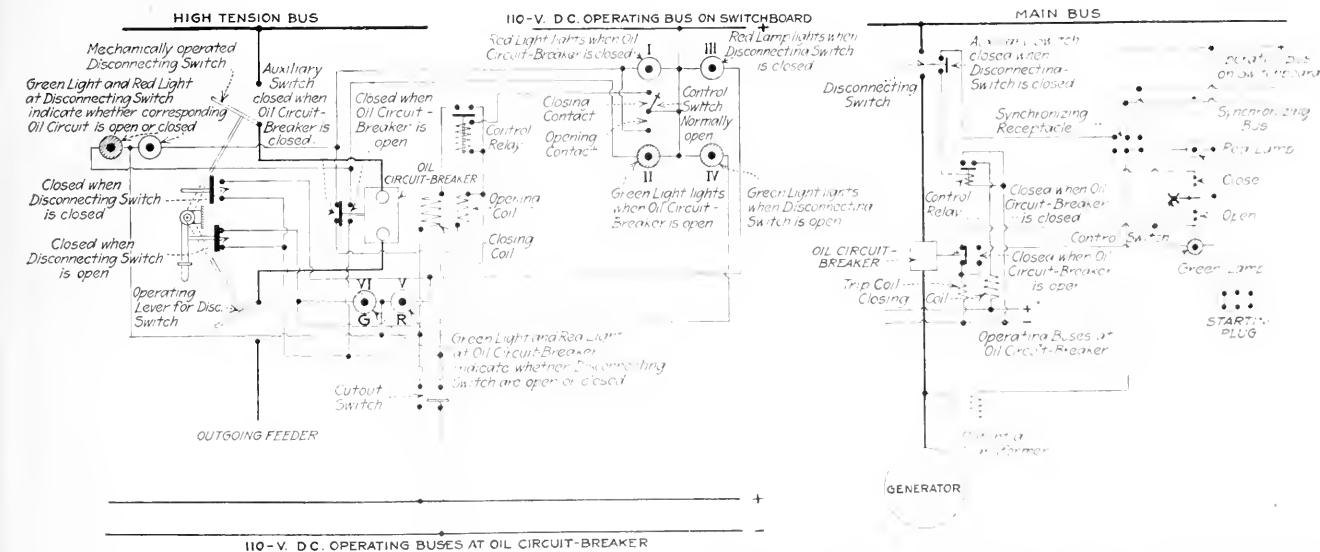
BY M. M. SAMUELS AND F. N. BECHOFF

JUST a few of the many ideas that can be embodied in electric switching installations to make operation safer for the apparatus as well as the attendants were mentioned in a previous article¹ by the authors of this paper. Some additional points will be emphasized in this article. Among the subjects which will be discussed are the best location for indicating, or pilot, lamps and the construction to be preferred; the possibility and value of interlocking circuit breakers, synchronizing devices and disconnecting switches when the latter are operated by mechanisms instead of by switch hooks; methods of protecting transformers; electrical versus mechanical interlocking of switches which must not be closed simultaneously, and weaknesses of auxiliary switches and relays.

In order to remove as much uncertainty as possible regarding the open or closed condition of oil switches and disconnecting switches when they or their respective circuits must be inspected or repaired, indicating lamps can be permanently placed at the points from

It is not advisable to use exposed colored bulbs for the pilot lamps, since they are easily damaged and since an operator when renewing lamps might accidentally place a green bulb in a socket intended for a red bulb and vice versa. White bulbs installed in a metal box with red and green lenses in the cover are preferable; the cover should be constructed in such a way that the red and green lenses cannot be interchanged. Details of a box, with lamps and lenses, which fulfills these requirements and allows ample space for the necessary conduit connection and wiring are shown in Figs. 6, 7 and 8. A barrier is provided between the two bulbs so that they can illuminate only their respective lenses. To identify the circuits a name plate can be affixed to the cover.

In addition to providing for the interlocking of oil-circuit-breaker control and synchronizing circuits,² it is possible, when using mechanically operated disconnecting switches, so to interlock the control circuit with the mechanism of the disconnecting switch that it is



FIGS. 1 AND 2—INDICATING LAMPS ON SWITCHBOARD AND AT OIL CIRCUIT BREAKER AND MECHANICALLY OPERATED DISCONNECTING SWITCH THAT PREVENT FAULTY OPERATION; METHOD OF INTERLOCKING CIRCUIT BREAKER CLOSING CIRCUIT WITH SYNCHRONIZING RECEPTACLE AND AUXILIARY SWITCH

The arrangement shown in Fig. 1 is feasible only with disconnecting switches operated by mechanisms; the connections indi-

cated in Fig. 2 prevent the closing of the oil circuit breaker when the disconnecting switch is open.

which they are controlled and at the switch positions too. This is not impracticable if the disconnecting switches are operated by mechanical devices instead of hook switches and are provided with auxiliary switches to control the indicating lamps.

An arrangement which will suggest how this idea can be carried out is shown in Fig. 1, desirable locations for the pilot lamps being indicated in Fig. 3. This scheme can be employed with outdoor open structures as well as with indoor compartment structures.

impossible to close the oil circuit breaker unless the disconnecting switch has previously been closed. A method of securing this desirable feature is indicated in Fig. 2.

Even if indicating lamps are used, it may happen that an operator, after having adjusted the speed of a generator to secure synchronism, will close the oil circuit breaker, only to discover that the disconnecting switches are still open. If an operator were sent to close the disconnecting switches and he accidentally did so before the other operator reopened the oil circuit

¹"Safety Features in Switching Apparatus," by M. M. Samuels and F. N. Bechhoff, ELECTRICAL WORLD, Vol. 71, p. 656.

²Fig. 5, page 657, ELECTRICAL WORLD, Vol. 71

cut breaker, serious damage might result as a generator would then be connected to a bus with which it was not in synchronism.

When disconnecting switches are used as bus-selector switches (Fig. 4) it may happen, when attempting to

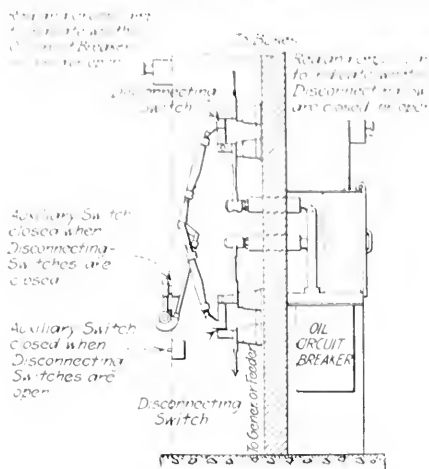
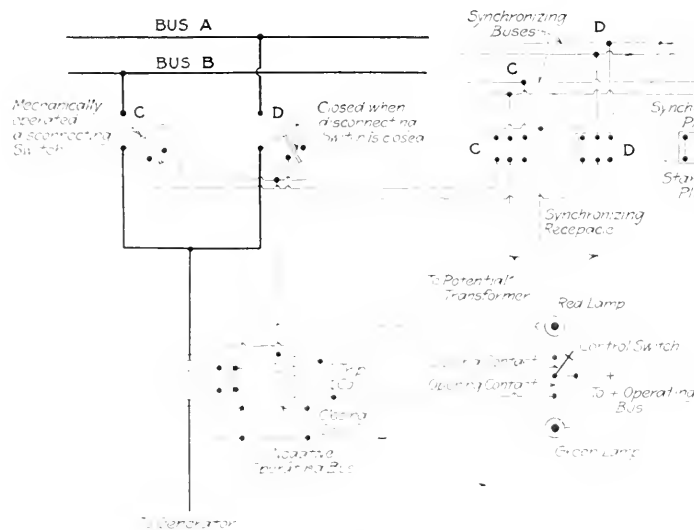


FIG. 3—PROPER LOCATION OF RED AND GREEN INDICATING LAMPS ON SWITCH STRUCTURE. INDICATING LAMPS ARE OPERATED BY AUXILIARY SWITCHES ON OIL CIRCUIT BREAKERS AND MECHANICALLY OPERATED DISCONNECTING SWITCHES

synchronize two systems, that the wrong disconnecting switch will be closed. If this condition exists and the operator closes the oil switch after apparently synchronizing the two circuits he expects to connect, two buses will be connected which may be entirely out of phase. This would not be liable to happen with mechanically operated disconnecting switches having pilot lamps on the board from which the oil switches are controlled. Absolute safety would be assured if the disconnecting switches, circuit breaker and synchronizing plug were



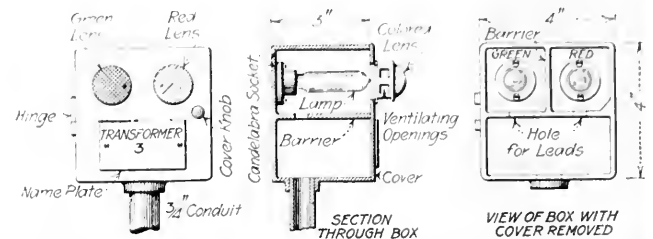
FIGS. 4 AND 5—SYNCHRONIZING CONNECTIONS SUITABLE WITH TWO SETS OF BUSBARS AND ONE OIL SWITCH; SIGNAL LAMPS AT HIGH-RATED TRANSFORMER TO INDICATE WHETHER TRANSFORMER IS DISCONNECTED ON BOTH SIDES OR NOT

Interlocking of the synchronizing connections with the auxiliary switches and mechanically operated selector disconnecting switches as shown in Fig. 4 prevents throwing of generator on bus with

electrically interlocked so that the circuit breaker could not be closed unless the disconnecting switch corresponding to the position in which the synchronizing plug was placed were closed.

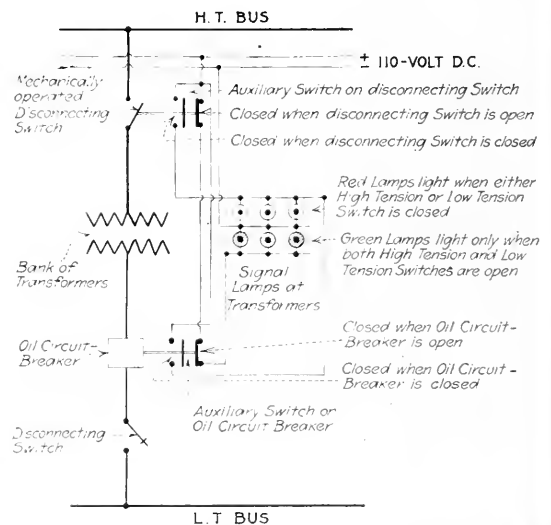
Some liability insurance companies now require that red and green lamps be placed near each transformer of high rating or high voltage and so connected that the

red lamp will indicate when the switch on either the high-tension or the low-tension side of the transformer is closed and that the green lamp will indicate when both the high-tension and low-tension switches are open. This can be accomplished very easily with the connection shown in Fig. 5. The two auxiliary switches controlling the red lamps are connected in multiple, while the two auxiliary switches controlling the green lamps are in series. Where each transformer is installed in a separate compartment it is advisable to provide signal lamps (Fig. 5) outside of the compartment near the door.



FIGS. 6, 7 AND 8—SIGNAL BOX FOR RED AND GREEN INDICATING LAMPS ON SWITCH STRUCTURES; BARRIER PREVENTS ONE LAMP FROM ILLUMINATING BOTH LENSES; UNSYMMETRICAL HINGED COVER PREVENTS INTERCHANGEABILITY OF COLORS

All modern high-rated transformers are now equipped with dial thermometers, which indicate the transformer temperature. Some have a contact to ring a bell alarm when the temperature exceeds a given limit. A second contact may be attached to such thermometers in order to trip the transformer oil circuit breaker when the temperature rises above a certain limit. This is particularly advisable when a transformer is placed far enough from the operator to cause danger of the transformer burning out in the interval of time between re-



which it is not in synchronism; all auxiliary switches in Fig. 5 operating red lamps are connected in multiple, whereas the auxiliary switches controlling the green lamps are connected in series.

ceiving an alarm and reaching the transformer. Where the transformer is so situated means should also be provided for the operator to trip the circuit breaker from a point near the transformer if an occasion should arise making it necessary. A scheme which will provide such safety features is illustrated in Fig. 9.

Usually water-cooled transformers are equipped with

flow indicators which can be electrically connected with the temperature indicator alarm circuit so that interruption of water circulation will automatically give an alarm. When thermometers are used in connection with transformers they should be so installed that it will not be necessary for an operator to climb a lad-

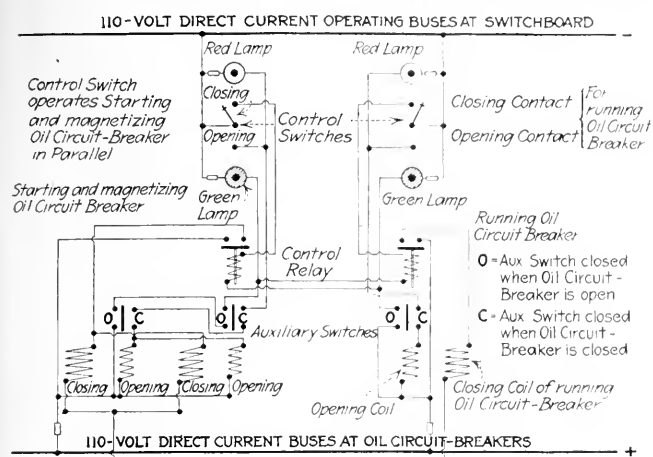


FIG. 9—SYSTEM OF CONNECTIONS FOR INTERLOCKING STARTING, MAGNETIZING AND RUNNING SWITCHES OF LARGE MOTORS; PROPER OPERATION OF INTERLOCKING CONNECTIONS DEPENDS ON RELIABILITY OF AUXILIARY SWITCHES

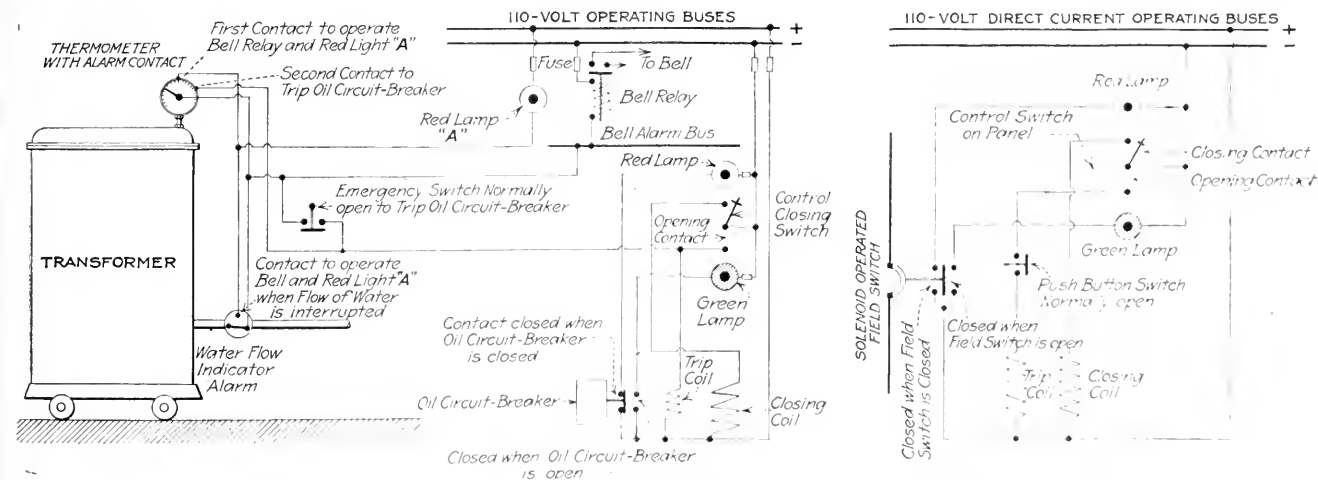
der in order to read the temperature. Use of contact-making thermometers will eliminate this objection.

Up to the present time, so far as the authors know, there has not been developed an auxiliary switch for oil circuit breakers and other apparatus which is adequate for all purposes. Considering the fact that the operation of nearly all safety devices in power houses and substations depends chiefly on the proper and reliable operation of auxiliary switches, it is obvious that even with modern indicating and automatic safety devices there cannot be a high degree of safety unless

known to the authors, it is sometimes necessary to use multiple contacts, but this precaution does not always prevent auxiliary switch trouble. Usually there is an auxiliary switch in the tripping circuit of each circuit breaker, and if this switch fails the circuit breaker will fail to open when overloaded or short-circuited, thus causing considerable damage to the transformers and other apparatus connected therewith.

The interlocking of circuit breakers to prevent the simultaneous closing of two or more of them where such simultaneous closing would be dangerous is usually accomplished by auxiliary switches. For instance, when large motors are started by means of a compensator a magnetizing switch, a starting switch and a running switch are provided. It is important that the control circuits of these three switches be interlocked so that the running switch cannot be thrown in until the motor is brought to speed by the magnetizing and starting switches. It is of even greater importance not to have the starting and running switches both closed at the same time, since under this condition the compensator would burn out. Interlocking to prevent such trouble may be accomplished with hand-operated switches by mechanical means, but with electrically operated oil circuit breakers it is necessary to interlock the control circuits electrically by means of auxiliary switches unless the control switches are mechanically interlocked. Although interlocking of the control circuits gives a more flexible arrangement, it cannot be considered the safest method unless a thoroughly reliable auxiliary switch is employed. The connections for electrically interlocking oil circuit breakers used in starting either synchronous or induction motors are shown in Fig. 10.

What applies to auxiliary switches is likewise true of relay contacts. Although progress has been made in the design of various types of relays, their contacts



FIGS. 10 AND 11—TEMPERATURE AND WATER-FLOW ALARM CONNECTIONS FOR TRANSFORMER; FOUR-WIRE CONTROL CIRCUIT FOR OIL SWITCHES

An additional contact is provided on the transformer temperature alarm for tripping the circuit breakers at excessive temperatures; an emergency tripping switch is also provided at the trans-

former. In Fig. 11 the push-button is in the opening side of the control circuit.

a standardized, practically infallible auxiliary switch is developed. Auxiliary switches which may have been perfectly satisfactory for apparatus used in the past are not at all adequate for modern circuit breakers because their rupturing capacities and velocities of operation have both been increased. All auxiliary switches should be easily accessible for connection, inspection and repair. Owing to unreliability of auxiliary switches

should be further improved, since the majority of modern relay contacts are unable to carry the current required to trip large circuit breakers. Often it becomes necessary to resort to auxiliary relays, which are only an additional evil, because the size of nearly all relays is restricted by the secondary ampere rating of the current transformers, which generally does not exceed 5 amp. White 5-amp. secondaries are sufficient on cur-

rent transformers for use with meters and also for operating automatic devices on circuits of low capacity, they are hardly suitable for oil circuit breakers of high rupturing capacity. Therefore it is suggested that the secondary rating of current transformers for such protective purposes be increased. When this is done it will be possible to develop relays with contacts of adequate size. While the same current transformer is suitable for both the meters and relays in small installations, two separate sets of current transformers are advisable in large installations: One set should be used for the meters and the other for automatic relay protection. With this arrangement it is obvious that an increase in the rating of the secondaries of the relay current transformers would not destroy the accuracy

of the meter reading, a consideration of importance.

It is still customary to install all relays on the switchboard, this arrangement being necessary because the present relays require constant attention and frequent inspection and adjustment. With current transformers having a higher secondary rating it will be possible to design relays of large sizes and more rugged construction. Such relays would not have to be mounted on the switchboard but could be placed near the oil circuit breakers or other apparatus which they are to protect, thus eliminating unnecessary conduits and wiring and minimizing the switchboard space necessary.

In conclusion, provisions should be made for disconnecting control devices from the control bus to permit repairing and inspection.

Self-Inductance of Short Reactance Coils

Formulas Which Can Be Applied with Accurate Results to Calculate Self-Inductance of Thick Coils—Curves Based Upon These Formulas and Methods of Using the Information That Is Thus Derived

BY H. B. DWIGHT, CANADIAN WESTINGHOUSE COMPANY

IN CALCULATING the self-inductance of commercial reactance coils it is useful to have formulas which make special allowance for the thickness of the winding, which is considerable in usual types of coils, such as current-limiting reactors, paralleling coils for transformers and the coils used with reactance-type circuit breakers. In this article formulas are given for coils whose length is shorter than their mean diameter. These formulas are similar to those for long thick coils which were recently published in the ELEC-

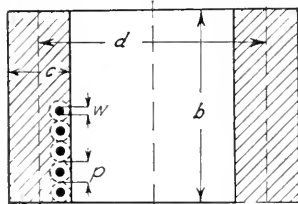


FIG. 1—SHORT THICK COIL ON WHICH CONCLUSIONS ARE BASED

TRICAL WORLD¹ and with them cover the complete range of circular coils.

The formulas for self-inductance of short coils are derived from an expression for the mutual inductance of two coaxial circles. This was given in the form of a convergent series by Maxwell,² and the series has been extended by E. B. Rosa and L. Cohen.³ More recently, a further extension has been made by T. R. Lyle,⁴ who has used the series to obtain a formula for the self-inductance of a short thick circular coil by means of a method involving Taylor's theorem.

The same formula for thick coils, to the fourth power of the dimensions, has been derived by the writer by two other independent methods, and thus a check has been made on the accuracy of the terms up to and in-

cluding the fourth power. By the first of these methods the series for the mutual inductance of two circles was integrated to give the mutual inductance of two coaxial and concentric thin solenoids of equal length. This expression was then integrated over the section of the thick coil indicated in Fig. 1, giving the formula for the self-inductance of the coil. The other method, which gave the same result, consisted in integrating the series for two circles so as to give the mutual inductance of two equal thin disks on the same axis. Then this expression was integrated over the section of the coil to give its self-inductance.

The above-mentioned self-inductance formula is very suitable for precision calculations, especially when the terms of the sixth power are included. These were worked out by Dr. Lyle and published in an appendix to his article referred to above. But the formula is extremely long for engineering work, and it can be considerably simplified by expanding some of the terms, such as $\log x$ and $\tan^{-1}x$, into series. Good accuracy is obtained for thick coils whose length is as great as their diameter by keeping all terms up to and including the fourth power of the dimensions.

For short coils, in which the length b (Fig. 1) is less than the mean diameter d but greater than the thickness c , the precision formula can be expanded in terms of c/b as follows:

L , in henries =

$$\frac{2\pi dN}{0.3937 \times 10^9} \left[\left\{ \log h \frac{4d}{b} \right\} \left\{ 1 + \frac{1b^2}{8d^2} + \frac{1c^2}{24d^2} - \frac{1}{64} \left(\frac{b^4}{d^4} - \frac{7b^2c^2}{6d^4} - \frac{11c^4}{45d^4} \right) \right\} + \frac{1c^2}{6b^2} \left(\log h \frac{b}{c} \right) \left(1 - \frac{1c^2}{20d^2} \right) - \frac{1}{2} - \frac{\pi c}{3b} + \frac{1c^2}{8d^2} + \frac{1b^2}{32d^2} + \frac{25c^2}{72b^2} + \frac{1}{96} \left(\frac{b^4}{d^4} - \frac{19b^2c^2}{8d^4} + \frac{8c^4}{15b^4} - \frac{67c^4}{75b^2d^2} + \frac{17c^4}{40d^4} \right) + \frac{1}{qN} \left(\log h \frac{p}{w} + 0.14 \right) \right] \quad (1)$$

¹"The Self-Inductance of Long Reactance Coils," by H. B. Dwight, ELECTRICAL WORLD, Feb. 9, 1918, p. 300.

²"Electricity and Magnetism," Vol. II, para. 705.

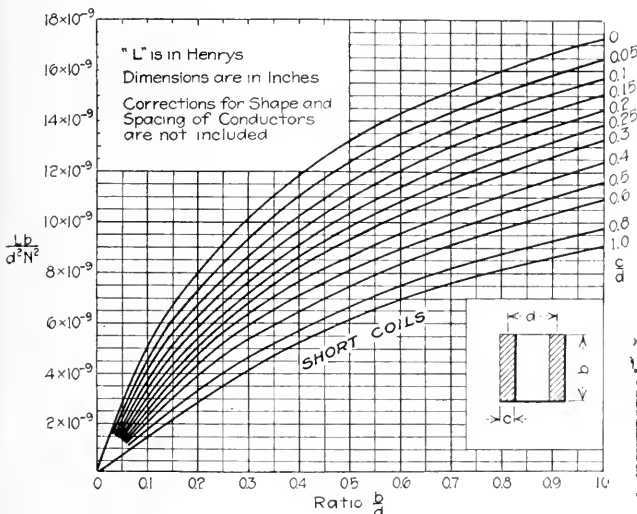
³"Bulletin of the Bureau of Standards," Vol. 2, 1906, No. 3, page 366.

⁴"Philosophical Transactions of the Royal Society of London," Vol. 213, 1913, page 421.

For flat coils, in which the axial length b is less than c , the expansion can be carried out in terms of b/c , as follows:

L , in henries =

$$\frac{2\pi dN^2}{0.3937 \times 10^9} \left[\left\{ \log \frac{4d}{c} \right\} \left\{ 1 + \frac{1b^2}{8a^2} + \frac{1c^2}{24d^2} - \frac{1}{64} \left(\frac{b^4}{a^4} - \frac{7b^2c^2}{6a^4} - \frac{11c^4}{45a^4} \right) \right\} + \frac{1b^2}{6c^2} \left(\log \frac{c}{b} \right) \left(1 + \frac{1b^2}{4d^2} + \frac{1b^2c^2}{4a^2} \right) - \frac{\pi b}{3c} \left(1 + \frac{1b^2}{5d^2} + \frac{1b^2c^2}{15d^4} - \frac{2b^4}{35d^4} \right) - \frac{1}{2} + \frac{1b^2}{8d^2} + \frac{25b^2}{12c^2} + \frac{43c^2}{288d^2} + \frac{1}{96} \left(\frac{16c^4}{25d^4} - \frac{1b^2c^2}{24d^4} + \frac{8b^4}{15c^4} + \frac{23b^4}{3c^2a^2} + \frac{31b^4}{24d^4} \right) + \frac{1}{qN} \left(\log \frac{p}{w} + 0.14 \right) \right] \quad (2)$$



$w = 0.08$ cm. The mean diameter of the coil is $d = 10$ cm., the length is $b = 10$ cm., and the thickness is $c = 1$ cm.

The self-inductance L , of a thin coil of diameter $d = 10$ cm. is given by formula (1) by omitting the terms in c and the last bracket.

Thus,

$$L_s = (2\pi \times 10 \times 10^3) / 10^9 [1.386(1 + 0.125 - 0.0156) - 0.5 + 0.0312 + 0.0104] = (\pi/100) \times 2.159 \text{ henries.}$$

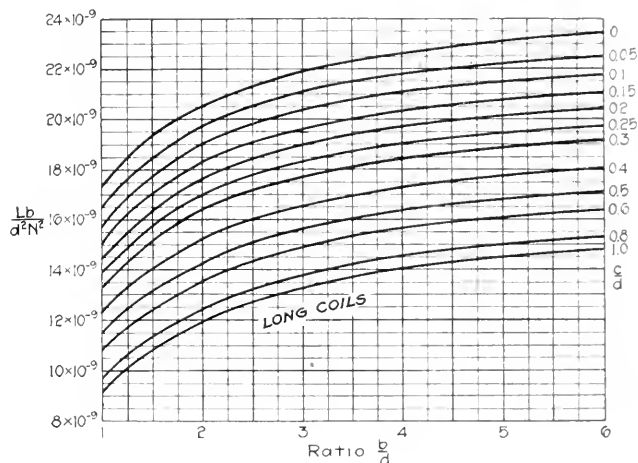
The other terms of formula (1) are

$$(2\pi/100) [1.386(0.00042 + 0.00018) + 0.0038 - 0.1047 + 0.00125 + 0.0035 - 0.0002 + 0.00036] = -(\pi/100) \times 0.190.$$

Therefore the self-inductance of the coil is

$$(\pi/100) \times 1.969 = 0.06185 \text{ henry.}$$

The self-inductance of the same coil, calculated by the



FIGS. 2 AND 3—CURVES FOR DETERMINATION OF THE SELF-INDUCTANCE OF REACTANCE COILS

For coils of square section, in which b is equal to c , the formula becomes

L , in henries =

$$\frac{2\pi dN^2}{0.3937 \times 10^9} \left[\left\{ \log \frac{4d}{c} \right\} \left\{ 1 + \frac{1c^2}{6d^2} + \frac{37c^4}{5760d^4} \right\} - 1.1949133 + 0.146293 \frac{c^2}{d^2} - 0.010860 \frac{c^4}{d^4} + \frac{1}{qN} \left(\log \frac{p}{w} + 0.14 \right) \right] \quad (3)$$

For this case formulas (1) and (2) will also solve the problem. Therefore formulas (1) and (2) are sufficient for calculating with ordinary accuracy the self-inductance of thin or thick cylindrical coils whose axial length is shorter than their mean diameter.

The self-inductance of both long and short reactance coils is plotted in Figs. 2 and 3, which are curves for coils of various thicknesses. These can be used for obtaining approximate values of inductance and for making a check on calculations. However, more accurate values will often be required that can be obtained from the curves, and direct calculation by the formulas will be necessary.

Problem I.—To find the self-inductance of a coil wound with 1000 turns of round wire in ten layers of 100 turns each. The diameter of the insulated wire is $p = 0.1$ cm. and the diameter of the bare wire is

engineering formula for long thick coils, is 0.06194 henry.

Problem II.—To find the self-inductance of a coil of mean diameter $d = 10$ in. (25.4 cm.), of axial length $b = 2$ in. (5.08 cm.) and of thickness of winding $c = 2$ in. (5.08 cm.). It is wound with 400 turns of square wire with very thin insulation.

By formula (1),

$$L = \frac{2\pi \times 10 \times 160,000}{0.3937 \times 10^9} [2.996(1 + 0.005 + 0.0017) - 0.5 - 1.0472 + 0.005 + 0.00125 + 0.3472 + 0.0052] = 0.04666 \text{ henry.}$$

By formula (2),

$$L = \frac{2\pi \times 10 \times 160,000}{0.3937 \times 10^9} [2.996(1 + 0.005 + 0.0017) - 1.0556 - 0.5 + 0.005 + 0.3472 + 0.0060 + 0.0088] = 0.04666 \text{ henry.}$$

By formula (3), $L = 0.04664$ henry.

National Research Council to Be Permanent

By order of President Wilson, the National Research Council, which was organized in 1916 at his request by the National Academy of Sciences, as a measure of national preparedness, is to be perpetuated. Representatives of the government will, upon the nomination of the academy, be designated by the President as heretofore as members of the council.

Burning Dust-Bearing Coal

Results of Tests to Determine Its Air Admittance, with Conclusions as to How This Fuel Can Be Burned Efficiently—Better Control of Boiler Plant, with Increased Reliability and Flexibleness, Attained

BY L. A. STENGER

CONSIDERATION of the fundamental laws of coal combustion and conditions affecting boiler and furnace performance led the writer to study the air flow through coals. Several interesting observations were made which have a direct bearing on the important question of fuel conservation in this country. Preliminary tests showed that the weight of air passing

graded coals are indicated in Fig. 1. This indicates that air flow was sharply restricted by grain sizes near $\frac{1}{8}$ -in. (3.175 mm.) and increased at very rapid rates as the grains were larger. That part of coal near $\frac{1}{8}$ -in. grain size and less is designated as dust. The extent to which dust in the coal affects the air flow is shown by Fig. 2. This curve represents the average of air-flow tests on different surface wet coals as received ready for firing.

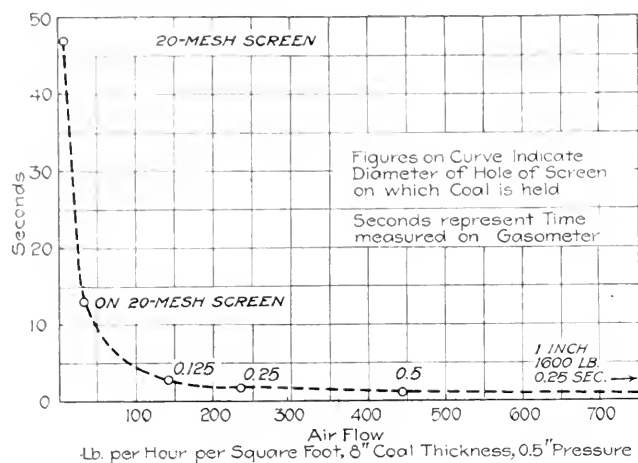


FIG. 1—RATE OF AIR FLOW THROUGH SCREEN-GRADED COALS

through a given coal per unit of time is dependent upon the difference in air pressure through the bed, thickness and area of the bed, state of surface wetness of the coal, and most important, the degree of fineness of the coal particles. These tests were made with a simple apparatus like a gasometer, which would deliver a volume of air at constant pressure through a cup with screened bottom, which contained the coal under test. The time taken to force the known volume of air through the coal was measured with a stop watch. This furnished data to compute unit air flow.

Different coals of various screen gradings, dust contents, conditions of surface wetness, etc., were tested under comparative conditions. Tests comparing surface, dry, dust-bearing coal with the same coal when the surface was wetted throughout the mass showed that the wet coal allowed approximately twice the air flow that the dry coal would. This is due to the fact that the water collects the small grains, holding them together and to the larger pieces, thus preventing their settling and filling the void spaces. After the coal is again dried, if it is not agitated too much, the dust is cemented together loosely by the deposited soluble salts of the coal. The resulting increase of air flow explains the improvement in combustion of wetted coal. It was also proved that layers of dust, placed either at the top, bottom or in an intermediate position in the coal mass, retarded the air flow to a much greater extent than if the dust were distributed uniformly throughout the coal.

The comparative rates of air flow through screen-

RELATION OF AIR ADMITTANCE TO BOILER PERFORMANCE

The relation of air "admittance" of coals to steam-boiler performance is shown in Fig. 3, which gives results obtained from systematic measurements on air flow plotted against data from evaporation tests, with chain grates serving 556 hp. B. & W. boilers. Each of these tests was made with care and attention to details so as to get the best attainable boiler capacity and efficiency. The duration of the tests was from eight to nine hours each. Slack and screenings were used, the largest pieces being not over $1\frac{1}{2}$ -in. (3.81-cm.) in size, usually having wet surfaces as fired and varying in dust content. Some of the tests were made with coal screened approximately dust-free to compare the performance of the coarse fraction with a dust-bearing coal of the same kind. This was done with both Illinois and Youghiogheny screenings. The B.t.u. value of each of the coals as fired was placed on the chart to show its small comparative influence on boiler performance. A dust-free 9900 B.t.u. coal gave much better results than a dust-bearing 12,000 B.t.u. coal.

It should be understood that the figures representing

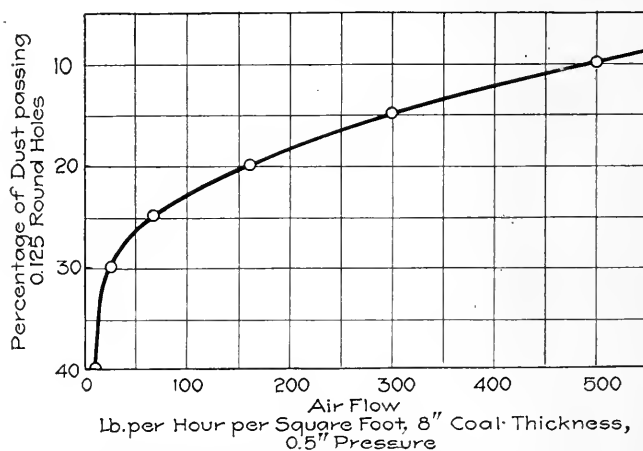
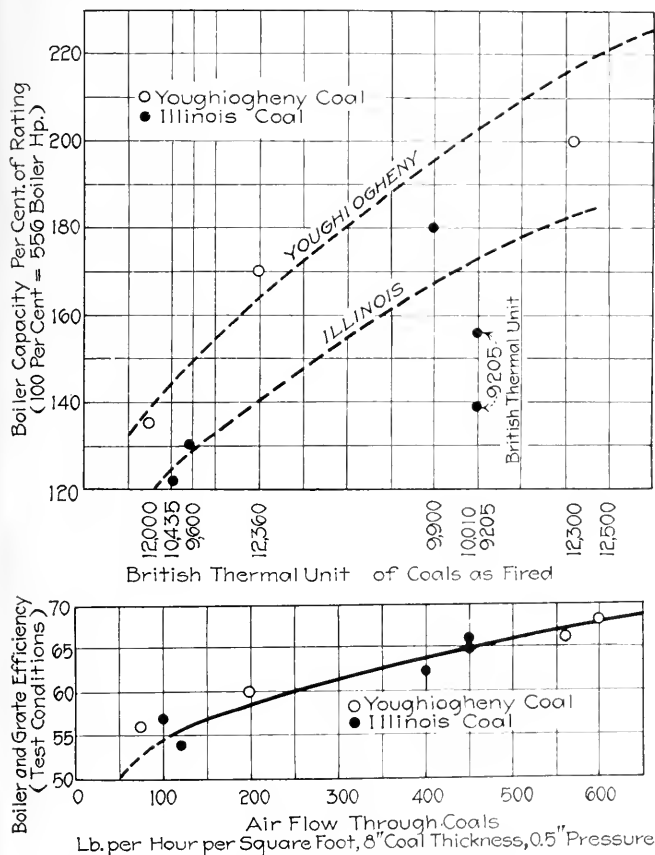


FIG. 2—RATE OF AIR FLOW THROUGH COALS HAVING DIFFERENT DUST CONTENTS

air flow through cold coal before firing it are no index to the amount of air flowing through the burning fuel bed, but they do show that a coal having limited air admittance cannot be burned efficiently as ordinarily fired and that there is an important relation between that property of fuels and boiler and furnace performance.

Losses in efficiency due to dust in coal are traced to the difficulty in maintaining a free-burning, uniform fuel bed. Holes, ridges or streaks will form. Air passing through holes and areas of burned-out ash causes augmented chimney losses. Areas of coal impermeable to air lie inert, are only coked, not burned, and finally contribute to losses in the ash pit. Boiler capacity is limited, owing to low efficiencies and to reduced rates of combustion.

A study of the data presented herewith and other experiences with dust-bearing coals on different types of stokers, including forced-draft stokers and hand-fired furnaces, shows that it is impossible to attain as good results as may be had from dust-free coals of lesser B.t.u. values. There is not much hope that the operating boiler efficiencies ordinarily obtained in large



FIGS. 3 AND 4—RELATION OF MEASURED AIR FLOW TO BOILER PERFORMANCE

plants can be raised and maintained at any desirable standard if dust-bearing coals are burned with ordinary furnace equipment. To add to the trouble fuel is becoming poorer in all respects and more expensive. Limitation of boiler capacity also contributes to low plant efficiency. This leads to higher costs, both of boiler-house equipment and of operation. Although good types of forced-draft stokers with the ability to increase steam output to 250 or 300 per cent of boiler rating aid much in this regard, their operating efficiency is lowered by dust-bearing fuels.*

*The "operating boiler efficiency" $e = (100 - a) \times b \times c \times 10^{-4}$, where a = the more or less indeterminate losses of the plant, from banking fires, leaks, etc. a varies inversely with the load factor and may be from 5 to 20 in value; b is the operating boiler efficiency, and c is the thermal efficiency of prime movers, including auxiliaries; e is known from $3420 \div \text{B.t.u. per kw.-hr.}$ The operating boiler efficiency will always be less than the average boiler and grate efficiency determined from evaporation tests on the same type of fuels used in the plant, and it depends on conditions of fuel, labor and boiler-plant control.

A plan for permanently raising operating boiler efficiency and the boiler capacity of a steam-power plant follows: Crush all coal, if necessary, so the largest lumps will not be over 1 in. (2.54 cm.) in size. Screen on a mesh chosen to remove all dust of $\frac{1}{8}$ -in. (3.175-mm.) size and less. Dry and pulverize the dust and burn in pulverized coal-burning furnaces serving a part of the present boiler installation. The coarse coal may be burned in the remaining furnaces, in which no changes have been made.

The data in the table give comparative estimates on the plan, based on these assumptions: 9600 B.t.u. and 13 per cent moisture in coal as bought; 25 per cent of the dust is screened from coal (dust having 8600 B.t.u. and 15 per cent moisture or 10,000 B.t.u. and 1 per cent moisture as fired); 40 cents per ton of dry dust is the approximate cost of screening all coal and drying and pulverizing the dust, or 9 cents per ton of coal bought. These costs are based on present prices of a pulverizing plant of about 75 tons daily output and include all the usual fixed and operating charges. It may be noted that the operating boiler efficiency and some other figures set forth for the suggested plan are weighted averages.

COMPARATIVE DATA ON PLAN DESIGNED TO BRING ABOUT INCREASE OF BOILER EFFICIENCY

	Present Operation	WITH SUGGESTED PLAN		Plant Average
		Coarse Coal	Pulverized Coal	
Operating boiler efficiency (per cent).....	55	72	76	73
Calorific value of coal as fired (B.t.u.).....	9600	9900	10,000	9922
Lb. coal as fired per 1000 lb. water evaporated.....	181			134
Lb. coal as bought per 1000 lb. water evaporated.....				139
Lb. coal as required per 1000 lb. water evaporated (includes coal for drying dust), total.....	184			140
Lb. coal saved.....				44
Coal saved (per cent).....				24
Added cost of coal per ton bought due to treatment.....				\$0.09
Net financial saving (per cent) with coal costing:				
\$1 per ton at plant.....				13.2
\$2 per ton at plant.....				19.7
\$3 per ton at plant.....				21.2
Approximate increase in boiler rating, from 125 to 175 per cent of rating (per cent).....				40.0

It may be seen that the net saving is based upon the possible increase in boiler operating efficiency only. A further saving is possible in plants with the usual load factor of lighting and power plants by bringing about a decrease of the quantity a in the plant efficiency formula given in the footnote. This saving was not estimated on account of the indefiniteness of the figures involved. It would be no inconsiderable economy, owing to less banking of fires, as a smaller number of boilers would have to be fired to carry the peak load than under the conditions previously existing.

With the suggested plan in operation the boiler plant could be better controlled and it would be more flexible and more reliable. There would be much less ash to dispose of. The savings brought about in money, coal and transportation and the inexpensive increase of power capacity as compared with the previous output would be very helpful at any time, and most of all in the immediate future, when the problem of war-time economy looms so large.

Experiment in Insurance Co-operation

More than One Hundred Electric and Gas Companies in New York State Unite to Protect Themselves Against Claims for Accident Compensation—Experience Shows Excellent Results from Plan Adopted

BY CHARLES E. MORRISON, C.E.

General Manager Utilities Mutual Insurance Company

PRIOR to July 1, 1914, when the workmen's compensation act became effective in New York State, the public utility interests, as represented by both the electric and gas industries, conceived the idea of forming some sort of a mutual organization for the purpose of taking care of their needs in respect to compensation insurance, particularly with the thought that by so doing they might practically demonstrate the advantages of co-operation in connection with this detail of their business. This included, naturally, not only the payment of claims for accidents incurred but also its corollary, "accident prevention."

As a result of this thought on the part of the public utility operators, the Utilities Mutual Insurance Company was organized with approximately 100 electric and gas companies constituting its membership.

The scheme was to conduct the operations on a purely businesslike basis, and in effect the organization was, as its name indicates, a truly mutual compensation insurance company, confining its activities, however, exclusively to this form of insurance and to New York public utilities. Numerous advantages were to be derived by thus restricting it to preferred classified risks.

To every member company the same premium was charged that would be charged by a tariff or stock compensation insurance company, and then, after having set up appropriate and adequate reserves for losses that had been incurred through accidents, as well as charging against operations all necessary expense, the undivided surplus was to be distributed among the member companies as a dividend, thus operating to reduce the net cost to the members themselves.

So far as is known, this is one of the first practical demonstrations in the utilities field of companies getting together for the purpose of reducing operating expenses by a mutual or co-operative organization.

There are, of course, many national, state and local scientific, commercial and other bodies in the industry which generally seek to assist one another by the exchange of technical, commercial or other ideas, data and information; but perhaps it remained for the Utilities Mutual to demonstrate conclusively that it was as feasible to pool the interests of the industry for the purpose of securing the financial returns from co-operative action as along other lines.

BUSINESS SUCCESS OF THE UNDERTAKING

As one looks back on the organization as first constituted, it seems as though it were a very foolhardy undertaking for a group of public utility operators to originate an insurance company with practically no knowledge of insurance matters, but it remains to be said nevertheless that these operators, through the application of business methods, have made their undertaking a very profitable one.

In no year has the company returned less than 20 per cent in the form of dividends, and its surplus has

always substantially exceeded this amount. In effect, this means that by the application of business methods to the detail of compensation insurance for public utilities we are able to cut the cost materially below that of the stock or tariff companies. A question naturally arises as to how these results have been accomplished.

CHIEF FACTORS IN SUCCESS

We say, without fear of contradiction, that perhaps the largest contributors to this success are the 100 per cent moral hazard, the mutual interest and the co-operative spirit that naturally exist among public utility operators as a class. This spirit, as a result of the elimination of competition, may unquestionably be more intensively developed among them than in any other single industry, and as a consequence the insurance carrier—which is in effect the member companies themselves—has reaped the benefits in that safety first suggestions have been uniformly and willingly complied with by the operator and accidents correspondingly decreased.

The recommendations offered to our member companies deal primarily with the physical hazards existing in their plants and are the result of the most careful engineering inspections. It is wise to note here, however, that there is a very marked difference between our engineering inspections and those of other companies or organizations. It rests primarily on the fact that we believe more can be accomplished by a sincerity of purpose than by an arbitrary attitude that this or that may be wrong and therefore *must* be corrected. Our engineers are known personally to the staff of each member company as responsible, painstaking men, and they always get a cordial reception when they undertake an inspection. It is because they get close to the operatives that an interest is created in their work and their recommendations and that, as a sequence, the reduction in the number of accidents has taken place.

We endeavor to make at least two examinations of each company's property in each year—the same engineer never making two successive inspections. This enables us to place a check on the observation powers of each inspector and to create a friendly rivalry among them. As soon as these inspections are made the home office is advised, and a communication with a report is sent to the manager of the member company requesting him to inform the home office as to what action will be taken with respect to these recommendations. Invariably the reply is that they will be complied with immediately or as soon as the material and labor can be supplied for the purpose.

While these recommendations deal largely with the removal of physical hazards or defects and the installation of safety devices, they act also as a stimulus to further effort on the part of the employees and

the management. They also apply to housekeeping conditions the morale and esprit de corps of the employees. Careful supervision is kept of these recommendations through a follow-up system, to see that eventually all are complied with.

The inspections are quite frequently followed by safety first talks and committee meetings, together with illustrated moving pictures on standard safety first practice. We endeavor to see that all of our member companies are supplied with the invaluable bulletins of the National Safety Council, as these always have some vital message to tell.

Accident statistics are kept of each member company, so that at any time it is possible to develop each company's experience for the purpose of correcting unsafe practices. This develops a comparison of each mem-

demonstrated beyond question by the record of fatalities which in the electric industry contribute most largely to the losses. The following will serve for an example: Among approximately 5000 employees with an annual payroll of about \$5,000,000 the six months ended June 30, 1917, contributed just one fatal accident.

Even in this case it is questionable if the accident was a result of operating conditions, as it is felt, and we believe proved, that the employee died from natural causes. This one fatality compares with six fatal accidents occurring in the preceding six months. While it is appreciated that there may be a considerable element of chance or luck in this, there are good grounds for believing that the more intensive inspection service in the later period contributed very largely to this reduction of fatal accidents.

ACCIDENT REDUCTION AS A BUSINESS PROPOSITION

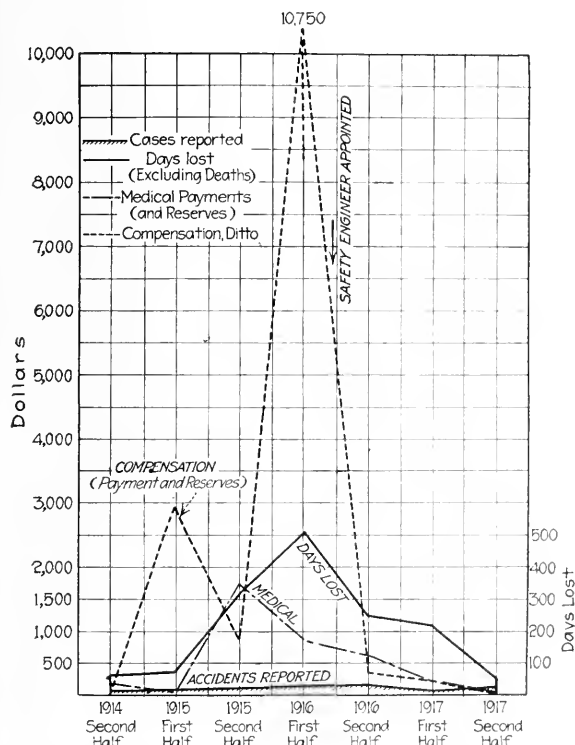
One particular reason why our member companies are so willing to co-operate for the protection of their employees—aside from the purely humanitarian one—is that they can readily see how their personal interests are being served by the reduction of accidents at their respective plants. Every life that is saved, every accident that is prevented, means so much less in the cost to the company as a whole, and therefore so much more surplus to be divided among the individual member companies in proportion to the premiums that they pay.

On a purely dollars-and-cents basis this co-operative spirit has returned to the public utilities of the State in the past three years a sum in excess of \$100,000. Such an amount is not to be belittled in these times of increasing production costs, and we know of no other department in public utility operations that compares with this return.

There is submitted with this article a curve which indicates what may be expected to happen when the safety first and accident prevention problems are attacked in a consistent and intelligent manner.

This curve represents the experience of a public utility company in the State of New York. It will be noticed that to the left of the peak the compensation costs, medical costs and days lost, which latter do not include fatalities, are very irregular and excessive. The peak represents several serious accidents, and at this time it was deemed advisable to secure the services of a safety engineer. A glance at the curve to the right of the peak will show how the compensation costs, medical costs and days lost have consistently fallen.

Perhaps immediately after the several serious accidents was the strategic time to prepare intensively against similar occurrences, and perhaps also eighteen months may not legitimately be considered as conclusive evidence of accident experience. However this may be, nevertheless we do know from the curve that less money has been spent for compensation, less money has been spent for medical attention, and fewer days of lost time have been recorded, since the installation of the safety engineer than before it. No further evidence, it is believed, is necessary to indicate the vital need of attention to careful and safe practices among employees nor to prove how enormously it may contribute to accident reduction.



HOW A UTILITY COMPANY'S ACCIDENT COSTS DECREASED WITH APPOINTMENT OF A SAFETY ENGINEER

ber company's experience with that of the average of all, and if the experience of the individual is less satisfactory than that of the group as a whole, there is immediately created an incentive on the part of the operator or general manager to better this record in order to present as clean a slate as that of others to whom he is personally known. Should an abnormal record develop with respect to any one particular company, a conference is arranged with the general manager for the purpose of discussing in detail his safety first work or lack of safety first work.

Frequently an inspector will be assigned for an intensive investigation of two or three weeks to one of these member companies for the purpose of studying the underlying spirit of the organization and to determine whether there is not some element or factor which is tending to cause carelessness on the part of employees and therefore to promote accidents. Sometimes also the safety engineer of one organization will be loaned to another in the interests of "safety first."

That these inspections have produced results is

Economic Aspects of Summer Load—I

Features of a Class of Service Which, When Properly Handled, Yields Profitable Revenue and Exerts Great Influence in the Popularization of Electricity—How Power Business Grows in the Hot-Weather Term

THE economic value of summer service by central stations is of widespread interest to managers of companies whose systems are within commercial reach of vacation resorts. A comparatively high rate per kilowatt-hour is often applied to this class of service



FIG. 1—NEWPORT "COTTAGE"; SUMMER REVENUE TO CENTRAL STATION FROM THIS MANSION HAS EXCEEDED \$600 A MONTH

on account of the few months during which it is in demand and the resulting relatively large overhead charges associated with the distribution of energy to customers of transient or semi-permanent character.

It is doubtful if any general statement can be made that summer service is unfailingly profitable to central stations, so much depends upon the intelligence with which it is provided and maintained. In a recent study of summer service among central stations made by a representative of the ELECTRICAL WORLD, it was found that very few analyses have been made by managers of the investment and operating costs of this class of busi-

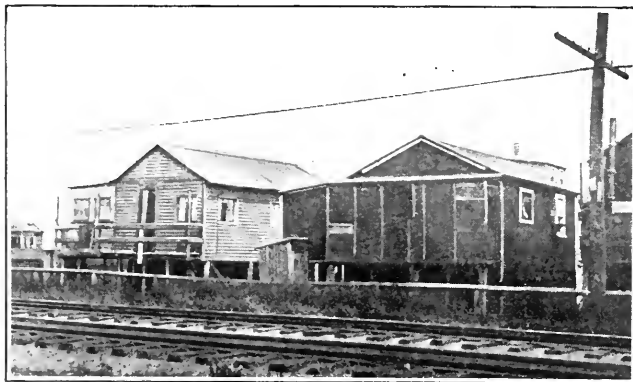


FIG. 2—SUMMER HOMES AT REVERE BEACH, MASS.; WITH THESE HOMES INVESTMENT MUST BE KEPT AT MINIMUM

ness. Data as to revenue are much more accessible. The entrance of the United States into the war has left central-station managers little time in many cases in which to analyze the summer load, and the policy of extreme conservatism regarding extensions has held back development on many properties. None the less, from

an extended survey of the summer-load field, it appears clear that if this business is to be handled profitably, certain points must be considered, and in the following paragraphs some of these will be discussed.

An extraordinary range of revenue yield is found in summer service. The multi-millionaire's "cottage" at Newport, R. I. (Fig. 1), has yielded over \$600 per month to the local central station in the height of the summer entertaining season. The humble cabin at Revere Beach, Mass. (Fig. 2), brings the lighting company perhaps \$4 to \$5 for the entire season from May to Labor Day. Between such limits as these are returns of the most varied character, and the "acid test" of profit or loss depends for its outcome upon service cost in its broadest aspects, including a careful control by the central station of the investment required.

Where a large seasonal revenue is obtained it naturally follows that a much greater outlay for distributing lines can be carried successfully than where

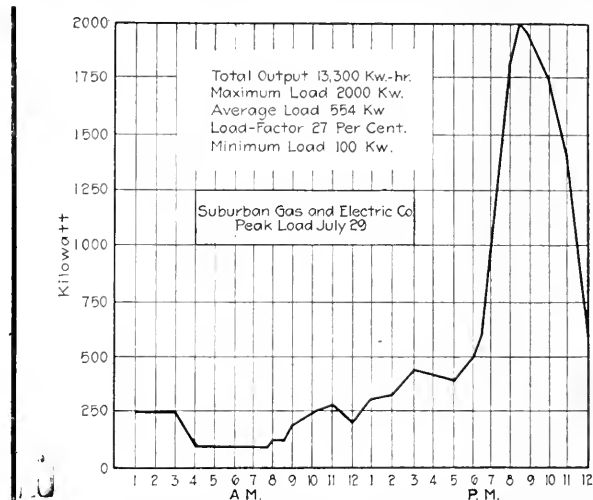
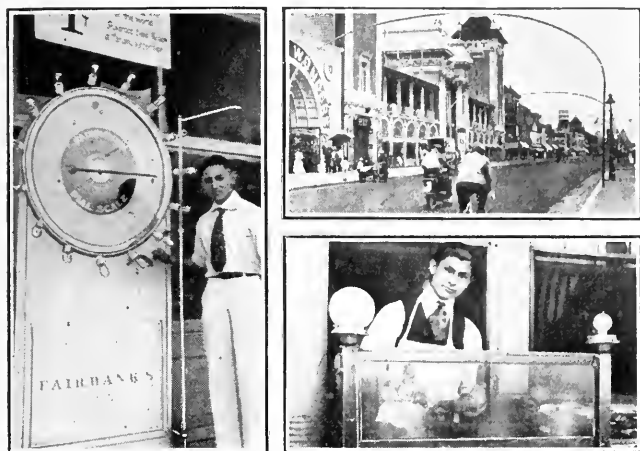


FIG. 3—LOAD CURVE OF COMPANY SERVING REVERE BEACH ON THE DAY OF MAXIMUM SUMMER PEAK

the income yield of a customer is nominal. Fine establishments such as one sees at Newport, Bar Harbor, York Harbor, Me., and other high-class vacation resorts justify underground service entrances almost invariably. Customers occupying these costly estates often insist on the absence of all pole-line construction in the immediate vicinity of their residences.

On the other hand, the types of summer homes shown in Fig. 2 must be served at rock-bottom investment cost, and in the case shown in the photograph this has been accomplished by carrying the secondary mains past the cottages and feeding the latter in pairs off two-wire drops. The individual cottage leads are connected with the drop lead by ordinary overhead soldered joints, without extra insulating equipment or structural installation beyond the house attachments. The service is carried downward from the outside insulators to the entrance near the meter location by a short vertical run of iron conduit. Shacks of the kind illustrated are extremely

poor fire risks, and first-class wiring within and close to the building is essential. The actual cost of a service in such cases probably does not exceed \$4 or \$5. In the case of the Revere company, the customers occupying these little establishments pay the cost of wiring from the pole to the house, including secondary leads serving a group of houses. The company provides all primary



FIGS. 4, 5 AND 6—PENNY SCALE AND SAUSAGE STAND GET CENTRAL-STATION SERVICE; PART OF AMUSEMENT BOULEVARD IS SHOWN IN UPPER RIGHT-HAND PICTURE

wiring, the transformer for the cottage group and the individual meters. The tenants usually return year after year.

THE SUMMER-SEASON PEAK LOAD

Both at Newport and Revere, and in many other instances where a vacation load forms a great part of the service, the annual peak comes in the summer season. Fig. 3 shows the load curve of the Revere company on the day of maximum peak, which occurred July 29. In the *ELECTRICAL WORLD* of Sept. 1, 1917, page 422, an analysis was printed of the economic advantages of interconnection between the plants of the Salem Electric Lighting Company, the Malden Electric Company and the Suburban Gas & Electric Company of Revere. The fact that the Revere company's peak load occurs in summer, and in the form shown in Fig. 3, is significant in the foregoing connection, since the Salem and Malden peaks occur in the winter. The Revere peak can thus be handled in part by the reserve equipment available at Salem in the summer evenings, and the generating machinery in the Revere station need be used only on the peak or whenever additional energy is temporarily required at Salem. The tie line between the three systems, all managed by Charles H. Tenney & Company, of Boston, enables the advantages of the summer peak load at Revere to be reaped to the full, and the service is handled with minimum investment and operating cost.

Summer service at Revere Beach typifies this class of business at many other highly popular resorts on the Atlantic coast. This beach is within a 5-cent-fare distance of both Boston and Lynn. In the heated season sometimes 200,000 persons visit Revere on a single Sunday or holiday, and the patronage on a week-day evening or afternoon is always heavy in good weather. A view on the Revere Beach boulevard is shown in Fig. 4, this stretch of waterfront devoted to amusement being about a mile long and occupied by the most varied concessions.

The boulevard is illuminated by a great variety of sign and outline lighting, and in addition by about 2100 8-cp. lamps mounted in groups of fifty on wooden frame arches spanning the roadway. Service is rendered from dusk to 11 p. m. between May 30 and Labor Day, inclusive, the concessionnaires along the beach meeting the service cost. About \$1,500 per year is derived by the company from this service.

Instances of the energy consumption of various types of concessions are interesting. A large bathing establishment used energy for lighting as follows: From May to September, inclusive, 850, 1554, 1697, 2366 and 1629 kw.-hr., or a total of 8096 kw.-hr. for the season, at 10 cents per kilowatt-hour. A dance hall consumed 9914 kw.-hr. in the season, at 10 cents, and a large coaster purchased 9800 kw.-hr., the monthly consumption at 10 cents per kilowatt-hour being 724 (May), 1889, 2473, 3527 and 1193 kw.-hr. A theater and dance hall with a 35-hp. motor consumed, including lighting, 27,730 kw.-hr., yielding the central station \$1,886 from June to September inclusive, and a merry-go-round consumed 25,372 kw.-hr. from May to September inclusive, at a cost of \$1,768. A coaster establishment used 44,586 kw.-hr. during this period, paying the central station \$2,729. This last place was equipped with five 400-watt floodlamps, a 40 hp. motor for hauling three 1-ton, ten-passenger cars to the top of the incline of the scenic railway, a 0.5-hp. organ motor, seven 500-watt bracket lamps and a 1-hp. motor driving a deep-well pump which is used to supply water to a lagoon through which the patrons pass. Another amusement palace and dance hall, equipped with 33 hp. in motors driving mirth-provoking devices, consumed 51,365 kw.-hr. during the season, at a cost of \$3,068, including lighting service. The lighting and power service of another coaster totaled 32,230 kw.-hr. (100 hp. connected load), at a cost of \$2,111 to the concessionaire. Another merry-go-round yielded the central station \$1,126 on 12,519 kw.-hr. (25.5 hp. in motors on the place); another scenic railway, with 75 hp. installed, consumed 37,380 kw.-hr., at \$2,369, from May to September, inclusive, and another coaster consumed, with its lighting, 10,295 kw.-hr., bringing a revenue of \$1,014 to the Revere company.



FIG. 7—SEVERAL LARGE COTTAGES AT YORK HARBOR, ME., ARE SUPPLIED FROM A SINGLE TRANSFORMER

Besides these large customers, there are many small establishments at this beach. It is, of course, necessary to maintain a minimum seasonal charge in all these installations of small size. The net lighting rate of the Revere company, which also serves a large all-the-year residential and business population in the territory oc-

cupied by it, is 10 cents per kilowatt-hour, with a minimum charge of \$1 per month for each installation. In case the service is not used at least five months, so as to afford the company \$5 net income for its use at the regular rates, the customer is required to pay to the company an additional amount sufficient to make this income \$5, the additional amount, however, not being

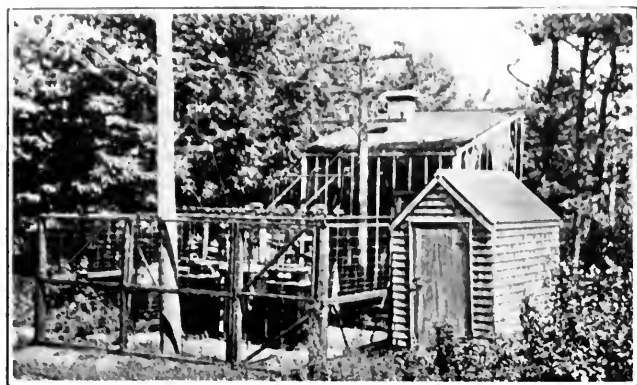


FIG. 8—OUTDOOR SUBSTATION SERVING CENTRAL-STATION SUMMER CUSTOMERS AT YORK HARBOR, ME.

allowed to exceed \$2 per meter. There are no free lamp renewals on this schedule.

Examples of small lighting customers on summer service are shown in Figs. 4 and 6. The latter illustrates a frankfurter stand equipped with five 50-watt lamps, and the former a penny scale equipped with fifteen 10-watt lamps. These little installations are long-hour users of energy. On the Revere system it is customary in summer to read all meters weekly and make weekly collections of bills. The collector reads the meters.

Large customers at Revere Beach receive the benefit of a lower rate in case during any four consecutive months the customer uses more than 10,000 kw.-hr. of energy. The first 10,000 units are billed at 10 cents net, and the excess at 5 cents per kilowatt-hour.

The illuminating department of the Bay State Street Railway at Newport, R. I., has about 300 summer customers. On July 1, 1916, the company established a so-called short-term rate for residences as follows: Customers using light during the months of May, June, July, August, September and October pay only 21.5 cents per kilowatt-hour, with a 10 per cent discount on bills paid on or before the tenth of the months in which they are rendered; minimum charge, \$2.22 per month. Customers having service connected for more than fifteen days during any one month are billed at the minimum charge rate for a full month. Some of the largest residences in the Newport summer colony have consumed 1200 kw.-hr. or 1300 kw.-hr. in a single month. The lighting of garages, laundries, kitchens, gardeners' quarters and lodges is considerable, and when the season is gay elaborate electrical illuminations are used in connection with lawn parties.

The yearly lighting rate at Newport for consumptions up to 100 kw.-hr. monthly is 11.25 cents net, and the power rate is 10 cents net for the first 200 kw.-hr., with a minimum charge of \$2.50 per month in business places. Some of the larger residences purchase energy on power rates for the operation of elevator motors and other machinery. There is no special power rate for summer service. There is also a large summer electric railway traffic.

Besides the large residences supplied, in practically every case by underground services, in the celebrated Bellevue Avenue district, the company operates in an extensive suburban zone, having many customers on its lines during the summer who use smaller amounts of energy, say \$5 or \$10 worth per month. Bills are rendered monthly to all customers. As a rule deposits are not required. Some of the large customers pay for their service at the end of the season, preferring not to remit checks month by month, but in general the bills are settled monthly.

On the Maine coast electrical appliances are exceedingly popular in some of the higher class resorts, notably at York Harbor. The York County Power Company serves this district.

The York company's system includes 165 miles (265 km.) of primary lines, 70 miles (112 km.) of highway lighting circuits with summer peak load of about 1000 kw. and a winter load of 400 kw. There are a considerable number of summer hotels served by the company, yielding from \$1 to \$10 per day in revenue. In round numbers, the cottages yield from \$2 to \$75 per month from electric service. The company prefers to keep the cost of all line extensions within \$100. The summer business brings in more revenue in one month than the rest of the service produces in a year. The first 100 kw.-hr. are billed at 20 cents per kilowatt-hour on the seasonal rate, all energy in excess being billed at 10 cents. There is a minimum charge of \$2 per month of occupancy. The yearly lighting rate is 9.25 cents. A seasonal power rate is in use, beginning at 12 cents per kilowatt-hour for the first 200 kw.-hr., with reduction to 6 cents per kilowatt-hour for all energy in excess of 600 kw.-hr. per month. A minimum charge is made of \$2 per month for installations of less than 2 hp. and \$1 per horsepower per month for installations of more than 2 hp.

In supplying summer homes the joint use of poles by the central station and the telephone company saves on the investment, and the practice of running grouped house services from a centrally located transformer (Fig. 7) minimizes the outlay for overhead construc-



FIG. 9—ONE OF THE PIERS AT OLD ORCHARD BEACH WHICH AFFORD A LARGE LOAD IN THE SUMMER MONTHS

tion. A summer hotel in this district accommodating about seventy-five patrons, with twelve 25-watt lamps in its dining room, open thirteen weeks, pays about \$1 per day for electric service. One 25-watt lamp per room meets the requirements well.

Hydroelectric energy is distributed through much of the Maine coastal district, and outdoor substations

serving many summer cottagers are illustrated in Fig. 8. These installations are built as inexpensively as is consistent with safe and reliable service. A few thousand dollars will provide an outdoor substation capable of meeting the electrical wants of summer communities extending over from 10 miles to 20 miles (16 km. to 32 km.) of coastline, even under present price conditions. Every house has a separate service if on the company's lines. The cottage meters are removed whenever a place is vacated, even if another tenant moves in within two hours. Meters in business establishments, amusement places, etc., are read Mondays, collections being made Wednesdays. If payment is not made by the end of the week, the service is cut off.

Long-hour lighting service is often a feature of summer resort work, the revenue being dependent upon the extent of amusement concessions offered. At Newport the Casino yields about \$100 a month in lighting revenue alone. Piers like the one at Old Orchard shown in Fig. 9 are open many evening hours each week and often contain moving-picture establishments and other attractions using much electrical energy. At Old Orchard there is a scheme of decorative street lighting by stringers of 10-watt lamps from July 1 to Sept. 1, about 1500 lamps being in service. These, with seventeen 750-watt lamps, wired in multiple for beach service, yield a revenue to the central station of about \$1,225 per year. The town pays for this and also meets the cost of the electric sign shown.

The experience of a central station in Massachusetts suggests the importance of more thorough analyses of cost in extending lines to summer camps. A line was built at a total service cost, including two transformers and meters for nine cottages, of about \$1,000. The cottages were on an island about one-quarter of a mile (0.4 km.) long and with its nearest point about 200 ft. from the mainland. No. 6 copper was run along the island, with 30-ft. (9-m.) chestnut poles and single-phase, 2300-volt service. Although four pumps motor-driven and of 5 kw. combined rating were in service for water supply, the total revenue for a season was only about \$85. The total connected load was under 10 kw., and two overhead stranded steel guy wires connected the island circuit with the mainland. The company feels that the volume of business is too small to justify the service, which includes the occasional expense of sending a troubleman more than three miles from the generating plant to the island. There is a very small use of energy despite the maintenance of a net rate of 10.8 cents per kilowatt-hour. It was felt that had the cottagers borne the cost of the extension and been charged a summer rate of 15 cents per kilowatt-hour the business might have been profitable.

A rate of 25 cents per kilowatt-hour has been successfully used for some years by the Manchester (Mass.) Electric Company in handling seasonal business with exclusive underground service among Boston North Shore cottagers. Where the density of service is high or the volume of business large much lower rates are of course justified.

In a future issue of the ELECTRICAL WORLD further information on the economic aspects of summer service will be given in the concluding part of this article, which will contain comparisons of revenue earned by central stations from month to month, with their changing peak loads and output variations.

Book Reviews

FINDING AND STOPPING WASTE IN MODERN BOILER ROOMS. By engineers of the Harrison Safety Boiler Works, Philadelphia, Pa. 276 pages, 213 illustrations. Price, \$1.

The saving of coal is the purpose of this practical handbook, which is addressed to power-plant owners, managers, engineers and firemen. The preface states that such statements, tables, charts, etc., have been selected as were supported by experiments and tests, references being given wherever possible to the original authorities. The latter include many well-known engineers and writers in technical periodicals, also authors of papers before engineering societies, while the excellent bulletins on the utilization of fuel issued during recent years by the United States Bureau of Mines have been freely drawn upon. Pains have been taken to compare statements and to check each source of information against others. The work is divided into five sections, dealing with fuels, combustion, heat absorption, boiler efficiency and testing and boiler-plant proportioning and management. The book is well worth being in any engineer's reference file or library.

ENGINEERING MATHEMATICS. A Series of Lectures Delivered at Union College. By Charles Proteus Steinmetz. New York: McGraw-Hill Book Company, Inc. 320 pages, 110 illustrations. Price, \$3.

This is the third and enlarged edition of a particularly interesting textbook on mathematics as commonly required by engineers in general but particularly by electrical engineers. The subject is treated with much freedom and originality. The book is divided into seven chapters, dealing with the following respective topics: The general number, the potential series, trigonometric series, maxima and minima, methods of approximation, empirical curves, and numerical calculations. There are also appended notes on function theory. Considerable skill is shown in presenting practical engineering problems illustrating the use of the mathematical processes described. The author also deserves praise for having altered the text of the first edition in order to conform to international convention concerning vector phase representation. The book will be of value to electrical engineering students and of interest to all who come in contact with applied mathematics.

Books Received

CLEARING THE GROUND. By "Lumber-Man." London: Constable & Company, Ltd. 312 pages.

MANAGING A BUSINESS IN WAR TIME. Chicago, New York and London: A. W. Shaw Company. Two volumes, 424 pages, illustrated. Price, \$3.

ELECTRICITY METERS, THEIR CONSTRUCTION AND MANAGEMENT. By C. H. W. Gherardi. London: Benn Brothers, Ltd. 504 pages, 406 illustrations. Price, 15s.

ELEMENTS OF FUEL-OIL AND STEAM ENGINEERING. A Practical Treatise Dealing with Fuel Oil, for the Central-Station Man, the Power-Plant Operator, the Mechanical Engineer and the Student. By Robert Sadler and Charles H. Delany. San Francisco: Technical Publishing Company. 320 pages, illustrated. Price, \$3.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

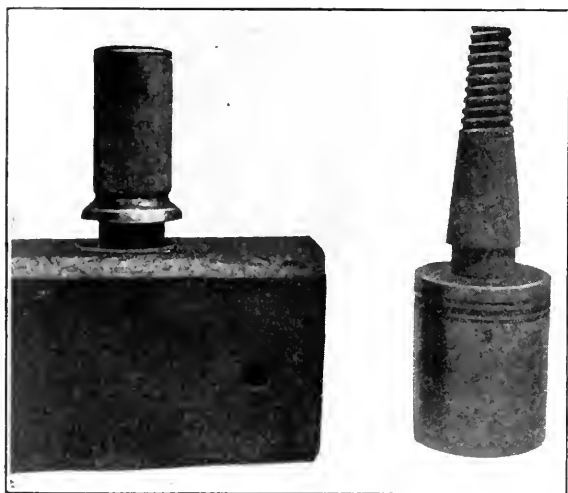
GAGES USED FOR TESTING

WOOD PINS AND PINHOLES

Allowances Are Made for Over-Size and Under-Size Dimensions—Careless Workmanship Will Not Be Accepted and Waste Will Be Minimized

When wood pins are used to support insulators, the shanks should be of such a size that a reasonably close fit in the cross-arm will be obtained. An over-size shank may split an arm, while one too small will make the pin loose, weak and liable to decay. Obviously, pins made of such a rough material as wood cannot be procured of exact and uniform dimensions, so reasonable allowances must be made in purchasing.

The specifications of one company provide that the standard N. E. L. A. dimensions may be exceeded by not more than 2 64 in. (0.8 mm.) at the butt and by not more than 1 64 in. (0.4 mm.) under the shoulder. In



CONVENIENT GAGE FOR TESTING WOODEN PINS

order to simplify the testing of pins ordered under this specification, an iron gage with a 1 1/2-in. (3.8-cm.) opening was made. By inserting the shanks in this gage pins may be tested with considerable rapidity. If the pin goes in as far as the shoulder and fits loosely, it is rejected as being under size; on the other hand, a pin which will not go in so that the shoulder is within 3/4 in. (1.9 cm.) of the gage surface is considered too large and is also rejected.

Cross-arm dimensional specifications must likewise be of a practicable kind so that they will neither cause the rejection of adequate material nor permit the acceptance of pieces which represent careless workmanship. This company covers this point by the following specification: "Cross-section dimensions of cross-arms must not vary more than 1/8 in. (3.2 mm.) above or below the dimensions shown in blue prints. Holes must not be more than 1/4 in. (6.4 mm.) off center longitudinally, or more than 1/8 in. (3.2 mm.) out of line." In checking pin-hole dimensions the gage shown is useful.

ISOLATING THE NEUTRAL

OF TRANSFORMER BANKS

Tests of Change from Delta to Star Operation Show Why Insulation of Neutral of Three-Phase Star-Connected Transformers Is Important

When three transformers are used on a four-wire circuit the neutral point of the transformer bank should be isolated except in special cases, says George Wagner, superintendent of distribution of the Madison (Wis.) Gas & Electric Company. That is, it should have no connection with the neutral wire of the circuit or the ground. Some companies have tried to connect the primary neutral points of transformer banks which supply comparatively large single-phase loads in addition to three-phase loads. To take care of the unbalanced load they have installed a larger transformer in the phase supplying the single-phase load. The primary neutral wire was connected with the idea that it would carry the excess primary current for the larger transformer so as to divert it from the windings of the smaller transformers.

Some laboratory tests recently made by the Madison company brought out the fact that under the conditions cited the primary neutral carried practically no current. The tests indicated that if a single-phase load is supplied from one phase of a three-phase bank of transformers the other two transformers act as one single-phase transformer operating in parallel with the transformer on the loaded phase and share the load with it. The oscillograph records showed that the current through the primary winding of the large transformer divided and part of it passed through the primary of each of the other two transformers. The current waves of the two transformers were about the same, exactly in phase and just 180 electrical degrees from the current in the transformer on the loaded phase. The tests also showed that the current in the neutral wire is practically zero so long as the voltages are balanced. As soon as the voltages are unbalanced in the secondary delta a circulating current is set up in the delta and there is a flow of current in the neutral wire of the primary circuit.

When a single-phase load is supplied from one phase of delta-connected secondaries the load is distributed over the three transformers, the transformer on that phase supplying about one-half and the other two together the other half. The exact proportions of the load supplied by each seem to depend upon the power factor of the circuit. The three transformers divide the single-phase load in about the same proportion whether the primary neutral is connected or isolated.

The results of these tests were verified in the field by testing a bank of transformers supplying a 200-amp., three-phase load and two 100-amp. spot welders connected with only one phase. Every time a spot welder was operated current was drawn from all three transformers, the current in the neutral being practically

nothing. When the voltage on one phase was varied with the feeder regulator, however, a comparatively heavy current was set up in the neutral wire.

It follows, therefore, says Mr. Wagner, that there is no occasion for making one transformer of a bank larger than the other two combined to supply three-phase power and an additional single-phase load. Inasmuch as the neutral wire carries practically no current there would be no excess current under any circumstances in the windings of one or both of the smaller transformers if the larger transformer carried full load. In determining the sizes of transformers necessary for an installation like this it should be borne in mind that the transformer on the phase carrying the single load actually supplies only about one-half of the single-phase current; the other two supply the rest.

The tests also indicate clearly that the primary neutral points of three-phase transformer banks should be isolated unless the transformers have ample capacity to take care of their regular load plus any circulating current that may be set up on account of an unbalanced voltage condition. If one phase wire should become grounded the voltage of that phase would drop on account of the heavy current, but a transformer bank with a primary neutral connected thereto would immediately tend to equalize the voltages on the three phases. The two transformers on the ungrounded phase would draw a heavy current trying to boost the voltage on the grounded phase. The probable result would be that the primary fuse on one transformer would blow and the other two would then carry the load on open delta. If the capacity of these two transformers was insufficient, they would be overloaded and would be liable to damage.

If the primary neutral point of the transformer bank is isolated, no circulating current can be caused by unbalanced voltages, but if the fuses of one transformer rupture, the other two transformers are actually in series between two-phase wires and their secondary voltages are 0.865 normal, or about 200 instead of 220. Furthermore, the voltage across the secondary and the primary of the transformer with the fuse blown is zero when the load is straight resistance or single-phase load. If there are any three-phase motors on the circuit, they may continue running and they will tend to maintain a delta voltage. If the motors are stopped, they will, as a rule, not start, because it would be equivalent to trying to start them on single-phase energy.

CAUSE OF METERS HUMMING AND THE REMEDY FOR IT

Trouble Usually Found Due to Location of Meter and Inattention to Internal Condition

BY GEORGE M. HEWITT

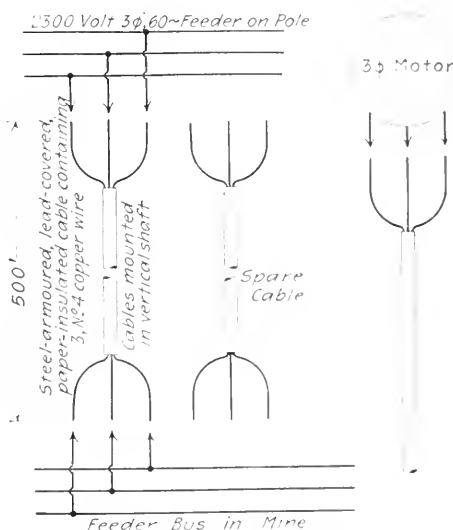
A humming meter makes an annoying noise that usually causes the customer to think that it is operating even though he has no lamps burning. Unless the meter is mounted upon a solid support, the small vibration will be amplified. Therefore, meters should not be placed upon hollow walls or thin partitions which may act as sounding boards or amplifying mediums. The meter tester can often help to reduce the noise by putting rubber washers back of the meter.

The humming of meters may be due to internal causes, for instance, loose laminations and improper assembling of operating elements, or it may be due to defects in the meter. Noise in Westinghouse meters may be caused by defective ball bearings or by the top bearing pin becoming rusted or by clogging due to dirt and dried oil in the first and second register wheels. With the General Electric meters the noise may be caused by defective top bearings, a flat jewel, a weak jewel spring or a loose light-load compensator. Other makes of meters may hum because of gummed-up top bearings, loose parts or flat jewels.

HOW A MINING COMPANY USES CABLE POTHEADS

Disconnecting Feature Employed to Save Installation of Reversing Controllers and Time in Making Emergency Connections

Two interesting and economical uses of disconnecting potheads have been worked out by N. L. Allen, electrical engineer for the American Zinc Company of Tennessee. Sometimes, in connection with the operation of its concentrator, it is necessary to reverse certain motors when the belts are thrown off for repairs.



SCHEMATIC DIAGRAM SHOWING ARRANGEMENT OF POTHEADS

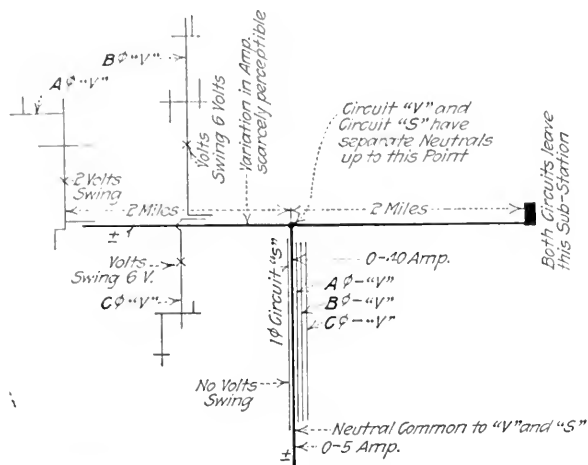
Since it is not necessary to do this very often, three G. & W. Electric Specialty Company disconnecting potheads have been installed at each motor in the three-phase leads to permit reversing the leads quickly and to avoid the necessity of reversing controllers. Of course, where the reversing of motors is more frequently necessary reversing controllers are provided. Another use of potheads is in the leads from the surface feeder to the feeder bus in the mine. The feeders on the surface, which operate at 2300 volts, three-phase, 60 cycles, are connected by means of disconnecting potheads at the pole to steel-armored, lead-covered, paper-insulated cable containing three No. 4 copper wires. These cables go down into the mine a distance of about 500 ft. (152.4 m.) to the feeder bus. A spare cable is provided for emergencies. Both of these cables are "phased out" and marked so that the potheads at both ends can be quickly and properly changed in case of damage to the operating cable.

LOCATING THE CAUSE OF VOLTAGE VARIATION

Consumers' Complaint of Flickering of Lights Leads to Extensive Investigation of Distribution System for Trouble

BY J. J. REZAB

On receiving complaints from several consumers, a central station in the Middle West discovered that an entire section of the system was affected by periodic variation in line voltage. Recording voltmeters placed in secondary circuits showed that in some instances a



SUPERIMPOSING TWO CIRCUITS CAUSES VOLTAGE TROUBLE

variation of as much as 6 volts occurred during peak hours with a frequency of 17 cycles a minute. The distribution system was fed from a substation that received its energy supply from two sources. The system consisted of three-phase, four-wire circuits with grounded neutrals and was about four miles (6.4 km.) long.

A hasty examination of the line and a review of all the power banks showed everything normal. The regulators were checked for hunting, and the compensators were tested for loose connections. It happened that a frequency changer was running idle on the line as a synchronous condenser, so a small load was placed upon the disconnected side in the hope of steadying the line; but this proved ineffectual. The primary circuits were interchanged and the neutral wire of a parallel circuit was tied to the main neutral without helping the condition of the line.

By means of a split-core current transformer the current on the neutral of one branch of the line showed a variation of from zero to 40 amp. at a periodicity of 17 per minute. The current in the phases showed no variation and the voltage did not fluctuate. Another interesting feature was that while the current in the neutral of the feeder current showed little variation, the voltage was subject to 6-volt swings. The tests at last unearthed the cause of the trouble. A single-phase circuit had been installed in the same section with a three-phase circuit, and to economize on wire only one conductor was strung for the circuit, the neutral of the three-phase system being used as the return circuit. Ordinarily this arrangement would have been suitable, but the two circuits were connected to independent sources of energy that were not in synchronism. As a

result two currents occurred in the neutral wire, one moment in opposition, causing zero current, and the next moment in the same direction, causing high current.

METHOD THAT REDUCES THE COST OF SOLDERING

Utilization of an Acetylene-Gas Supply Connected to a High-Pressure Rubber Hose Permits Access to Out-of-the-Way Locations

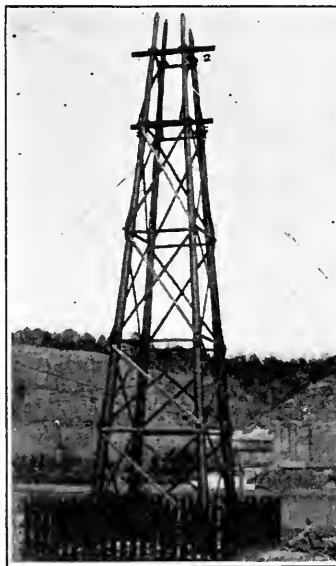
The cost of soldering lugs on cables, leads to armature windings, etc., has been reduced as much as 60 per cent by the Iowa Railway & Light Company of Cedar Rapids by using an acetylene-gas torch for this work instead of molten metal or soldering irons. The gas is purchased in tanks and is conducted to the burner used for melting the solder by means of high-pressure rubber hose. This method permits workmen to reach locations easily which would be almost inaccessible with soldering irons, and thus the labor cost involved in the soldering process is reduced to the minimum.

WOODEN TOWER FOR A LONG-SPAN CROSSING

Necessitated Because a Steel Tower Could Not Be Secured Promptly to Serve Army Camp

To supply Camp Pike with service promptly the Little Rock Railway & Electric Company had to erect a 13,000-volt transmission line within a very short period. Since the camp was on the opposite side of the Arkansas River from the company's generating station, a 2000-ft.

(606-m.) span had to be provided to cross the river. One bank of the river was about 160 ft. (48.7 m.) higher than the other, so that a relatively tall tower was required on the lower side. Not being able to secure steel towers on short notice, the company erected the wooden one shown in the illustration.



CEDAR TOWER SERVING CAMP

The tower was constructed of four 75-ft. (23-m.) red-cedar poles securely embedded in concrete and cross-braced with 6-in. (15.2-cm.) diagonals. Cross-arms, 4 in. by 6 in. (10 cm. by 15.2 cm.), were used. The total cost of the tower, which was completed in the required time, was less than one-tenth that of the steel tower of the same strength. Of course, the wooden structure will not have so long a life as a steel one would have had, but it is adequate for the purpose, as service will have to be supplied only temporarily.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

STANDARDIZING THE 50-WATT TUNGSTEN IN NEW ORLEANS

Practically No Difficulty Is Encountered in Changing from 25-Watt and 40-Watt Lamps to One of Larger Size

Within two weeks from date of delivery an initial order of 1000 50-watt tungsten lamps was entirely sold out by the New Orleans Railway & Light Company as a result of a campaign to educate the public to the value of this larger-sized lamp. It was felt that there were a great many 25-watt and 40-watt lamps in use which could be changed over to a new 50-watt lamp with better satisfaction to the consumer, and the effort was made to try to standardize the 50-watt size for household use.

As the new lamp is sold at the same price as the smaller lamp, practically no difficulty was encountered. It appeared to the public to be a chance to take a larger lamp at the same price. Further shipments of these lamps are on order and will be received at regular intervals during the rest of the year, and the campaign will be continued from time to time until this lamp is in general use.

UTILITY AND PUBLIC RECIPROCAL RELATIONS

Member of Oklahoma Commission Believes that the War Will Show How to Co-operate to Build Up Community

In a paper devoted to public relations, read before the Oklahoma Gas, Electric and Street Railway Association, A. L. Mitchell of the Corporation Commission of Oklahoma laid emphasis on the reciprocal relations that exist between the utility on the one hand and the public on the other. He closed the paper in the following words:

The most valuable asset that any public utility can have is the favor of the public that it serves. The truth of this statement is realized by most utilities at this time. Some are more successful than others in applying their realization of this fact in practice. One of the compensations in the war emergency is that the American people are forgetting supposed differences among themselves in their unanimous hostility toward the nation's enemy. With the public utilities and the public making every effort to be useful in the winning of the war, neither has time to waste in magnifying the importance of a grievance toward the other. It is likely that both will learn that if they can work best by co-ordinating their efforts toward the putting down of a common enemy, they can likewise work best by co-ordinating their efforts in the building up of the community in which they both live and in whose best success both can expect to share.

In any growing community it is necessary for all interests to experience some of the inconveniences of the pioneer. If there ever was a time when all interests and all individuals should stand shoulder to shoulder for the common betterment of mankind, it is in the present time of national emer-

gency. When the storm is over and the clouds have lifted we expect to see the fruits of unity of purpose for the betterment of mankind. If the same spirit can be perpetuated for the betterment of the community in which each individual and each utility lives, most of the trouble due to misunderstanding of the relationship between the public and the utility will have been overcome.

INTERESTING PROVISIONS OF ARSENAL SERVICE CONTRACT

Government to Pay for Extension, with Stipulations for Company to Take It Over Later as Conditioned by Revenue Received

There has recently been executed between the Edison Electric Illuminating Company of Boston, Mass., and the Watertown arsenal a contract for the supply of electric energy by the former to the latter which contains several provisions of interest to central stations in the way of furnishing service to the government at this time. About seventy new buildings are under construction at Watertown as a part of the war program, and last summer a contract was entered into between the parties named above for the supply of electrical energy based on a line capacity of not over 250 kva. at any moment. The additions to the Watertown establishment require a line capacity of 20,000 kva. at any one moment and 14,000 kva. continuously, the supply of which necessitates the installation of four underground transmission lines, each consisting of a three-conductor 4/0 13,200-volt cable, or three transmission lines in addition to that required by the contract of last summer. These lines connect the arsenal with the L Street station of the company and are to be used solely for furnishing electric energy to the arsenal, except by prior written authority of the contracting army officer. The service includes the operation of motors, electric furnaces, lamps, etc. The arsenal is about 6 miles (9.6 km.) from the L Street station.

FOUR LINES FOUND NECESSARY

Last fall it was orally agreed that three lines would be provided, but it was soon found that a fourth line would be required. On Nov. 1, 1917, the company increased its power rates by the incorporation of a coal clause, and it had previously agreed with the arsenal that the energy billed over the two additional lines should be supplied at the rate agreed upon for the first line. As the cost of the service to the arsenal would be less if the running cost of the schedule of prices were applied to a single contract than if it were applied to more than one contract, it was decided to be in the best interests of the United States to amend the contract of last summer so that the schedule of rates agreed to then would apply to all electrical energy furnished by the company to the arsenal.

The supplementary agreement provides that all of the

lines are to be installed by the company at its own expense and in locations obtained by it, except that it is to be indemnified by the United States for part of the expense of installing the fourth line. As the line capacity of 2500 kva. at any moment provided for in the contract of last summer has been increased by the supplemental contract to a capacity of 5000 kva. at any moment, the minimum yearly payment per line has been raised from \$25,000 to \$50,000, making a total minimum charge per year, when all four lines are connected to the arsenal, of \$200,000; but the arsenal is not required to pay the minimum annual rate provided for the fourth line, viz., \$50,000 per year, unless and until the company shall have repaid to the United States the latter's investment in the fourth line as follows:

The United States agrees to pay the Edison company the actual amount paid by the latter for the transmission-line cable used in the fourth line installed complete ready for service, including all testing, teaming, freight and handling charges, and an additional allowance of 3 per cent of the amount so expended by the company to cover the engineering expenses of the company exclusive of duct and manhole costs and not exceeding \$120,000. The company agrees to pay 4 per cent interest on the total amount paid by the United States. The cable installed under these provisions becomes the property of the United States, but so long as it is required for the purpose of supplying energy to the arsenal it can be used by the company for that purpose only without further payment to the United States than the interest above mentioned. If and when, before Jan. 22, 1921, the United States shall have paid the company \$500,000 for electrical energy, the company is then to repay to the United States the amount paid for the fourth cable, which thereby becomes the property of the company; but the company is not obliged to repay this amount, except at its option, before Jan. 22, 1920, although before then the United States may have paid the company over \$500,000 for energy.

FINAL PROVISIONS OF CONTRACT

If the supplemental contract is not extended on Jan. 22, 1920, and the United States has not then paid the company a total of \$500,000 for energy, or if the contract is extended and at the end of three years the United States has not paid the company this total for energy, so that the company is not obliged to repay the amount paid out by the United States for the fourth cable, then the company is to take the title to the cable and pay the United States such an amount as under all the circumstances shall be fair, considering the entire investment which the company has been required to make in order to supply the entire service required by the original and supplemental contracts, the length of time the company furnished energy to the arsenal, the amount of revenue received for this energy, etc. If the parties cannot agree upon a fair amount, the matter is to be referred to the chief of ordnance, United States Army, for determination, and if his determination is not accepted, arbitration is to follow.

All transmission-line cables and associated ducts which are within the arsenal premises and the meters, transformers, service switches and other apparatus usually installed by the company are installed by it in this case but become the property of the United States, which is to pay the entire cost to the company. Reason-

able access to the meters, etc., is provided the company under proper regulations. The switching apparatus installed by the United States in its substation at the arsenal is required to be of a design approved by the central-station company.

SPECIAL CONTRACT FOR HOUSING OF EMPLOYEES

Homes Built for Workmen of Tire Company Are Equipped with Electric Ranges Which Give Satisfaction to Both Builder and Tenant

The Industrial Securities Company, Chicago, which is attending to the housing of employees of the Perfection Tire & Rubber Company, Fort Madison, Iowa, has just completed the construction of twenty-one houses containing every modern convenience, including arrangements for electric cooking. When the question of utility service for these houses was approached it was discovered that the local gas company was not in a financial condition to attend to the wants of the home builders. The local rate for electric service was then 8 cents per kilowatt-hour, the company receiving its energy from Keokuk, Iowa, 20 miles (32 km.) distant.

Arrangements were made with the Fort Madison Electric Company, however, to take the business on a contract, from which the following is an extract:

"The first 7 kw.-hr. per counted room at 8 cents per kilowatt-hour. All energy consumed in excess of this amount at 3 cents per kilowatt-hour. Counted rooms for rate-making purposes include the billiard room, bedrooms in excess of three, dining room, dressing room, garage, conservatory, ballroom, kitchen, library, living room, music room, nursery, office, parlor, reception room if larger than 120 sq. ft. (10.8 sq. m.), sewing room, stable and studio. Rooms not counted include the alcove, attic, bathroom, bedrooms (first three), cellar, closets, coal bins, den, garret (if unfinished), hallways, unfinished rooms, sleeping porch, sun parlor and reception hall if smaller than 120 sq. ft."

It was figured that a family of four or five persons occupying a home of three counted rooms should be able to do cooking, washing, sweeping and lighting electrically through the use of 90 kw.-hr. per month. The use of 90 kw.-hr. billed at the foregoing rate would amount to \$3.75, making an average rate of 4.16 cents per kilowatt-hour. The rate, of course, would be different for houses of different sizes, as the houses constructed have ranged from four to eight rooms each and the families average about five persons each.

When the first unit of ten houses was constructed Standard electric ranges were installed. This installation was completed in December, 1917. The first monthly accounts averaged \$4.50 per month per customer. Since that time the housewives have had more experience with electric cooking, and for the last two months the bills have averaged \$3.85 per customer per month. These housewives have found that the fireless cooker attachment of the range is a great electricity saver.

All houses in the second unit constructed contain Hughes electric ranges.

A. H. Burg of the real estate department of the Industrial Securities Company, in speaking of this installation, stated that most of the families have electric irons, electric washers and vacuum cleaners. For

convenience, the company has installed baseboard outlets in practically every room in all of the houses.

Mr. Burg said further: "We consider that by using electricity in these houses and making liberal use of extra outlets for labor-saving appliances we are giving our working people greater assistance in housework than by the adoption of any other arrangement known at present. The women living in these houses are very well satisfied, which makes for harmonious industrial relations.

"Considering the price of electric ranges and the cost of installations, we do not believe the investment as expensive by 20 per cent as if we had installed gas and bought gas ranges. The electrical installations in these houses were handled just the same as plumbing fixtures. They were purchased by the builders of the houses and are sold with the houses to the tenant as a part of the regular equipment under a general part-payment plan. Under this plan the tenant pays for all of the electricity as well as the water used during his occupancy."

THE MARGIN OF RESERVE CAPACITY IN WAR TIME

Record of Reliability Must Not Fail, Nor Must Central Stations Be Made to Distinguish Between Essential and Non-Essential Customers

In view of the difficulty of securing funds with which to carry forward central-station plant developments looking toward substantial capacity increases, coupled with long and uncertain deliveries of installation of generating equipment for ordinary commercial service, the question of allowable reserve capacity assumes more than usual interest and importance. A great deal of thought has been expended upon the safe allowance for reserve which a central station should plan to maintain, and a widely acceptable expression of this allowance is found in the custom of retaining a reserve equal in rating to the largest generating unit of the station. The question now is, shall a closer margin be permitted in view of the relatively large amount of war business being served by the central stations, its non-permanent character and the willingness, for the present at least, of ordinary users to suffer some inconvenience in case of plant trouble?

At a recent round-table conference of the managers of a group of central stations this question was discussed at some length. The point was made that the war business must be served first, last and all the time, and that it exercises an absolute priority against ordinary commercial service. The view was advanced that a central station should go very slowly at present in increasing its capacity except for war service, and that the reserve capacity may properly be allowed to decrease considerably before the utility draws upon the resources of the manufacturers and the bankers for plant enlargement for commercial demands pure and simple. In case of a failure of units, partial or complete, the argument ran, let the war service be supplied first, and if trouble makes it necessary for the commercial service to be cut off to a greater or less degree until repairs can be effected, let the consumer of said commercial service do the worrying. Then when the war is over the amount of invested capital to be carried in plant will be less than if expansion had followed the ordinary

lines, and in the meantime resources will be more effectively devoted to purely war purposes.

As soon as the central-station manager attempts to classify his customers as essential and non-essential to the war work of the country, he takes upon himself an exceedingly heavy responsibility and a most difficult task. The whole central-station industry has been built up on the basis of a remarkable record for reliable service, and so far as possible this record should not be allowed to fall off during the war period. It is unquestionably true that the munitions plant should be the first to be supplied with service in case of trouble, but surely the efforts of the central station should not stop here. A conservative policy with respect to taking on new business is one thing, and cutting off or threatening to discontinue existing customers is another. Expansion of plant must proceed to-day along lines with which the government is in sympathy, but even more in serving war customers is a substantial reserve in plant capacity most desirable. Through the practice of economies in operation the existing equipment can be made to do much more work in many cases than before; and through interconnection for energy interchange between adjacent plants, no matter whether of common or unrelated ownership, a good deal of reserve capacity formerly held against the "rainy day" in a particular station can be released for other uses. Here, indeed, will be the probable solution of not a few plants seeking to maintain a safe reserve in the face of what is almost a governmental interdiction of local station expansion along the orthodox lines. As the amount of war business to be handled grows, new equipment must of course be added in many cases, and if interconnection, extending in some instances to local mill plants and even to office-building and similar power installations, is worked out along proper engineering lines, the bogie of the shrinking individual reserve will tend to disappear, and along with this advance will go a maintained service reliability which will always be the pride of the industry.

NO FREE RENEWALS FOR SMASHED LAMP BULBS

The Boston Policy of Placing Burden of Careless Breakage on Customer Has Worked Out Satisfactorily

The Edison Electric Illuminating Company of Boston, which has been very liberal in regard to broken and lost lamps, has found that present-day conditions have made certain economies necessary, among them being a change in lamp policy outlined in a notice sent to customers which stated that on and after Feb. 15, 1918, a charge would be made for lamps replaced where the glass is broken. This does not change the renewal service furnished by the company, but places the burden of careless and excessive breakage on the customer.

The handling of broken lamps under the new rule has been in effect now for more than two months with remarkable success, the company states, and is operating with notable smoothness. The customers seem to appreciate that property furnished for their use by the company must be properly handled and receive due care in order to prevent its unnecessary destruction.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press,
of the World

Generators, Motors and Transformers

Alternating-Current Asynchronous Motors with Short-Circuited Rotors.—J. A. MONTELLIER.—Practical notes upon the theory and performance of these machines, the use of which in silk-weaving and similar factories was recently advocated in the same journal. *L'Industrie Electrique*, April 10, 1918.

Induction Generators with Phase Advancers.—Dr. Kapp in the discussion on L. B. Wedmore's paper at the Birmingham meeting of the Institution of Electrical Engineers made a strong plea for the use of induction generators in conjunction with synchronous generators and phase advancers to simplify and reduce the cost of protective devices and switch gear of large generating stations. The phase advancers would enable the induction machines to take their fair share of the reactive component of the load. In the editorial comment on this paper it was stated that the reliability of the phase advancer must be considered in comparison with the exciter. The use of governors with induction generators, the mechanical difficulties arising from small air gaps of the induction machine, the need of a laminated rotor, the loss in the end bells due to induced currents of slip frequency, and so on, must also be considered. Where it is merely a matter of supplying reactive current, it is probable that the future great demands will be made on the rotary converter rather than on the induction generator, and when the adoption of the latter machine to simplify switch gear does prove feasible, it should be seriously investigated before action is taken.—*London Electrician*, April 5, 1918.

Standardization of the Ends of Electric Motor Shafts.—A step toward further standardization has been taken by the electrical constructors of France in adopting uniform dimensions for shaft ends. A table of these is given.—*Revue Générale de l'Electricité*, April 13, 1918.

Mechanical Design and Specifications of Turbo-Alternator Rotors.—S. F. BARCLAY.—Concluding paper on the subject read before the Institution of Electrical Engineers. In this section the design of rotor end bells is described, together with the best methods available for procuring adequate ventilation.—*London Electrician*, March 29, 1918.

Ventilating System for Steam Turbine Alternators.—E. KNOWLTON and E. H. FREIBURGHUSE.—The power output which can be obtained from generators depends for the most part on the dissipation of heat in the machine. While natural ventilation methods are adequate for generators driven by slow reciprocating engines, a greatly increased amount of air is required owing to the change in the method of operation. Excessive temperature shortens the life of the insulating material, decreasing it in proportion to the temperature and the time during which it is maintained. Curves are given which show the percent of rated loads which turbine

alternators can carry as a function of the temperature of the entering air.—*General Electric Review*, April 1918.

Elementary Principles of Continuous-Current Armature Windings.—F. M. DENTON.—This is an article continued from the issue of April 5, in which continuous-current armature windings are classified and the derivations of the usual winding rules are developed by a simple method based upon an understanding of the well-known Gramme ring type. The rules governing multiplex, single re-entrant, treble re-entrant and series-parallel windings are also considered.—*London Electrician*, April 12, 1918.

Lamps and Lighting

High Candle-Power Projection Incandescent Lamps.—A considerable amount of work on the design of incandescent lamps for projection work has been carried out of late. According to a recent contribution by O. Kruh in *Elektrotechnik und Maschinenbau*, it has now been found possible to make lamps taking up to 200 amp. and giving 30,000 to 40,000 hefner candles. While even 100,000 candles is considered practicable, the chief limit is the size of the lamp bulb. The great difficulty hitherto in constructing such high-candle-power lamps has been with the leading-in wires. It is not easy to secure an air-tight joint for such high currents, but according to the author this can be done by a special method, which, however, he does not disclose in this article. Such lamps work at about 0.25 watt per candle (hefner). The filaments are mounted in the form of straight bars, as close together as possible, and their useful effect is increased by the use of concave mirrors behind the filaments, the latter being at the center of curvature of the mirror. The mirror can be so adjusted that the image of the filaments completely covers the interstices between them.—*London Electrician*, April 12, 1918.

Generation, Transmission and Distribution

Electric Power Supply and Coal Conservation.—The problems which would be involved in assembling more than 600 segregated districts into a comprehensive system, in selecting sites for the proposed super-power stations and in combining by-product plants with the generating plants are subjects discussed in this article, which represents a discussion on the interior report of the coal conservation sub-committee on electric power supply of Great Britain.—*London Electrician*, March 29, 1918.

Some Advantages of Central-Station Service.—W. S. BUCHANAN.—The prevalent practice to-day is toward centralization of energy production and the elimination of the isolated-plant idea, with the object of effecting substantial economies in both operating costs and fixed charges. This article discusses this subject in detail.—*The Central Station*, April, 1918.

Ventilation System for Steam-Turbine Alternators.—E. KNOWLTON and E. H. FREIBURGHUSE.—The cause of moisture condensation on the internal parts of the generator and the means of preventing this troublesome condition are discussed.—*General Electric Review*, May, 1918.

Types of Electric Motors, Their Construction and Characteristics.—GORDON FOX.—Some desirable features that should be embodied in a motor are outlined to assist in the selection of machines from the standpoint of mechanical design and construction. The subject is discussed under the following headings: Pole pieces and armatures, the commutator, windings, brush-holders and brushes, and bearings.—*Power Plant Engineering*, May 1, 1918.

Control of Large Amounts of Power.—E. B. WEDMORE.—Protection of systems in which a large amount of power must be generated and distributed was discussed in a paper read by the author before the British Institution of Electrical Engineers. The chief subject dealt with was limitation of disturbances by sectionalizing and by the employment of reactances. Under the latter head generator reactances, feeder reactances and busbar reactances were considered. Improvements of power factor, the interconnection of stations, influence of live load on short-circuit current and limiting disturbances by the use of protective relays were other subjects discussed. The appendix gives the rupturing capacity of oil switches, rating of reactances, desirable arrangement of busbars, the value of busbar reactances in limiting current, the extent to which load can be transferred through reactances, considerations that should be taken into account in designing current-limiting reactances, etc. Diagrams are given showing the force exerted on parallel conductors carrying current, a typical oil switch and a typical isolated switch subject to large forces and small forces. Various curves showing the effect of different methods of reducing short-circuit current are also given. An arrangement permitting the maximum transfer of load is illustrated. The author says that from experience with stations designed in recent years and having a maximum short-circuit current of ten times their normal rated output, it is necessary that the smallest current transformer on the main switch-board should have a carrying capacity of not less than one-twentieth of the station output.—*London Engineering*, April 19 and 26, 1918.

Standardized Flexible Distribution Systems in Industrial Plants.—BASSETT JONES.—The second and concluding article on the subject gives the method of installing a lighting system in the new factory of the Sprague Electric Works at Watsessing, N. J. The arrangement of the entire system is produced and photographs of the installation are given.—*General Electric Review*, April, 1918.

Joining High-Tension Underground Cables.—While cables laid in bad condition may give good service for years, faulty joining will probably cause constant trouble. Three things are necessary in this connection—a good union of the conductors, insulation of the joint, and protection of the joint against dampness. Apart from accidental defects, the most common causes of destruction are external injury, chemical action, electrolysis, earth slides, floods, vibration and overten-

sion. The author considers the best means of combating these sources of injury, including two methods of protection against electrolysis—first, connecting the lead sheath to earth; second, the insulation of the sheath from the earth.—*Boletín de la Asociación Argentina de Electro-Técnicos* (Buenos Aires), February, 1918.

Installations, Systems and Appliances

Electric Winding Engine.—JOHN F. PERRY.—The chief systems of electric winding are briefly described and their merits compared with the steam methods. Eight alternative schemes are presented. The distribution of energy losses and working and initial costs are analyzed by the aid of diagrams. A table is given showing the performance of electrically driven winding engines, giving the depth of the pit, the output per ton-hour, net load, etc.—*London Electrician*, April 5, 1918.

Electrophysics and Magnetism

Photoelectric Effects on Mercury Droplets.—JOHN B. DERIEUX.—It has been shown that never more than one elementary charge at a time is detached from a neutral air molecule by primary or secondary X-rays. It seems probable that in the photoelectric effect on mercury droplets two electrons are never liberated at the same time, and that when two liberations appear to be simultaneous there are really two distinct liberations, the interval between them being too short for the observer to separate them. In investigations with mercury droplets subjected to long wave lengths the lines were too faint to give a rapid discharge even with the collimator slit open wide and the lamp operating on high energy owing to the minuteness of the droplets. The long wave-length limit evidently lies between 253.5 μ . and 312.6 μ .—*Physical Review*, April, 1918.

Young's Modulus of Drawn Tungsten.—H. L. DODGE.—This paper is the fourth of a series upon the effect of temperature on the elasticity of tungsten wires. Tests were made upon a piece of drawn tungsten wire containing approximately 99 per cent tungsten and 1 per cent thorium. The Young's modulus of drawn tungsten was found to be 35.5×10^{11} dynes per square centimeter at 20 deg. C. The modulus decreases uniformly with increase of temperature up to 1000 deg. C., at which temperature it is 32.3×10^{11} dynes per square centimeter.—*Physical Review*, April, 1918.

Theory of the Oscillations of the "Singing" Arc.—LIEUT.-COL. J. B. POMEY.—The author works out a problem to show what the amplitude of the oscillating current of the "singing" arc depends on and gives a formula by which a close approximation to the value of the efficient intensity of the singing oscillatory current may be derived.—*Revue Générale de l'Electricité*, April 20, 1918.

Electrochemistry and Batteries

The Fixation of Atmospheric Nitrogen.—In the *Zeitschrift des Vereines Deutscher Ingenieure*, H. Andriessens describes an arrangement working on the same principle as the Birkeland furnace for obtaining nitrogen by the direct combustion of air and for which 80 per cent higher output is claimed by the adapter. In the Andriessens furnace it is the aim to obtain the maximum linear extension of the arc and the minimum flame surface, on the ground that the reaction velocity

between nitrogen and oxygen is extraordinarily high, so that the sooner the products can be removed from the flame zone the less the extent to which dissociation will occur. The nitric oxide should be cooled down in the shortest possible time, the writer says, but previous methods do not take account of this requirement. To obtain the maximum length arc with the smallest flame surface an air blast is delivered between two vertical rod electrodes set below but in the same vertical plane as the line joining the poles of a powerful electro-magnet. The net result of the air blast and magnetic field is to spread the arc over a surface limited by a helix which may have a pitch of only a few millimeters. The air velocity may be four times that usual in the Birckland furnace. From a 35-kw. furnace the yield may be 70 gm. (referred to 100 per cent nitric acid) as compared with 30 gm. to 45 gm. from a Birckland furnace of equal power, it is said.—*London Electrical Review*, April 12, 1918.

The Storage-Battery Industry.—L. JUMAU.—In this article, which is a sequel to others published in the *Revue Générale de l'Electricité* for Aug. 4 and Oct. 6, 1917, the author describes the principal processes used in making electrodes for lead storage batteries and the different methods employed for mounting them. He sums up the results that may be obtained with storage batteries such as ampere-hour capacity, life of the electrodes, etc.—*Revue Générale de l'Electricité*, April 20, 1918.

Units, Measurements and Instruments

Losses in Sheet Iron at High Frequencies.—MARIUS LATOUR.—In this study, communicated to the International Society of Electricians in its session for 1918, the author determines the power dissipated separately in the form of Foucault currents and hysteresis in a sheet of iron, admitting that there is a constant angular retardation between the induction in the iron and the field which produces it. From this he deduces the thickness which the sheet iron of an apparatus fed by a high-frequency current ought to have in order that the minimum total power should be dissipated. Then he calculates the extent to which the voltage and the current in the circuit of a self-inductive coil are out of phase.—*Revue Générale de l'Electricité*, April 13, 1918.

Miscellaneous

Hydroelectric Power—Its Relation to Industry.—J. A. JOHNSON.—The author says: "The nation is facing the greatest crisis in its history, not only in a military sense, but in a political and economic sense, and we are on the eve of a great development of the hydroelectric power resources of this country." He then goes on to outline different types of hydroelectric development, pointing out how some have uniform continuous flow of water and others have variable flow, discusses the cost of developing hydroelectric power and calls attention to the results of failure to co ordinate power developments and industrial applications.—*Metallurgical and Chemical Engineering*, May 1, 1918.

The Electric Commercial Vehicle.—The electric truck is desirably fulfilling service requirements due to the increased capacity and improved operation obtainable with present storage batteries. A vehicle equipped with a standard battery and having a carrying capacity of 1000 lb. to 1500 lb. (453 kg. to 680 kg.) will run about 50 miles (80 km.) on one charge, while the larger

sizes carrying from 3 tons to 5 tons will travel from 35 miles to 40 miles (56 km. to 64 km.). The lack of battery-charging facilities that heretofore existed has now been overcome considerably, and there is no doubt that the commercial electric vehicle is here as a permanent transporting medium. The running costs of this type of electric vehicle are low in spite of the fact that the initial outlay is higher than for either steam or petrol wagons. The depreciation on an electric vehicle may be figured at 10 per cent, while 15 per cent is reasonable for the petrol wagon.—*London Engineer*, April 12, 1918.

How the Electric Truck Releases Men for Productive Work.—F. C. MYERS.—Seven examples show how as many as several hundred men have been released from the work of handling material in industrial plants through the installation of carrier and tractor trucks each of which has its field of application and operates economically under certain conditions. The carrier trucks carry their load, while the tractor trucks pull their load along. Neither type depends on tracks or special roadway. Grades up to 15 per cent can be negotiated without trouble, but the steepness of the grade will, of course, decrease the weight that can be carried or hauled. In some instances wooden runways and concrete yard roadways are desirable. The average cost of operation for a ten-hour day is approximately \$1.20 in the plants referred to, including interest, depreciation and maintenance.—*Industrial Management*, April, 1918.

Fuel Problem in the Middle West.—A. A. POTTER.—That future emergencies can be averted by more adequate fuel storage, by greater attention to fuel economy, by the more careful regulation on the part of the government of the quality of fuel leaving the mines and by bettering fuel-transportation facilities is the opinion of a number of power plants in the Middle West, says the author. The larger power plants are expecting to store greater amounts of coal than usual. Some plants expect to provide storage capacity sufficient for thirty days. Spontaneous combustion has caused some difficulty in storing many of the Middle Western bituminous coals, but storage under water will be used to a considerable extent. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, states that in addition to the investment in land for storage facilities and the railway improvements attached thereto there is considerable expense in carrying coal over year after year; but even this outlay and expense is warrantable from a business point of view. A detailed study of coal-car movements in the Middle West during the past four years discloses the fact that the average time required to move cars is extremely long. In most cases cars carrying coal will average less than 20 miles (32 km.) per day. When this time is added to the time required for empty cars to return to the mines, it is evident that the coal tonnage handled per car per year is very limited and very much smaller than reasonably efficient operation should produce. This delay is partly blamed upon the railroads for throwing cars on sidings and into yards with unnecessary switching, instead of delivering them to their destination in one or two hauls. Pooling of engines, cars and routes and routing coal so as to avoid large cities will tend to improve the situation.—*Journal of the American Society of Mechanical Engineers*, May, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

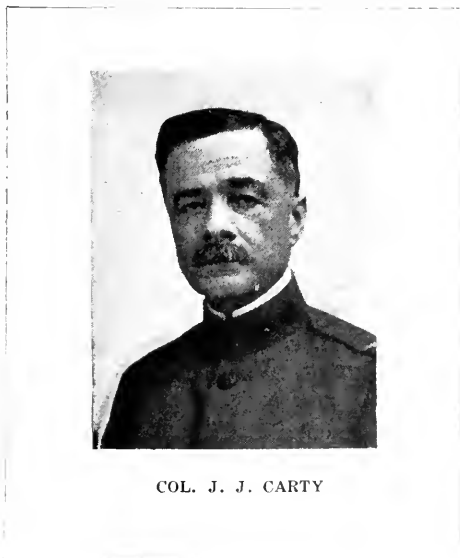
PRESENTATION OF EDISON

MEDAL TO COLONEL CARTY

Chief Engineer of the American Telephone & Telegraph Company, Now Serving in the Army Signal Corps, Receives Honor

A large audience, gathered in the Engineering Societies Building, New York, at the annual meeting of the American Institute of Electrical Engineers on May 17, witnessed the presentation of the eighth Edison medal to Col. John J. Carty of the United States Army Signal Corps, chief engineer of the American Telephone & Telegraph Company. The award of the medal to Colonel Carty for his work in the science and art of telephone engineering was announced in the *ELECTRICAL WORLD* of May 4, 1918.

Those to whom the medal has been awarded in previous years are Elihu Thomson, Frank J. Sprague, George



COL. J. J. CARTY

Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell and Nikola Tesla.

Dr. A. E. Kennelly, professor of electrical engineering at Harvard University and Massachusetts Institute of Technology, told of the history and significance of the medal.

Dr. Michael I. Pupin of Columbia University said: "Carty's life is filled with romance. He never went to college. At the age of eighteen, when other boys entered college, he entered the service of the American Bell Telephone Company and at the age of twenty-eight became chief engineer of the great New York Telephone Company."

E. W. Rice, Jr., president of the Institute, made the formal presentation of the medal.

In accepting the medal Colonel Carty gave credit for the American telephone achievements to the engineers who have been associated with him in the Bell system

and paid a tribute to Major-General George O. Squier, chief signal officer of the United States Army.

The newly elected Institute officers, who serve during the administrative year beginning on Aug. 1, 1918, were the directors' nominees, as follows:

President—Prof. Comfort A. Adams, Harvard University and Massachusetts Institute of Technology, Cambridge, Mass.

Vice-presidents—Allen H. Babcock, San Francisco; William B. Jackson, Chicago; Raymond S. Kelsch, Montreal; F. B. Jewett, New York; Harold Pender, Philadelphia; John B. Taylor, Schenectady, N. Y.

Managers—G. Faccioli, Pittsfield, Mass.; Frank D. Newbury, Pittsburgh; Walter I. Slichter, New York.

Treasurer—George A. Hamilton, Elizabeth, N. J.

WESTINGHOUSE BUSINESS

TOTALS LARGE FIGURES

Value of Unfilled Orders on April 1, 1918, Is \$147,000,000, of Which \$110,100,000 Is for Regular Products of Company

Evidence of the large demand upon electrical manufacturing companies is shown by the statement in the annual report of the Westinghouse Electric & Manufacturing Company that, as of April 1, 1918, the value of unfilled orders in hand was \$147,857,580. Of this amount \$110,185,007 was for regular products of the company. On March 31, 1917, the value of unfilled orders for regular products of the company was \$39,776,739. Sales billed in the fiscal year ended March 31, 1918, by the company and its proprietary companies, except the New England Westinghouse Company, aggregated \$95,735,407. This total compares with \$89,539,442 in the preceding fiscal year. The amount of sales billed, as stated for the year just ended, includes shipments since June 15, 1917, from the machine works (formerly Westinghouse Machine Company), also \$4,536,000 for munitions.

"The volume of sales billed for the regular products of your company," says Col. Guy E. Tripp, chairman of the board of directors, "was greatly in excess of any previous year."

In mentioning the large total of unfilled orders in hand, Colonel Tripp adds: "No facilities heretofore employed on regular products are engaged on munition work."

Colonel Tripp said in part in speaking of the work and changes of the year:

The plan referred to in the report for last year for the merger of the Westinghouse Machine Company with your company was made effective as of June 15, 1917. The accounts of the two companies were consolidated on a basis that resulted in no change in the surplus of your company because of the merger.

The property and plant account includes expenditures during the year in connection with the new plant known as the Essington Works, located near Philadelphia, to which reference was made in the report for last year. This plant,

which is now completed and nearly equipped, is operating with a force of about 3000 men, which it is expected will be increased to approximately 5000 during the year. Contracts with the United States government for equipment for cargo ships will occupy the capacity of this plant for approximately two years.

Another important improvement completed during the year is a factory at Trenton, N. J., for the manufacture of incandescent lamps. This factory has been in operation for some months.

The increase in investments includes a subscription for Liberty loan bonds of the second issue, the only other important additions being the capital stocks of other companies acquired under the merger of the Westinghouse Machine Company and your company.

In the latter part of 1916 a proposal was submitted to your directors for the purchase of a small portion of your holdings in the British Westinghouse Electric & Manufacturing Company, Ltd., in order that a controlling interest might be transferred from the United States to England. After careful consideration your directors concluded that the commercial position of the British Westinghouse Electric & Manufacturing Company, Ltd., would be improved if the control of that company were owned in England instead of the United States, but decided that the sale of your entire holdings was the only satisfactory solution of the situation. Accordingly negotiations were concluded under which your holdings of 4 per cent debenture stock and preference and ordinary shares in the British company were sold to a syndicate formed in London (Electric Holdings, Ltd.) and payment therefor has been received in 5 per cent prior lien debenture bonds maturing in ten years. These bonds are secured by the pledge of all the said securities sold and certain other additional collateral. This change in your investments was made without change in book values and has, therefore, not affected the balance sheet.

Certain new trading agreements of mutual advantage have been entered into between the British company, Electric Holdings, Ltd., and your company. The great increase in the demand for the regular products of your company, as shown by the volume of business completed during the year and by the volume of orders in hand, has required large increases in working and trading assets.

The consolidation of accounts resulting from the merger of the Westinghouse Machine Company with your company brings into the balance sheet this year the outstanding balances of bonds and debentures issued by the Machine company. The total of the annual sinking fund requirements with respect to all these issues is \$150,000.

Your company's ten-year collateral notes, aggregating \$2,720,000, maturing Oct. 1, 1917, were paid and the collateral has been returned to the treasury of the company. Additional notes of the issue of fifteen-year 5 per cent notes due Jan. 1, 1924, were offered during the year and redeemed, leaving only \$52,500 outstanding of the several issues of notes made in 1909.

Reference has already been made to the large increases in inventories made necessary by the unprecedented volume of your company's business. As a result your company during the year increased the total of its outstanding notes payable by \$12,282,301, the total amount of notes payable outstanding as of March 31, 1918, being \$30,186,051. This includes \$15,000,000 one-year notes and \$2,433,551 on account of Liberty loan bonds subscribed for by your company and its employees.

In the report for last year you were advised of a modified agreement made with the British government with respect to the contracts for the manufacture of Russian rifles. The New England company under this modified agreement was regularly producing rifles in excess of the originally estimated capacity of its plants, but when slightly more than 1,000,000 rifles had been delivered, and probably because of the conditions arising in Russia resulting in the withdrawal of that country from the war, the British government in December, 1917, exercised its privilege of cancellation of the undelivered part of the contracts. However, almost simultaneously with the receipt of this notice of cancellation inquiries were received from the United States government as to the manufacture by the New England company of heavy Browning machine guns. Negotiations resulted in the receipt of orders from the United States government, thus

enabling the New England company to retain its organization, not only to its own advantage but especially to the advantage of our government in having available for immediate use both manufacturing facilities and a trained organization for the production of machine guns. Deliveries began in April and are in advance of the schedule fixed by the contract.

The cancellations of the Russian rifle contracts resulted in your company sustaining the full loss of \$5,000,000, against which a reserve in that amount was set aside last year. Your directors therefore authorized the absorption of this amount in said reserve. The necessary entries were made as of Dec. 31, 1917, so that the books of your company as of March 31, 1918, include no accounts relating to the contracts for Russian rifles.

The entire outstanding capital stock of the New England Westinghouse Company is owned by your company and is carried at a valuation considerably below the estimated value of its real estate and buildings and other assets which are free of all indebtedness or encumbrance of any nature. The contracts with the United States government for machine guns are on a cost plus basis.

The abnormal conditions prevailing during the year called for unusual effort on the part of the officers and employees of your company. The board of directors has pleasure in hereby expressing its appreciation of the efficient manner in which the unusual conditions were met and the general devotion to the company's interests evidenced throughout the year.

The income account for the last year follows:

Gross earnings—Sales billed.....	\$95,735,407
Cost of sales—Factory cost, including all expenditures for patterns, dies, new small tools and other betterments and extensions; also depreciations of property and plant, inventory adjustments and all selling, administration, general and development expenses and all taxes.....	80,225,937
Net manufacturing profit.....	\$15,509,470
Other income—interest and discount.....	\$308,835
Dividends and interest on sundry stocks and bonds owned.....	903,559
Miscellaneous—royalties, etc.	112,869
	1,325,263
Gross income from all sources.....	\$16,834,733
Deduction from income—interest on bonds and debentures	\$303,917
Interest on notes payable.....	1,108,046
Miscellaneous interest	17,089
	\$1,429,052
Net income available for dividends and other purposes	\$15,405,681

The surplus as of March 31, 1917, \$18,105,298, was increased by the net income of \$15,405,681 for the year, making the gross surplus \$33,510,979.

In addition to the regular quarterly dividends at the rate of 7 per cent per annum on the preferred and common stocks, a special "Red Cross" dividend was paid, making a total of \$5,610,848 for all dividends paid during the year.

Special appropriations were made for the protection of inventory book values and to establish a research and development fund. After deducting these appropriations and other miscellaneous adjustments the net surplus as of March 31, 1918, is \$26,404,694, an increase of \$8,299,396 over the net surplus as of March 31, 1917.

Damage by Tornado in District of Iowa

A tornado twisted through Newton, Iowa, on Tuesday of the present week. Some damage was done to the buildings of several washing-machine manufacturers, but a representative of the ELECTRICAL WORLD telegraphs from that district that these companies will make deliveries as usual and that output will be curtailed for only a few days. The electric central station was not injured, but the damage to poles and lines is estimated at \$5,000. Telephone and telegraph lines were also damaged.

WATER POWER COMMITTEE BEGINS TO FRAME BILL

W. H. Onken, Jr., Shows that Industries Depending on Hydroelectric Energy Are Far More Valuable than Generating Systems

The joint water-power committee of the House of Representatives has begun the framing of the bill which will be based upon the so-called administration water-power bill and is to be reported to the House in the form of an amendment to the Shields bill passed by the Senate some time ago.

It was intended last week that hearings should continue for the benefit of some members of the House who desired to be heard, but the committee decided to close the hearings and held the record open only for the insertion of a statement prepared by William H. Onken, Jr., editor *ELECTRICAL WORLD*, who had attended all of the hearings, and who, because of the unbiased position in controversy of the editor of the *ELECTRICAL WORLD*, it was felt, could treat of subjects which had not received much attention at the hearings. Mr. Onken's statement ended the taking of testimony.

It is not known in Washington when the bill will be reported to the House. A number of points, it is stated at the office of the committee, have been tentatively agreed upon, but it is expected that there will be much discussion over a proposal being made by Representative Anderson of Minnesota and Representative Raker of California that the commission provided for in the bill shall consist of more than the Secretaries of War, Interior and Agriculture. It is stated that these Representatives are urging a commission of five, two members to be experts in water-power legislation and administration, although not necessarily engineers.

A COMMON FALLACY

In Mr. Onken's statement he pointed out that it is a fallacy to believe that in granting a license to develop water power the government is parting with something that is very valuable, for, he said, the value rests not in the water power itself, nor in any great measure in the electricity generated from it, but to an enormous degree in the industries, cities, farms and homes dependent on electricity as a modern necessity. The industries depending upon electricity are infinitely more important, he said, than the electric generating systems. He directed attention to the enormous savings made possible by hydroelectric development, and said that during 1917 540,000,000 tons of bituminous coal were mined, requiring the employment of more than 500,000 men and for its shipment the movement of hundreds of thousands of cars and locomotives.

"Since on the average it requires 1000 tons of coal to produce 125 hp.-years of electricity," Mr. Onken said, "35,000,000 undeveloped water horsepower put to use would save the necessity of mining 280,000,000 tons of coal per annum and the labor of from 500,000 to 700,000 men." These men, he said, would be available for military and industrial purposes.

Mr. Onken also said:

"As typifying what hydroelectric development means to a community and at the same time showing the enormous waste caused by non-development, the case of Niagara Falls is unique. The mighty cataract alone, not including the rapids, is capable of developing

5,000,000 hp. This, if sold at the modest rate of \$20 a horsepower year, or what is equivalent to 3 mills per kilowatt-hour, would yield a revenue of \$100,000,000 per annum. This amount of money is equal to a 5 per cent return on an investment of \$2,000,000,000, and yet what government would spend that stupendous amount of money to reproduce the spectacle? It is true, we have power companies which develop a fraction of the power available, but the roar of Niagara is as nothing compared to the din of the industries set in motion by the electricity generated from only a fraction of the water in the cataract.

THE SITUATION AT NIAGARA FALLS

"At Niagara Falls are the greatest electrochemical industries of the world. More could be established there if more power were available, but because of the shortage of power many have been forced over into Canada and still others have gone abroad. These electrochemical industries are of vast importance to this nation. They started at Niagara Falls and for the greater part they still remain, handicapped as they are for want of electricity. On these electrochemical industries depend numerous other industrial establishments throughout the country, valuable in times of peace, but infinitely more valuable in the critical times of war.

"First of the electrochemical enterprises in point of electric power requirements is the aluminum industry. Next in line come the ferro-alloy compounds, including ferro-silicon, ferro-chromium, ferro-molybdenum and so on. The next electrochemical industry in point of size is devoted to the manufacture of calcium carbide, used chiefly in the production of acetylene. Artificial abrasives, which constitute the basis of all modern grinder work, are also manufactured at Niagara Falls, as well as caustic soda, chlorine in the form of bleaching powder and other chlorine products; chlorates, which are used in the match industry, in the textiles, for the manufacture of oxygen and in other chemical operations; sodium, used in the textile industries as a bleaching agent and which is still more important in the manufacture of sodium cyanide; phosphorus, carbon bisulphide and numerous other products absolutely indispensable to industry to-day.

"I need not call the attention of the committee to the importance of aluminum and aluminum products. The ferro-alloys, however, give one a very good idea of how indispensable the products of the electrochemical industry are. Approximately 75 per cent of all the steel made in this country to-day is made in the basic open-hearth furnace, and all that steel requires in its manufacturing the use of ferro-silicon. In other words, the whole of the steel industry in this country is at the present time dependent on ferro-silicon made in the electric furnace by the application of electric power. With no ferro-silicon there can be no open-hearth steel.

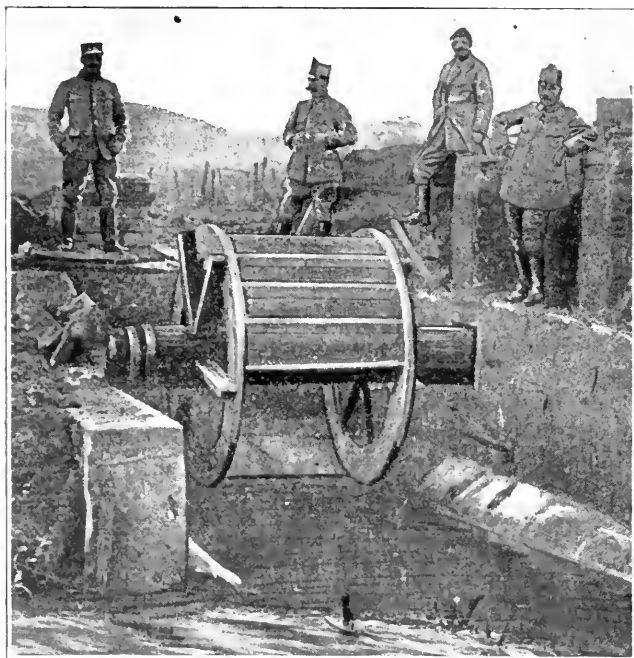
GREAT IMPORTANCE OF ELECTROCHEMICAL INDUSTRIES

"The artificial abrasives show the extreme importance of electrochemical industries to other general industries. The automobile and aeroplane furnish a citation. All of the abrasives used in this country at the present time are electric furnace products. Now, there is hardly a single portion of an automobile or of an aircraft that has not got to be ground in some form or

other. There is not a single bit of steel in the automobile that is not dependent on the electrochemical industry for ferro silicon. There is not a single part which has been lightened in weight that does not involve the use of ferro-chromium. By the use of alloy steel alone the weight of automobiles has been cut in half and at the same time increased in strength and reduced in cost. So greatly does the automotive industry depend on these products that without the use of the high-speed tool steels which the electrochemical industries alone make possible, and without the use of the grinding wheels which the electric furnace has given to the world, a plant which can manufacture 500 cars a day could turn out only 100 cars a day with the same outfit and the same men.

"It is needless for me to continue further along this line to impress you with the vast importance of electrochemical products to other industries, ignoring entirely the fixation of atmospheric nitrogen for fertilizer and for munition work. I merely cite the case to show how infinitely more important are the industries depending upon electricity than the electric generating system itself. It is of interest to note in this connection that the combined income from the sale of electrical energy of the Niagara Falls Power Company and the Canadian Niagara Power Company for 1917 was a trifle more than \$3,000,000. I have no statistics showing the output of electrochemical products manufactured from the electricity sold for that purpose nor the cost of the numerous other products which in their fabrication involve electrochemical products. However, the citations given indicate the stupendous value of these products as compared with the cost of the electricity used in their manufacture."

Using Water Power for Lighting Battery Dug-Outs in France



This French official photograph, received from the ELECTRICAL WORLD correspondent in France, shows an improvised waterwheel for generating energy to light the dug-outs of a French battery.

THE ECONOMIC VALUE OF THE SUPPLY JOBBERS

Association Decides at This Week's Hot Springs Meeting to Make Their Economic Function Clear—Co-operation with Contractors

At the regular meeting of the Electrical Supply Jobbers' Association held this week at Hot Springs, Va., the association, on the invitation of a committee from the National Association of Electrical Contractors and Dealers, voted to co-operate with the latter body in furthering the education of contractors and dealers in cost accounting and in proper merchandising methods.

CO-OPERATION WITH THE CONTRACTORS

To that end the committee of the jobbers' association on harmony in the industry recommended that jobbers having a retail business become members of the contractors' association and that they also urge all contractors and contractor-dealers to join, as well as dealers and merchants conducting retail electrical departments. In addition, a committee from the jobbers' association will attend the meeting of the contractors' association to be held in Cleveland next July.

There being a division of opinion as to what constituted retail business, which is the basis on which dues in the contractors' association are paid, that term was definitely defined by the committee in its recommendation. In general, the term as defined and accepted by the jobbers excluded sales to industrial plants.

ECONOMIC FUNCTION OF THE SUPPLY JOBBER

On the recommendation of the Atlantic division, the main body decided unanimously on Wednesday to appoint a committee to investigate all channels of publicity by which the position of the supply jobber may be strengthened in the electrical trade. The agitation against all jobbers as middlemen, which, although it has heretofore existed in a mild form, has taken more definite shape and purpose since the government itself advocated direct purchases from manufacturers, has been brought home to the consciousness of the electrical supply jobbers, and it was felt that the functions of the supply jobbers are not known, or, if known, are not properly appreciated in the electrical trade.

All middlemen are now under fire so to speak, and manufacturers are doubtful as to the proper channels to choose for the distribution of their goods. There is an unfounded suspicion that all electrical supply jobbers do is to meet every so often behind closed doors to decide upon and fix prices. Of course, those who have attended jobbers' meetings know that this is not so, but that knowledge is not so general as it might be. In addition, full advantage is not taken of jobbers' supplies by industrial plants, which, through lack of knowledge of the presence of jobbing houses in the immediate vicinity or the completeness of jobbers' stocks, order directly from manufacturers, oftentimes at a loss of time and money. To rectify this system and to set the jobber right with the trade and with the world, the association plans to embark on a campaign of educational publicity.

The appeal will be to the manufacturer as well as

to the purchaser and will dwell on the functions of the jobber which make his existence a necessity and his service of definite value to the consuming public. As an unfailing source of supplies and also as a banker in a limited sense, the jobber is already better known by the contractors than by any other branch of the electrical industry, and it is the purpose of the association to give manufacturers, owners of industrial plants and the public the same insight into the jobbing business as that possessed by the electrical contractor and dealer. An effort will be made also to impress the latter with the value of the service the jobber renders him.

It was decided to have the committee undertake this investigation at once so that it could lay its plans before the executive committee for action as soon as possible. A suitable appropriation of money is to be thereupon made to carry on the work, which will be restricted at present to the trade and trade press.

Other matters brought up for discussion on Wednesday included a system of cost accounting. Duplicating the contribution made last year, the jobbers again donated from their funds \$2,000 to the American Red Cross.

ATLANTIC DIVISION JOBBERS SURVEY CONDITIONS

At the meeting of the Atlantic division on Tuesday a general survey was made of the conditions in the electrical industry. This was both instructive and interesting. The conditions of business in the East remain fairly normal, with high spots here and there in centers where the manufacture of munitions or of other material for the war is under contract. With these exceptions no change is manifest in the demand for electrical merchandise. True, there is a falling off in the sale of devices classed as luxuries, but there is also a greater demand for labor-saving appliances due to conditions in the domestic help market.

Building operations are practically at a standstill, but activities in the industrial world more than compensate for losses in that direction. In addition government work has stimulated trade in the shipbuilding and munition centers.

A gradual change for the better is apparent in the merchandising attitude of central-station companies, and the disposition is to give wider recognition to the jobber and to the contractor-dealer as economic factors in the distribution and sale of electrical goods.

A singularly pleasant feature in the general jobbing situation is that the number of jobbing firms has not increased in the East, nor has the stability of those houses engaged in the jobbing trade been one whit weakened by war conditions. As a matter of fact, taken by and large, the jobbers are quite prosperous in the East and face the future calmly and without fear. It is felt that just as in England so in this country the claim of the jobber as a legitimate and economic entity in the distribution chain will be established more firmly than ever in spite of the feeling that the middleman should be cast into the discard as an unnecessary appendage in any meritorious scheme of merchandising.

The movement for a wider adoption of trade acceptances so far has shown but indifferent results, chiefly owing to the failure to press the scheme energetically. It is recognized that the plan is still new and that un-

less it is universally adopted in the jobbing trade it possesses disadvantages especially in competitive situations where delinquents have wide latitudes in choice of payments due to the varying credit practices.

On the whole, collections are good in the Atlantic district, the government and industries working for it strange to say being slowest in settling accounts. In some sections the disposition of contractor-dealers to aspire to become jobbers as well has been noted but has caused no alarm. Hardware, department and drug stores are enlarging their sales of electrical appliances, but this widening of the avenues of distribution is not an unwelcome sign, especially when the articles are handled by those conducting business on well-recognized merchandising lines.

From reports made by a Canadian jobber conditions in Canada are by no means assuring. There is a decided decline in business and merchants are husbanding all their resources. The prosperity which Canada enjoyed in 1916 and 1917 was due to the large munition orders placed by England and with the filling of those contracts prosperity ceased. Collections are difficult to make, and while no great shrinkage in values is anticipated the outlook is anything but pleasant in that country. This, however, was the only pessimistic note sounded in the meeting.

It was estimated that the jobbers have now over 50 per cent more capital tied up in stocks than before the entry of the United States in the war.

The next meeting of the Atlantic division of the Electrical Supply Jobbers' Association will be held in Cleveland at the time of the general meeting in November.

MEETING OF THE CENTRAL DIVISION

Rising costs of conducting wholesale business in electrical supplies caused by (1) wage and salary increases, (2) higher costs of packing materials and shipping and delivery services, and (3) increasing amounts diverted to federal taxes, were discussed by the Central Division of the association on Tuesday.

Several jobbers reported that without increasing the number of their employees their payrolls had increased 15 per cent or more in amount during the past year, making with the increase of the previous year a total increase of more than 25 per cent since 1916.

Questionnaires answered by fifteen Middle West jobbers showed that their operating expenses for the first four months of 1918 compared with the same period of 1917 had increased by an average of 3.15 per cent, while their respective volumes of business for the same period had decreased 1.7 per cent. The jobbers' income and excess profit taxes paid during 1917 represented an average of 1.37 per cent of their gross sales and 23.7 per cent of their net profits, the figures reported showing extreme ranges of 4.7 per cent to 0.8 per cent and 6 per cent to 55 per cent respectively.

New England Section to Hold War Convention

A war convention without social features will be held in September or October this year by the New England Section of the National Electric Light Association at Springfield, Mass., the sessions occupying two days.

MISSOURI CONVENTION SHOWS A KEEN INTEREST IN RATES

Great Majority of Papers and Discussions Reflect
Situation Created by Increasing Costs—
Concerted Action Promised

In every sense, the convention of the Missouri Association of Public Utilities at St. Joseph, Mo., May 17 and 18, was a businesslike meeting. For the time being the central-station men of that State have ceased the discussion of the detailed problems of operation and have concentrated all thought and action on the broader and fundamental question of securing adequate net earnings. Furthermore, it is admitted that the situation in Missouri has reached a stage wherein the time for consideration of small economies that might be made in operation is past. Sweeping increases in rates are necessary to give the utilities relief. Moreover, it does not appear to the central-station executives that they are getting relief promptly enough in the present critical condition of affairs.

That the Missouri convention did have long and well-attended sessions filled with vital business discussions this year was perhaps more striking because of the contrast this convention presented to the thoroughly enjoyable convention boat trips of former years. With Hugo Wurdack of St. Louis presiding, the convention was opened by addresses from two Missouri mayors. Mayor J. C. Whitsell of St. Joseph expressed willingness to aid the local utilities in educating the public to the fact that only a small percentage of public utility company receipts are net earnings. Only a few, he said, realized that a difference exists between the money the company takes in and the net revenue. Mayor H. W. Kiel of St. Louis stated that changing conditions are making the public see the value of utility service to the city. He expressed the belief that higher rates would have to be paid for that service.

THE PRESIDENT'S ADDRESS

The address of President Bruce Cameron of St. Louis was read by Secretary F. D. Beardslee in the president's absence. The paper stated emphatically that the postponement of the convention at a time when such vital problems are to be discussed would have been a grave mistake and dealt at length on the St. Louis street railway situation. Last February the street-railway employees demanded an increase in wages. The money to pay it could not be secured from the earnings of the company on the rates of fare in effect. Application was made for increased fare, and the city of St. Louis opposed this increase before the commission. In spite of this the commission granted the increased fare and the workmen were granted increased wages. Whether the city of St. Louis will attempt to fight still further in the courts and take the responsibility of bringing on a strike of the railway employees in consequence remains to be seen. Mr. Cameron favored the skip stop as a conservation measure both for saving coal and saving time. He predicted that prices of labor and material would reach higher levels than those now in effect and pointed out that high prices would continue for a long while still, even should the war be ended. His recommendation was that changes be made to take these things into account. As one of these changes he suggested the coinage of a 7½-cent piece to take the place of the 5-cent piece, the pur-

chasing power of which is no longer sufficient to secure the formerly common 5-cent commodities.

J. S. Tritle, manager of the St. Louis office of the Westinghouse Electric & Manufacturing Company, in a paper on "How the Manufacturer Is Meeting the Problems Created by War," recited data on the increased business which his company is doing. On June 30, 1914, the company employed 11,702 men, and on Feb. 28, 1918, it had 36,534. When war broke out Aug. 1, 1914, the company had on its books unfilled orders amounting to \$8,000,000; on April 1, 1918, unfilled orders amounted to \$153,000,000, not including gun business of the New England Westinghouse Company.

PUBLIC UTILITIES' RATES AND REVENUES

The paper by H. Spochrer of St. Louis on "Taxes Affecting Public Utilities" indicated one broad and ever-widening avenue through which revenues of public utilities are taken from them. Especial attention was directed to such discriminatory taxes as the franchise tax and the gross income tax not assessed against other industries. The author named a total of twenty-one separate taxes and gave the total of each paid by the Union Electric Light & Power Company. In the aggregate these taxes amount to 12 per cent of the average price per kilowatt-hour.

Col. Philip J. Kealy of Kansas City presented a paper which was one of the most important. It sounded the keynote of the convention in the following words:

"We are here to work out plans not to reduce operating costs or to effect small economies, but plans to preserve the very existence of the industry itself. One of the principal things we now have to do is to effect that change in our own psychological attitude that we must later effect in that of the general public. We must get away from our local viewpoint with all its prejudices and face our problem as a national emergency. We must, in our own minds and in the minds of the public we serve, stamp our companies with a national character and have them considered as a vital and essential part of our war preparations."

In addition to this, the paper was a résumé of what has been accomplished nationally on this line and was an outline of what the Missouri association can do to help carry on the national movement. Not the least part of this program consisted of work to prepare the public mind for rate increases which the companies must have and which commissions are willing to grant when shown the facts.

Discussion of this paper brought out that this work of public education must be done by newspaper advertising, by personal explanation among influential citizens, and by all other available means of disseminating information. The question of how to answer the argument of the man who says a utility should not break rate contracts, even though it be losing money, also came up. Several good answers were suggested. One form of explanation was that public utility contracts are long-term contracts as compared with ordinary commercial obligations. They are based on years of experience in normal times. Now times are very abnormal. The public utilities are giving service at a loss. A contract that is being fulfilled at a loss is sure to be expensive to the party served in the long run. An inferior service will be delivered or some other trouble will develop. It is better for both parties to

readjust the contract to profitable terms. Another argument advanced was that the public did not object to breaking public utility rate contracts as long as the break was in its favor. Then, why should it object to the same procedure when the break favors the company?

THE WAR AND THE UTILITIES

The paper by H. Wurdack of St. Louis on "The Effect of War Upon Utilities" was an analysis of statistics from Moody's and Poor's manuals and of conditions as they have been observed. The author concluded from his analysis that: (1) Regulation will only be tolerated by the American people as long as it seems to work to their advantage; (2) laws and limitations made in peace times to govern peace conditions are in many cases found to be wholly inadequate, improper and inoperative in a war emergency, and (3) commissions, local authorities and communities must allow liberal and speedy remedy if total destruction of utilities is to be averted.

He also suggested as remedies that rates should be increased enough to reimburse companies for losses already sustained and enough to prevent further losses, and recommended that unnecessary capital expenditures be curtailed to the limit and some means be provided for financing necessary work at reasonable capital costs.

As a fitting culmination of these papers and this discussion on rates and revenue, the resolutions committee submitted a previously planned and carefully drawn resolution which the association, acting as a committee of the whole, will later present to the Missouri commission. The purport of resolution follows:

That all public utilities are entitled to increases in rates sufficient to cover increased costs and that new or changed schedules of rates should be allowed to take effect and should not be suspended by the commission until an adverse showing has been made to justify suspension. Furthermore, the resolution declared that all operating costs incurred by franchise requirements not essential to the maintenance of service should be discontinued for the duration of the war. The resolution was aimed particularly at the present practice of the commission of suspending all applications for increases in rates instead of permitting them to become effective by law thirty days after filing.

THE COAL PROBLEM

Gov. Wallace Crossley, Fuel Administrator for Missouri, being in the city on other business, addressed the convention extemporaneously. He predicted more serious coal troubles next winter than prevailed last winter. He expressed the opinion that the activities of the national fuel and transportation departments should be co-ordinated. In the discussion following his talk many central-station operators testified that the grade of coal now being delivered from mines was twice as high in ash as formerly and estimated that a saving of 30 per cent in coal cars could be made by compelling mines to ship clean coal. A committee is to be appointed to supply Governor Crossley with accurate data on the inferior coal service now being rendered to Missouri utilities.

M. F. Henry, secretary of the Missouri Fuel Administration, in a paper told the delegates that higher

freight rates on coal amounting to 15 cents to 50 cents a ton could probably be expected within six weeks. He also spoke of the national Fuel Administration's plan for classifying power plants in order to shut down inefficient isolated plants. The inefficient plants in Missouri, he said, will soon find their fuel supply cut off.

In the discussion the opinion was expressed that the Fuel Administration could do more good by regulating the quality of coal than by concerning itself with stopping small leaks in central-station plants.

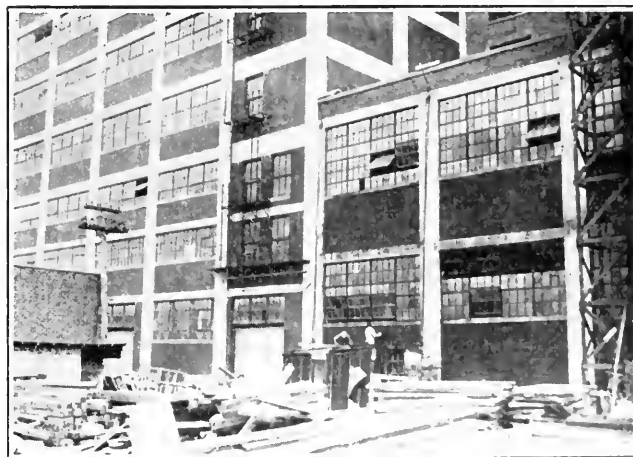
Others who took part in the convention program were Prof. H. C. Lanier of the University of Missouri and J. A. Whitlow, engineer with the Missouri Public Service Commission.

Mr. Whitlow declared the commission had been requiring extensive publicity on the details of all rate increases granted before entering a decision, in order to maintain favorable public relations for the companies. Concerning rates of return, he said there were some good reasons why higher returns should be granted now. With the small electric utilities—that is, those in towns of 1000 or less—he said operating costs are now 18 cents to 20 cents per kilowatt-hour. He predicted that some of these will have to be shut down for the period of the war, as they could not sell their product at a price which would even sustain the property.

ELECTION OF OFFICERS

Officers elected for the ensuing year are: President, J. H. Van Brunt, St. Joseph; first vice-president, J. M. Scott, Kansas City; second vice-president, L. P. Andrews, Sedalia; third vice-president, H. Spoehrer, St. Louis, and secretary-treasurer, F. D. Beardslee, St. Louis. The executive committee is composed of P. J. Kealy, Kansas City, and B. C. Adams, Joplin, and the public affairs committee comprises V. L. Elbert, St. Joseph; J. F. Porter, Kansas City; Bruce Cameron, St. Louis, and E. C. Deal, Springfield.

How Electric Energy Helps to Conserve Wheat



Electricity helps conserve wheat. The new building in the middle of the picture is a 7000-kw. substation at the Cedar Rapids mill of the Quaker Oats Company, which receives power from the Iowa Railway & Light Company. Electricity here turns the wheels of what is said to be the largest cereal mill in the world, and produces more than 1,000,000 wheatless breakfasts daily.

Women Employees Are Helping Too



These employees of the New York Edison Company, Bronx district, took part in the third Liberty loan parade and are actively working for the Red Cross and a performance of "Fancy Free" to be given on the evening of May 28 at the Casino Theater, the entire proceeds of which will go to the Red Cross auxiliary of the New York lighting companies.

SOUTH DAKOTA ASSOCIATION MEETING AT SIOUX CITY

Discussion on the Electric Range as an Agency for
Fuel Conservation Brings Out
Interesting Points

The second annual convention of the South Dakota Electric Power Association was held at the Carpenter Hotel, Sioux Falls, on May 15 and 16. An address of welcome was made by R. D. Springer, secretary of the Sioux Falls Commercial Club.

H. F. Brownell, president of the Sioux Falls Rotary Club, gave a paper on "Service," in which he pointed out that in every business it should be the aim to render service to the purchaser. "Service" was defined as that part of the commodity which is not paid for but which must be rendered in order to build up a successful business.

In his paper on "Electric Ranges and Ovens," H. Hamilton Jones of the Hughes Division of the Edison Electric Appliance Company pointed out that it is the patriotic duty of every central-station manager to push the sale of electric ranges and ovens as a means of conserving the coal and meat supply and thus helping to win the war.

The following important facts were brought out by the discussion: A rate of 4 cents or $4\frac{1}{2}$ cents per kilowatt-hour is not a prohibitive rate. The station peak is not materially increased by the installation of electric ranges. An effort should be made to place the first ranges in a town in the homes of people of moderate means where the mistress uses the range herself, rather than in homes of the wealthier people where a maid does the cooking. The big disadvantage of the electric range is the cost of heating water.

The "Question Box" brought about the discussion of the following subjects: The necessity for increasing rates, especially in the smaller steam plants; transmission-line problems—use of iron wire, lightning troubles,

farmer consumers; the advisability of trying to get a public utility law passed.

The time and place of the next convention were left for the executive committee to decide. The following officers were elected: President, A. H. Savage, Flan-dreau; first vice-president, E. J. Sherwood, Mitchell; second vice-president, L. V. Schneider, Salem; secretary-treasurer, O. J. Gronsdaahl, Hartford; executive committee, W. C. Blanchard of Aberdeen, F. D. Brown of Huron and N. C. Draper of Sioux Falls.

PROGRAM ARRANGED FOR THE N. E. L. A. CONVENTION

Tentative Outline of Business for the War Meeting
Which Is to Be Held at Atlantic City, N. J.,
on June 13 and 14

The tentative program for the convention of the National Electric Light Association at Atlantic City on June 13 and 14 follows:

Thursday Morning, June 13—Presidential address; reports of secretary, treasurer, membership committee; reports Commercial, Technical, Accounting and Electric Vehicle Sections; new business.

Thursday Afternoon—Report of National Committee on Gas and Electric Service; report of committee on public utility conditions—war financing of utilities, rate increase activities, etc.; report of public policy committee; discussion of central-station aspects of the labor problem; female employment; meter reading and testing; economized accounting.

Thursday Evening—Patriotic addresses on the broader national topics of immediate importance to the industry, by distinguished speakers (details in the hands of the president).

Friday Morning, June 14—Address and general discussion on the coal situation; important war-time topics introduced by the Technical and Hydroelectric Section.

Friday Afternoon—Important war-time topics introduced by the Commercial, Accounting and Electric Vehicle Sections.

Friday Evening—Round-table discussions and films of war activities of special interest to member companies, with other appropriate features.

A circular letter issued to members by Secretary T. C. Martin displays prominently the announcement that "no ladies are expected in attendance, and there will be no provision for entertainment."

The hotel reservations are in the hands of Frank W. Smith of the convention committee. It is confidently expected that ample accommodations for all delegates in attendance will be provided at the Traymore, where the convention will be held. Hotel reservations should be made immediately through the hotel committee, addressed to Mr. Smith, 130 East Fifteenth Street, New York. The committee will be glad to provide any detailed information required and will promptly advise the delegates as to the reservations. Those desiring to secure accommodations at other hotels will have their wants promptly cared for by the committee, on application, which should also be addressed to Mr. Smith. Should such information be required, the official circular of the Atlantic City Hotel Men's Association, listing some forty hotels, will be sent on request.

As soon as definite information from the membership is in the hands of the convention committee steps will be taken by it to insure as far as possible a sufficiency of parlor-car accommodation from New York and Philadelphia and homeward.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

New York Jovian League.—At a luncheon on May 15 Frank Dixon, Red Cross Commissioner to France, talked on "My Personal Experiences in France" before the New York Jovian League. On June 15 the league will hold its summer rejuvenation at the Hotel Shelburne, Brighton Beach, N. Y.

Electrical Club of Detroit.—Dr. E. J. O'Brien, who recently returned from active service in France to Base Hospital No. 17, talked before the Electrical Club of Detroit at the regular luncheon of May 11. William S. Gilbreath, secretary and manager Detroit Automobile Club, addressed the Electrical Club on May 18.

Iowa Association of Electrical Contractors and Dealers.—At the annual meeting of the Iowa Association of Electrical Contractors and Dealers J. E. Sweeney of Waterloo was elected state chairman, and J. N. Holoway of Mason City was elected treasurer. This meeting was held at Fort Dodge on April 30 and 31.

A. I. E. E., Schenectady Section.—Prof. Comfort A. Adams, president of the A. I. E. E. and professor of electrical engineering at the Massachusetts Institute of Technology, was the main speaker at the annual meeting and dinner of the Schenectady Section of the American Institute of Electrical Engineers on May 24.

N. E. L. A., Philadelphia Company Section.—William K. Kerford was elected chairman of the Philadelphia Electric Company Section of the National Electric Light Association at a meeting on May 15. Major William M. L. Coplin, director of Base Hospital No. 38, spoke on "From the Trench to the Base Hospital."

Massachusetts State Association of Contractors and Dealers.—On May 9 the Worcester district of the Massachusetts State Association of Electrical Contractors and Dealers transferred its meeting place from Worcester to Fitchburg. Representatives of the Westinghouse Electric & Manufacturing Company and the Worcester Electric Light Company were present and addressed the meeting.

Electrical League of Cleveland.—The Electrical League of Cleveland participated in the big Red Cross parade held on May 18. On May 20 mobilization was completed for organization of the league in the competition for the "victory chest" to be donated to the organization securing the largest amount of subscriptions for the Red Cross in Cleveland. Lieut. John H. Clark spoke to the league on navy expansion on May 9.

New York Electrical Society.—The three hundred and sixty-fifth meeting of the New York Electrical Society was held on May 23. V. T. Goggin gave an illustrated lecture on how Camp Devens was constructed.

N. E. L. A., Brooklyn Company Section.—On May 7 A. E. Muenich presented a paper entitled "Street-Lighting Engineering and Construction" before the Brooklyn Company Section of the National Electric Light Association.

Jovian Electric League, Los Angeles.—At the May 15 meeting of this league H. Hinkovic, a former member of the Croatian Parliament and member of the Yugoslav committee of London, spoke on the subject of European politics and racial differences.

I. E. S., New England Section.—At the last meeting of the season of the New England Section of the Illuminating Engineering Society Edmund Leigh, chief of plant protection, Military Intelligence Bureau, Washington, D. C., delivered a talk on "Plant Protection," and M. Luckiesh of Nela Park, Cleveland, Ohio, talked on "Timely Aspects of Lighting." This meeting was held on May 21.

The Engineering Foundation.—A special meeting of the Engineering Foundation will be held on May 28 at 8.30 p. m., in the auditorium of the Engineering Societies Building in New York. Dr. George E. Hale will address the meeting on the "National Research Council." The foundation is composed of representatives of the national societies of Civil, Mining, Mechanical and Electrical Engineers.

Association of Iron and Steel Electrical Engineers.—Two hundred and nineteen members of the Cleveland, Youngstown and Pittsburgh sections of the Association of Iron and Steel Electrical Engineers inspected the Ohio and McDonald plants of the Carnegie Steel Company on May 18. The two bar mills of the latter plant recently put into operation were viewed. B. W. Gilson, chief electrical engineer of the Carnegie Steel Company and vice-president of the association, was host to the big delegation of visitors. The meeting concluded with a dinner at the Ohio Hotel in the evening and a discussion of the day's trip through the local mills.

Western Society of Engineers of Chicago.—Preparation by American engineers for leadership in the coming industrial development of Russia is urged by the Russian Society of Engineers of Chicago. A series of lectures by Russian and American engineers on the industrial needs of Russia and the mutual benefits to be derived by commercial intercourse is being arranged for all Chicago engineers by the Western Society of Engineers. The first meeting was scheduled to be held at the rooms of the Western Society of Engineers, Chicago, on May 22, with addresses by William J. H. Strong, consulting engineer, on the industrial development of America and similar possibilities in Russia, and by W. W. De Berard, Western editor *Engineering News-Record*, on publicity.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Sale of Municipal Plant Administrative Action.—Mandamus will not lie to compel the mayor of a city to file referendum petitions and call an election thereon for the purpose of referring to the people of said city the action of the city council in ordering a sale of its electric light plant pursuant to the Revised Laws 1910, 541, giving the city the right to dispose of its real property, as such action involves administrative discretion and is not within the referendum powers reserved to the people of municipalities, the Supreme Court of Oklahoma held (170 P. 1165).

Utility Cannot Contract to Release Itself Arbitrarily from Contracts.—A corporation assuming the performance of a public duty to domestic consumers, as the furnishing of electricity for light, may make and enforce reasonable rules and regulations for the conduct of its business, but it cannot compel its patrons to enter into contracts releasing it from its obligations when and as it may arbitrarily elect, but must to extent of their needs and within the limits of facilities serve alike those accessible thereto who apply therefor and submit to such rules and regulations, according to the Supreme Court of Appeals of West Virginia in *Chambers vs. Spruce Lighting Company* (95 S.E. 192).

Injunction to Step Further Progress of Municipal Project Diverting Water.—The riparian rights of a power company, consisting of a small parcel of land extending to high-water mark below a dam and reservoir constructed by a city for water-supply purposes, a contract with a riparian owner below the dam for a portion of the riverbed with a right to regulate flowage, and options for other lands and rights, all of which were apparently acquired after the city's water development was practically completed, did not entitle such company to relief by injunction against the further construction of the dam and reservoir and the diversion of water, the United States Supreme Court held (38 S.C.R. 245). If a city's development of the water of a river for a water supply was unauthorized, its act in damming the river and diverting the water was that of an ordinary wrongdoer, and a power company owning riparian lands and rights and which had adopted a plan of development had only the usual remedy for a tort by an action at law for damages unless exceptional circumstances rendered resort to a court of equity appropriate, which was not the case where the company could not for the present be injured and might never be substantially affected by the diversion of the water.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Saving Energy at Cleveland.—On the new bridge across the Cuyahoga River at Superior Avenue, Cleveland, 100 of the 1500-cp. lamps are to be replaced by 1000-cp. lamps in order to conserve energy.

First Coal Over Government Railroad in Alaska.—The first commercial shipment of coal from the mine operated by the Alaskan Engineering Commission was made in the last week of April. A consignment of 100 tons from the Chickaloon field went to Seattle, Wash., on the steamship Alameda. The coal was shipped in sacks under a freight rate of \$5 per ton for shipments of 100 tons or more and \$7.50 per ton on shipments less than 100 tons.

Power Survey at Denver.—The electrical bureau of the Civic and Commercial Association of Denver is making a complete survey of all the power plants in the city with the idea of effecting fuel economy. A dozen enumerators employed by the bureau are engaged in obtaining data concerning all plants rated at more than 5 hp. The next step planned by the bureau is to offer free engineering advice to the proprietor of each power plant, in the interest of saving power or fuel.

Daylight Saving Reduces Revenue.—The San Joaquin Light & Power Company has applied to the California Railroad Commission for an increase in rates, testifying in support of the claim that the daylight-saving law will reduce its revenue \$50,993 for the year. The company asks a rate increase so that it may earn 8 per cent on its investment. Owing to water shortage and fuel prices the company claims that its fuel cost this year will be far in excess of last year's costs.

Training School for Replacement Troops of Engineer Corps.—The government is to establish immediately at Camp Humphreys, Va., a training school for replacement troops of the Engineer Corps. These men will have intensive training to fit them for special service in connection with the engineer units in the service. There will be a complete school, in which all the trades identified with the engineer units of the army will be taught by means of short intensive courses. As this school will have room ultimately for approximately 30,000 men, many instructors will be required, and an appeal is made to qualified men beyond the draft age to enlist in the Engineer Corps as instructors. A thorough knowledge of the trades followed by machinists, blacksmiths, wheelwrights, carpenters, concrete foremen, electricians, dynamo experts, miners, painters, riggers, sheet-metal workers,

foundrymen, automobile and motor truck makers, gas-engine men, draftsmen, photographers and foremen of construction is required, and the applicant must furnish credentials showing knowledge of one of these lines. Full particulars and application blanks will be furnished by Captain Louis T. Grant, E. R. C., secretary Engineer Training Schools, Camp Humphreys, Va.

Study of Bituminous Coal Storage.—The engineering experiment station of the University of Illinois has just completed a study of the problems involved in coal storage and has published the results in a 200-page illustrated book designated as Circular No. 6, "Storage of Bituminous Coal." The study was made under the direction of H. H. Stoeck, professor of mining engineering. The reasons and advantages of storing coal are given, the kinds and sizes of coal which may be safely stored are described, and the many factors entering into successful storage are discussed. Copies of Circular No. 6 may be had by addressing the engineering experiment station at Urbana, Ill. The price is 40 cents per copy.

Thrift and Economy a Duty.—The Council of National Defense and the advisory commission to the council believe that a concerted effort for economy by the people of the nation will not only go far toward paying America's expenses in the war, but will also reduce consumption of raw and manufactured materials essential to the conduct of the war. The council urges all to refrain from unnecessary expenditure of every kind and to bear constantly in mind that only one thing is now of real importance, and that is the winning of the war. This war is more than a conflict between armies; it is a contest in which every man, woman and child can and should render assistance. Thrift and economy are not only a patriotic privilege but also a duty, the council adds.

Rate Case in Columbus, Ohio.—To decide a dispute between the city of Columbus and the Columbus Railway, Power & Light Company as to the justice of a rate for domestic lighting fixed by the City Council, Ohio Public Utilities Commission engineers have made an appraisal of the property used for light and power service. It was figured that the reproductive value is \$6,240,046, as compared with \$7,105,808, the valuation found by company appraisers. Present value is given as \$5,725,963. It is said that the city will endeavor to secure a reduction in the valuation. The ordinance rate was placed at 5 cents on Dec. 27, 1915. The company contended that this was too low and appealed to the commission. The city then asked appraisal. A hearing will be held by the commission later. For some time the company has been endeavoring to secure an amendment to its franchise which would allow an increase in the street-railway fare. The council refused the request for this change, and since then the company has been employing publicity to urge the necessity for proper compensation as a relief from war conditions.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Free Service.—In deciding a complaint of the town of Sigel against the Central Illinois Public Service Company, the Illinois Public Utilities Commission says that where the terms of a franchise ordinance granted subsequent to the enactment of the utilities act provided in good faith that the town should receive the same free service as surrounding communities the commission, expressly denying establishment of a precedent, authorized the utility to continue rendering free service in compliance with the terms of such ordinance.

Direct-Current Service.—Acting on a petition of the Monmouth Public Service Company, the Illinois Public Utilities Commission has decided to approve rates for direct-current electric power service approximately 10 per cent higher than charges for alternating-current power service. The commission would not consider the question of discontinuance of service on a petition to increase rates for such service. A rate schedule for direct-current power service will not be approved, the commission held, where it appears that the schedule is intended to make the rates intolerably high for the purpose of forcing its discontinuance.

Bond Sale Authorized in California.—The California Railroad Commission has issued an order authorizing the Sierra & San Francisco Power Company to issue \$1,000,000 of its first mortgage 5 per cent forty-year gold bonds, payable Aug. 1, 1949. The order of the commission permits the company to sell the bonds at not less than 80 per cent of their face value plus accrued interest, and provides that the bonds shall be used by the company to reimburse its treasury in part for capital moneys expended for improvements prior to Feb. 8, 1918. After such reimbursement, all funds obtained through the issue of the bonds shall be expended only for such purposes as the commission may authorize in a supplemental order or orders. In its decision the commission suggests that the company proceed with the construction of substations, distribution lines and other improvements estimated by the company to cost \$197,344.31. The commission further recommends that the company expend approximately \$150,000 for the construction of a third penstock to its existing Stanislaus plant and \$450,000 for the installation of a 5000-kw. unit at its so-called Upper Stanislaus plant. It is estimated that the installation of the third penstock will increase the company's generating capacity by 3200 kw., while the expenditure of \$450,000 on the upper Stanislaus plant will add 5000 kw.

Henry L. Doherty was recently given the degree of doctor of laws at the commencement of Lincoln Memorial University at Cumberland Gap, Tenn.

E. L. Munger, who has been superintendent of the Gloucester (Mass.) Electric Company for the last twenty-three years, has been promoted to the position of general manager of the company.

George E. Haggas has been appointed assistant to the general manager of the Cumberland County Power & Light Company, Portland, Me. Mr. Haggas has been connected with the company since 1915, when he was engaged to do valuation work in the engineering department. He is a graduate of the University of Michigan.

J. I. Banash, for eleven years actively engaged as engineer at the Underwriters' Laboratories, Inc., in the examination and testing of hazardous appliances, has been appointed engineer-in-charge of the casualty department. He succeeds S. V. James, who is now mechanical engineer on special research work at the laboratories.

John D. Ball, professor of electrical engineering at the School of Engineering of Milwaukee, has been appointed dean of the school to succeed Prof. William Baum, resigned. Professor Ball was a graduate of the University of Illinois and went to the School of Engineering about a year ago from the General Electric Company, with which he had been connected for about ten years.

W. Irving Mellen, commercial manager of the New England Telephone & Telegraph Company, Pittsfield, Mass., has resigned to become sales manager of the Pittsfield Electric Company June 1, succeeding H. W. Derry. Mr. Mellen has been in the employ of the New England company for about eighteen years, seven of which were spent at Springfield, Mass., and eleven at Pittsfield.

William Baum, who has been dean of the School of Engineering of Milwaukee for the last two years, has resigned to become research engineer for the Milwaukee Electric Railway & Light Company, which office has been newly created. Prior to his educational work, Professor Baum was connected with the General Electric Company for fourteen years, during three years of which he was the company's foreign representative.

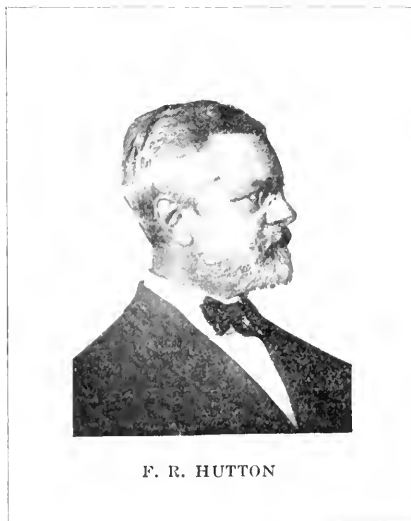
Robert L. Brunet, for the last five years public service engineer of the city of Providence, R. I., has resigned to become industrial and efficiency engineer of the Jenckes Spinning Company, Pawtucket, R. I. He expects to leave his present post June 15. Mr. Brunet was formerly power engineer of the Essex Division, Public Service Corporation of New Jersey, and earlier was in the employ of the General Electric Company at Schenectady, N. Y. In his work at Providence Mr. Brunet has ably represented the city in connection with public utility rate changes, service standards and various franchise and operating matters.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Obituary

Prof. F. R. Hutton, past-president of the American Society of Mechanical Engineers, died on May 14 at the age of sixty-five years. Professor Hutton was graduated from the School of Mines, Columbia University, 1876. A year later he was appointed instructor in mechanical engineering as an associate of the late Prof. W. P. Trowbridge. He entered the faculty as adjunct professor in 1881 and became professor in 1890. Upon the death of Professor Trowbridge in 1892 the chair of engineering which he occupied was divided, and professorships in civil engineering and electrical engineering were added to



F. R. HUTTON

the already existing professorships of mining and mechanical engineering. Professor Hutton was made head of the mechanical department. He continued to direct this department until his resignation, July 1, 1907. At this time he resigned and was elected professor emeritus. For six years during his professorship he was dean of the faculty of applied science. Columbia conferred upon Professor Hutton in 1882 the degree of Ph.D. and in 1904 the degree of Sc.D. He became secretary of the American Society of Mechanical Engineers in 1883, three years after its organization. Professor Hutton was the member appointed by the society to the conference and building committee of the United Engineering Society. This committee was organized to plan the new Engineering Societies Building at 29 West Thirty-ninth Street. Professor Hutton was also one of the board of trustees which is the holding corporation for the United Engineering Society. He declined re-election to the

office of secretary in January, 1906, and at the annual meeting in the following December was unanimously elected president. In addition to these activities he was a contributor to scientific literature. His most important books, which have received considerable acceptance in the educational field in the United States and in England, are "The Mechanical Engineering of Power Plants" (in later editions, "The Mechanical Engineering of Steam Power Plants"), "Heat and Heat Engines" and "The Gas Engine." He did considerable editorial work as associate editor of Johnson's Encyclopedia, as one of the editors of scientific and engineering titles for the Century Dictionary, as departmental editor of the *Engineering Magazine*, and as a contributor to technical journals and a lecturer to scientific and popular audiences in New York and elsewhere. At the close of Professor Hutton's administration as president he was appointed by the council to the office of honorary secretary.

Samuel D. Binkowitz, Chicago manager of the Illinois Wire & Cable Company, died at his home on April 25.

F. E. Getts, manager of the Electrical Engineers' Equipment Company, Chicago, died recently at Los Angeles, Cal.

Duncan H. Graff of the sales department of the American Carbon & Battery Works, East St. Louis, Ill., died on May 7.

Charles S. Powell, an electrical engineer, died at his home, Cleveland, Ohio, on May 11. Mr. Powell was for some years Cleveland representative of the Westinghouse Electric & Manufacturing Company. In 1902 he was sent to London, where he assisted in establishing a branch office of the company. A few years ago he returned to Cleveland and engaged in the electrical engineering profession.

Winfield Scott Chaplin, a noted teacher of technology, died recently at the age of nearly seventy years. Mr. Chaplin was a graduate of West Point, but he served in the army only a short time. In 1873 he was appointed professor of mechanical engineering in Maine State College and four years later became professor of engineering in the Imperial University of Japan, where he remained until 1882. On his return to America in 1883 he took a chair at Union College, and in 1886 he went to Harvard University, where for five years he served in the double capacity of professor of engineering and dean of the Lawrence Scientific School. In 1891 he became chancellor of Washington University, where he remained until 1907, when he retired from active work. Professor Chaplin won a wide recognition for his educational work, and among the distinctions which he received was the degree of doctor of laws, conferred on him by Harvard University, that of doctor of technology, by the University of Japan, and the Order of the Rising Sun, by the Emperor of Japan. He had a wide affiliation with technical societies.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

PORTABLE ELECTRIC TOOLS OFFER JOBBERS MORE PROFIT

Grinders, Drills and Similar Articles Can Be Sold by
Present Force to Trade Already Called On, with
Resulting Profit to Jobber and Manufacturer

In an analysis of their relations with their distributors, manufacturers of portable electric tools may be divided into two classes, namely, those who have their own complete sales force and those who sell through agents. Generally speaking, those who have their own sales force are concerns whose primary business is pneumatic rather than electric tools. The development of electric tools followed pneumatic tools, and the new line was simply dumped on the old sales force with orders to "go to it." Those who do distribute through their own sales force claim to do so for the advantage it gives them of keeping the entire business in their own hands. This group in the industry, however, is not strongly sold on its own plan. Were it not for the fact that they are loaded up for months ahead with war business, they would listen now to a plan for changing and broadening their lines of distribution. Some of them are thinking very strongly about it even now.

Of the group which is selling through agents not many are taking advantage of the established lines of distribution within the electric trade. They are not using the electrical jobber with his large sales forces in daily touch with the important industrial plants of the nation. One reason for this is that there was an easily reachable and perfectly legitimate channel through which a certain volume of business could be built in the existing machine-tool sales field. Machine-tool dealers in this field were prepared to handle portable electric tools and to sell some of them. The manufacturers have therefore gone after business through these dealers with some success. On the other hand, the electrical jobber was not found to be in a particularly receptive mood by the manufacturer of portable electric tools, because to induce him to take up a new line he must be imbued with the idea that his men could handle it at a profit. None the less, the jobber can be reached, in some instances has been reached, by certain manufacturers, as is indicated by the following testimony from a manufacturer of portable grinders. He said: "Electrical jobbers should be selling our grinders for several reasons:

- "1. There is a good big percentage of profit in each sale made.
- "2. There is a good demand for these tools among industrial plants, navy yards, arsenals, etc.
- "3. The grinders are absolutely reliable and when sold stay sold.
- "4. The tools are light and portable, and jobbers' salesmen calling on industrial plants can very readily carry the grinders with them, demonstrating them to the prospective buyer right in his own plant. The salesmen already have entree to these plants.
- "5. The product gives jobbers' salesmen an opportunity to call on purchasing agents, master mechanics, etc., presenting something new to them and also putting before these men equipment that will mean more efficient production in their various departments.

"Where jobbers have really become interested in the sale of our grinders they have been able to do a very satisfactory business with them.

"After seeing how readily the grinders could be sold, a Hartford jobber instructed his men to push them, with the result that in three months following they had sold 109 grinders. What they have been able to do other electrical jobbers should be able to do."

That many incidents like this one in the grinder field have not been reported from the portable-drill and other small tool fields is probably due to a lack of appreciation of the mutual advantage these two groups could be to each other. The great advantage to the manufacturer would be better distribution. Broader distribution would mean to him not only more stable business but greater volume and a faster turnover. For the jobber the advantage would be more profit. His sales forces are calling on industrial plants to sell supplies as it is, and might just as well introduce a few portable tools. These carry an increased margin of profit that will act to raise the total gross profit on industrial business without increasing the sales expense. With a profit of from \$20 to \$50 per tool for the jobber, every sale is worth while. It seems probable that the enterprising jobbers looking for lines to sustain the business already impaired by lack of domestic building activities will investigate this line more closely in the near future.

INCANDESCENT-LAMP FACTORIES ARE ACCUMULATING STOCK

Buyers Are Being Urged to Estimate Fall and
Winter Needs—Shortage in Supply
Is Not Unlikely

Just how much the observance of the so-called daylight saving law is affecting the sale of incandescent lamps has not been determined. Experts are making estimates and, roughly speaking, it is believed that from 5,000,000 to 10,000,000 fewer lamps a year will be sold. With an annual production of about 210,000,000 lamps, these figures, in comparison, may not look formidable; but, nevertheless, they constitute quite an item. The demand for lamps has fallen off, as it always does, with the lengthening days and approach of summer.

Manufacturers now say they are accumulating a good stock in all their plants in nearly every size. The production of miniature lamps, which ran behind alarmingly during last fall and winter, while still not normal, is being much increased. The floodlamp situation, at one time acute, is improving. The stock of standard sizes for electric railway cars is in good shape. Some factories admit that on account of extra buying pressure locally certain sizes are still short, but they say that conditions are bettering.

The government's initial orders for cantonments, hospital and naval bases, war ships and munition plants, particularly in the East, have been about filled. This drain has caused a shortage everywhere. Heavy renewal requisitions, however, are expected, and for these the producers are to a great extent well prepared.

What the manufacturers, some of whom are launching an educational campaign on the subject, desire the trade to understand is that within the next few weeks—no later than June, they say—buyers should give earnest attention to placing orders for their fall and winter requirements. This is because war conditions are radically different in every aspect from normal times. The traffic situation will be more congested, and another shortage similar to that of last fall may occur. The productive capacity of the plants has not been lessened, and the output is directed to strengthening district stocks. Deliveries are interfered with by embargoes, but are improving. Labor is also uncertain, which has a tendency to lessen production. Orders for lamps of unusual design or construction are given short shrift. This policy is followed to prevent any curtailment in the output of regular lines.

JOBBER STOCK PROBLEM OF THE COMING MONTHS

More Frequent Ordering than in the Past May
Become the Rule Owing to the General
Delivery Situation

In the coming months more judgment will be needed by jobbers in placing stock orders than ever before. While there are price increases every now and then, generally speaking they are not large. In fact, for some months the price of electrical staples on the whole has been remarkably steady for these times. There is every indication, therefore, that so far as electrical supplies are concerned the peak has virtually been reached.

While there is no immediate prospect of a decline, the natural sequence to a prolonged advance in price is lower prices. There is no such thing as missing that phase. The far-sighted men are, however, making careful effort to minimize its effect.

Certainly this is not the time to speculate. There are too many elements in favor of more conservative action. On the other hand, this is no time for a jobber to let his stock run low. The government and other buyers need the jobber and his stock. Therefore stock must be kept full regardless of the prevailing price. Over-stocks must be avoided not only because of the speculative troubles but because too much stock should not be tied up indefinitely in an inactive condition when others are clamoring for these goods.

While, of course, the value of purchasing in large quantities must not be lost sight of or underrated, nevertheless it must also be borne in mind that the most important factor at present is not price but delivery. Consequently it is not improbable that the policy of more frequent ordering to replenish stock will become more general. A string of orders would seem to present a greater chance of delivery of some material, an order here and there, than a smaller number of orders each of larger size.

METAL MARKET SITUATION

Government's Attitude Toward Increase in Price of
Copper Not Disclosed—Tin Short

Whether the copper producers and refiners have abandoned their attitude toward an increase in the government price of the metal has not been disclosed. On June 1 the present figure of 23.50 cents a pound expires by limitation. The so-called "insiders" are not talking for publication, and covered wire and cable manufacturers no longer speak of an increase in the price of their products.

No arrangements have been effected for the equitable distribution of tin as between war material demands and commercial uses. The metal is decidedly short and prices nominal, but ruling high. The War Industries Board has commandeered all stocks of platinum, allowing \$105 per Troy ounce on purchases. Fluctuations in the quotations on old metals are negligible.

NEW YORK METAL MARKET PRICES

	May 13			May 20		
	£	s	d	£	s	d
Copper:						
London, standard spot....	110	0	0	110	0	0
	Cents per Pound			Cents per Pound		
Prime Lake	Govt. price 23.50			Govt. price 23.50		
Electrolytic	Govt. price 23.50			Govt. price 23.50		
Casting	Govt. price 23.50			Govt. price 23.50		
Wire base	26.25 to 26.75			26.25 to 26.75		
Lead, trust price.....	7.00			7.00		
Nickel, ingot	40.00			40.00		
Sheet zinc, f.o.b. smelter.....	Govt. price 15.00			Govt. price 15.00		
Spelter, spot	7.15 to 7.57½			7.50		
Tin, Chinese*	\$1.05			\$1.03		
Aluminum, 98 to 99 per cent.....	Govt. price \$22.10			Govt. price \$22.10		

OLD METALS

	Cents per Pound		Cents per Pound	
Heavy copper and wire.....	21.50 to 22.00		21.50 to 22.00	
Brass, heavy	13.50 to 13.75		13.50 to 13.75	
Brass, light	10.50 to 11.00		10.50 to 11.00	
Lead, heavy	5.75 to 6.00		6.00 to 6.25	
Zinc, old scrap.....	5.00 to 5.50		5.25 to 5.75	

*No Straits offering. †In 50-ton lots, carloads, 32.10 cents per lb.; 10-ton to 14-ton lots, 32.20 cents per lb.

THE WEEK IN TRADE

GOVERNMENTAL orders for electrical equipment, accessories and supplies of every description are making the highest sales records in the history of the trade. Manufacturers, jobbers and dealers are participating in current prosperous conditions, according to their capacity and facilities.

An increased demand is reported for small and medium-size motors, with stocks lower. Storage batteries are selling rapidly, with the supply diminishing. Domestic appliances are having a sale far above that of last year. Conduit of all sizes is scarce in the East and South but in a better position in the Far West. A shortage of labor is said to be affecting many lines of electrical manufacturing. Deliveries have been more prompt in some sections, especially in the Middle West and Northwest. But along the Atlantic seaboard freight embargoes are yet restricting trade.

Collections are reported better—fair to prompt. Credits are being limited on outstanding accounts for special reasons.

NEW YORK

Outside of government orders trade with jobbers, distributors, producers and dealers is referred to as quite satisfactory. The sale of electrical goods and equipment is on a much larger scale than a year ago; in fact, some jobbers state that their business has more than doubled. One well-known manufacturing jobber, in a formal financial statement, reports sales for the four months ended April 30 of nearly \$1,750,000. The concern's gross business in 1917 was \$5,234,323.

As yet no concern is expressed relative to the future supply of staples. A curtailment in production is guardedly mentioned, but no predictions are being made or speculations advanced. Further developments are awaited.

Financially the trade position is sound, conservative methods and tactics being the rule. Collections have strengthened.

CROSS-ARMS.—Stocks in the East are the lowest on record. In certain sizes none are to be had, and substitutes are being considered.

PORCELAIN INSULATORS.—On low-tension insulators, from 5000 volts to 6600 volts, deliveries are better. On high-tension insulators, from 32,000 volts to 33,000 volts, shipments are running behind. Prices are unchanged.

POLES.—The government is taking over chestnut-pole stocks. Cedar is commanding a better price. For poles on stump an advance of from 5 to 10 per cent was made during the past six weeks.

HOUSEHOLD SPECIALTIES.—In heating appliances, especially tableware, the supply is fair. Shipments are coming through subject to embargoes, with deliveries back two months on several Western lines. There is a possibility of the price of washing machines being revised on account of the recent advance of 10 per cent on galvanized material.

COLLECTIONS AND CREDITS.—Generally collections have improved, and in many instances they are prompt.

POLE MATERIAL.—With the government's extraordinary steel requirements the supply and price of pole hardware is sure to be affected, to express the views of one large distributor. The lack of necessary priority orders is interfering with shipments.

SCHEDULE MATERIAL.—A leading manufacturer on Saturday last announced a lowering of jobbers' discount from 40 to 35 per cent on his entire line.

RUBBER SPECIALTIES.—Producers of rubber electrical specialties have made no announcement as yet since the

government took control of crude-rubber prices, fixing them at from 62 cents to 68 cents a lb.

CONDUIT.—No improvement is reported concerning conduit. The supply continues far from satisfactory, orders of importance being filled on the allotment basis. A couple of cars came in this week because of the temporary lifting of embargoes.

CHICAGO

Electrical contracting activities continue to show a satisfactory increase over the previous week. During the week ended May 8 there were issued 752 electrical permits, aggregating 10,667 incandescent lamps and 1621 hp. Compared with the previous week's figures this shows an increase of 14 per cent in the number of jobs—44 per cent in light capacity contracted for and 23 per cent in power capacity. During the same week a year ago there were issued 836 permits, showing a decrease for this year of only 10 per cent. Building operations have fallen off again. For the week ended May 8 there were issued seventy-three building permits, involving construction work to the amount of \$752,900. This is considerably less than the business done the previous week. Comparisons with the previous week's figures show a decrease of 31 per cent in the number of jobs and 16 per cent in the volume of business. For the same period last year there were issued 122 permits, involving \$1,405,200, showing a decrease for this year of 40 per cent and 46 per cent respectively.

RECTIFIERS.—There is quite a demand for small rectifiers for charging batteries at present. One local company finds it difficult to fill its orders, not because of lack of material but from shortage of labor.

LAMPS.—The demand for portable lamps, especially of the reedware type, is very good at present, and deliveries are fair.

CONTROLLING DEVICES.—Several manufacturers in this territory are behind in their orders, owing to the filling of government work. They state that they could fill these orders in better shape if it were not for the difficulty in getting labor for their plants.

INSTRUMENTS.—A large instrument maker in this locality reports large orders for instruments with deliveries fair. The labor situation in this work is bad.

CABLE.—The Kansas City Light & Power Company has just purchased a large order of underground cable.

LARGE TURBINES.—An Iona company is soon to place an order for a 20,000-kw. unit.

FANS.—Electric fans are beginning to move in the states of Oklahoma, Arkansas and Missouri. A short and severe hot spell caused all dealers through this territory to put in fan windows.

MOTORS.—Flour mills are reported to be heavy purchasers of motors at this season.

INCANDESCENT LAMPS.—Stocks are reported to be getting in somewhat better shape in this territory.

BOSTON

The electrical trade in New England now reflects little but war conditions, and every week it seems that ordinary industrial activities grow less important. Business is running at a very high tide, and the extent to which government requirements influence commerce is beyond any previous experience. Despite the heavy calls upon the jobbers and manufacturers entailed by war production plants, stocks are still in pretty fair shape, though railroad congestion hampers refilling in many lines. Collections rule somewhat better than during the late winter, but in order to maintain them satisfactorily the credit departments are obliged to work harder than normally is the case.

Prices are firm this week, with little prospect of softening for the present. Deliveries do not show the desired improvement, although previous shortages are being made up in lamps. The coal situation is very disquieting, and conservation is being urged against the apprehended repetition

of last winter's famine conditions. Labor is restive in the electric railway field and central-station linemen show some dissatisfaction with wages and working conditions. The outlook is excellent for legislation looking toward the financial betterment of electric railways and their re-entrance into the electrical supply market on a broad scale.

INDUSTRIAL ELECTRIC TRUCKS.—The demand for war service plant applications is remarkably active, and the difficulties of making prompt deliveries are the chief obstacle to a record-breaking business. Prices remain fairly steady.

MOTORS.—A recent increased demand for motors of ½-hp. and 1-hp. rating is noted, especially for pumping service on large private estates. The shortage of steel for tanks hampers this business somewhat. Motor stocks, especially in smaller sizes, are temporarily lower and the larger sizes are still obtainable only upon relatively long shipments. The opinion is heard that present prices will stand for some time.

FARM LIGHTING SETS.—These are in good demand, with improved road conditions and liberal advertising. The practice of selling some of the best outfits with the batteries initially charged and the wiring ready for immediate service with minor adjustments is proving a help in increasing sales.

STORAGE BATTERIES.—Government demands are so great that the ordinary user is having some difficulty in securing this class of equipment promptly. Stocks are getting low, and plenty of batteries already sold are now on the railroads en route to distributing points.

AUTOMOBILE ACCESSORIES.—The demand is substantial, especially for cars undergoing rebuilding. The trade in charging sets is below normal just now.

FLOODLAMPS.—A fair volume of business is being handled in New England, but manufacturers report a larger amount of business in other parts of the country.

REFLECTORS.—Business is quiet in street-lighting equipment, but very active in products suited to cantonment, navy yard and shipyard service. No recent or prospective price changes are in evidence.

MOTOR CONTROLLERS.—Equipments to fit the requirements of small-motor duty are in demand, especially in shoe factory and pumping service. Stocks are in reasonably good condition, and shipments and deliveries are understood to be well ahead of the game in comparison with motors.

FANS.—Jobbers and dealers are ready for the advance of General Humidity. It is known that some buyers have shaded their 1918 orders as compared with last year. In some quarters a disposition is noted to gamble a bit on a cooler summer.

ATLANTA

There is very little change in general conditions to record for this week. Official announcement has been made that Atlanta and New Orleans have been selected as distributing centers for the Quartermaster's Department. This will call for the erection of new warehouses at New Orleans and extensions to the present Southeastern warehouse facilities in Atlanta.

Coastal cities report a great influx of skilled labor for shipbuilding work. Although extensive housing plans are contemplated, and more or less work has already been done along this line, facilities are far from being adequate. It is expected that construction of this type will expand the present market for staple lines, which, manufacturers and jobbers state, shows exceptional possibilities for 1918. The Foundation Company of New York will invest \$1,250,000 at New Orleans for the establishment of a plant to construct a new unsinkable type of steel steamship.

LAMP CORDS.—Stocks are in good shape and ample to take care of the present requirements. Buying continues steady. Prices remain firm.

PANELBOARDS.—There is considerable activity here. Deliveries are being made in two weeks on the panelboards and in ten days on the cabinets.

CONDUIT.—Large orders are being placed, but shipments are very discouraging. The long-expected government requirement for steel has tended to stiffen prices on lots sold from local stocks. While it is conceded that conduit is going to be very scarce during the next few months, no material increase in price is anticipated locally.

SECOND-HAND APPARATUS.—Better promise of shipment on standard motors and transformers has had some effect on the market. Some pieces are not moving so rapidly as they did several months ago. There is a good demand, however, for small direct-current motors, generators, rheostats and miscellaneous material.

WIRING DEVICES.—The volume of business continues large. Prices have advanced this week. Shipments are coming in fairly well.

BOXES AND FITTINGS.—Prices are firm and shipments good. This line has been quite active during the first quarter, and one manufacturer states that sales are well over the same period last year. Jobbers have ample stocks.

ELECTRIC HOISTS.—Shipyards and government warehouses have opened up an extensive field for these, and substantial sales are reported. Although a large quantity of this equipment is being purchased in the East, South-eastern representatives are handling numerous inquiries. The government and industries securing preferential shipments can get the small outfits in two or three weeks. The delivery promise on monorail apparatus, however, has been advanced to eight to twelve months.

SEATTLE

General business continues on the high levels established months ago, with noticeable increases in sales along several lines, including power apparatus for shipyards, which will shortly be in complete operation. A feature of the week's business was a large order placed by a Seattle manufacturing concern for measuring instruments, ammeters, voltmeters, etc. The order is one of the largest ever placed in the Northwest. A pole order of considerable magnitude for electric transmission-line construction was also placed. The contract is for new work, which is gratifying, as other orders placed since the first of the year have been for maintenance only. Trying labor conditions are affecting the electrical trade seriously, and measures of relief afforded are exceedingly small. Conduit shipments have loosened up considerably and power apparatus, including motors, is coming through better.

The feature of the week's industrial activity was the taking over of the shipyard of the Seattle Construction & Dry Dock Company by the United States Shipping Board, which in turn leased the plant to the Skinner & Eddy Corporation for an indefinite period. Subsequent to the transaction the Shipping Board awarded a contract to Skinner & Eddy for additional steel ships, to cost \$100,000,000. This order smashes all Pacific Coast records, bringing the grand total of shipbuilding contracts to approximately \$250,000,000.

Several industrial plants of considerable size and importance allied to shipbuilding are making arrangements to begin early operations in the Puget Sound district. Work on a two-hundred-thousand-dollar factory for manufacturing machinery for steamships was started in Aberdeen. Orders for considerable electrical equipment for this particular plant were placed during the week. Another large wooden shipbuilding plant is projected in Everett. A four-story concrete hotel one block long and 260 ft. deep, for navy yard workers, is announced for Bremerton, and twelve apartment houses, containing sixteen apartments, for Vancouver, Wash. Approximately \$170,000 will be spent at Camp Lewis in constructing additional barracks for 6000 more troops. Base hospital improvements costing \$100,000 are also planned.

The market for building materials is increasing steadily, now that the government has authorized wood construction for industrial housing. Further increases in demand will result in orders for 50,000,000 ft. of Douglas fir. The production of spruce for aircraft purposes will be tripled.

The domestic appliances movement continues gratifying.

Washing and sewing machines, perhaps, are the best sellers, though vacuum cleaners, flatirons and smaller household utensils are moving briskly. The volume of sales, according to a majority of the jobbers, is far ahead of the same time last year. Dealers report that benefits are still resulting from the pre-Christmas sales campaign. Central stations in this territory are energetically pushing sales with pleasing results. Fixture sales are considerably heavier than anticipated or reported heretofore. This is due to an increase in residence building, apartments and summer homes. Prices show but slight changes and stocks are ample and varied. Jobbers are carrying light stocks of fans, as are the dealers. The season here is short.

SAN FRANCISCO

Reports for the past week show that the dealers' counter business has been poor and that the contracting business has been fair. The members of the recent N. E. L. A. conference at Del Monte returned to their tasks greatly heartened and stimulated. The value of building construction under way in the three cities of San Francisco, Los Angeles and Oakland respectively, for the month of April, was \$910,000, \$776,000 and \$593,000, government work being censored and not included. Deliveries are much better, it being possible to procure large sizes of conduit, large sizes of rubber-covered wire and other staples.

Oriental shippers are hampered by a lack of available shipping space, and it is reported that a big Honolulu warehouse and dock deal has been held up indefinitely on account of this lack of space for material. The United States government reports considerable work to be done to the Fort Mason quartermaster's depot and the Benicia arsenal. New packing plants are being erected at Livingston, Palo Alto and Wheatland. The Union Oil Company is constructing new tanks, office buildings and housing at San Jacinto. The shipbuilding yards of Moore & Scott and the Bethlehem Steel Works have arranged to construct new machine shops and certain office buildings. Word has been received from Washington, D. C., that the first place to receive government aid in the housing of shipbuilding yards will be Mare Island, the government navy yard, where work is to be done under the direction of the Navy Department.

CREDITS AND COLLECTIONS.—Credits and collections are reported fair, with a tendency on the part of credit men to limit outstanding accounts but to assist dealers by the extension of longer terms when the dealers have sold the more expensive devices on time payments.

FIXTURES.—Sales are good but considerably hampered by a strike in one of the large Eastern factories. There is very little call for fixtures that are manufactured along the Coast in various shops, because of lack of building demanding their use. Sales are being confined to glassware with a few brass fittings or rods for supports.

STORAGE BATTERIES.—Manufacturers report a call that is greatly increased over last year, this being due to the greater number of cars used and the heavy service demands that are being made on them.

SEWING MACHINES.—The demand for electrically driven machines and for separate motors continues practically unabated, and will without doubt be increased by the present Red Cross drive.

MOTORS.—The call this year has exceeded all expectations, even after allowing for increased sales for pumping plants due to the lack of rainfall. Strangely enough, this call is for larger sizes, ranging from 15 hp. to 30 hp., showing that large estates, which formerly depended upon natural methods of irrigation or regular systems, have been forced to call for electrical aid.

ELECTRICAL PUMPS.—Recently there has appeared a demand for a small electrical pump driven by 1 1/2-hp. to 1/2-hp. motors, and used to average the pressure in large apartment houses or residences.

MOVING PICTURE DEVICES.—A new adapting device is being shown by dealers, operators and theaters, which is designed to do away with the old carbon arc and its requirement of direct current. This adapter utilizes the 600-watt, 30-volt Mazda C lamps.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List per 1000 Ft.
No. 14 solid	\$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor	
No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
No. 14 Solid	
Less than coil	List to + 15%
Coil to 1000 ft.	10% to 57.25
No. 12 Solid	
Less than coil	List to 15%
Coil to 1000 ft.	10% to 66.75

Twin-Conductor	
No. 14 Solid	
Less than coil	List to 12.00
Coil to 1000 ft.	\$97.75 to \$120.66
No. 12 Solid	
Less than coil	List to + 15%
Coil to 1000 ft.	10% to \$126.80

DISCOUNT—CHICAGO

Single-Conductor	
No. 14 Solid	
Less than coil	15% to + 10%
Coil to 1000 ft.	10% to 20%
No. 12 Solid	
Less than coil	15% to + 10%
Coil to 1000 ft.	10% to 20%

Twin-Conductor	
No. 14 Solid	
Less than coil	15% to + 10%
Coil to 1000 ft.	10% to 20%
No. 12 Solid	
Less than coil	15% to + 10%
Coil to 1000 ft.	10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to + 10%
1/5 to std. pkg.	8% to 20%
Std. pkg.	25% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	12% to + 20%
1/5 to std. pkg.	List to 20%
Std. pkg.	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	
No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40
12 to 50	.35
50 to barrel	.31
Barrel lots	.285

BATTERIES, DRY—Continued

CHICAGO

Each Net	
No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40
12 to 50	.35
50 to barrel	.3175-.3195
Barrel lots	.2875-.2895

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 100 FT.—NEW YORK

Less Than Coil	
Coil to 1000 Ft.	
3/8-in. s. stp.	List to \$82.50 \$67.50 to \$69.75
1/2-in. d. stp.	\$75.00 to \$84.00 69.00 to 72.00
1/2-in. s. stp.	List to 110.00 List to 93.00
1/2-in. d. stp.	90.00 to 93.00 92.00 to 96.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	
Coil to 1000 Ft.	
3/8-in. single strip	List \$63.75
3/8-in. double strip	78.25-78.75 71.25-71.75
1/2-in. single strip	List 85.00
1/2-in. double strip	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	
\$15 to \$60	\$60 to \$150
7/32-in.—	
\$38.50-\$55.00	\$24.45-\$26.00 \$21.50-\$24.00
1/4-in.—	
\$42.00-\$60.00	\$27.00-\$28.20 \$23.50-\$26.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	
\$15 to \$60	\$60 to \$150
7/32-in.—	
\$36.67-\$55.00	\$25.00 \$22.50
1/4-in.—	
\$40.00-\$60.00	27.00 25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	5.3% to 6.8%	3/4 in. to 3 in. 7% to 15%
2500 to 5000 lb.	6% to 14%	9% to 17%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

Less than 2500 lb.	5.3% to 6.8%	3/4 in. to 3 in. 8.3% to 10.7%
2500-5000 lb.	7.3% to 8.8%	10.3% to 12.7%
(For galvanized deduct six points from above discounts.)		

FLAT IRONS

NEW YORK

List price	\$5.00 to \$6.00
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Per 100 Net	
Less than 1/5 std. pkg.	10% to \$5.00
1/5 to std. pkg.	25% to 4.50
Standard packages, 500. List, each \$0.07	

CHICAGO

Per 100 Net	
Less than 1/5 std. pkg.	\$6.25
1/5 to std. pkg.	5.25
Standard packages, 500. List, each \$0.07	

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B.....	100	\$0.30
60-watt—B.....	100	.35
100-watt—B.....	24	.70
75-watt—C.....	50	.70
100-watt—C.....	24	1.10
200-watt—C.....	24	2.20
300-watt—C.....	24	3.25
Round bulbs, 3 1/4-in., frosted:		
15-watt—G 25.....	50	.53
25-watt—G 25.....	50	.55
40-watt—G 25.....	50	.55
Round bulbs, 3 3/4-in., frosted:		
60-watt—G 30.....	24	.77
Round bulbs, 4 3/4-in., frosted:		
100-watt—G 35.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.....	List
Std. pkg.....	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	List
Std. pkg.....	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$31.00 to \$34.90
Coil to 1000 ft.....	24.98 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$29.00
Coil to 1000 ft.....	21.50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100.....	\$20.00 to \$24.00
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CHICAGO

Net per 100.....	\$21.75 to \$33.00
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200, S.E., 300, A.X., 1 1/2 4 S.....	30.00
103—C.A., 9, 4R, B, 1 1/2.....	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list.....	25%-30%	20%
\$10.00 to \$50.00 list.....	35%-42%	25%-37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list.....	40%	35%
\$10.00 to \$50.00 list.....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80 to \$38.00
1/5 to std. pkg.....	14.80 to 20.00
Standard package, 2200. List per 1000	

\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000.	

\$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	1000 5 1/2 N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.....		\$11.85 to \$29.00	\$30.70 to \$30.75
1/5 to std. pkg.....		11.10 to 15.60	24.20

CHICAGO

Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	1000 5 1/2 N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.....		\$11.85	\$30.75
1/5 to std. pkg.....		11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/8-in. cap key and push sockets. 500		\$0.33
1/8-in. cap keyless socket..... 500		.30
1/8-in. cap pull socket..... 250		.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List to + 10%
1/5 to std. pkg.....	8% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.....	24% to 25 cents
1/5 std. pkg.....	30% to 23 cents

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:		
30-amp. S. P. S. T.....		\$0.80
60-amp. S. P. S. T.....		1.20
100-amp. S. P. S. T.....		2.25
200-amp. S. P. S. T.....		3.48
300-amp. S. P. S. T.....		5.34
30-amp. D. P. S. T.....		1.20
60-amp. D. P. S. T.....		1.78
100-amp. D. P. S. T.....		3.38
200-amp. D. P. S. T.....		5.20
300-amp. D. P. S. T.....		8.00
30-amp. 3 P. S. T.....		1.90
60-amp. 3 P. S. T.....		2.68
100-amp. 3 P. S. T.....		5.08
200-amp. 3 P. S. T.....		7.80
300-amp. 3 P. S. T.....		12.00
Low Grade:		
30-amp. S. P. S. T.....		0.42
60-amp. S. P. S. T.....		0.74
100-amp. S. P. S. T.....		1.50
200-amp. S. P. S. T.....		2.70
30-amp. D. P. S. T.....		0.68
60-amp. D. P. S. T.....		1.22
100-amp. D. P. S. T.....		2.50
200-amp. D. P. S. T.....		4.50
30-amp. 3 P. S. T.....		1.02
60-amp. 3 P. S. T.....		1.84
100-amp. 3 P. S. T.....		3.76
200-amp. 3 P. S. T.....		6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.....	List to + 5%
\$10 to \$25 list.....	11% to 12%
\$25 to \$50 net.....	14% to 15%
	Low Grade
Less than \$10 list.....	5% to 10%
\$10 to \$25 list.....	16% to 20%
\$25 to \$50 list.....	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.....	+ 5%
\$10 to \$25 list.....	10% to 11%
\$25 to \$50 list.....	14%
	Low Grade
Less than \$10 list.....	5%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.51
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List
1/5 to std. pkg.....	8% to 15%
Std. pkg.....	25% to 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	List to + 20%
1/5 to std. pkg.....	List to 15%
Std. pkg.....	20%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....	List to 10%	List to 30%
\$2.00 to \$10.00 list.....	10% to 50%	5% to 40%
\$10.00 to \$50.00 list.....	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25%	20%
\$2.00 to \$10.00 list.....	25%	20%
\$10.00 to \$50.00 list.....	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price.....	\$5.90 to \$6.00
Discount.....	25% to 30%

CHICAGO

List price.....	\$4.50 to \$6.00
Discount.....	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per 100 Lb. Net
No. 18, less than full spools.....	\$0.41 1/4 to \$0.42 1/4
No. 18, full spools.....	0.36 1/4 to 0.43 1/4

CHICAGO

	Per 100 Lb. Net
No. 18, less than full spools.....	\$0.60 to \$0.65
No. 18, full spools.....	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net
	Less than 500 Ft. 500 to 1000 Ft. 1000 to 5000 Ft.
No. 14.....	\$18.00 \$12.50 \$14.00 \$9.85 \$12.25
12.....	23.25 25.40 19.96 21.80 15.60 19.35
10.....	32.10 35.20 27.76 30.20 21.63 27.60
8.....	45.63 49.15 38.61 42.10 30.18 38.00
6.....	72.10 77.85 61.71 66.75 48.25 60.30

CHICAGO

	Price per 1000 Ft. Net
	Less than 500 Ft. 500 to 2500 Ft. 2500 to 5000 Ft.
No. 14.....	\$18.00 \$13.00 \$11.50
12.....	25.33 \$25.69 22.02 \$25.33 18.55 \$20.40
10.....	30.49 35.04 27.94 30.03 22.86 28.23
8.....	42.54 48.97 38.92 41.98 31.90 39.42
6.....	61.46 67.38 56.15 62.43 50.53 56.39

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$35.25 to \$36.85
25 to 50 lb.....	31.10 to 38.85
50 to 100 lb.....	30.10 to 36.16

CHICAGO

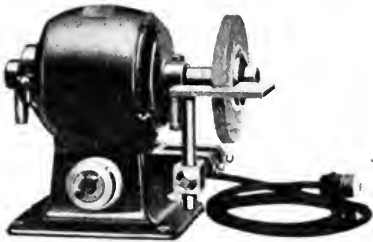
	Per 100 Lb. Net
Less than 25 lb.....	\$35.42 to \$39.00
25 to 50 lb.....	31.42 to 39.00
50 to 100 lb.....	33.42 to 28.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Buffing and Grinding Motors

Double-spindle and single-spindle motors for grinding and buffing are being marketed by the Bodine Electric Company, 2254 West Ohio Street, Chicago. These machines are made both in alternating-current and direct-current types. The motors all develop 1/6 hp. and carry wheels of 5-in. (12.7

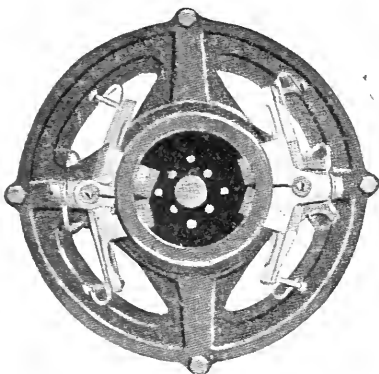


COMBINATION OUTFIT OPERATED FROM A LAMP SOCKET

cm.) diameter. Direct-current motors have a speed of 3000 r.p.m. and alternating-current motors a speed of 3400 r.p.m. The grinders are designed to operate from a lamp socket.

Automatic Motor Starter

Single-phase, polyphase and direct-current motors are automatically accelerated by means of the Johns type motor starter being marketed by the Machine Products Company, 2018 Locust Street, St. Louis, Mo. This device, according to the claims made by the manufacturer, attaches to the end of the motor bearing and effects a saving in wall and floor space over other types of starting equipment. It consists of



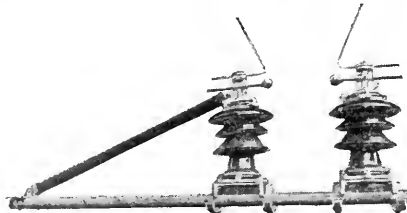
MOTOR STARTER SMALL IN SIZE AND SELF-COOLING

a plate mounted upon the motor shaft and revolving within the housing. Upon this plate are carried a set of slip rings, a set of laminated contacts, a centrifugally operated mechanism and a ventilated-type resistance. The resistance element is always in series with the motor circuit, the current being car-

ried to the starter through the medium of the brushes and slip rings. Upon closing the motor switch the plate revolves with the motor armature and the weights are thrown outward by centrifugal force. The distance the weights are moved outward depends directly on the speed of the motor. These weights actuate the contact arm and thereby cut out resistance from the motor circuit as the armature attains full speed. A device is provided which prevents the return of the contact arm should the motor speed decrease because of load or decreased voltage, but allows its return when the motor has come to a standstill.

Sphere-Gap Lightning Arrester

A sphere-gap lightning arrester now being manufactured by the Electrical Engineers' Equipment Company of Chicago consists essentially of a sphere gap and a horn gap in series with re-



HORN GAP AND SPHERE GAP IN SERIES

sistance to ground. This construction has been adopted by the company since it has been shown that a sphere gap will handle high-frequency surges more rapidly than a horn gap. A sphere gap will charge and discharge with great rapidity owing to its great surface and capacity. The horn gap is used to dissipate the arc which results from the surge, as this arc will follow up the horns and extinguish itself. The resistance tube is placed in series with the horn gap and affords an extremely straight path to ground.

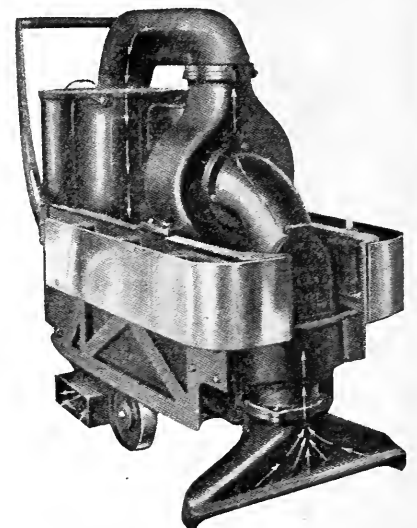
Motor-Driven Hammer

A minimum number of parts is used in a motor-driven hammer that is being manufactured by the United Hammer Company, Oliver Building, Boston, Mass. These "Fairbanks" power hammers are operated by an adjustable crank allowing the operator to lengthen or shorten the strokes at will. Motion is applied to the hammer head by means of a connecting rod which carries a cross-head connected to the head by means of links. A heavy spiral spring is used to obtain an elastic blow which removes danger of breakage and also

prevents undue shock to the machine. With this arrangement a short quick blow is secured which is most effective and desirable in hammer work. The shaft journals are cast integral with the frame. The hammer is driven by a motor mounted on the machine and connected to the hammer pulley by means of a belt. The motor is left continually in operation during working hours, the belt slipping around the motor pulley when the hammer is not in operation. To start the hammer, pressure is applied to the foot treadle, which through an idler pulley engages the belt and starts the hammer, and as the pressure is increased the speed of the hammer and the force of the blow are increased accordingly. These machines are made in ram weights from 25 lb. to 300 lb. (11.3 kg. to 136 kg.) and require, respectively, motors from 2 hp. to 7.5 hp.

Motor-Driven Broomless Floor Sweeper

Waste that is liable to fall on the floor in cotton mills can be efficiently swept up and recovered by means of the Firth broomless floor sweeper that is shown in the accompanying illustration. It is equipped with an Edison B-4 storage battery and a 0.10-hp., 12-volt motor directly connected to a special fan which creates a suction that picks up the sweepings and delivers them to a waste receiver. This suction



WASTE PICKED UP AND DELIVERED DIRECTLY TO RECEIVER

air is passed and screened through the receiver, and the discharging current is regulated to force the lint and waste automatically from the spinning frames and other machinery into opposite

alleys and spare floors, to be picked up later by the machine. The motor is started and stopped by means of a key switch. The battery will drive the motor under ordinary conditions at normal constant speed for four hours and can be recharged by means of a General Electric Company Tungar rectifier that is furnished with the machine if desired. The apparatus is manufactured by William Firth, 200 Devonshire Street, Boston, Mass.

Automatic Electric Toaster

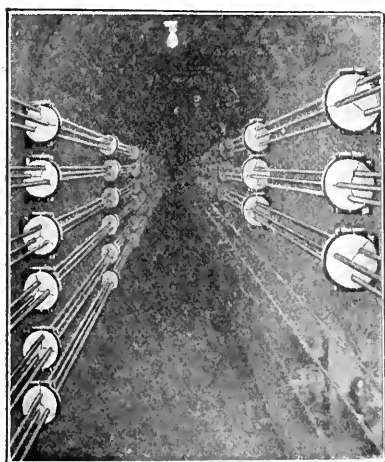
Toast can be automatically turned off by an electric toaster being manufactured by the Rutenber Electric Company of Marion, Ind. When the toast is done on one side a touch of the hand on the metal frame automatically turns the toast so that the other side faces the heat. The device also has extra heating surfaces for warming pieces of toast already done.

Locking Socket for Lamp

Maxolite lighting units are now being provided with locking sockets to prevent the removal of incandescent lamps by unauthorized persons. If an attempt is made to remove the lamp, it will rotate without backing out, and the manufacturers claim that this feature is superior to a device which locks the lamp rigidly in place, because any one trying to remove a rigidly locked lamp by force would be likely to break the bulb. This device is being marketed by the Central Electric Company of Chicago.

Three-Phase Wiring Supports

A device that permits an equilateral triangular arrangement of low-tension high-capacity conductors is being manufactured by the Delta-Star Electric Company, 2433 Fulton Street, Chicago.



NEAT AND COMPACT ARRANGEMENT OF THREE-PHASE CONDUCTORS

The manufacturers claim that this support gives a balanced circuit and reduces impedance to a minimum. It makes a compact and neat wiring arrangement for several distribution sys-

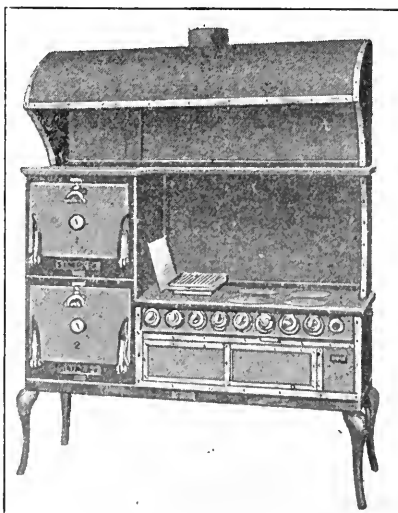
tems and allows a good space factor for the conductors. The support is especially desirable in mills, mines, railroad shops and on consumer premises.

Speed-Reduction Gears That Require Small Space

The description of the mechanical drive for steam-plant auxiliaries and electrically driven units manufactured by the Poole Engineering & Machine Company of Baltimore, Md., that appeared in the May 11 issue of the *ELECTRICAL WORLD* was misleading. The planet gears are not held stationary but rotate on their own axes and also revolve about the center of the pinion shaft as a center. The internal gear is held stationary and does not rotate as stated in the article.

Double Electric Range

A double electric range that has two ovens and four or six heating units has been placed upon the market by the Simplex Electric Heating Company, Cambridge, Mass. Each unit has a



RANGE MARKETING EITHER WITH OR WITHOUT A CANOPY

separate switch and is fused in a cut-out box placed at the end of the range. A small signal lamp indicates whether the current in each unit is turned on or off. The ovens have double walls filled with heat-insulating material. Each oven has a top and bottom heater. They are wired for a three-wire, 120-220-volt service and are furnished either with or without a canopy.

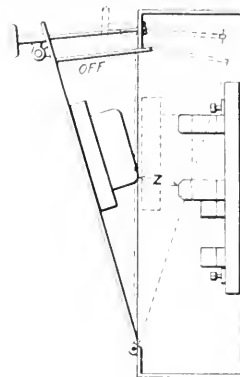
Motor-Driven Air Station

An isolated prepayment air station for supplying air to automobiles is being marketed by the Electric Appliance Company, 701 West Jackson Boulevard, Chicago. Air is furnished by a Brunner air compressor operated by an Emerson motor, both of which are contained in the pedestal base of the station. The station is equipped with 32 ft. (9.7 m.) of 0.3 in. (0.8 cm.) six-ply hose which is wound on a drum placed inside the base. This holder is

released by the deposit of a coin which at the same time starts the compressor. The compressor continues in operation until the holder is released and drawn back into the station.

Safety Switches

Externally operated inclosed switches are being manufactured by the Meyers Electric Safety Switch Company, 1236 Mission Street, San Francisco, Cal. The switches are being made in two types,



KNIFE BLADES ATTACHED TO FLANGED DOOR INSURE SAFETY

namely, type A and type B. Type A is a fused knife switch inclosed in a sheet-metal box. The knife blades are attached to the deeply flanged door of the box, so that opening the boxes operates the switch. This switch may be located in the open position. It is made in sizes suitable for 30 amp. to 100 amp. Type B is of the same general construction as type A, but is used only for such service as requires a service or entrance switch. It is made in sizes ranging from 30 amp. to 200 amp.

Electric Sign

The Flashtrac Sign Works, 210 North Clinton Street, Chicago, Ill., are manufacturing an art-glass electric sign constructed so that the sign sockets are flush with the art glass, permitting the sign lamps to project beyond the art glass. The sign is constructed in such a way that each letter is supported individually and is a separate unit. The entire frame is constructed of 1/8-in. (0.3-cm.) angle iron heavily coated with zinc to make it rust-proof.

Automobile X-Ray Station

For operating between the field hospitals and firing line a complete X-ray equipment mounted upon an automobile and deriving its power from a 2-kw. direct-current generator driven by the gasoline engine has been developed by the Bleaden-Dun Company, 11 South Desplaines Street, Chicago. The transformer and synchronous motor mounted in the cabinet of the cab operate the X-ray machine, which is of the interruptless type. The radiographic table can be tilted 90 per cent and is equipped with one X-ray tube under the table for fluoroscopic work and one tube above for radiographic work.

Combined Wire Holder and Insulator

No tie wires are necessary in the insulator recently brought out by Hubbard & Company, Pittsburgh, Pa., that may be attached to any type of support. The insulator has an arc-over



OPEN-END WALL PLATE PREVENTS ICE FORMING UNDER WIRE HOLDER

voltage of 1900 volts and provides a good safety factor for voltage up to 500 volts. An open-end wall plate is said to prevent ice forming under the plate in winter and forcing the holder from the wall.

Humidity Controlled by Electric Regulator

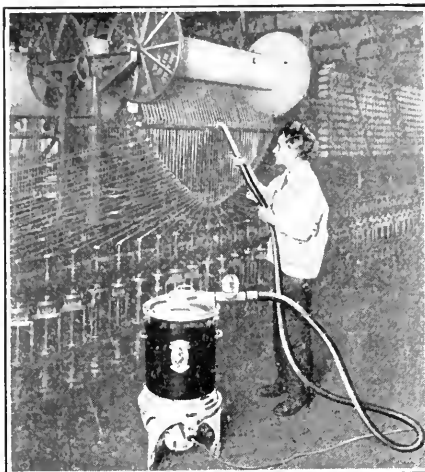
In order to regulate and maintain constant humidity of the box drying room, a Western manufacturer has installed automatic electrically controlled heaters. The humidity often varies in this plant from 40 to 100 per cent in twenty-four hours. In fact, with a change of wind the humidity at times varies 30 per cent in one hour. An instrument was designed in which a small rope of human hair is so connected to the mechanism that the change of linear dimension is multiplied sixteen times by a contact beam, which in turn closes a relay circuit and actuates the potential circuit contactor governing electric heaters. Before being used in the instrument the hair was treated so as to remove any oil present. The requirement was that the humidity in this room be held at 55 per cent, and in order to do this under the most adverse weather conditions it was calculated that a heater capacity of 33 kw. would be required.

The electrical distribution system at the plant is three-phase, 440 volts. When the humidity control apparatus was installed the only transformers conveniently available were 2200 to 110-120 volts. These were used as auto-transformers by making star connections on the lower side and taking taps out of the center. Then by connecting to the center taps on the low side of the respective transformers three-phase current at 125 volts was available. The high side of the transformer was connected delta. With this arrangement under the maximum unbalance imposed on the system, the voltage has been found to vary to an amount not in excess of 3 volts. Three very sensitive thermostats were located along the center line of the room at the quarter, half and three-quarter points respectively. These thermostats actuated two electrical contacts, which energized a relay on the control board. The re-

lay in turn energized one of the double-pole magnetic contactors, so that each contact controlled a section of the heaters totaling 2.5 kw. in rating. Twenty-two 1500-watt electric heaters were used, these being specially designed for three-phase, 125-volt operation.

Vacuum Cleaner for Factories

Dust and lint can be efficiently removed from machines in textile mills and similar plants by a vacuum cleaner that is now being marketed by the Kent Vacuum Cleaning Company of Rome, N. Y., and is known as the "Vacuna Jumbo." The cleaner works on the same principle as the one described in the March 23 issue of the ELECTRICAL WORLD, the only difference being that it is of a larger size. It has but one moving unit—the single motor shaft on



REMOVING LINT AND DUST FROM TEXTILE MACHINES

which are mounted two metal turbines for producing the vacuum. The ends of these shafts are housed in ball bearings contained in grease chambers.

The motor used is of the universal type and is made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Besides removing dust and lint from the intricate parts of the mechanism, this machine prevents the particles from escaping into the air, from which they will again settle on the machines and works. Fire hazard is also reduced in textile mills because the lint does not collect and become soaked with oil.

Motor-Generator Set for Automobile Batteries

The St. Louis Electrical Works, 4060 Forest Park Boulevard, St. Louis, Mo., are manufacturing a line of motor-generator sets especially designed for charging automobile starting and lighting batteries. The motor-generator sets are designed for simplicity and high efficiency. Three sizes of machines are made. One size will deliver 40 amp. at 60 volts and weighs 520 lb. (236 kg.).

A second size will deliver 25 amp. at 40 volts and weighs 274 lb. (124 kg.). The third size will deliver 12 amp. at from 24 volts to 30 volts and weighs 143 lb. (65 kg.). The largest size will charge as many as sixty-four batteries at one time.

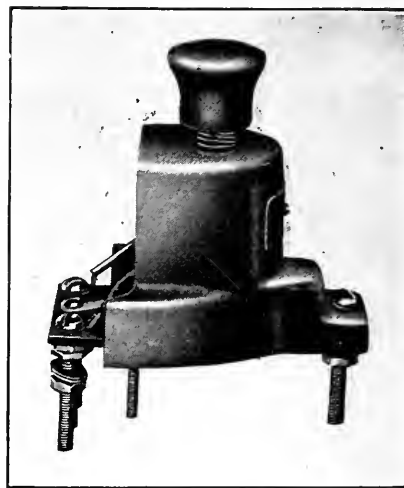
The generator in these sets is of the straight-shunt type. The shunt winding is made of enameled wire. The poles are built of laminations, and the armature is constructed of electrical sheet steel with a comparatively large number of slots. Both the motor and generator are equipped with ball bearings.

Feeder Wire Splicer

A light feeder wire splicer that is easily installed and so designed as to permit removal and reuse is being manufactured by the Ohio Brass Company, Mansfield, Ohio. This device is non-fouling, and can be pulled over cross-arms with foreign wires without catching and thereby causing damage to the wires.

Cut-Out for Farm-Lighting Systems

Farm-lighting systems can be automatically controlled by the reverse current cut-out, as shown in the accompanying illustration. This device will close the circuit when the generator voltage is about 40 volts, and will automatically open it when the charging current is reduced to zero and the battery voltage is higher than the generator. It is especially adapted for use with a gas-engine-driven dynamo set of 1200 watts or less, and is made in standard sizes for 40 volts and 30 amp. Combining reverse cut-out with the start-stop and ignition switch, protec-



COMBINED CURRENT CUT-OUT AND START-STOP AND IGNITION SWITCH

tion is obtained against the damage usually caused when switches are closed at the wrong time. The engine is started by pushing a handle of the switch. This device is manufactured by the Ward Leonard Electric Company, Mount Vernon, N. Y.

Trade Publications

BLOWERS.—The Coppus Engineering & Equipment Company, Worcester, Mass., has issued a bulletin describing its turbo-blowers for undergrate draft.

MOTOR PROTECTION DEVICE.—"The Proper Care of Electric Motors" is the title of a booklet issued by the Motor Protection Company, Pawtucket, R. I.

PIPES.—The A. M. Byers Company, Pittsburgh, Pa., has issued a circular showing a micro-study of Byers wrought-iron pipe and how a cross-section of Byers 1½-in. pipe appears magnified sixty diameters.

ELECTRIC LIGHTING SYSTEM.—"Electrically Lighted Country Places" is the title of a circular issued by the Brackett, Shaw & Lunt Company, Somersworth, N. H., describing its "Quality" electric lighting system.

WATER SYSTEMS.—The Brackett, Shaw & Lunt Company, Somersworth, N. H., has issued a circular describing the Reliance hydro-pneumatic water system. This system gives water under pressure for country places and has all the conveniences of city water systems.

MOTOR GENERATORS.—The St. Louis Electrical Works, 4060 Forest Park Boulevard, St. Louis, Mo., has issued a booklet describing and illustrating its motor-generators and charging panels, which are designed especially for charging automobile starting and lighting batteries.

ELECTRICAL LABORATORY APPARATUS.—The General Electric Company has issued bulletin No. 40,406, describing a complete line of small electrical laboratory apparatus for educational institutions. These units have been designed and built to incorporate the general characteristic features of large commercial electrical types, but of dimensions, capacities and interchangeability of parts adapted to experimental and instruction purposes. This bulletin is well illustrated and gives a list of nearly 120 institutions where G-E electrical laboratory apparatus have been installed.

RECEPTACLES AND APPLIANCES.—"Diamond H" switches are illustrated and described in a bulletin being distributed by the Hart Manufacturing Company of Hartford, Conn. The devices included in the booklet are push-button switches, rotary push and rotary surface switches and flush receptacles. Remote-control and automatic door switches are also described in full, with details of construction. The "Diamond H" relay-control system, with double-throw combinations, is illustrated by wiring diagrams. No-voltage-release remote-control switches are discussed and wiring diagrams printed.

LIGHT FOR THE CLOTHING INDUSTRY.—The Edison Lamp Works of the General Electric Company have prepared bulletin No. 43,410, containing the latest information as to the correct methods of lighting industrial plants, especially those devoted to the manufacture of clothing for our fighting forces at home and abroad. The bulletin is well illustrated, showing various lighting schemes most suitable for industrial purposes, and the facts are brought out that to conserve the employees' health, to save coal, to increase the output and to keep the workers contented, it is necessary that a shop be well illuminated according to modern methods.

INSULATING MATERIALS.—One of the most comprehensive catalogs issued on this line is that recently distributed by the Mitchell-Rand Manufacturing Company of New York City, entitled "Everything in Insulation." Not only are the many forms of insulating illustrated, but a detailed description is given of the treatment of the raw material through the various process stages until the finished article is reached. Various tables of values to those interested in the meaning, purpose and application of these specialties are furnished, with carefully prepared chapters by an expert on insulating paints and varnishes, waxes and compounds. The cross-index gives additional value to this very complete publication, copies of which may be obtained free on application to the company.

ELECTRIC INDUSTRIAL STOVES.—A new folder of publication No. 223 has recently been issued by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., which illustrates and describes the C-H electrical industrial stoves for laboratories, printing and publishing plants, celluloid, hat and shoe factories, test rooms and industrial service in general. The stoves are made in two types, one with a rectangular heating surface

and the other with a disk or circular surface. The heating units are electrically welded to the working surface. The folder describes other details of construction and gives sizes, wattage and other data.

Trade Notes

G. V. P. LANSING, 508 West 112th Street, New York City, has been made local representative for the F. S. Payne Company, manufacturer of electric elevators, Cambridge, Mass.

THE M. B. AUSTIN COMPANY, manufacturer of the Austin line of conduit fittings and wiring devices, Chicago, is the new name of what was formerly M. B. Austin & Company.

THE INTERNATIONAL INSULATING CORPORATION of New York City has taken over the Dickinson Manufacturing Company of Springfield, Mass. The new company's facilities will be materially enlarged.

McMEEN & MILLER, engineers, Chicago, are being dissolved on account of war conditions. It is probable that Kempster B. Miller will continue in practice at the old address. Announcement will be made as soon as plans are more definitely formulated.

THE MAIN ELECTRIC MANUFACTURING COMPANY of Pittsburgh, Pa., is exporting lighting plants of several sizes to South America and India. The United States government has also recently ordered lighting plants in the larger unit size from the company.

THE EASTERN TUBE & TOOL COMPANY is now the name of what was formerly the Eastern Flexible Conduit Company. The company has added to its former line the manufacture of drill chucks and small tools. The factory is at 41 Gardiner Avenue, and the general office address is 594 Johnson Avenue, Brooklyn, N. Y.

THE CHAMBER OF COMMERCE OF PARIS, France, announces that the Paris Sample Fair, which was to be held from May 15 to 30, has been postponed to the first weeks of September. The chamber has received a certain number of pamphlets giving details relative to this national fair, and members may obtain copies of these at its offices.

THE CRANE PACKING COMPANY of New York City has moved to larger quarters in the Park Row Building. Julian N. Walton has been appointed manager. A. W. Payne, connected for some time as manager of the New York district, has been made sales manager of the United States and Canada with headquarters at the home office in Chicago.

F. E. LAUDERBACH has been appointed district manager for the Bussmann Manufacturing Company, St. Louis, Mo. He will have charge of the company's sales in Ohio, western Pennsylvania, West Virginia, Virginia, North and South Carolina, Georgia, Florida, Tennessee, Kentucky and Indiana. Mr. Lauderbach was formerly supervising engineer and manager of the St. Louis office of the National X-Ray Reflector Company.

THE ENAMELING & STAMPING CORPORATION OF NEW YORK, Long Island City, N. Y., has purchased the plant of the Fickling Enameling Corporation of that place. W. I. Fickling is president of the new company, and H. F. Holbrook, formerly president of the Holbrook company, secretary and treasurer. Its capacity has been greatly enlarged, and still further additions are being made to ovens and equipment.

D. C. & W. M. B. JACKSON, engineers, Boston and Chicago, on account of two members of the firm having gone into the national service and the third member expecting to do so as soon as practicable, announce that they will close their offices and suspend business for the duration of the war as soon as the work with which they are now occupied can be completed. The firm expects to resume business on the conclusion of the war.

THE DRIVER-HARRIS COMPANY of Harrison, N. J., announces the election of the following officers: Frank I. Driver, president; Arlington Benschel vice-president; Leon O. Hart, second vice-president; Frank L. Driver, Jr., third vice-president; Percival E. Reeves, treasurer; Stanley M. Tracy, assistant treasurer, and M. C. Harris, secretary. Wilbur B. Driver, formerly vice-president, general manager of manufacturing, has retired from active participation in the business. Mr. Driver says that probably he will engage in a similar line.

New Incorporations

THE GRAZIER ELECTRICAL PRODUCTS COMPANY of Johnstown, Pa., has been chartered with a capital stock of \$10,000 by J. S. Grazier and others.

THE LILLOCK ELECTRICAL COMPANY of Iowa City, Iowa, has been incorporated with a capital stock of \$5,000 by C. H. Myers, C. W. Lillock and others.

SPIERRY & BITTNER of Pittsburgh, Pa., has been granted a charter with a capital stock of \$10,000 to deal in electrical machinery. William A. Bittner is treasurer.

THE RAILWAY & POWER EQUIPMENT COMPANY of New York, N. Y., has been organized with a capital stock of \$100,000. The directors are: A. G. Logan and Ernest Stuart of Brooklyn.

THE KAY BEE MANUFACTURING COMPANY of Los Angeles, Cal., has been chartered with a capital stock of \$25,000 by Kirk White, B. A. Weyl and Charles E. Fleming. The company proposes to manufacture lighting fixtures, etc.

THE GUIDE & SIGNAL LIGHT COMPANY of Shelbyville, Ind., has been organized to manufacture an oscillating device for fans and searchlights, invented by L. Greenberg of Indianapolis. C. S. Camplin of Detroit, Mich., will be manager.

THE ELECTRICAL SERVICE & SUPPLY COMPANY of Sharon, Pa., has been incorporated with a capital stock of \$5,000. The incorporators are: Charles R. Nelson of Sharpsville; George R. Davis, Frank L. Kreider, Karl Kohn and C. L. Kemery of Sharon.

THE B. F. S. MANUFACTURING COMPANY of Worcester, Mass., has been incorporated by B. F. Stenman, Carl W. Fors, Charles E. Mattson and Henry Lindberg. The company proposes to manufacture electric valve grinders and special machinery.

THE LIBERT LIGHTING SUPPLY COMPANY of New York, N. Y., has been incorporated by Henry Hoffman, Maurice P. Hartman of New York City and Aaron Weiss of Brooklyn. The company is capitalized at \$5,000 and proposes to deal in electric and gas supplies, etc.

THE BEACH ELECTRIC COMPANY of San Francisco, Cal., has been incorporated by Harry Beach, Theodore O. Pass, A. P. Burr, all of San Francisco, Cal. The company is capitalized at \$10,000 and proposes to do a general electrical and mechanical electrical engineering business.

A. A. SHEA, INC., of Springfield, Mass., has been incorporated with a capital stock of \$12,000 to manufacture and deal in electrical machinery and equipment. The directors are: Augustus Shea, 91 Pearl Street, Springfield president and treasurer; L. R. Schechterle and E. J. Roberts.

THE VENTILATOR FAN COMPANY of New York, N. Y., has been incorporated with a capital stock of \$5,000 to do a general electrical and mechanical engineering business. The incorporators are: J. Gember, 10 Prospect Park S. W., Brooklyn; M. A. Connelly and Paul G. Burroughs of Brooklyn.

THE WILSON ELECTRIC COMPANY of Jacksonville, Fla., has been incorporated with a capital stock of \$5,000 to manufacture and deal in and repair electrical supplies and machinery, etc. The officers are: Jesse L. Wilson, president; M. W. Wilson, vice-president, and W. J. Wilson, secretary and treasurer.

THE INTERNATIONAL INSULATING CORPORATION of New York, N. Y., has been incorporated with a capital stock of \$60,000 by O. and A. Heinemann 25 West Forty-fifth Street, and J. Schechter, 10 Wall Street, New York City. The company proposes to deal in insulating materials, phonographs and talking-machine records.

CONNETT, BURTON & COMPANY of New York, N. Y., has been incorporated by W. S. Lare, H. Rogers and H. McAndrew, 30 Broad Street, New York City. The company is capitalized at \$300,000 and proposes to act as agents contractors and engineers, in connection with electrical work, ice manufacturing, textile plants, etc.

THE ABELSON-LATLEY LIGHT CORPORATION of New York, N. Y., has been incorporated by S. Andrews, 12 Locust Street, Flushing; L. Fischel, 242 West Seventy-second Street, and H. H. Seabrook, 510 Audubon Avenue, New York City. The company is capitalized at \$50,000 and proposes to manufacture individual electric-light and power plants.

New England States

BANGOR, ME.—A 500 kw. generator is being installed in the Veazie power plant the Bangor Railway & Electric Company, a cost of about \$50,000. The company is now erecting transmission lines to Passadumkeag to supply electricity to the mill of the American Realty Company. This 33,000-volt line runs from Ellsworth to Brewer, Mead, through Castigan, Passadumkeag, and then to Lincoln. A power installation now being placed in the shipbuilding plant the Bangor Shipbuilding Company at South Brewer.

BIDDEFORD, ME.—The Public Utilities Commission has granted the petitions of the York County Power Company of Biddeford for approval of contracts with the Gunquit Village Corporation for lighting the streets of the village for a period of five years from June 1, 1918. Also for municipal lighting in the town of Wells for five years from July 15, 1917.

DERRY, N. H.—The Derry Electric Light Company is contemplating extending its electric transmission line from East Derry over the Hampstead Road to furnish electricity to residents in that section.

MANCHESTER, N. H.—Bids, it is reported, have been taken by the Manchester Electric Light & Power Company for the construction of an addition, 25 ft. by 45 ft., to its local power house. F. W. Gray, 131 Elm Street, Manchester, is architect.

PORTSMOUTH, N. H.—Plans are being prepared for 200 houses which are soon to be erected by the Emergency Fleet Corporation, to be located at Portland, for the employees of the Atlantic Corporation shippers.

ENOSBURG FALLS, VT.—The Water and Light Commissioners have been instructed to purchase a suitable hoist for operating the four headgates at the municipal electric-light plant, and also to purchase a Tirrill voltage regulator, the cost not to exceed \$400, the old dynamo to be exchanged in part payment of same.

CLINTON, MASS.—Work has been started on the construction of a power house and a 100-ft. smokestack at the Ubahia Mills. Two new boilers will be installed.

NORTH BILLERICA, MASS.—The Board of Selectmen has approved the application of the Lowell Electric Light Corporation for extensions of its electric lines in Pine, Orange and Chadwick Streets.

STERLING, MASS.—At a special town meeting held recently it was decided to appropriate \$7,000 for the purpose of extending the electric lighting system to supply electricity to residents in Washacum Park.

STOCKBRIDGE, MASS.—The State Board of Electric Light and Gas Commissioners has approved the merger of the Stockbridge Lighting Company, the Lenox Electric Company and the Great Barrington Light Company, to be operated under the name of the Stockbridge Lighting Company.

WORCESTER, MASS.—The New England Power Company is planning to erect a new office building at 36-37 Harvard Building, to replace the one damaged by fire on March 9.

LONSDALE, R. I.—Work is under way at the installation of a new power system in the Lonsdale and Ashton mills of the Lonsdale Company. The mills, operated by water and steam power, are now being equipped for electrical operation. Energy for operating the mills will be furnished by the Rhode Island Power Transmission Company, a subsidiary of the Connecticut River Transmission Company of Brattleboro.

BRIDGEPORT, CONN.—Extensions are contemplated to the plant of the Remington Arms-Union Metallic Cartridge Company in Bridgeport, including the erection of an addition, 112 ft. by 256 ft.; one two-story building, 50 ft. by 220 ft.; two one-story buildings, 60 ft. by 120 ft., and several other one-story structures.

NEW HAVEN, CONN.—Work has begun by the United Illuminating Company for laying the cables for the ornamental lighting system in Grand Avenue from Olive Street to Mill River.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way.

John H. Deeves & Brother, 103 Park Avenue, New York City, for the construction of an addition, 30 ft. by 40 ft., to its boiler plant.

BROOKLYN, N. Y.—Plans have been prepared by the Bush Terminal Company, 100 Broadway, New York, for the construction of an addition to its local transformer station. Improvements are also contemplated to the present building.

BROOKLYN, N. Y.—Contract has been awarded by the James A. McCafferty & Sons Manufacturing Company, 505 Driggs Avenue, Brooklyn, for the construction of an addition to its plant in Middle Village to W. Southall of Middle Village, to cost about \$50,000. The company manufactures dry batteries, etc.

BROOKLYN, N. Y.—Plans are being prepared by Helmle & Corbett, of Brooklyn, architects, for the building to be erected for the Williamsburg Hospital, at the corner of Driggs Avenue and South Ninth Street. The proposed building will be 126 ft. by 150 ft., seven stories high. The cost is estimated at \$350,000.

BUFFALO, N. Y.—The Demarest Heating Corporation is considering plans for extensions and improvements to its plant.

BUFFALO, N. Y.—Plans have been prepared for the erection of an addition, 35 ft. by 55 ft., to the engine plant at the works of the Fleischman Malting Company, at 2212 Niagara Street, to cost about \$12,000.

BUFFALO, N. Y.—Extensions are contemplated by the Foster Specialties Company, Eighteenth Street, including the erection of a three-story addition, 50 ft. by 250 ft., to its mold shop, a one-story foundry and a six-story general manufacturing building.

NEW YORK, N. Y.—The Interborough Rapid Transit Company is building a new transformer station at 150 East Fifty-seventh Street, to cost about \$45,000.

NEW YORK, N. Y.—Bids will be received by the Board of Health, Department of Health, Centre and Walker Streets, New York City, until June 3 for furnishing and installing lighting fixtures, etc., together with all necessary alterations, etc., as follows: (a) In the pavilion for venereal diseases; (b) in the dormitory for female help on the grounds of the Riverside Hospital at North Brother Island, borough of Bronx. Plans may be seen and blank forms, etc., obtained at the office of the purchasing agent of the Department of Health, Centre and Walker Streets, New York City.

NEW YORK, N. Y.—Bids will be received by W. W. Wotherspoon, superintendent of public works, Capitol, Albany, until June 18, under terminal contract No. 105, for installing the electric wiring, lighting, power, battery-charging equipment and auto scales for Pier 6, East River, New York City. Plans and specifications, proposal blanks, etc., may be obtained at the office of the superintendent of public works, Albany; office of the assistant superintendent of public works for the Middle Division of Syracuse, office of the assistant superintendent of public works for the Western Division at Rochester, and at the canal office, Spaulding's Exchange, Buffalo.

NIAGARA FALLS, N. Y.—Plans are being considered by the City Council for the installation of new electrically driven pumping machinery in the municipal water-works pumping station on Buffalo Avenue.

NIAGARA FALLS, N. Y.—Preliminary plans have been prepared by the Niagara Falls Gas & Electric Light Company for the construction of a new gas plant in Niagara Falls. Willis Adams, Loan Association Building, is engineer.

SCHENECTADY, N. Y.—Plans are being prepared for the erection of an addition, about 120 ft. by 175 ft., to the boiler house at the local plant of the American Locomotive Company.

WATERTOWN, N. Y.—The Brown bill reorganizing the Water Board of the city of Watertown under the name of the Water, Light and Power Board, giving it authority to generate electricity on power sites already owned by the city, to light the streets of the municipality, and to sell excess power within and without the city, has been signed by Governor Whitman.

WELLSVILLE, N. Y.—Notice has been filed by the Kerr Turbine Company of an increase in capital stock from \$500,000 to \$2,000,000, to provide for expansion. The company manufactures turbine engines.

DOVER, N. J.—The New Jersey Power & Light Company of Dover has secured a contract to furnish electricity to operate the plant of the Thomas Moore Trench Machine Company, recently established at Rockaway.

GLOUCESTER CITY, N. J.—Work has begun on the construction of the proposed new power plant to be located on the site of the old Gloucester baseball grounds by the Husey & Jones Company. The new plant will supply energy to the plants of the Pennsylvania and New Jersey Shipbuilding companies.

JERSEY CITY, N. J.—Plans have been prepared by the Central Railroad of New Jersey, Communipaw Avenue, for the erection of an addition to its local power house, to cost about \$50,000.

JERSEY CITY, N. J.—The Board of Freeholders has approved an appropriation of \$25,000 to provide for initial expenditures in connection with the construction of the proposed new central power plant for Hudson County.

NEWARK, N. J.—Bids will be received by the Board of Education, Newark, until June 3, for electric work, lighting fixtures and heating system for the new addition to the Hawkins Street School. R. D. Argue is secretary.

NEWARK, N. J.—Plans are being considered by the Heller & Merz Company, Hamburg Place, for the erection of a new power house, 33 ft. by 70 ft., at its plant. R. G. Corry, 30 Cortlandt Street, New York City, is architect.

NEWTON, N. J.—Plans are being considered for the erection of an addition about 50 ft. by 50 ft. to the power plant of the Sussex Print Works, to cost about \$10,000. Andrew Kidd, Jr., 95 Liberty Street, New York City, is architect and engineer.

VERONA, N. J.—Bids will be received by the Board of Education of Verona until June 4, for the electrical work in connection with the new school building to be erected on Laning Avenue, near Elmwood Road. Bids will also be received for the installation of a heating system. John Culvert is district clerk.

WOODBIDGE, N. J.—Bids will be received by the Township Committee of Woodbridge until June 3 for electrical work in connection with the new municipal building to be erected, and the installation of a new heating system. Andrew Keyes is township clerk.

BEAVER FALLS, PA.—Work has begun on the installation of the proposed new street-lighting system here. The contract calls for the erection of 100-cp. gas-filled electric lamps mounted on steel poles. Owing to the high price of steel and the government demand for it the Borough Council has granted the Duquesne Light Company permission to use wooden poles temporarily.

LEBANON, PA.—Contracts have been awarded by the Lebanon Steel Foundry Company for the erection of an annex, 100 ft. by 200 ft., to its plant. A second two-ton Heroult electric furnace is to be installed with sufficient number of annealing furnaces to handle the product.

NEW CASTLE, PA.—The New Castle Electric Company has filed notice with the Public Service Commission of an issue of \$11,000 in bonds, the proceeds to be used for improvements.

NEW CASTLE, PA.—Notice has been filed by the Shenango Valley Electric Company with the Public Service Commission of an issue of \$39,000 in bonds, the proceeds to be used for extensions and improvements to its system.

PHILADELPHIA, PA.—The Philadelphia Electric Company is contemplating the erection of an addition, about 20 ft. by 45 ft., to its building at Arch and Mascher Streets.

PHILADELPHIA, PA.—Plans have been prepared for an addition, 30 ft. by 52 ft., five stories and basement, to the plant of James F. Burns, 713 Cherry Street, Philadelphia, manufacturer of electrical supplies and devices.

PHILADELPHIA, PA.—Contract has been awarded by John Bromley & Sons to George W. Stewart & Company, 2123 Germantown Avenue, for extensions and improvements to its boiler plant at Front and Dauphin Streets.

PHILADELPHIA, PA.—Work has begun on the construction of a one-story addition, 280 ft. by 345 ft., at the woodworking plant of George W. Smith & Company, located

Middle Atlantic States

BROOKLYN, N. Y.—Plans have been prepared by the Long Island Railroad Company for the erection of a new engine house, 100 ft. by 100 ft., at Eighth Avenue and Sixth Street, to cost about \$15,000.

BROOKLYN, N. Y.—Contract has been awarded by the Brooklyn Gas Company to

on Forty-ninth Street, near Botanic Avenue, to cost about \$150,000. The office of the company is at 3907 Powelton Avenue.

PITTSBURGH, PA.—E. R. Crawford, president of the McKeesport Tinplate Company, has announced that work will begin on the erection of a new steam power plant at its local mills, to cost about \$1,200,000, as soon as possible. Negotiations are pending with the government for the right to erect a wall 400 ft. long and 15 ft. high along the bank of the Youghiogheny River, at the site, between the Thirtieth and Fifteenth Street bridges, Port-view Township.

WILMINGTON, DEL.—Application has been made to the City Council by the Tidewater Power Company for permission to extend its street railway on South Front Street to the city limits and to construct a connecting track on Third Street.

BALTIMORE, MD.—The United Railways & Electric Company has been granted permission to construct its proposed extension to Wagner, in Anne Arundel County, near Baltimore, to serve several industries.

CUMBERLAND, MD.—The City Commission has notified the Edison Electric Illuminating Company of its intention to renew the contract for street-lighting for an additional term of ten years. On July 1, 1917, the city entered into a contract with the company whereby the latter was to light the streets and city buildings for one year ending June 30, 1918. Under the terms of the contract the city has the option of extending the contract for 10 years at the expiration of the year.

HUNTINGTON, W. VA.—Bids will be received by the Board of Commissioners of the city of Huntington until June 10 for lighting the streets of the city. Further information may be obtained from the city clerk and the city engineer. K. L. Hamilton is city clerk.

NEWPORT NEWS, VA.—Application has been made to the City Council by J. N. Shanahan of Hampton, representing the Emergency Fleet Corporation, for permission to construct a street-car line on Fiftieth and Fifty-fifth Streets and Virginia Avenue to furnish transportation to the workmen at the shipbuilding town now being established north of the city limits.

North Central States

CINCINNATI, OHIO.—The Mayor has requested the Cincinnati Traction Company to begin work at once on the construction of an extension to its Warsaw Avenue line.

CINCINNATI, OHIO.—Application has been made to the Council Committee of Street Lighting by J. H. Wulfekoetter, representing the residents of Cottage Hill, asking for a better street-lighting service in that suburb. The present system he states is inadequate, and that many of the streets have no lamps.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until May 31 for motor drives for two sluiceways for the Division Avenue pumping station. Blanks and specifications may be obtained on application to the commissioner of water.

CLEVELAND, OHIO.—An agreement has been reached between the Municipal Electric Light Department and the Cleveland Electric Illuminating Company through the National Council of Defense whereby an interchange of electric output will be made. The proposed connection will cost about \$90,000 and will include the erection of an overhead line between the East Fifty-third Street station of the municipal system and the power plant of the Cleveland Electric Illumination Company on East Seventy-second Street, to provide interchange of power in case of breakdown of either plant. It will be financed by the National Council of Defense.

GALION, OHIO.—The plant and holdings of the North Electric Company of Galion have been taken over by a new corporation to be known as the North Electric Manufacturing Company. The company is capitalized at \$3,000,000 and will carry on the business in this city on a much larger scale.

MASSILLON, OHIO.—Work has begun by the Massillon Electric & Gas Company on the construction of a new switchboard at its plant on South Erie Street, to replace the one destroyed by fire recently. J. F. O'Connor is superintendent.

POMEROY, OHIO.—Work has begun on the construction of the power house for the local lock and dam under the supervision of E. H. Groot, government super-

intendent of the lock and dam. The building is to be 40 ft. by 19 ft.

TOLEDO, OHIO.—The Liberty Equipment Company, recently incorporated with a capital stock of \$100,000, proposes to operate a tractor train service between Detroit, Mich., and Toledo, Ohio, at once. The company will begin with a high-power tractor and 16 trailers. Later on the Liberty Highway Company will operate tractor trains between Toledo and other cities. Frank C. Schmidt and Frank L. Baird are interested in both companies.

YOUNGSTOWN, OHIO.—The Hydraulic Gas & Power Company contemplates increasing its capital stock from \$200,000 to \$300,000, the proceeds to be used for extensions and improvements to its system.

INDIANA HARBOR, IND.—The Mark Manufacturing Company has awarded the contract for the construction of its proposed new steel plant at Indiana Harbor to the Powers-Thompson Company of Joliet, Ill. The original plans provided for an expenditure of \$2,000,000, but it is estimated that the plant complete will cost about \$5,000,000.

SHELBYVILLE, IND.—The Guide & Signal Light Company, recently organized, is planning to establish a plant for the manufacture of an oscillating device for fans and searchlights, invented by L. Greenburg, of Indianapolis. C. S. Camplin of Detroit, Mich., will be manager.

CARBONDALE, ILL.—The Illinois Central Railroad Company is planning to erect a 72-stall roundhouse and mechanical plant in Carbondale, to cost about \$200,000. Much of the heavy work will be transferred from the Burnside shops to this plant.

CHICAGO, ILL.—Contract has been awarded by the Electric Steel Company, Wood and Thirty-first Streets, to the E. W. Sproul Company, 1120 West Thirty-first Street, for the erection of a one-story extension, 130 ft. by 300 ft., to its foundry.

GALLESBURG, ILL.—The installation of the new ornamental lighting system in the business section of the city is nearly completed. The cost of system is estimated at about \$30,000.

MOLINE, ILL.—A new 22,500-kw. turbine is being installed at the power house of the Tri-City Railway, Light & Railways Company in Moline.

ROCKFORD, ILL.—A resolution has been adopted by the City Council providing that steps be taken to secure a bond issue of \$500,000 for establishing a municipal electric-light plant in Rockford.

MILWAUKEE, WIS.—Contract has been awarded by the Pawling & Harnischfeger Company of Milwaukee for the construction of a machine shop addition, 80 ft. by 175 ft., to its main plant at Thirty-eighth and National Avenues.

MILWAUKEE, WIS.—Plans are being prepared by the Allen-Bradley Company, 495 Clinton Street, for the erection of an addition, 50 ft. by 100 ft., to its shop. The company manufactures rheostats and other electric controlling devices, etc. A. C. Eschweiler, Goldsmith Building, is architect.

MILWAUKEE, WIS.—The Universal Machinery Company, 784 Thirtieth Street, Milwaukee, has engaged Frank E. Gay, architect, 86 Michigan Street, to prepare plans for its proposed new foundry and machine shops, to be located at the foot of Sixty-fourth Avenue. The foundry equipment will include one 10-ton crane and a number of smaller cranes and hoists. The cost of the work is estimated at \$250,000. E. C. Devlin is president.

CHASKA, MINN.—Bids will be received by the City Council of Chaska until June 3 for one 4-in., two-stage, high-lift centrifugal pump, directly connected to a 20-hp., 60-cycle, 220-volt General Electric squirrel-cage induction motor with hand compensator. The outfit to be designed to deliver 250 gal. per minute against a total head of 115 ft. J. M. Aretz is city clerk.

COLERAINE, MINN.—Bids will be received by the Board of Education of School District No. 2, Itasca County, Coleraine, until June 1 for electric wiring and fixtures for school buildings at Marble and La Prairie. Separate bids to be submitted for fixtures in each building. W. T. Bray, Fidelity Building, Duluth, is architect.

GLEN LAKE, MINN.—Bids will be received by Sund & Dunham, architects, 514 Essex Building, Minneapolis, until May 31 for a built-in refrigerator and refrigerating machinery at the tuberculosis sanatorium for Hennepin County. Rose & Harris of Minneapolis are engineers.

WILLMAR, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until May 28,

for the erection of farm buildings, including general contract work, plumbing and electrical work, at the State Asylum at Willmar. Plans are on file at the office of the Board of Control St. Paul, office of the superintendent of the institution, Willmar, and at the Builders' Exchange in St. Paul, Duluth and Minneapolis. C. H. Johnston, 715 Capital Bank Building, St. Paul, is architect.

KANSAS CITY, MO.—Plans have been completed by the City Engineering Department for commercializing Blue River from its mouth to Fifteenth Street. Plans provide for a dam at Tenth Street, but for no lock, the boats and barges to be placed on a low car below the dam and pulled around it to a higher level on track by electric power. The cost of the entire project is estimated at about \$1,000,000.

CROSBY, N. D.—The building occupied by the Crosby Light & Power Company and the Crosby Auto Company was recently destroyed by fire. The damage to the electric plant is estimated at \$18,000 and to the auto company at \$10,000.

PEMBINA, N. D.—Bids will be received by the school board of Pembina at the office of the clerk until June 11 for the construction of grade and high school. Separate bids to be submitted on heating, plumbing, electric wiring, vacuum piping, etc. Copies of plans and specifications may be obtained at the office of W. D. Gillespie, architect, Fargo, upon deposit of \$5. Peter Lere is clerk.

SCHUYLER, NEB.—At an election held recently the proposal to issue \$10,000 in bonds for improvements to the municipal electric light plant was defeated.

PLAINVILLE, KAN.—The contract for erecting the proposed new electric transmission line from Plainville to Palco and also installing the distributing system in the latter place has been awarded to J. H. Lee. The Plainville Mill & Elevator Company, which is to furnish electricity in Palco, reserves the right to use the line and may install an electric system in Zurich.

QUINTER, KAN.—At an election held recently the proposal to issue \$5,000 in bonds for improvements to the municipal electric light plant was carried.

Southern States

GIBSONVILLE, N. C.—Plans are being considered by the Gibsonville Milling Company to erect an electric transmission line from Summers Mill to Gibsonville, a distance of 5½ miles.

ESTILL, S. C.—The Estill Enterprise & Fertilizer Company, recently organized, is contemplating the construction of a fertilizer plant. The proposed plans provide for the installation of a fertilizer mixer, cotton gin, ice factory and electric plant, to be driven by an oil engine. Part of the machinery, it is understood, has been purchased.

ACWORTH, GA.—Plans are being considered for equipping the Acworth Hosiery Mills with electrically operated knitting machines, to cost about \$16,000.

KEY WEST, FLA.—The Bell Telephone Company is planning to erect a new telephone exchange to cost about \$200,000.

DAYTON, TENN.—The Dayton Light & Power Company is erecting an electric transmission line from Spring City to Dayton with a view of abandoning its steam power plant at Dayton.

NIXON, TENN.—The Nixon Electric Light & Power Company, recently organized, has acquired the plant and holdings of the Nixon Electric Company. The new owners contemplate the installation of a new 17½-kw. alternator. W. L. Hoover is manager.

ROCKWOOD, TENN.—The Public Light & Power Company of Chattanooga is contemplating rebuilding its electric transmission line from Lenoir City to Rockwood in the near future, changing system from 19,000 to 66,000 volts.

ANNISTON, ALA.—A committee has been appointed by local business men to organize a company to build an electric or a gas-electric railway from Anniston to Camp McClellan. W. H. Weatherly, L. L. Crump and others are interested in the project.

DECATUR, ALA.—The construction of an electric railway from Decatur to Florence, Sheffield and Tusculumbia, a distance of about 45 miles, is under consideration. H. L. Morrill and D. S. Echols of Decatur, and C. E. Warwick of Vicksburg, Miss., are interested in the project.

DANVILLE, ARK.—The installation of an electric-lighting system in Danville is reported to be under consideration.

HELENA, ARK.—Bids, it is reported, are being received by the A. M. Richardson Lumber Company of Helena, recently incorporated, for equipment for power plant and mill. A. M. Richardson is one of the incorporators.

LITTLE ROCK, ARK.—The Arkansas Battery Company of Little Rock is planning to equip a plant and will purchase machinery to cost about \$16,000. W. P. Calloway is president.

PARAGOULD, ARK.—The plant of the Henry Wrepe Company, manufacturer of staves, etc., including machinery, boilers, engines and other equipment, was destroyed by fire, causing a loss of about \$75,000.

PINE BLUFF, ARK.—H. J. Burkhardt of Pine Bluff is reported to be contemplating equipping a woodworking plant, at a cost of about \$250,000.

PRAGUE, OKLA.—Arrangements are being made by the city of Prague for the erection of an electric transmission line south and west to connect with the transmission system of the Oklahoma Power Transmission Company. The work will include the erection of 22 miles of transmission line, an outdoor substation, equipped with three 75-kva., 33,000-2300-volt, single-phase transformers, two 500-gal. per minute motor-driven centrifugal pumps, directly connected, air compressor, etc. Bids, it is understood, have been received for the above equipment.

SHATTUCK, OKLA.—Bonds to the amount of \$75,000 have been voted for rebuilding the municipal electric-light plant and water-works system.

STILLWATER, OKLA.—Bids will be received by the State Board of Agriculture, Capitol Building, Oklahoma City, until June 4 (extension of date from May 2), for the erection of two buildings at the Agricultural and Mechanical College, including electrical work, etc. The cost of the building is estimated at \$200,000. F. M. Gault is president.

WALTER, OKLA.—The Blue Ribbon Oil & Refining Company, recently organized, is reported to be in the market for equipment for a 10,000-barrel pumping station and a refinery with a daily capacity of 5000 barrels. John Aldridge of Oklahoma City is president and general manager.

BANGS, TEX.—Martin & Davis are planning to rebuild their cotton gin, recently destroyed by fire. The cost is estimated at about \$200,000.

BRACKETTVILLE, TEX.—Extensive improvements and extensions, it is reported, are contemplated to the municipal electric-light plant.

McKINNEY, TEX.—The capital stock of the McKinney Telephone Company has been increased from \$45,000 to \$125,000, the proceeds to be used for extensions and improvements to its system.

Pacific and Mountain States

HANFORD, WASH.—Application has been filed at the land office by the Black-rock Power & Irrigation Company asking for an easement for the erection of a high-tension electric transmission line from Hanford to Priest Rapids, a distance of 35 miles. The company, it is assumed, contemplates irrigating a large tract of land lying above the proposed high line canal.

SEATTLE, WASH.—Plans are being prepared by Daniel Huntington, city architect for the addition of another floor to the municipal auxiliary steam-driven electric plant at Eastlake Avenue and Neilson Place. The additional space is to be utilized as an electrical testing laboratory.

SEATTLE, WASH.—Contract has been awarded by the Puget Sound Traction, Light & Power Company to the Stone & Webster Engineering Corporation of Boston, Mass., for the construction of a new coal-conveyor, concrete tunnels and hopper adjacent to its power house at 6600 Fourteenth Avenue, S.

SEATTLE, WASH.—Arrangements have been made by the City Lighting Department to purchase the surplus energy generated by the Stimson Mill Company at Ballard by using the waste material at the mill for fuel. The company agrees to deliver 1300 kw. for 12 hours and 300 kw. for the remaining 10 hours of the day at 0.4 cent per kilowatt-hour.

SEATTLE, WASH.—The Northwest Trading Company of Seattle is in the market for equipment for an electric-light and power plant of about 3000 kw. capacity. A turbine generating set is preferred, otherwise suitable generators directly connected to reciprocating engines, or an offer for

any plant from 1,000 up to 3,000 kw. The electrical system must be three-phase, 6600 volts, 60 cycles. Auxiliary apparatus including suitable boilers for coal, fuel and surface type condensing apparatus with cooling water figured at 75 deg. Fahr, is desired.

TACOMA, WASH.—Bids will be received by Hamilton E. Gronen, commissioner of light and water, Tacoma, until June 3 for furnishing the annual supply of incandescent lamps in accordance with specifications on file in the office of the commissioner.

WALLA WALLA, WASH.—As the first step toward the construction of a hydro-electric power plant to be run in connection with the municipal water-works system, the City Commissioners have ordered a survey of Mill Creek between the intake and Tiger Canyon. It is estimated that sufficient power can be obtained from Mill Creek to pump the water from the deep wells.

WATERVILLE, WASH.—Application has been made to the Douglas County Commissioners by the Chelan Falls Power Company for permission to construct and maintain an electric transmission line in Douglas County.

GOLD HILL, ORE.—The sale of the Rogue River Public Service Corporation's properties in Jackson and Josephine Counties to Newton W. Roundtree of Portland, for a sum just sufficient to cover the court charges, and subject to the bonded indebtedness, has been confirmed by the United States District Court. The holdings include a large acreage in the two counties and the power plants and franchises at Grants Pass and Gold Hill, with transmission lines and franchises in both cities.

PORTLAND, ORE.—Preparations, it is reported, are being made by the Pacific Power & Light Company for the erection of a 6600-volt, three-phase transmission line to supply service to two beet-sugar factories of the Utah-Idaho Sugar Company. The company is also planning to build a new outdoor substation near Kaholotus.

REEDSPORT, ORE.—Preliminary plans are being prepared by the Umpqua Light & Power Company for the construction of a new electric transmission line across the Umpqua River at Reedsport. The Umpqua company recently took over the property of the Gardiner (Ore.) Light & Power Company.

BERKELEY, CAL.—The contract awarded the Pacific Fire Extinguisher Company by the City Council for street lighting has been declared void by the District Court of Appeals in the district embraced by Derby, Warren and Garber Streets.

BISHOP, CAL.—Plans are being considered by the Nevada-California Power Company of Riverside for the erection of a high-tension transmission line to Ely, Nev., to cost about \$330,000.

BOLINAS, CAL.—The Chetco Mining Company is contemplating the installation of electrically driven pumping equipment at its local properties.

FRESNO, CAL.—Plans have been prepared for the installation of an electrolier-lighting system on South Van Ness Avenue.

LA MANDA PARK, CAL.—Tentative boundaries for a county lighting district have been located by the lighting committee. The proposed district extends from the Pasadena City limits to Oak Avenue and north from Colorado Street to White Street.

MARICOPA, CAL.—The Side Hill Oil Company has contracted with the San Joaquin Light & Power Corporation of Fresno to supply electricity for drilling and pumping of all wells on its property. Steam power will be used until the transmission line can be extended to the mine.

ONTARIO, CAL.—Plans have been approved for the erection of a new power house by the Ontario Power Company, to cost about \$60,000. It is proposed to build the new power plant just above Hog's Back, in San Antonio Canyon. It is expected to have the plant completed by Jan. 1, 1919.

REDDING, CAL.—Application has been filed by the city of Redding with the State Railroad Commission for an appraisal of the electrical distribution system of the Northern California Power Company in Redding. The city proposes to establish a municipal plant, for which \$40,000 in bonds have been voted.

RED BLUFF, CAL.—The installation of a municipal electric-lighting system in Red Bluff is under consideration.

SANTA ANA, CAL.—Plans have been filed by Kaufman & Sons of Santa Ana for the erection of a new factory at 1625 East First Street. The company manufactures spot lamps.

SANTA BARBARA, CAL.—A movement is under way for the installation of ornamental lamps on Anapamu Street from State Street to Anacapa. The proposed plans provide for removing overhead wires and placing them in conduits.

BONNERS FERRY, IDAHO.—The property of the Bonner Water & Light Company has been offered to the city for \$80,000. The first offer made through a bonding house several weeks ago was for \$125,000.

SANDPOINT, IDAHO.—The Falls Creek Mining Company is contemplating the installation of a power plant to furnish power for its proposed mill and compressor. The plans provide for the construction of a penstock 900 ft. long, providing for a fall of 260 ft.

OGDEN, UTAH.—The power station and car barns of the Bamberger Electric Railroad Company were recently destroyed by fire, causing a loss of about \$750,000.

BUTTE, MONT.—Improvements involving an expenditure of about \$70,000, are contemplated by the Butte Electric Railway Company in the near future. The proposed work will include double-tracking, new switches, etc.

HARLOWTON, MONT.—Work has begun on the installation of electrically driven machinery throughout the entire plant of the Montana Flour Mills Company, to replace steam power. Electricity to operate the mill will be furnished by the Montana Power Company.

COPPERFIELD, NEV.—The Washoe Copper Company of Copperfield is contemplating the erection of a new forge shop, engine plant and compressor works at its new plant near the Nixon-Nevada property. Copperfield has no post office.

Canada

GRANDE PRAIRIE, ALTA.—Plans are being prepared by the Town Council for the installation of an electric-lighting system, to cost about \$6,000.

CLOVERDALE, B. C.—The Whitlock Waterworks, Ltd., has contracted with the British Columbia Electric Railway Company for an extension of the electric transmission line to the waterworks pumping station. Preparations are being made to replace the gasoline engine with electric motors.

MISSION, B. C.—Extensions are contemplated to the plant of the King Beach Company of Mission, including the installation of additional boiler equipment.

NEW WESTMINSTER, B. C.—The Timberland Lumber Company is erecting a saw mill on the Fraser River, to cost about \$100,000.

REVELSTOKE, B. C.—Improvements are contemplated by the Lanark Mines Company, including the construction of a power plant and installing equipment. W. B. Dornberg of Spokane, is manager.

SYDNEY, N. S.—The Dominion Coal Company, it is reported, contemplates a power development at New Waterford, including the erection of a large power station.

COBALT, ONT.—The power house at the Penn Canadian Mine was recently damaged by fire, causing a loss of about \$5,000.

LEASIDE JUNCTION, ONT.—The Canadian Northern Railway Company is planning to build a roundhouse, coaling plant, ice house, etc., at Leaside Junction. George C. Briggs of Toronto is architect.

PERTH, ONT.—Plans are being considered for remodeling the street-lighting system this spring. It is proposed to change it from 132 to 60 cycles.

SAULT STE. MARIE, ONT.—The power plant of the Great Lakes Power Company was damaged by fire recently, causing a loss of about \$150,000. The plant will be rebuilt at once.

TORONTO, ONT.—Foundations are being laid for machine shop, blacksmith shops, pine and electric shops at the plant of the Dominion Shipbuilding Company, located at the foot of Bathurst Street. The main building will be 485 ft. by 220 ft. The company has contracts for the construction of 12 steel ships.

LEVIS, QUE.—The Levis County Railway Company, it is reported, contemplates improvements to its system involving an expenditure of about \$150,000.

REGINA, SASK.—Improvements are contemplated to the municipal electric-light plant, involving an expenditure of from \$175,000 to \$200,000, and will include the installation of a 5000-kw. electric generating unit.

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Preparing for Conditions After the War

THE United States is to-day fulfilling her part in the great struggle for democracy, and yet if we would fulfill our own destiny in the years that lie ahead, it will be necessary for us to look beyond the contending armies, to look at the blue sky above the trenches, and ask ourselves, "After the war, what?" Having seen the vision of service, we must be careful not to let it fade. We must not feed on false optimism or false philosophy, or, ignoring stern facts, drop back into listlessness. The great problem of immediate importance is the winning of the war, and many trials and tribulations, much suffering and sacrifice must be endured before the war will be won. After that new conditions of life, society, trade and commerce will confront us. We must prepare now to meet them so as to be able to cope with them when they arise. Like the other nations in the combat, we shall be confronted with a colossal war debt, and if we are to face the future with equanimity, we must increase the national income by increasing the productivity of our industries. This will necessitate most cordial relations between capital and labor. Since the other nations will likewise endeavor to increase their productiveness and seek wider markets, our industries must be protected against dumping, and those which are unable to develop themselves by reason of undue foreign competition or other causes will need government assistance. Industries on which other and larger branches of national production depend must be promoted and safeguarded, and measures must be adopted to insure that the experience gained and the progress made by us during the war shall not be thrown away when new relations are established. The financial and economic strain will not be successfully met unless careful consideration is given to these matters in advance. One way of preparing for these after-the-war conditions is outlined in part in this issue.

Placing Emphasis on Home Financing

WHILE a great deal has been said and written about the advantages of selling securities of utilities to the people in the communities served, not nearly enough emphasis has been placed on this method of finding capital. Those who read figures giving the results of certain efforts along this line oftentimes fail to grasp the bigness of the thing. Many, for instance, have read that the Northern States Power Company raised more than \$1,000,000 in one year by this method;

but that sum by itself does not convey the real picture. When it is stated that \$1,000,000 was one-fourth the total capital requirements of the company for that year, we get the proper perspective on the success of the plan. This record was established in a territory composed of several hundred communities; but in the larger cities the method has been equally successful. St. Louis people recently bought \$1,500,000 of 7 per cent preferred stock of the Union Electric Light & Power Company in the short space of twenty days. The central station entered this campaign after the sale of the first Liberty loan and against the protest of brokers who said the thing could not be done. Nevertheless, the sales expense was less by far than it would have been if the capital had been secured through the regular channels.

The foregoing are merely typical instances of what has been done in two communities. Records of equal success have been made in California, in Maryland, in Oklahoma and in Ohio. In some cases the method was tried under the spur of necessity, in others it was a matter of choice. Successes are on record in many states; and they are successes in every sense of the word, for the effort succeeded not only in raising required capital but also in creating better public relations. It seems fitting, therefore, at this time, when capital is difficult to secure through regular channels, to place emphasis on these successes and to point out that there is an opportunity to do more home financing when Liberty loan and other governmental drives for money are not pressing.

Hydroelectric Heating Service

THE supply of heating service by hydroelectric systems is a possible field for preparedness work this year which should receive careful consideration. The shortage of coal which looms ahead in not a few sections of the country for the coming winter, far off as that season still appears, renders the extension of electric heating applications on systems where the supply of energy is derived from waterfalls a very important subject. Every pound of coal which can be saved by substitution means more fuel available for war and other vitally necessary service allied with military operations. It is not to be expected that the heating of buildings on a large scale by electricity will be carried out, but there is an immense field of service for anti-chill heating, so to speak, both in winter and in the fall and spring months.

If the fuel demand continues along the lines now apparent both in the anthracite and soft-coal fields,

many premises comfortably, even luxuriously heated last winter, will be subjected to a rigorous curtailment in the fall of this year. Householders will shut off certain rooms and live in more restricted quarters as regards warmth, and in a good many industrial and mercantile establishments closer control of heat will be insisted upon, accompanied often by actual stoppages of steam supply to departments not absolutely requiring such service.

Now there is an immense field in residential and commercial service where either high-intensity, short-hour or low-intensity, long-hour electric heating may prove of great value, and this is the time for companies prepared to supply energy for such service at low cost to get in touch with the manufacturers of electric radiators and other specialized heating devices for small spaces and make their plans for the extension of such service in time for the fall demand. The portability, cleanliness and simplicity of such equipment are strong points in its favor, and even if the energy is supplied at lighting rates there are many installations possible where short daily use would prove advantageous. For central stations supplying energy from coal-driven plants there are also many opportunities for usefulness in off-peak cooking and other special applications of an industrial character. A vigorous effort should be made this summer to capture a substantial amount of noon-hour electric cooking and heating business in down-town restaurants, hotels and clubs. The slump of the load curve between 12 m. and 2 p. m. in many cities where a big power load exists is literally a thorn in the flesh of efficiency, and every installation using electric heat during that valley helps to conserve coal at the point of use and also at the steam generating station. Hydroelectric plants are, of course, specially suited to the economic development of this kind of service.

Classifying Customers for Utility Convenience

THE work of progressive public service companies inclines one to the belief that it is virtually impossible to analyze too thoroughly their potential fields of service. Central stations may well take a leaf from the book of a large street-railway system which recently completed a card-index record of prominent individuals in its territory. The manager of this company believes that the people residing near his lines are the chief source of his revenue and hence are his most valuable asset. The company referred to can pick out within a few moments all the lawyers in the cities and towns in its territory, if it so desires. It can put in shape almost before one realizes it a complete list of school principals, municipal officials, members of committees in church and society organizations, leaders of women's clubs and persons falling under other classifications. Whenever something arises on the system which interests a particular class, or which interests the marked persons of a particular community, it is now a simple matter to draw out the names and addresses and circularize any group desired.

It costs a central station of good size a substantial sum to write a letter to all its customers, and often there is no need in a particular case to address 100 per cent of the list. Surely there would be something well

worth while in a classified and up-to-date analyzed list which could be segregated for the purposes of selling different classes of appliances or for recommending certain improvements in specialized illumination. Such lists, it is true, are often prepared as occasion demands; but it is safe to say that more work and more effective work can be done where a thoroughly representative permanent list of classified customers exists.

Many central stations know very little about their customers in detail, barring group exceptions, so that much of the effectiveness of distinctive publicity and service extension work along profitable lines is lost. Each manager must decide how far he wishes to analyze his patronage; but unless we are greatly mistaken he can hardly go too far in this direction in the interest of establishing a service of maximum value to the community in terms of the investment.

Electric Truck Service in War Time

IS IT not time to consider the electric truck seriously as a war measure of conservation? As things now look it is more than probable that there will be a considerable scarcity of gasoline during the next year. So much is needed for the truck service of the army and for auxiliary motor craft that the price is certain to rise notably even if there is not such an actual shortage as would justify the government in commandeering the major part of the supply. Steps have been taken to curtail the output of pleasure automobiles, but on the other hand the registrations show plainly that this year there will be more cars in operation than ever before. Under these circumstances it looks very much as if the electric truck would become desirable as an instrument of real conservation. It is quite certainly more economical than horse-drawn vehicles for a large part of our city service, and it is equally evident that under the fuel conditions of the next year or two it will be able to give the gasoline truck a very hard rub. To be sure, it calls on the central station for energy, but it calls for it normally at night, during the period of low load, where its added demand helps the load curve of the station and tends to economical production.

A clear line should here be drawn between electric vehicles as a whole and trucks. To make a thorough success of the electric pleasure care there needs to be an elaboration of charging stations covering the territory so as to make recharging convenient and easy. This would imply considerable investment which at present is perhaps not justified. On the other hand, a large increase in the electric truck service could be made without any considerable addition to the cost of charging stations and with very little increase in their number. The energy needed for driving the trucks constitutes a very desirable night load, taking coal, to be sure, but under circumstances which render its use economical. The work of central stations is now encompassed with government regulations. They are not at liberty to make extensions indefinitely with the hope of picking up business when so large an amount of their output is needed for work associated with the war. Their investment, however, would not have materially to be increased in order to handle the recharging of a considerable fleet of electric trucks belonging to various industries already customers of the central

station. It therefore would seem to be good policy to make an effort to encourage this kind of load, both to help out the load factor and to assist in the conservation of gasoline.

If the increase of trucks for city use in the next two or three years were chiefly in electric trucks, the gain all along the line would be very material. To the central station it would represent added business at a valuable point on the load line; to the user of the truck a convenient and economical method of distribution in city work, and to the government the release of a very large amount of petrol for military and naval uses. We are not advocating any sensational exploitation of electric trucks. They are quite able to take care of themselves at the figures for liquid fuel likely soon to be enforced. As a practical measure of economy in the distribution of goods the electric truck has already made an excellent reputation, and it will not take very much encouragement on the part of central-station operators to increase the use of these vehicles to a point where the saving will be very material. In theory the gasoline truck produces its power efficiently, in practice it is operated a large part of the time under very inefficient conditions; so that if one were looking merely for conservation of B.t.u., electric service would probably show on the right side of the balance sheet. In addition, there is the possibility of specially large and profitable uses of electric trucks in cities supplied from hydroelectric plants, in which there is generally a surplus of power at night that could be most efficiently used. Certainly the subject is one well worth looking into seriously and thoughtfully, with a view of seeing whether encouragement of this particular class of vehicles by the central stations will not have on the whole so good an economic effect as to warrant special effort.

The Summer Load of the Central Station

ONE of the things which worry the central-station manager who serves summer resorts is the problem of handling seasonal load with a fair prospect of remuneration. The exact character of the summer demand varies widely from place to place, ranging from the petty service of little cottages, peanut stands and frankfurter emporiums to the furnishing of complete electric service to half-million-dollar estates. The paper on the economic phases of summer load which is concluded in the current issue gives data from both these extremes and from intermediate points. That summer business adds materially and sometimes very largely to the earnings of the central stations admits of no dis-

pute. That it is as profitable as all-the-year-round load at the same price nobody is inclined to argue. It results very commonly in a maximum capacity demand during the summer months, much greater than in any part of the off-season period, thereby establishing readiness-to-serve at a cost which considered by itself would be somewhat staggering.

The economic nature of the situation hinges chiefly on the steadiness of the load and the length of the season. As respects the first, the diversity factor in the load of a summer colony may often be rather a favorable one, particularly when service is extended to all sorts of purposes, from lighting shacks to furnishing considerable blocks of power to a roller coaster. Summer customers as a rule, too, are not very fussy about extreme precision in regulation and are glad to get light on any reasonable terms to avoid the use and trouble of lamps and candles. A summer resort full of big estates is a very different matter, for it represents usually a load which is not only of considerable magnitude but which persists through a longer season and to a certain extent all through the year. The smaller and less pretentious resorts are likely to have but a short season, very variable from year to year, and never with any material amount of load after the heat of summer is over. The two extremes of summer service must therefore be treated on somewhat different principles. The big country place requires the best of service and may in the aggregate yield as good a return on the investment as the town establishment of the same owner, which is connected for a period not much longer and often not so well equipped with electric service.

It is the small resort, particularly the cheaper sort, which offers the most troublesome problem. Outside construction must be cheap, but inside construction cannot be shaved down on account of fire risk. The total amount of service, except for places of amusement, is small, and the latter furnish load only over a very brief season. The main point of the situation is that this kind of summer load can only be handled profitably at a higher rate than the regular one, on account of the large fixed charges and the small individual services, which involve many meters if energy is metered and many moral hazards if it is not. It is fortunate that the state commissions are taking a sensible and reasonable view of the situation and are making provision for remunerative summer rates. Granted these, such service can be made to pay a handsome addition to the yearly total. In certain territory a gain can be made by establishing interconnection with city plants and taking energy from the summer minimum of these to eke out the summer maximum at the resorts.

WHAT has the electrical industry done, particularly the central stations, toward winning the war? This is the theme that runs through the next issue—the N. E. L. A. "win-the-war" convention issue. The issue has been designed to be a supplement to the Atlantic City convention. None of the customary papers will be presented at the convention, but in the pages of the *ELECTRICAL WORLD* will be found a number of articles detailing the progress and developments of the past year in engineering and commercial activity. Due attention will be paid also to the problem of sub-

The Coming Issues

stituting female for male labor in the electrical manufacturing industry, and consideration will be given to the general background of central-station labor retention. Public relations broadly, with emphasis on the rate situation and the relation of utilities to the government's war program, will be other features of this issue. In addition, the problems affecting the present and future relations of manufacturer to central station will be touched upon. Economy in certain of its phases, as brought about by the war, will be the keynote of the engineering topics discussed.

Readjustment and Reconstruction Commission—I

A Suggestion to the President of the United States that He Appoint Qualified Men to Act Under His Authority and Direction in Preparing for After-War Problems

BY WINGROVE BATHON
Washington Representative ELECTRICAL WORLD

PEACE will come some day. In the meanwhile American industry is doing nothing whatever in an organized way to prepare for the necessary readjustment.

On the other hand, England and her colonies, France, Italy, the Teutonic empires, the far Eastern countries and the Latin-American countries have begun to prepare for readjustment and reconstruction.

What must we do?

This article, and articles to follow, are for the purpose of suggesting the immediate creation of an agency to deal with the situation which will confront American industry at the end of the war—to gather facts now, to make plans now, to educate now, and to lead the industries of the country in the victories of peace when the right time comes.

SCOPE OF THE PROPOSED COMMISSION

In detail, this is to suggest that a great service would be done the American people, and perhaps all of the free peoples of the world, in view of the resources of the United States, which must be drawn upon for a long period by the whole world after the war, if the President of the United States would appoint forthwith a commission, to be the President's own commission, to prepare for after-the-war problems—such a commission to be one not hampered by legislative enactments of Congress as to powers upon which it might be difficult for Congress to agree, not curbed and controlled by government appropriations or the fear of lack of them, but nevertheless certainly be established under the government sanction of an executive order and be assisted by the creation of an advisory council of government officials and possibly by the chairmen of some committees of Congress. Many executive officials and legislators are themselves too busy with the work of the war to lay aside their burdens of to-day to deal with after-the-war problems. Their assistants and associates should be used.

As to the main commission, it should include not only leaders in industry of all forms, taken from the ranks of private endeavor, but it should include leaders in labor, leaders in education and leaders in every other endeavor which enters into industrial effort. Such a commission should report only to the President and should take as much of its inspiration from his leadership as he may have time to spare from the conduct of the war with which he is charged by the Constitution. Such a commission might very well include in its appointees the following:

E. H. Gary, president of the American Iron and Steel Institute.

Samuel Gompers, president of the American Federation of Labor.

Arthur N. Talbot, president of the American Society of Civil Engineers.

C. P. Main, president of the American Society of Mechanical Engineers.

E. W. Rice, Jr., president of the American Institute of Electrical Engineers.

Sidney J. Jennings, president of the American Institute of Mining Engineers.

William H. Nichols, president of the American Chemical Society.

F. J. Tone, president of the American Electrochemical Society.

J. B. Doan, president of the American Machine Tool Builders' Association.

H. A. Wheeler, president of the Chamber of Commerce of the United States.

P. H. Gadsden, secretary of the American Electric Railway Association and resident Washington member of the Electric Railway War Board.

S. G. Williams, president of the Highway Industries Association.

In addition to these, the commission might also include the presidents of some of the various national organizations occupied with production and manufacture in the lumber, leather, rubber, textile, glass and other great industries of the country; also perhaps the president of the Farmers' Grange, the president of a great railroad, the president of a great shipping company, the president of a great educational institution, the president of a great insurance institution, and perhaps the president of the American Bar Association and the president of the American Medical Association, but, in any case, even if only to assure reports from abroad, the following representatives of American business in other countries:

A. V. Edwards, secretary of the American Commercial Club of Argentina, Buenos Aires.

Charles Lydecker, secretary of the American Chamber of Commerce for Brazil, Rio de Janeiro.

James R. Morse, secretary of the American Chamber of Commerce in China, Shanghai.

George M. Cassatt, secretary of the American Chamber of Commerce in England, London.

Charles H. Sherrill, secretary of the American Chamber of Commerce in Paris, France.

J. B. Stetson, Jr., secretary of the American Chamber of Commerce for Italy, Milan.

C. B. Parker, secretary of the American Chamber of Commerce for Mexico, Mexico City.

Preston M. Smith, secretary of the American Chamber of Commerce for Spain, Barcelona.

Theodore R. Yanco, secretary of the Chamber of Commerce of the Philippine Islands, Manila.

CHANGING FROM WAR TO PEACE BASIS

In Washington the peace-time industries of the country are now being placed upon a war basis in a gradual manner. There has been time for a gradual "turning over" in the further organization of the war, which has been proceeding steadily month by month. But when the industries of the country have been fully placed upon a war-time basis, when supplies of labor, sources of material, reserves of capital and the markets for production have all been altered to meet war needs, it will be impossible to place industry back upon a peace basis gradually without danger of disaster second only in importance perhaps to actual loss of the war.

To meet that danger there must be organized preparation, such as is now proceeding in all of the countries at war except the United States, and these suggestions are being made to set forth a working plan as a nucleus for discussion and action.

The facts and the prospects for the future are being discussed and acted upon in almost every country of the world except this. Literally thousands of books, pamphlets and other writings have been produced in foreign countries to educate the people along these lines. More than two years ago there was created in Great Britain a reconstruction committee, which has since become an agency of the British government, the work now being in charge of Dr. Christopher Addison, a Minister in the British Cabinet without portfolio, and more than two hundred sub-committees plentifully supplied with experts are now engaged in solving British after-the-war problems.

The details of what has been done in Great Britain and the other countries previously mentioned, some suggestions as to what should be done toward readjustment in this country, and suggestions for the personnel of an advisory council, also to be created by executive order, under the chairmanship, perhaps, of Frank Lyon Polk, counselor for the Department of State and second in command of that department, will be offered in following articles. The personnel of a suggested advisory council will be dealt with in the next article as of prime importance because this personnel will include many of the detailed legislative and executive war organization contacts of the United States, which must be continued at work long after the war in all likelihood, in order—to use a homely phrase—to assist in “unscrambling the eggs.”

There is need at once for a responsible high officer of the government, occupying a position such as that of the counselor of the State Department—and for him to have important associates—on such an advisory council, to answer fully, freely and day by day, now, the questions that a President's commission on readjustment and reconstruction might put to the government and to help solve the commission's problems.

After the war, because of accelerated thinking, we can secure the adoption of ideas that otherwise would not be acceptable or would be acceptable only after a very lengthy educational process. Therefore we have an opportunity now; for, in addition to such obvious readjustment and reconstruction work as the orderly reintroduction to industry of returned soldiers, the development of export trade and the use of our productive capacity for our industries expanded by war needs, we can use, now, the opportunity to secure the adoption by the people generally of economic theories for the husbanding of our exhaustible natural resources, such as coal and other fuels, iron, timber, etc., and we can also bring about now the adoption of policies which will insure the perpetual renewal of even some of the so-called inexhaustible natural resources, such as the soil and its products.

The tendency in any civilization after the struggle to subdue new lands is passed and life becomes less harsh is to seek ease and pleasure and not to put forth such great energy in production. The result is that the demand tends to become greater than the supply; that is, we consume more than we produce. This leads to social dissatisfaction and the moral influences which lead to decay.

INTERCONNECTION PLAN PROPOSED FOR RICHMOND

Fuel Administration Recommends that Virginia Railway & Power Company Buy Surplus of the Municipal Plant

Harry Flood Byrd, Virginia State Fuel Administrator, urges interconnection of the generating stations of the Virginia Railway & Power Company and the city of Richmond. His letter, addressed to the company and the administrative board of Richmond, says:

An investigation by electrical experts discloses that 4,000,000 kw.-hr. of power generated by water without cost by the electric plant owned by the city of Richmond is not being utilized and is being permitted to go to waste. The commercial sale of this power is prohibited under an existing city ordinance. The sale of this surplus power to the Virginia Railway & Power Company will enable the release of an estimated quantity of from 5000 to 6000 tons of coal annually. The city of Richmond will benefit by receiving the fair market prices of the power for which it is not now receiving any return.

The successful prosecution of the war will be advanced by the conservation of the coal saved—no small item—when even now vital war industries are being embarrassed by shortage of coal.

By an intercommunication of this character the city of Richmond will have a surplus of power which may perhaps be the deciding factor in the determination of the government to locate here war industries of an important nature. The shortage of power and coal in the New England States is now so acute that the government recognizes that the future war industries must be established where conditions are more favorable. As a war measure the connection as proposed is of such obvious advantage in making available surplus power now going to waste that the administration confidently expects the cordial co-operation of all parties affected.

The proposed arrangement will only last during the duration of the war. The individuality of each plant will not be disturbed. In view of the conditions as stated above, and following a conference with C. E. Stuart, chief of power and light division, United States Fuel Administration, Mr. Dickerson of the State Corporation Commission and representatives of the administrative board and the Virginia Railway & Power Company, I feel warranted in requesting that the interconnection be established at the earliest possible time.

To settle the financial details involved as between the city of Richmond and the Virginia Railway & Power Company, I suggest a board of arbitration, one member to be appointed by the city of Richmond, one by the Virginia Railway & Power Company, and these two to select the third. If desired, the administration will furnish an expert adviser. In this way, a fair price for the power sold by the city of Richmond to the Virginia Railway & Power Company could be arrived at.

The Fuel Administration will undertake to secure priority orders for the prompt shipment of the transformers and other equipment necessary to establish this connection.

The proposed interconnection in Richmond is earnestly desired by Dr. Garfield, who has been personally consulted and who is familiar with the situation.

Mr. Byrd has also made public a letter from Mr. Stuart pointing out the waste of city energy generated by water power, the seriousness of the fuel situation and the need for all the conservation possible. The government is attempting to centralize such plants, and Richmond is the first Southern city to be approached in the matter. Favorable action in Richmond would be extremely beneficial, Mr. Stuart believed, in having similar steps taken in other cities.

Company officials have indicated readiness to enter into negotiations for purchasing the surplus product of the municipal plant.

Sudden Short Circuits of Alternators—II

Thorough and Critical Exposition of Electromagnetic Phenomena Attending Sudden Short Circuits of Alternators in the Light of Recent Experimental Results—
Practical Methods of Calculating Characteristics

BY N. S. DIAMANT, RICE INSTITUTE, HOUSTON, TEX.

THE phenomena that take place when an alternator is short circuited are such governing factors in designing and operating alternating-current generators, in selecting oil switches and in laying out bus and switching arrangements that every engineer having to do with the generation of power or the apparatus used should have a practical working knowledge of the factors which affect the short-circuit characteristics. Now that larger units are being built and bigger networks are being served the dangers from short circuits are becoming more serious than they ever were.

In the May 18 issue of the ELECTRICAL WORLD a discussion of this subject was started by the author, in which he analyzed the electromagnetic phenomena which take place, considered three-phase sudden short circuits, made a critical analysis of short-circuit equations and gave physical interpretations of sudden short-circuit phenomena. In this issue he concludes the subject by discussing practical methods of determining the different short-circuit constants, single-phase sudden short circuits and the effect of load on sudden short-circuit armature currents.

PRACTICAL METHODS OF DETERMINING THE DIFFERENT SHORT-CIRCUIT CONSTANTS

The damping factors α_f and α_a can be determined experimentally by taking oscillograms of the rise of di-

and $C, C', C'',$ etc., of the armature current as indicated in Figs. 5 and 6. Then¹⁷

$$\frac{FC - I_{RR'}}{F'C' - I_{RR'}} = \epsilon^{\alpha_f \pi} \quad (4)$$

or, approximately,

$$\frac{FO + OC}{F'O' + O'C'} = \frac{FC}{F'C'} = \frac{F'C'}{F''C''} = \epsilon^{\alpha_f \pi} \quad (5)$$

Similarly,

$$\frac{FO - OC}{F''O'' - O''C''} = \epsilon^{2\alpha_a \pi} = \frac{OM}{O''M''} \quad (6)$$

or,

$$\frac{FO - OC}{F'O' - O'C'} = \frac{F'O' - O'C'}{F''O'' - O''C''} = \frac{OM}{O'M'} = \epsilon^{\alpha_a \pi} \quad (7)$$

where $M, M', M'',$ etc., bisect at every point the vertical lines $FC, F'C', F''C'',$ etc. (Figs. 5 and 6).

Applying this method of calculation to a 10,000-kva., 2400-volt, four-pole, 60-cycle alternator,¹⁸ Table III was obtained, in which columns 1 and 2 were measured off directly from the sudden short-circuit oscillogram. Taking the mean of column 5, $\alpha_f = 0.0155$, and from the mean of column 6, $\alpha_a = 0.0565$. α_f for the first cycle, however, is about 0.0244. From the armature current given in Fig. 6, the mean value of $\epsilon^{\alpha_f \pi} = 1.07$, whence $\alpha_f = 0.0215$, and $\epsilon^{\alpha_f \pi} = 1.19$ for the first cycle, whence $\alpha_f = 0.0357$.

The peculiar fact that the attenuation factors and

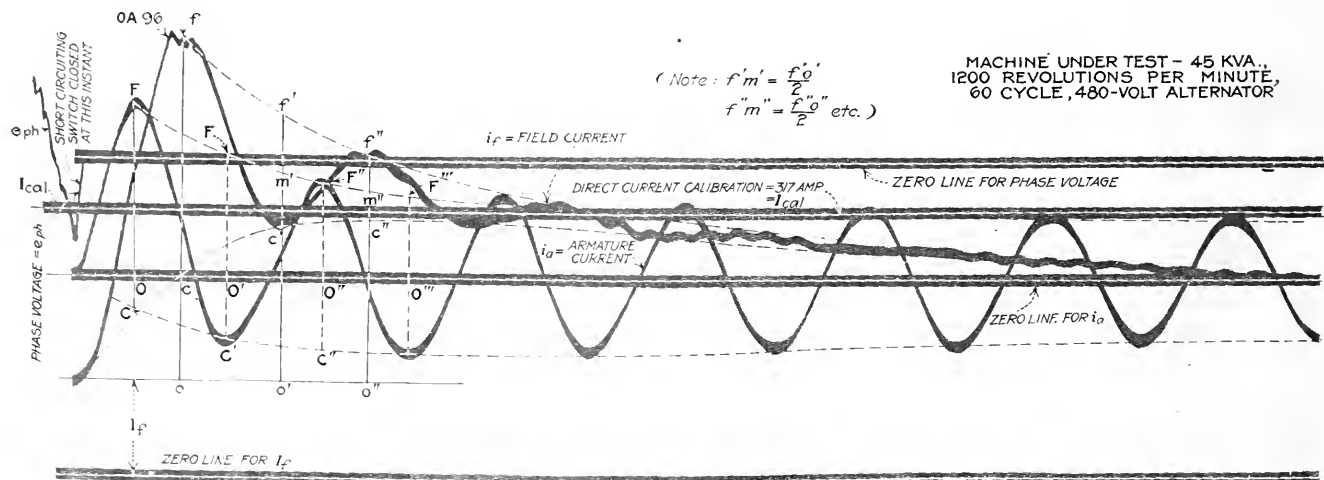


FIG. 5—SUDDEN SHORT-CIRCUIT FIELD AND ARMATURE CURRENTS OF A PARTICULAR MACHINE UNDER NORMAL EXCITATION

rect current in the field and armature respectively with the machine running at full speed and the secondary dead short-circuited. This method was developed by the author, and so far as tested by him it has given satisfactory results and affords a very convenient and probably a fairly accurate way of determining L and λ . The extent of reliability of this method must, of course, be determined by further practical experience.

If sudden-short-circuit oscillograms are available, the following methods may be used to determine α_f and α_a :

(1) Draw the exponential envelopes $F, F', F'',$ etc.,

especially α_f are larger for the first cycle or two of the sudden short circuit was mentioned before in the first

¹⁷This method was first described by C. M. Davis in the *General Electric Review* for August, 1914, p. 813. It was independently derived and used by the writer, who first gave its mathematical proof (*loc. cit.*, p. 2260). In a semi-graphical description of the method given recently by E. O. Shirley in the *General Electric Review* for February, 1917, p. 121, it is stated that this method of analysis is applicable only to a sudden short circuit at the terminals of the machine, in which case the resistance drop is negligible compared to the reactance drop. This statement is not correct in the opinion of the author. The methods described in the above section are general. The proof of (4) to (5) follows directly from (3) by writing expressions for $F, F', F'',$ etc., and C, C', C'' and adding and subtracting corresponding ordinates.

¹⁸See *Transactions A. I. E. E.*, Vol. 31, "Operating Characteristics of Large Turbo-Alternators," by A. B. Field (Fig. 2).

installment of this article. The explanation of this phenomenon seems to be that at the beginning of the transient period the rate of change of flux is so high and the flux distribution so non-uniform that the effective resistance is higher owing to the larger eddy current losses, while in all probability λ is smaller owing to the greater leakage and saturation and the larger

TABLE III—ATTENUATION FACTORS CALCULATED FROM TRANSIENT ARMATURE CURRENT (FIG. 6)

Ordinates $OF, OF',$ Etc.	Ordinates $OC, OC',$ Etc.	Sum, $OF+OC$ Etc.	Difference, $OF-OC$ Etc.	Ratios of Column 3, $\varepsilon^{a_f\pi}$	Ratios of Column 4, $\varepsilon^{a_a\pi}$
1	2	3	4	5	6
14.4	2	16.4	12.2	1.08	1.22
12.6	2.6	15.2	10	1.05	1.21
11.38	3.1	14.5	8.25	1.05	1.18
10.4	3.4	13.8	7	1.04	1.18
9.6	3.7	13.5	5.9		

induced currents. Thus the increase of r and the decrease of λ would make $\alpha = r/\lambda$ larger for the first few cycles of the short circuit than for the subsequent cycles. Considering the fact that neither r nor λ is absolutely constant, about the only thing that can be done is to employ average values which will give satisfactory results in ordinary practical work. Knowing of the existence of such peculiarities, however, it is possible to introduce them into the calculations as "refinements" whenever accuracy makes it desirable or necessary.

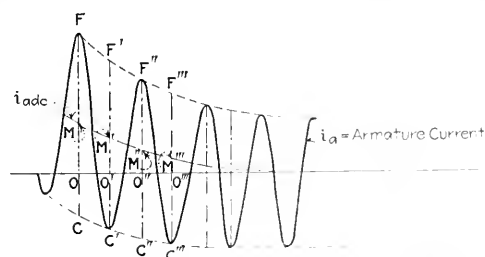
The armature and field attenuation factors can also be calculated from the transient field current by drawing the exponential envelopes $f, f', f'',$ etc., and $c, c', c'',$ etc., as indicated in Fig. 7. Then ¹⁰

$$\frac{fo + co}{f'o' + c'o'} = \frac{f'o' + c'o'}{f''o'' + c''o''} = \varepsilon^{a_f\pi} \quad (8)$$

and

$$\frac{fo - co}{f'o' - c'o'} = \frac{f'o' - c'o'}{f''o'' - c''o''} = \varepsilon^{a_a\pi} = \frac{mc}{m'e'}, \text{ etc.} \quad (9)$$

This method of calculation is illustrated in Table IV,



FIGS. 6 AND 7—SHORT-CIRCUIT ARMATURE AND FIELD CURRENTS WITH ENVELOPES AND COMPONENTS

in which columns 1 and 2 were measured off directly from curve i_f of Fig. 7 and columns 5 and 6 were calculated by means of (8) and (9).

Taking the mean of column 5, $\varepsilon^{a_f\pi} = 1.078$, whence $\alpha_f = 0.023$ and assuming $\varepsilon^{a_f\pi} = 1.125$, then $\alpha_f = 0.0374$. The mean of column 6 gives $\varepsilon^{a_a\pi} = 1.164$, whence $\alpha_a = 0.18$.

It may be noted that this method is independent of the time angle θ_i , at which the sudden short circuit may

occur, while the method involving equations (3) and (4), which gives α_a , fails when θ_i is nearly 90 deg., i. e., when the sudden short circuit occurs near the maximum point of the emf. wave, and the armature current is or becomes symmetrical so rapidly that $(oc - of)$, etc., = 0.

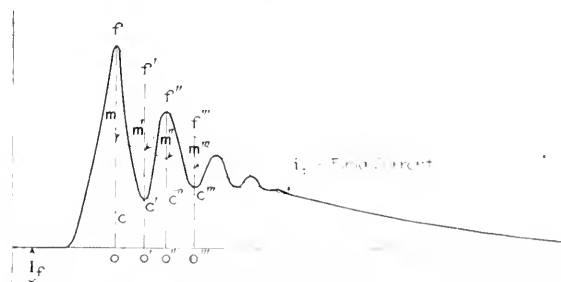
The determination of the attenuation factors is very

TABLE IV—ATTENUATION FACTORS CALCULATED FROM TRANSIENT FIELD CURRENT (FIG. 7)

Ordinates, $fo, f'o,$ Etc.	Ordinates, $co, c'o',$ Etc.	Sum, $fo+co,$ Etc.	Difference, $fo-co,$ Etc.	Ratios of Column 3, $\varepsilon^{a_f\pi}$	Ratios of Column 4, $\varepsilon^{a_a\pi}$
1	2	3	4	5	6
68.5	21.5	90	47.0	1.055	2.095
54	31.5	85.5	22.5	1.125	1.61
45	31	76	14	1.086	1.75
39	31	70	8	1.045	1.9
36	31	67	5		

important, as is beginning to be recognized, for the following reasons: (1) They permit the calculation, with fair approximation, of the maximum possible short-circuit current, which is important from the point of view of the stresses set up in the alternator; (2) they greatly affect the rate of decay of current and consequently the selection and rating of circuit breakers as was clearly brought out in a recent paper presented at the midwinter convention of the A. I. E. E.¹¹ In this connection it is of interest to consider Table V, which brings together some of the data given in the foregoing pages.

It may be observed from this table that the attenuation factors α_a and α_f are apparently limited to a fairly small range of values, for alternators ranging from 700 kva. to 15,000 kva. For example, α_a lies between 0.07 and 0.044, while α_f lies between 0.01 and about 0.03. The damping factor α_f of small salient pole alternators is, of course, about the same or smaller on account of the high inductance of the field spools, while α_a is larger than that of large turbo-alternators



owing to the comparatively high resistance of the armature.

From the foregoing it would appear that one may be justified in attempting to give representative average sudden-short-circuit characteristic curves of decaying armature currents to cover "modern alternators of normal design." This is done in the paper just referred to, in which it is proposed, quite rationally, to base the selection of oil circuit breakers upon such

¹⁰The proof of this follows directly from equation (2) by writing the equations of the envelopes and adding and subtracting corresponding ordinates.

¹¹"Rating and Selection of Oil Circuit Breakers," by Mahoney and Burnham, *Proceedings A. I. E. E.*, February, 1918. Also *ELECTRICAL WORLD*, February 23, 1918, p. 43.

average curves. However, considering the fact that Table IV is not so accurate and complete as might be desired, and further considering the large damping effect which will be caused by a comparatively small increase, up to a certain value, in α_a and α_f , it is well to exercise a little caution in the use of such average curves to apply to all modern alternators.

SINGLE-PHASE SUDDEN SHORT CIRCUITS

The principles involved in single-phase sudden short circuits are identical with those given for three-phase alternators, so that fundamental equations may be set up and expressions obtained for the field and armature currents in a similar manner. However, as the algebra involved in the solution of the equations is tedious and complicated, it will not be given here, but attention will be called to the following facts:

1. The double-frequency armature reaction superim-

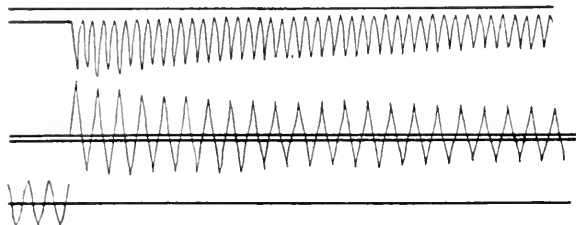


FIG. 8—SINGLE-PHASE SUDDEN SHORT CIRCUIT OF A 37.5-KW., 240-VOLT, 60-CYCLE ALTERNATOR AT NORMAL VOLTAGE AND SPEED

First wave—field current; second wave—armature current (note peaked appearance of the individual half waves as compared with those of Fig. 7, which, though taken on a different machine, are very similar in wave shape and smoothness to the three-phase sudden short-circuit current waves obtained with this alternator); third wave—armature voltage; second straight line from bottom—calibration curve (113 amp. direct current).

poses a double-frequency alternating current on the field current, which is made up of three components just like the three-phase sudden short circuit. This fourth double-frequency component, of course, persists during the sustained short circuit (Fig. 8).

2. The decaying direct current, I_{adc} (Fig. 4a), due to the change of flux in the armature, produces an alternating current of fundamental frequency in the field. This added to the double-frequency pulsation mentioned under (1) makes the alternate crests of the double-frequency component unequal, as clearly illustrated in Fig. 8. However, if the sudden short circuit happens to occur at $\theta_1 = 90$ deg.—i. e., at the maximum point of the emf. wave—then, as already explained, i_{adc} will be zero and thus the crests of the pulsating double-frequency current will be equal.

3. The armature current is more peaked, or in general the individual half-waves appear to deviate more from a sine wave, in case of a single sudden short circuit than in case of a three-phase sudden short circuit. This seems to be true more of some machines than others, and in case of wave shapes of armature current like the one illustrated in Fig. 8 it is fairly clear that the peaked appearance of the half-waves is due to the presence of a third harmonic. This third harmonic is no doubt caused by the double-frequency pulsation in the field. Theoretically, as already explained, the second, fourth, sixth, etc., even harmonics should be present in the field and the third, fifth, etc., odd harmonics in the armature. However, experience shows that in

ordinary work the harmonics higher than the third are negligible.

4. According to the experience of the author and others, it appears that the methods of calculation outlined in the first part of this article are applicable to single-phase sudden short circuits despite the fact that the armature and field current equations are rather long and complex.²¹

EFFECT OF LOAD ON THE SUDDEN SHORT CIRCUIT ARMATURE CURRENT

According to the theory developed in the foregoing, it should be quite clear that the load carried by the machine before a sudden short circuit will affect the arma-

TABLE V—DATA ON ATTENUATION FACTORS

Description of Machine	Attenuation Factors of Field and Armature	Calculated from Mean of Several Successive Cycles
45 kva., six-pole, 1200-r.p.m., 480-volt	$\alpha_a = 0.154$ $\alpha_f = 0.0257$ $= 0.0093$	Mean of several oscillations. From first cycle From several successive cycles
700 kva.,* 4000-volt, 60-cycle	$\alpha_a = 0.0677$ $\alpha_f = 0.019$ $= 0.010$	From several successive cycles From first two cycles From several successive cycles
10,000-kva.,† 2400-volt, four-pole, 60-cycle	$\alpha_a = 0.0565$ $\alpha_f = 0.0244$ $= 0.0155$	From several successive cycles From first cycle From several successive cycles
15,000-kva.,‡ 25-cycle, 1500-r.p.m., 11,000-volt	$\alpha_a = 0.059$, phase 1 $= 0.0444$, phase 2 $\alpha_f = 0.0291$, phase 1 $= 0.0167$, phase 3	From several successive cycles From several successive cycles From several successive cycles From several successive cycles

*See footnote 12. †See footnote 18. ‡Transactions A. I. E. E., Vol. 34, 1915, p. 2277 Fig. 4, "three-phase sudden short circuit at normal voltage."

ture current only in so far as it affects the amount of flux existing in the armature and field before and after the sudden short circuit. Thus for a given terminal voltage the armature current will be larger for a heavy inductive load than for no load in the proportion in which the flux in the machine (not the field excitation) or the generated internal emf. is larger in one case than in the other. In short, the transient armature and field currents are affected only indirectly by the field excitation existing at the instant of the sudden short circuit and depend directly upon Q_{adc} and Q_{fdc} (Fig. 4), which in turn depend upon the difference of the flux before and after the sudden short circuit.

This theoretical conclusion has been corroborated experimentally by the writer and others, and it has furthermore been found that the increase of armature current due to load is relatively unimportant in small alternators having high resistance in the field and armature, but becomes more important in case of large turbo-alternators having comparatively low resistance in the field and armature. A little consideration will show that this is as might be expected, since, for a given change in flux, Q_{adc} and Q_{fdc} (Fig. 4) are inversely proportional to the resistances r_a and r_f respectively.

Wages in Shipyards

The Shipbuilding Labor Adjustment Board has announced a schedule of minimum wages for labor in steel shipyards in the Great Lakes region. Here follow the wages, in cents per hour, for the electrical department: Electricians, first class, 70; electricians, second class, 65; wiremen, 55; joiners, 70; machinists, first class, 72½; helpers, 46.

²¹See Boucherot equations for single-phase short circuits.

Present Status of Brass Melting—I

Fundamental Principles Upon Which Success of Electric Melting Depends—Relative Merits of the Different Types of Furnaces That Are Now Upon the Market—The Central-Station Viewpoint

BY H. M. ST. JOHN

Commonwealth Edison Company, Chicago

IF ALL of the brass and bronze produced in the United States were to be melted in electric furnaces, the annual consumption of electrical energy for this purpose would be in the neighborhood of 200,000,000 kw.-hr. and the generating capacity required to supply the necessary power would be about 75,000 kw. There is little reason to expect the complete electrification of this industry, either now or in the future, but the expansion in this field which may reasonably be predicted will be sufficiently large to be interesting to the central-station companies.

The central station not only has an object in promoting the satisfactory progress of this development, but it has at stake interests which can be protected only by a constant oversight of such features of the development as directly concern itself. For example, the success of the central-station company depends upon the proper selection and correct use of the customer's equipment, since the customer's use of the company's service cannot possibly be satisfactory if its method of application is faulty. This may be a matter of minor importance in so far as it concerns the use of motors and other well-standardized equipment, but it is a matter of great importance when it involves new electrical devices or new processes which are not well understood and are, perhaps, entering the industrial world in a somewhat crude and undeveloped form.

Certain fundamental principles, upon which the success of electric brass melting directly depends, have hardly received, at least in public, the consideration which they deserve, and they will be discussed in this paper. In discussing them particular attention will be called to the bearing which they have upon electric furnace design and development.

In 1914 it was estimated by Gillett¹ that there were in the United States at least 3600 plants engaged to some extent in melting brass and bronze. It was further estimated that the value of the metal annually melted by these plants was in the neighborhood of

\$120,000,000, and that of this total the value of the metal lost beyond recovery during the melting operation was not less than \$3,000,000. When one considers the extensive use of brass and bronze in warfare and the enormous industrial expansion along metallurgical lines which has taken place in this country since 1914, it should be evident that corresponding figures for the

present time are much larger. Even if the total amount of metal melted annually were no greater now than then, the increase in market value of the metals concerned would of itself nearly double the value of the metal produced. The avoidance of waste in melting, which was even then considered important, therefore becomes particularly so at this time.

As has long been known, it is theoretically possible to eliminate much of this loss by the use of electric melting, particularly in the case of yellow brass and other alloys high in zinc. Most of the electric furnace development in the copper-alloy field has been carried out with this end in

THE CENTRAL STATION'S OPPORTUNITY

The central-station industry has something to gain by the successful development and use of electric furnaces; it has something to lose by their failure. It is in a position to protect this interest if it cares to do so. The central-station company can, by virtue of a little effort, inform itself quite fully concerning the possibilities of electric furnace application within its territory. It can, in a similar way, make itself familiar with such requirements of its customers as have a bearing on electric furnace use. It will then have a wider knowledge than its customers of the electric furnace situation at large; it will have a more detailed knowledge of electric furnace possibilities and requirements within its territory than has the electric furnace salesman. By proper use of this knowledge and of such influence as it ought to possess in the industrial community which it serves the central-station company can promote well advised applications, prevent misapplications, point the way to correct use, discourage incorrect use, and insure profitable development, within its field of operations, of that newest of electric load builders, the electric furnace.

view. Metallurgically speaking, the problem is not a simple one and progress has been rather slow. Important advances have been made since 1914, however, and the present outlook is rather optimistic.

Two widely different types of electric furnace are now on the market and in commercial use for melting yellow brass. One is highly efficient but limited in its use to a portion of the field only; the other is less efficient but otherwise more widely applicable. At least one other type of furnace has been experimentally successful and is reported as about to enter the commercial field. Two or three additional types are being actively developed and give some promise of eventual success.

So far as yellow brass is concerned, it cannot be said that an entirely satisfactory furnace has yet been produced, but the field has been partly covered, and the prospects for further advancement in the art are good.

Previous to the war the use of electric furnaces for melting copper alloys did not seem feasible except in cases where a large metal saving helped to counterbalance the higher cost of electric heat. Under present

¹H. W. Gillett, "Brass-Furnace Practice in the United States," *Bureau of Mines Bulletin No. 73*, p. 9 (1914).

conditions the high cost and poor quality of crucibles, the high cost and shortage of important metals, the high cost and scarcity of labor and the insistent demand for a high rate of production at any cost are factors which combine to make electric melting profitable in many cases where it would previously have been unprofitable. Whether electric furnace installations which owe their existence to these peculiar conditions will continue to show a profit when normal conditions once more prevail is still an open question. No one can say when conditions will again become normal, or, for that matter, what sort of conditions will be considered normal in the future. Much will depend upon the progress made in furnace design and in operating methods during the continued existence of the economic conditions which at present make possible the electric melting of copper alloys containing little or no zinc. The necessary progress can only be made by the combined efforts of such individuals and companies as are now profiting, and expect to profit in the future, from the increased use of electric furnaces.

ADVANTAGES OF ELECTRIC MELTING

Electric heat is expensive at best, and although it can be applied much more efficiently than heat derived from fuel, especially at high temperatures, it cannot profitably be employed except in cases where its use makes possible substantial savings of one kind or another to offset its added cost. The advantages which may naturally be expected to accrue from electric melting, as compared with melting in fuel-fired furnaces, are roughly as follows:

Metal Saving.—The saving of metal otherwise unavoidably lost is the principal economic advantage which the electric furnace is required to show in the melting of copper alloys, particularly in melting yellow brass. It has been completely demonstrated that such a saving can be made in the electric furnace by virtue of the fact that the furnace chamber can be tightly closed during the melting period and a neutral or reducing atmosphere maintained. As will be shown later on, it does not follow that every electric furnace is capable of a favorable performance in this respect. Conditions resulting from the war have greatly accentuated certain other advantages of electric furnace operation, but in more normal times no electric furnace can be expected to succeed in this field unless its use results in a saving of metal as compared with fuel-fired practice.

Improved Quality.—It has been found in most cases that a more uniform quality of metal can be produced in the electric furnace than in fuel-fired furnaces operating under similar conditions and that it is easier to produce an alloy of closely specified composition. In general, these advantages can be accepted as inherent in properly conducted electric furnace operation, resulting from the greatly reduced loss of volatile metals and from the elimination of contaminating combustion gases. So far as copper alloys are concerned, it is still undecided whether or not a higher quality of metal can be produced in the electric furnace as compared with the best of fuel-fired practice. It is beyond question, however, that high quality can be achieved more easily and with greater certainty. The successful electric furnace must be at least as satisfactory in these respects as the best fuel-fired furnace.

Exact Temperature Control.—The production of per-

fect castings, with the least possible number of defective pieces, depends in large degree upon the use of metal at a temperature which conforms closely with that known to be most favorable for the work in hand. The electric furnace lends itself readily to exact temperature control, which is an important advantage.

Increased Production.—In general, the speed of melting is greater in electric furnaces than in fuel-fired furnaces, because of the higher operating temperature and greater efficiency obtained. Furthermore, larger units can usually be employed than when fuel-fired furnaces are used.

Elimination of Crucible Cost.—The cost of crucibles is an item of considerable magnitude even in normal times. Under present conditions this cost is very high. Electric furnaces, which require no crucibles, therefore eliminate this expense. Large fuel-fired furnaces effect the same saving, but from a metallurgical point of view are seldom as satisfactory as fuel-fired crucible furnaces. Electric crucible furnaces deserve little consideration at the present time.

Incidental Savings.—The operation of large units results in an economy of floor space and labor, and increased production is attended by decreased overhead and interest charges per ton of metal produced.

Better Working Conditions.—More favorable conditions for the workmen, tending to increase their efficiency as well as their comfort, result when excessive heat, noise and fumes are eliminated. Properly selected and correctly operated electric furnaces are almost ideal in this respect. In installations where the reverse is true the trouble is due to the use of an unsuitable furnace, or to careless operation, or to both of these as contributing causes.

It should not be understood that these advantages necessarily follow from the use of any electric furnace which may happen to be selected. The furnace must be of suitable type, properly designed and correctly used. A misapplied electric furnace may prove worse in almost every respect than the fuel-fired furnace which it replaces.

First consideration must always be given to metallurgical requirements. Steel may be heated as rapidly as desired during the melting operation, provided that it is not exposed to contaminating elements during the process, but with copper alloys the case is quite otherwise. Copper is somewhat volatile and oxidizes much more readily than steel when in the molten state. Lead is also quite volatile, more so than copper, and oxidizes very easily. Zinc is exceedingly volatile at molten brass temperatures. All copper alloys must be treated carefully during the melting process in order that losses of metal by oxidation and volatilization may be kept at a minimum.

REQUIREMENTS OF ELECTRIC MELTING

Yellow brass for thin castings must be poured at a temperature not far below its boiling point in order that the metal may be sufficiently fluid. At this temperature zinc, which comprises 30 to 35 per cent of the alloy, has a tendency to vaporize rapidly. So long as the metal is contained in a tightly closed furnace chamber, which can easily be done in the electric furnace, this tendency is counterbalanced by the vapor pressure of the metal which has already been vaporized and with which the furnace atmosphere is saturated. When the

furnace is opened for pouring the metal or for any other purpose the vapor pressure is released and additional zinc will escape from the metal without restraint. If the heating has been perfectly uniform and all portions of the melt are at approximately the same temperature, the loss of zinc which ensues will constitute an unavoidable minimum. If the heating has not been uniform, some portions of the melt will be at a temperature higher than the desired pouring temperature, and such portions will lose zinc at a higher rate. If the lack of temperature uniformity is very great, the loss which occurs after the furnace is opened and during pouring will be decidedly excessive. In fact, some portions of the metal may be so seriously overheated during melting that the high vapor pressure formed within the furnace will force considerable quantities of zinc vapor through crevices in the furnace structure. In some cases it may be practically impossible to keep the furnace chamber closed, even to a reasonable degree. Under such conditions the zinc losses are likely to be quite as serious as in fuel-fired crucible furnaces, or even more so.

What is true of yellow brass poured at a temperature near its boiling point is also true, although in less degree, of yellow brass poured at lower temperatures and of other copper alloys. The lower the percentage of volatile metal the more easily the alloy will withstand uneven heating, but it can be accepted as an axiom of copper alloy melting that heat must be applied to the metal as uniformly as possible, whether the alloy under treatment is brass, bronze or some one of the less common alloys. If the application of heat in the furnace lacks uniformity to a serious degree, an excessive loss can only be prevented by some method of stirring the metal, and this stirring must be effected within the furnace, but without opening the furnace doors.

The metal as poured from the furnace must be uniform in composition, with its various constituent metals thoroughly well mixed and alloyed. In some cases a rigidly specified composition must be closely met. The finished casting or ingot must be of a quality at least as good, with respect to strength, freedom from cracks, blow-holes, etc., as that obtainable from fuel-fired crucible furnaces.

Since electric heat is more costly than that derived directly from fuel, it is important that the thermal efficiency of the electric furnace should be as high as can be obtained consistently with other requirements. A high thermal efficiency in electric melting, unless heat is generated in the metal itself, requires a high temperature heat source, placed as close as may be to the metal, under conditions which offer the least possible opposition to the flow of heat from the source to the metal. At the same time the walls of the furnace must be sufficiently thick and of high-heat-insulating quality in order that heat may not be dissipated uselessly from the outer walls.

In some types of furnaces these requirements are directly opposed to the metallurgical requirements already considered. In such cases thermal efficiency must be sacrificed to as great a degree as may be necessary in order to satisfy the metallurgical requirements. The highest efficiency consistent with good metallurgical results should be maintained; any higher efficiency is false economy. Of course, other things being equal,

the more efficient type of furnace will meet with greater success.

The electric furnace, to reap the full benefit of its economic possibilities, must operate in large units and must not use crucibles. The higher its speed of melting the better, so long as speed is not detrimental to metallurgical results.

The electrical characteristics of the furnace must be such as to make it a desirable load for the central-station company or the factory power plant. Its power factor must not be abnormally low and its power fluctuations must not be so violent as to endanger transformers and other electrical equipment or to interfere with satisfactory service to other customers of the central-station company that may be connected with the same power line.

It hardly seems necessary to add that the successful electric furnace must be sturdy and reliable, quite as capable of performing its function, day in and day out, under regular operating conditions, as are the best types of fuel-fired furnaces. The furnace and its adjustments should be as simple as possible, although with a large electric furnace it is permissible, and nearly always desirable, to use a higher grade of operator than would be employed to tend fuel-fired crucible furnaces.

A great variety of electric furnace types have been proposed and tried out for melting brass. It is hardly an exaggeration to say that every known method of applying electric heat to a metal has been utilized by one or another of the various designs which have reached at least an advanced experimental stage. Some of these types have been eliminated as inherently unsuited for the purpose; some have been abandoned because of difficulties which may eventually be overcome by other investigators; others, partially successful, have apparently reached the height of their development; still others seem to possess greater possibilities of ultimate success than have yet been demonstrated.

This article will be concluded in a coming issue, where the different types of furnaces will be described.

ORGANIZING INSPECTION TO INSURE CLEAN COAL

Stringent Measures Are Taken by the Fuel Administration to Prevent the Shipment of Fuel Mixed with Dirt

To guard against the waste and serious loss resulting last winter from the shipments of dirty coal, which occupied car space and also seriously decreased industrial plant efficiencies, the Fuel Administration has organized a division of inspection, with C. M. Means as manager. A chief inspector has been appointed in each of twenty-one representative districts and where necessary assistant inspectors will be added. These inspectors will examine coal in the mines, also that dumped from mine to tipple, watch the picking tables, and again inspect the coal as it is loaded in cars for shipment.

Standards will be established for insuring proper preparation according to use, so that all coal shipped must be of the quality required for its particular purpose.

The New Westinghouse Research Building

Description of Laboratory Structure Specially Designed to Facilitate Working Out the Many Problems in Research That Constantly Arise—One of Seven Laboratories in the Company's Engineering Department

BY C. E. SKINNER AND R. W. E. MOORE

THE research work of the Westinghouse Electric & Manufacturing Company has always been carried on under the direction of the engineering department. In 1906 the research division was organized as one of the several divisions of the engineering department, and it now has under its control seven laboratories.

The work of the division includes activities which are not usually classed as research work in other organizations. For example, it has charge of the preparation of all specifications for the purchase of the materials used by the company, together with the experimental and development work leading up to the writing of these specifications. It includes a process section, which has technical control of all the various processes used by the company in the manufacture of its product. It has charge of the routine chemical and physical testing for all departments, including the inspection department. It has technical control of the various metallurgical processes, such as those involved in the brass foundry, copper mill, scrap-recovery plant, etc. Through the activity of its members on various standards and other committee work it comes into contact with numerous activities not strictly of research nature both within and without the organization.

SEVEN LABORATORIES NOW ORGANIZED

The laboratories under the control of the division are the chemical laboratory, the physical testing laboratory, the process laboratory, the electrical laboratory, the molded-materials laboratory, the ceramic laboratory and the research laboratory. The latter is housed in what is commonly known as the "new research building." In accordance with the general organization plan of the engineering department of the company, the research division is divided into sections, each with a section head, reporting directly to the division engineer. The growing demands for more fundamental work made it desirable to provide a special building where advanced and new research problems could be better separated from the more insistent works problems. A location about a mile distant from the works was selected, partly on account of the crowded condition in the vicinity of the works, but more especially to secure a site relatively free from vibration, dirt and noise and which would afford a certain amount of isolation.

Architecturally, the building is plain but substantial. It is of reinforced concrete and brick, trimmed with white terra cotta. In its design special attention was given to the means of running pipe and wire services in such a way as to enable these services to be brought into any laboratory when needed, without disturbing any other part of the building.

The power house contains motor-generator sets for supplying single-phase, two-phase and three-phase current at 220 volts, and direct current at 250 volts (three-wire circuit). A motor-driven air compressor supplies

compressed air at 125 lb. pressure (8.75 kg. per sq. cm.) and a large motor-driven vacuum pump supplies the necessary house vacuum. A liquid air machine capable of supplying 1½ l. to 2 l. of liquid air per hour is also installed in the main power house. The storage battery is in a separate room in the basement of the power house and consists of a total of 218 cells, so divided that various groupings and combinations may be obtained.

In one end of the basement is the furnace room with a battery of electric furnaces of various types, together with the necessary control for melting, annealing and various metallurgical processes. Stacks are provided at each end of the building, with openings in the basement, for experimental furnaces using fuel, usually natural gas. The woodworking and metal-working shop and storeroom are also in the basement. On the first and main floor are the main and private offices, the library and the conference room. The remainder of this floor is assigned to physical, electrical and magnetic research. The second floor, which is not entirely finished, will be given over to the same general class of work as the first floor. The third floor is devoted to chemical and electrochemical research, illumination laboratories and a glass-blowing room.

The manufacture of electrical machinery and apparatus as carried on by the Westinghouse Electric & Manufacturing Company is perhaps one of the most complicated of businesses, and consequently, research problems of a very large variety are constantly being brought to those in charge of its research work. Facilities for such research must, of necessity, include provision for many lines of work, such as magnetic insulation, metallographic metallurgy, chemistry, both organic and inorganic, together with combinations.

PRESENT AND FUTURE ACCOMPLISHMENTS

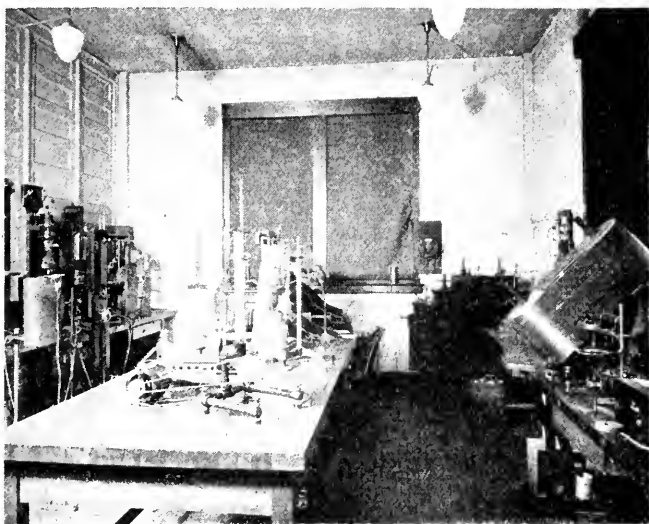
While this new laboratory has been occupied for only a comparatively short time, the work already accomplished gives much promise for the future. It is, of course, intended that the fundamental and advance work shall be carried out in this section of the research division and that the application work of the processes and products developed shall be carried out by the respective sections having more intimate contact with the works departments. Being under one management, men can be readily transferred from the more commercial sections to the research laboratory section or vice versa as the exigencies of the case demand. In this way, for example, a research man developing a new process for the control of some metallurgical operation can follow this up to the point of commercialization in the factory itself, still being a member of the research division. The scheme of organization above described insures the co-ordination of the various sections of the research division and the best possible co-operation of the research division with the other engineering divisions and the works departments.



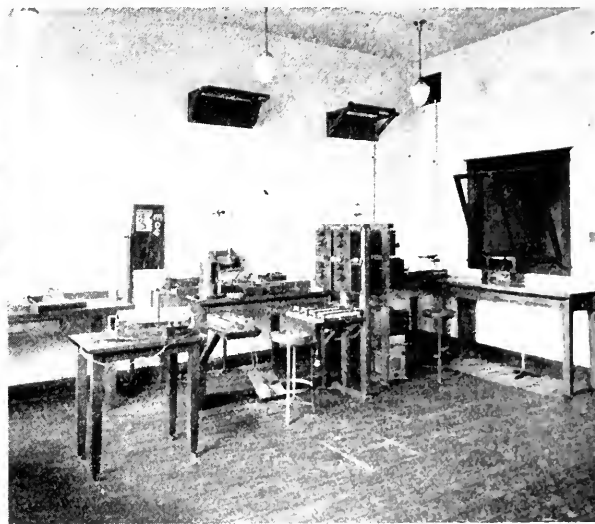
*General View of Research Building,
Showing Lincoln Highway in the Foreground.*



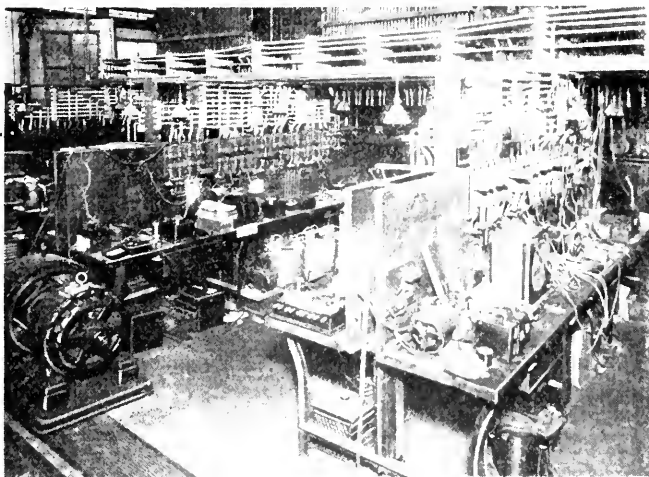
*Typical Workroom
Devoted to the Study of Liquid Dielectrics.*



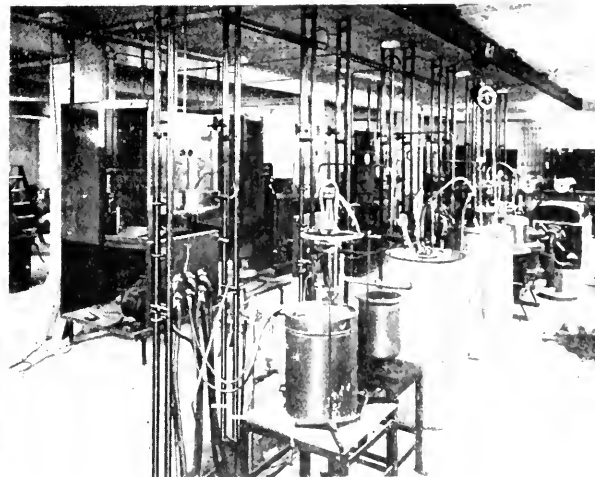
Typical Workroom Devoted to Metal-physics.



A Portion of the Magnetic Laboratory.



*Part of the Research Facilities
Devoted to Electrical Phenomena.*



*Battery of Electric Furnaces
for Metallurgical Research.*

Economic Aspects of Summer Load—II

Features of a Class of Service Which, When Properly Handled, Yields Profitable Revenue and Exerts Great Influence in the Popularization of Electricity—How Power Business Grows in the Hot-Weather Term

COMPARISONS of revenue earned by central stations from month to month with their changing peak loads and output variations throw considerable light upon the economic problem which companies face when supplying business of a higher seasonal character. Within a few months the Maine Public Utilities Commission had occasion to pass upon the equity of seasonal rates in the Old Orchard district, served by the York County Power Company, affiliated with the Cumberland County Power & Light Company of Portland.

At Old Orchard the York County company charged its year-round customers for energy, furnished under the same specifications as those governing its seasonal rate E, 9 $\frac{1}{4}$ cents per kilowatt-hour, with a minimum charge of \$12 per year. The seasonal rate itself, applying to customers taking service for four months or less per year, between June 1 and Oct. 1, was 20 cents per kilowatt-hour for the first 100 kw.-hr. per month, 10 cents per kilowatt-hour for all in excess, and a minimum charge of \$2 per month. The petitioners to the board claimed that the seasonal rate was too far in excess of the yearly rate to be equitable.

The accompanying diagram (Fig. 10) typifies the load conditions in the Old Orchard district. It is supplied from Biddeford over an 11,000-volt line, and were it not for the summer peak, the Old Orchard district load could be handled at 2300 volts. The variations of the input to the Old Orchard substation show that the peak load of the year came in August, the monthly input then being about 61,500 kw.-hr., compared with a December input of 10,200 kw.-hr. The total receipts from the Old Orchard district are about \$25,000 per year, of which the out-of-season business (October to May inclusive) represents about \$5,600. The number

in order to meet the winter demand was only 50 kw.

From the evidence it appears that the revenue from the seasonal business totaled \$19,400 for four months, or an average of \$4,850 per month; that 390 kw. more capacity had to be maintained to handle this business in summer, and that the summer business alone yielded \$12.43 per kilowatt of plant capacity per month, but prorated over the entire year the extra capacity required for the summer service yielded only \$4.15 per annum per kilowatt of plant capacity. The off-season revenue of \$5,600, on the other hand, was gained in eight months from an active capacity of 50 kw.; in other words, this capacity earned \$14 per kilowatt of capacity

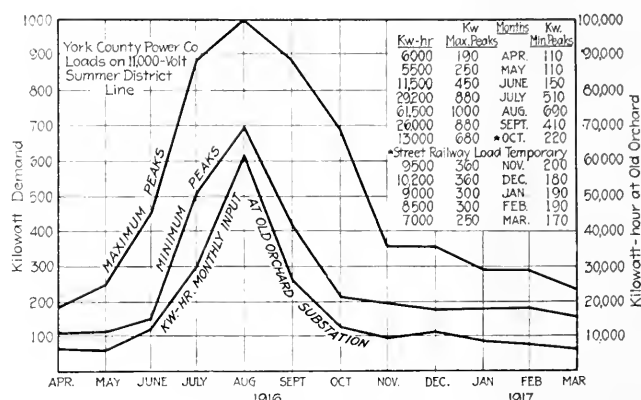


FIG. 10—LOAD CONDITIONS FOR TWELVE-MONTH PERIOD AT OLD ORCHARD BEACH, ME.

per month of off-season service, and two-thirds of this, or \$9.34 per month, the year through. In this case, therefore, it would seem that the year-around business is easily more than twice as valuable from the plant investment standpoint as the summer business, or, put-

HOW POWER BUSINESS AT SHORE RESORT GROWS IN SUMMER SEASON

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1. Kw.-hr. sold	216,013	171,899	164,352	239,402	174,820	240,355	245,105	251,555	239,901	185,072	197,120	227,331
2. Kw.-hr. at bus	281,632	232,875	245,381	293,338	268,327	298,188	356,071	373,123	324,410	284,168	305,049	335,840
3. Kw.-hr. power sold	11,889	9,915	14,553	27,816	30,044	56,581	58,492	57,478	43,600	15,763	19,514	18,431
4. Kw.-hr. lighting sold	204,124	161,979	149,799	211,586	238,283	242,607	297,579	315,645	280,810	268,405	285,535	317,409
5. Revenue, electricity	\$17,103	\$14,054	\$12,963	\$14,502	\$14,534	\$18,255	\$18,891	\$18,981	\$18,801	\$14,571	\$15,888	\$17,716
6. Revenue, power	\$521	\$838	\$680	\$1,036	\$1,600	\$3,210	\$3,060	\$2,969	\$2,160	\$634	\$793	\$812
7. Revenue, lighting	\$16,582	\$13,416	\$12,283	\$13,466	\$12,934	\$15,045	\$15,831	\$16,012	\$16,641	\$13,937	\$15,095	\$16,904
8. Peak load, maximum kw.	950	910	1,300	1,350	1,700	1,750	1,800	1,900	1,850	1,150	1,070	1,375
9. Station rating, kw.	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900
10. Average revenue per kw.-hr. sold, cents, approximate	7.9	8.2	7.9	6.3	8.3	7.6	7.7	7.5	7.8	7.9	8	7.8

of customers varied from 943 in August to 285 in January. The peak load in the Old Orchard district (not including the entire 11,000-volt feeder from Biddeford) required a capacity of 440 kw. to be maintained during the summer, whereas the approximate capacity required

ting it in another way, the summer business is probably less than half as desirable in relation to plant size as the year-around service. Nearly eight times the plant rating has to be carried through the year because of the summer business handled in four months or there-

abouts that would be needed without this relatively costly service. The August output was about six and two-thirds times the highest non-seasonal output. The connected load of the Old Orchard district varied from 322 kw. in January to 1071 kw. in August.

In considering this case the commission recognized that if the cost per unit of service, owing to the distribu-

the Old Orchard, Kennebunkport and York Harbor districts, or by \$1,677 in the Old Orchard district alone.

A comparison of the revenue from electricity sales by months in a New England central station serving a coastwise town which has a large year-round population and which contains one of the most popular shore resorts in that part of the country is shown in Fig. 11.

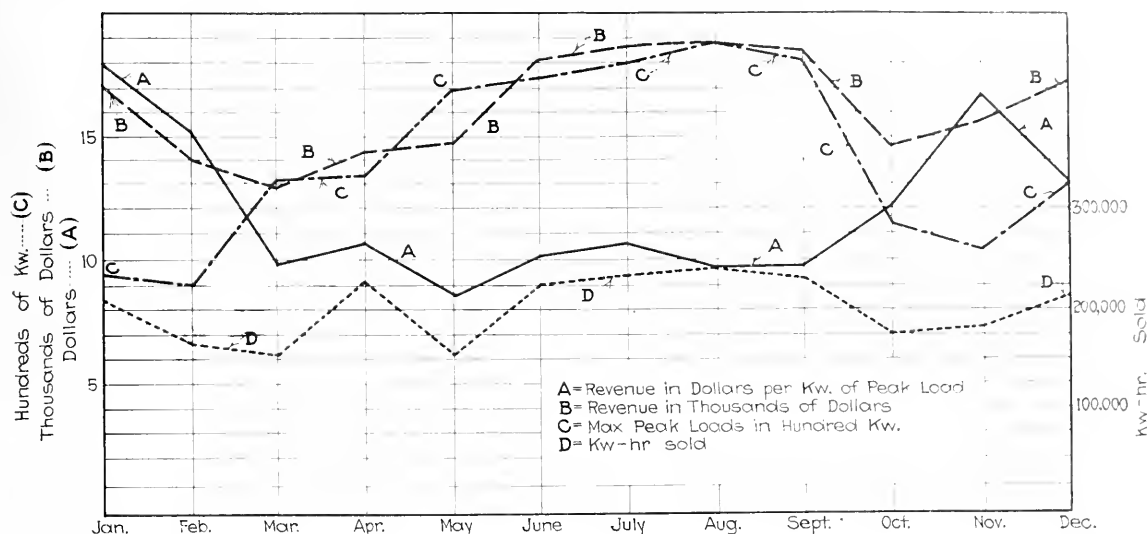


FIG. 11—COMPARISON OF CENTRAL-STATION MONTHLY REVENUE IN COASTWISE TOWN INCLUDING SHORE RESORT

tion of capacity and organization expenses over a shorter period, is substantially greater than the cost per unit to twelve-months-per-year customers, it must affect the whole cost of the company's operations too seriously for it fairly to be absorbed in the charges to the year-around customers. The commission found this to be "clearly a case where the summer customers ought

Curves are also plotted showing the variations in peak loads on this plant by months and the revenue per kilowatt of peak load. The base data from which these curves are plotted are given, with other information of a comparative nature, in the table. In Fig. 12 are plotted the daily peak loads of this plant for an entire year. On this system the peak load occurred in August, and

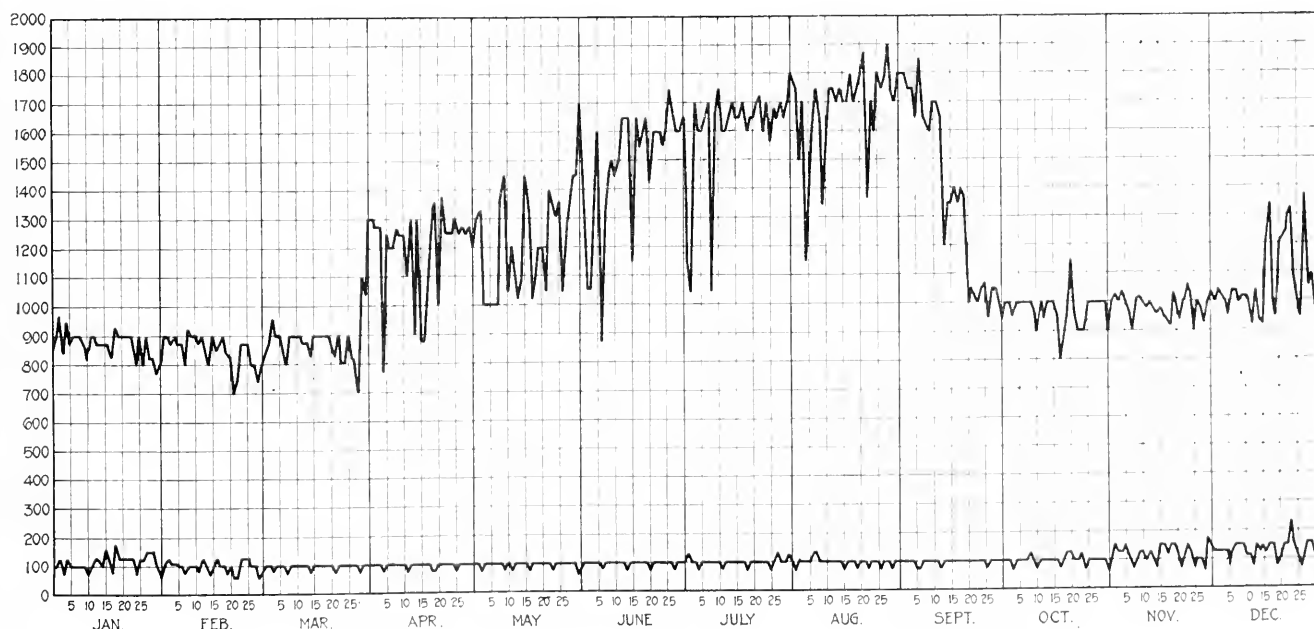


FIG. 12—ONE YEAR'S DAILY PEAK LOAD, IN KILOWATTS, OF PLANT REFERRED TO IN FIG. 11

to bear the extra cost of serving them." The commission came to the conclusion that 20 cents was too high a charge for the use of the lesser amounts of energy during the seasonal period, in comparison with the 9¼ cent rate furnished year-around customers. A maximum rate of 15 cents was established, and it was estimated that this would reduce the revenue by about \$6,073 in

reached 1900 kw., the maximum low-month peak being about 910 kw. and occurring in February. The capacity of the plant was 2900 kw. throughout the year. It will be noted that the revenue per kilowatt of peak load per month fell from \$18 in January to an average of about \$10 during the summer months. The revenue per kilowatt-hour was also somewhat less in the summer

season than at other times of the year. There is not so much difference in the case of this company as in some others between winter and summer rates, on account of the winter population, but the presence of a great amusement resort with a large amount of display lighting and power in the town increases the output materially in the summer. It will be noted that the kilowatt-hours sold from month to month varied in a general way in accord with curve of peak loads. The summer power business of concessionnaires at the shore resort is largely responsible for the great increase in power sales in the summer period, shown in the table, compared with the winter sales. The season is longer here than in many places at the shore, outline lighting of pavilions beginning even in April and extending well

TEN YEARS' RECORD OF PUBLIC UTILITY EARNINGS

Gratifying Increase in Gross Earnings, Say Harris, Forbes & Company, Is Incomplete Showing Unless Net Earnings Are Given

For some years past, Harris, Forbes & Company, New York, have prepared annually a tabulation of the earnings of the public utility companies whose bonds or notes they handle. They have received reports for 1917 from 100 companies covering in their operations territory in thirty-nine states of the United States and in two provinces of Canada. These show a total average increase for the 100 companies of 10.3 per cent in gross earnings. This is a larger percentage of increase than

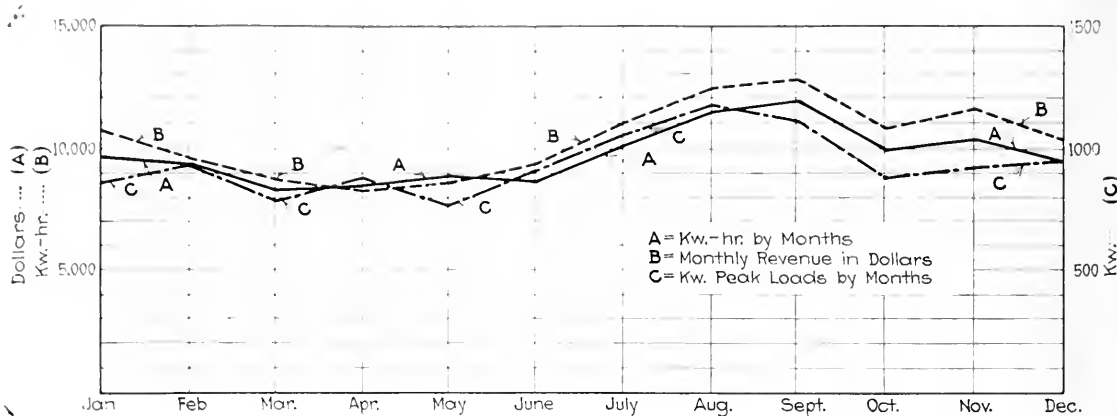


FIG. 13—CURVES OF MONTHLY PEAKS AND REVENUE FOR ATLANTIC COAST CENTRAL STATION

into the fall. The revenue shows no serious falling off until October. On account of the substantial year-round residential population which commutes to adjacent industrial cities, the winter revenue is larger than in many central stations serving shore resorts. Even with the stabilizing influence of this permanent population as a market for energy, however, the summer business involves a plant capacity of about 1000 kw. in excess of that needed for winter use.

Fig. 13 shows the curves of monthly peaks and revenue for a central station serving a group of diversified communities along the Atlantic Coast. In this case the ratio of revenue to load changes very little from month to month. The yearly peak occurs in September. The summer user is charged a net rate of 16 cents per kilowatt-hour for the first 300 kw.-hr., and the all-year rate is 14 cents net. Seasonal customers pay a minimum charge of \$6 per meter for the season, and yearly customers pay a minimum charge of \$1 per month. In this case there is probably not great enough difference between the year-round and summer populations taking service to impose the marked difference in seasonal service cost which can be recognized in such a community as Old Orchard Beach, in Maine. The revenue per kilowatt peak was \$12.80 in January and \$11.40 in September.

Radio Inspectors Needed by Government

The United States Civil Service Commission announces an open competitive examination for radio inspectors at entrance salaries from \$1,200 to \$1,600. Applicants should apply for Form 1312 to the federal commission or to the local boards where such exist.

the average during the past ten years, as will be seen from the following summary of gross earnings:

	P. C. of Inc.
60 companies, 1908 over 1907.....	7.3
61 companies, 1909 over 1908.....	11.3
66 companies, 1910 over 1909.....	12
70 companies, 1911 over 1910.....	9.3
73 companies, 1912 over 1911.....	8.6
83 companies, 1913 over 1912.....	7.4
84 companies, 1914 over 1913.....	2.9
86 companies, 1915 over 1914.....	2.8
90 companies, 1916 over 1915.....	10.4
100 companies, 1917 over 1916.....	10.3

Commenting on these results, the bankers say:

"It will be observed that the foregoing record shows uninterrupted annual increases in the aggregate gross earnings of these companies during the past ten years, the average annual increase being over 8 per cent. In normal times this tabulation alone might serve as an illustration of the stability of earnings of the well established public utilities. Under present conditions, however, the statement is incomplete without the facts as to net earnings. These companies, in common with practically all others, have been confronted during the past year with the problems of increasing costs of labor and material and higher taxes. It is therefore most gratifying to us that the aggregate net earnings of the 100 companies from which we have received reports show a falling off during 1917 as compared with 1916 of less than 2.8 per cent. Furthermore, the aggregate 1917 net earnings amounted to over two and three-quarters times the aggregate annual bond interest charges of these companies. We feel sure that this showing of earnings under adverse conditions is one of the most dependable indications of the desirability of public utility bonds for investment when selected with care."

Protective Lighting for Industrial Plants

Discussion Regarding the Intensity and Distribution of Illumination Required, Avoidance of Glare, Available Units and Most Desirable Methods of Installation

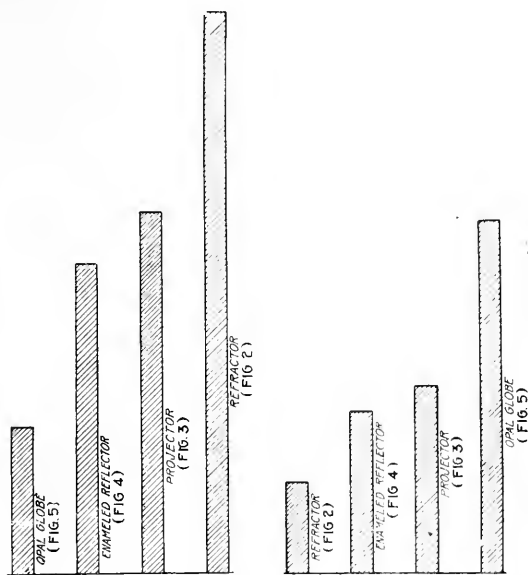
BY DAVIS H. TUCK

Electrical Engineer, Holophane Glass Company

AT THE present time, when industrial plants are working night and day turning out the enormous quantities of material required by the government for the successful prosecution of the war, it is necessary not only to illuminate the interior of the plant to conform to recommended practice but it is often of

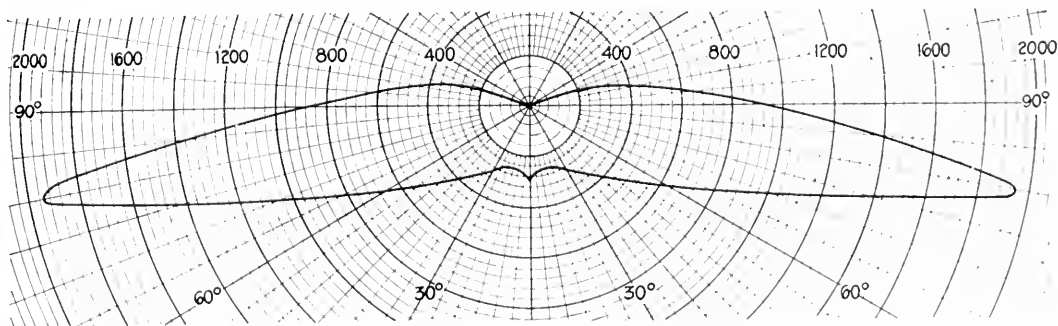
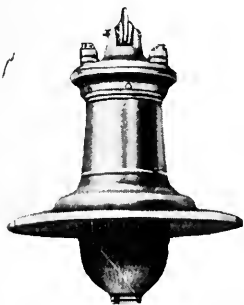
equipment which meet the requirements within varying degrees of practicability.

Fundamental Principles.—The fundamental principles of scientific illumination apply to exterior lighting as they do to interior lighting. They are these: (1) The intensity of illumination must be adequate; (2) the illumination must be uniform; (3) glare must be minimized. The details of design of lighting units and the



FIGS. 1 AND 2—COMPARATIVE AREAS ILLUMINATED EQUALLY BY FOUR TYPES OF EQUIPMENT USING THE SAME WATTAGE PER UNIT, AND THE RELATIVE ANNUAL COSTS* OF LIGHTING EQUAL AREAS EQUALLY USING THE FOUR TYPES OF EQUIPMENT

advantage to light the yards so that the workmen may see to pass from one building to another and to perform rough manufacturing work in the yards. With the large number of enemy fanatics at large, it is often



FIGS. 3A AND 3B—PRISMATIC-REFRACTOR UNIT WITH DISTRIBUTION CURVE IN VERTICAL PLANE

necessary to install a system of protective lighting that will enable the guards to apprehend the evildoers.

Although this field of lighting is relatively new in its demands, and although practice has not been standardized, there are fortunately several types of lighting

*Cost includes interest on investment, depreciation, maintenance and power cost.

poses, such as loading cars, shipbuilding, etc., an illumination intensity of 0.5 ft.-candle to 2 ft.-candles is advocated.

It is to be noted that at night the eye requires less illumination for equal discerning power than during the daytime. With the sky and surroundings comparatively dark the eye is adapted to a lower order of bright-

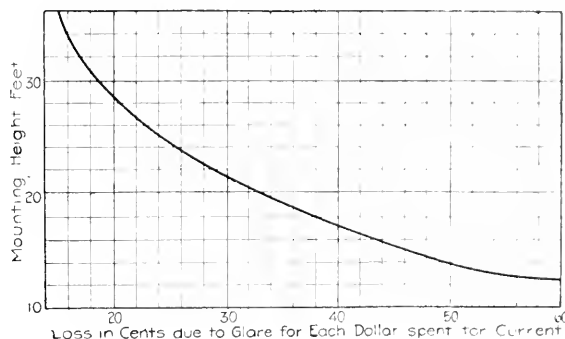


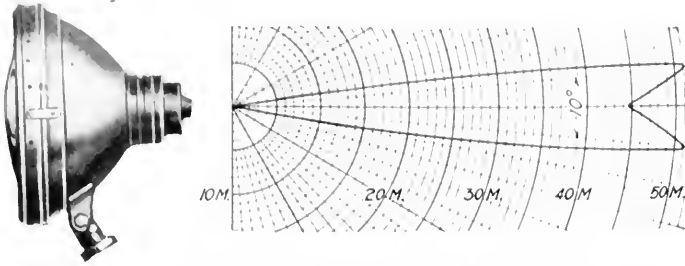
FIG. 4—RELATION BETWEEN MOUNTING HEIGHT AND LOSS OF LIGHT DUE TO GLARE

methods of installation are, however, somewhat different.

Adequate Intensity.—The intensity of illumination that is required is dependent upon the purpose for which the exterior illumination is intended. For ordinary yard lighting, where no work is performed and where the purpose of the lighting is only to enable workmen to pass from building to building, 0.025 ft.-candle to 0.05 ft.-candle is recommended. For an adequate system of protective lighting, from 0.05 ft.-candle to 0.2 ft.-candle is recommended. For yard lighting for working pur-

ness, and a relatively feeble stimulus will therefore produce effects equal to those produced by much greater stimuli during the day time.

Uniform Illumination.—It would seem that the fact that the illumination should be uniform would be self evident. Yet there are many yard-lighting installations



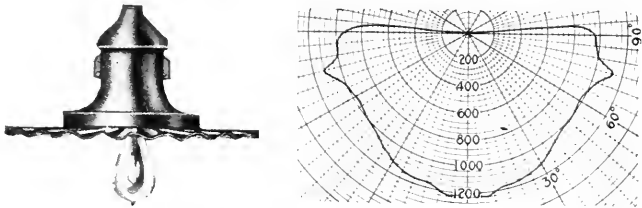
FIGS. 5A AND 5B—FLOODLIGHT PROJECTOR WITH DISTRIBUTION CURVE* IN VERTICAL PLANE

in use where the ratio of maximum to minimum is 300 to 1 or greater. It is evident that if the maximum illumination is adequate the minimum will be inadequate and vice versa. If both the maximum and minimum illumination are adequate, then there is a gross waste of energy and an unnecessarily large investment to carry. The maximum service for the minimum expenditure demands uniform illumination.

The silhouette method of yard lighting is of little avail for working or protective purposes. When an object is seen by silhouette effect only its outlines are visible and not its surface details or characteristics. These can be seen only by illumination effect. In the yard of an industrial plant there are usually many obstructions, such as cars, buildings, piles of material, etc., which offer vertical surfaces against which the contrast of a trespasser is indistinguishable. To provide for safety from attack it is highly important not only to see a person but to recognize the facial and other characteristics which suggest the evildoer. Unless a man has some well-known peculiarity of figure or gait, he cannot be recognized with silhouette lighting.

Glare.—Glare must be minimized. Glare is the result of a light source directly in the field of vision that is extremely bright when viewed in comparison with its surroundings.

It is very important that the yard-lighting system shall produce an effect which will surround those working in or patrolling the yards with conditions under which the eye is free to perform its functions properly.



FIGS. 6A AND 6B—PORCELAIN-ENAMELED REFLECTOR UNIT WITH DISTRIBUTION CURVE IN VERTICAL PLANE

Any system which fails in this respect is an extravagant system, no matter how efficient the lamps nor how efficiently the light may be directed upon the yard surfaces or objects. Glare serves seriously to reduce

the discerning power of the eye. Details and more distant objects can be equally well seen at much lower illumination intensities and hence at much lower costs when glare is avoided. Certain popular types of present day yard and protective lighting involve such a degree of glare that equally satisfactory vision would be possible with one-third of the light if the glare were eliminated. The one practicable method of minimizing glare is to mount the units high so as to be out of the ordinary range of vision.

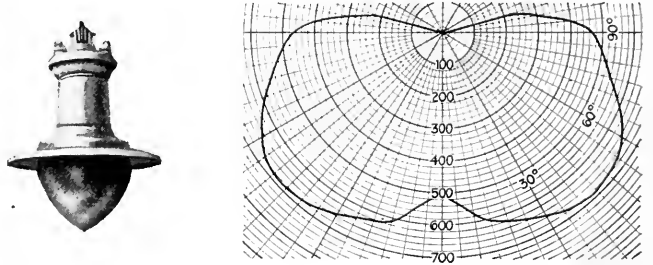
Available Units.—For purposes of protective and yard lighting four general types of equipment are in use:

1. The refractor unit, which gives a very broad, symmetrical light distribution and will uniformly illuminate areas when the units are spaced from eight to twelve times the mounting height (Fig. 3 a and b). In this and the following figures the use of a 500-watt gas-filled lamp is assumed.

2. The flood-light projector, which gives a concentrated beam of about 10 deg. to 20 deg. in a single direction and is adapted for the illumination of relatively small areas in inaccessible places, such as bridge piers (Fig. 5 a and b).

3. The porcelain-enameled reflector, which gives a relatively extensive distribution but which has its maximum candlepower beam at angles near the vertical (Fig. 6 a and b).

4. The opal globe, which gives a distribution similar to the porcelain-enameled reflector (Fig. 7 a and b).



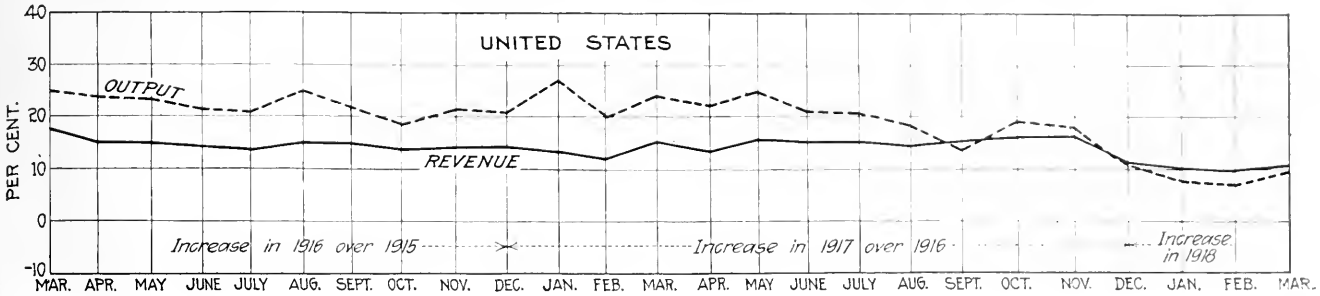
FIGS. 7A AND 7B—OPAL-GLOBE UNIT WITH DISTRIBUTION CURVE IN VERTICAL PLANE

Comparison of Available Units.—The most equitable basis for comparing exterior lighting equipment is that of maximum service at minimum cost. Fig. 1 shows diagrammatically the relative areas equally illuminated, using the four general types of equipment, the same lamp size being used for each. A similar diagram (Fig. 2) shows the relative cost of equal illumination of equal areas when using each of the four general types of equipment.

Method of Installation.—The details of installation depend on the local conditions such as the proximity of buildings, intensity desired, etc. The illumination for a large industrial plant grounds may be divided into two general parts—the protective lighting and the yard lighting. Units should be placed around the plant boundaries to give the illumination necessary to enable watchmen to apprehend trespassers. In close proximity to the buildings there should be other units for the purpose of yard work and for prevention of accidents. The state codes of New Jersey, Pennsylvania, Ohio and Wisconsin all specify that industrial roadways and yard thoroughfares shall be lighted.

*Note that the maximum spread of rays is only 20 deg., while with the units shown in Figs. 3, 6 and 7 the spread is 180 deg.

Central-Station March Operations



CENTRAL-STATION INCOME AND OUTPUT GAIN IN PER CENT BY MONTHS FOR NATION

MARCH business of the central stations, according to the returns made to the ELECTRICAL WORLD, shows a better improvement over March, 1917, than the two earlier months of the year showed over January and February, 1917, respectively. The percentages of gain in March, 11.1 per cent in revenue and 9.1 per cent in kilowatt-hour output, are reported by 51 per cent of the industry.

These gains are still below the large rates of increase reported during the very active months of 1917. Whether the industry is creeping slowly back to the greater scale of increase shown in, say, March, 1917, as compared with March, 1916—14.6 per cent in revenue, 23.6 per cent in output—only a prophet could say positively; but the tendency certainly appears to be toward gradual further improvement. Even if the industry holds a gain of around 10 per cent, that, of course, shows that business is reasonably sustained.

At the same time, it should be kept in mind that the statistics are subject to more acute and diverse influences than ever before, and hence that it is more difficult to draw accurate conclusions from them. In March there was the partial closing of industries as one factor, serious coal shortage as another, the further development of hesitation as to which classes of business are essential or “non-essential,” and, what is of

more importance with each month now, increased rates. Following the trend indicated in the earlier months of this year, the rate of increase in revenue was greater than the rate of increase in output.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

Month	Percent- age of Industry Represent- ed	REVENUE FROM THE SALE OF ENERGY			KW.-HR. OUTPUT		
		1917	1916	Per Cent In- crease	1917	1916	Per Cent In- crease
March.....	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April.....	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May.....	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June.....	63	23,279,000	20,168,000	15.6	1,407,800,000	1,165,629,000	20.8
July.....	63	22,768,000	19,680,000	15.8	1,397,482,000	1,159,410,000	20.5
August.....	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.....	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
Oct.....	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.0
Nov.....	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.1
Dec.....	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.3
		1918	1917		1918	1917	
January.....	62	27,035,000	24,977,000	8.2	1,508,353,000	1,422,121,000	6.1
February.....	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.4
March.....	51	23,050,000	20,755,000	11.1	1,271,684,000	1,165,161,000	9.1

The ELECTRICAL WORLD estimate for the entire industry for March, based on the actual returns from 51 per cent of the industry, is: Revenue, \$45,196,000; output sold, 2,493,500,000 kw.-hr.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

Month		Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States			
			1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase	
REVENUE	March.....	64	\$2,861,000	\$2,547,000	12.3	65	\$10,203,000	\$8,902,000	14.7	56	\$6,692,000	\$5,754,000	16.5	86	\$1,193,000	\$3,780,000	11.0	
	April.....	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	17.0	86	4,282,000	3,821,000	12.1	
	May.....	64	2,640,000	2,253,000	17.1	65	3,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5	
	June.....	64	2,641,000	2,250,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4	
	July.....	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2	
	August.....	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	21.9	
	Sept.....	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4	
	Oct.....	64	3,057,000	2,550,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1	
	Nov.....	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9	
	Dec.....	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6	
				1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.....	63	3,393,000	2,910,000	13.8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8	
Feb.....	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9.5		
March.....	62	2,812,000	2,599,000	8.2	54	9,161,000	8,272,000	10.7	44	6,794,000	5,790,000	17.3	77	4,283,000	4,094,000	4.6		
KW.-HR. OUTPUT			1917	1916			1917	1916			1917	1916			1917	1916		
	March.....	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,511,000	301,721,000	21.3	
	April.....	64	108,968,000	87,237,000	25.0	65	419,415,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1	
	May.....	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,511,000	17.3	
	June.....	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2	
	July.....	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7	
	August.....	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3	
	Sept.....	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	315,953,000	15.5	87	379,221,000	371,685,000	1.4	
	Oct.....	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6	
	Nov.....	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,573,000	6.1	
	Dec.....	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	18.8	82	395,518,000	377,058,000	4.8	
				1918	1917			1918	1917			1918	1917			1918	1917	
Jan.....	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.2		
Feb.....	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4		
March.....	62	110,362,000	103,753,000	6.3	54	462,487,000	418,157,000	10.6	44	331,138,000	294,120,000	12.3	77	367,697,000	349,151,000	5.3		

Electric Buses for City Transportation

Description and Tests of New Equipment for Rio de Janeiro—Example of the Employment of the Electric Vehicle for Urban Use—It Is Giving Very Satisfactory and Economical Service To-day, Notably in England

BY GEORGE DRAKE SMITH

Manager Electric Vehicle Department, Edison Storage Battery Company

THE last two or three years have seen a remarkable increase in the use of electric vehicles as passenger buses, and the success of a number of installations has greatly encouraged their use in this particular field. In England, especially, we find the electric passenger bus in quite common use and giving very satisfactory and economical service.

Recently the Rio de Janeiro Tramway, Power & Light Company decided to put trackless buses in service in Rio de Janeiro. Through its consulting engineers and purchasing agents, the Pearson Engineering Corporation, the company investigated carefully the various types of equipment for a trackless bus line and decided upon electric vehicle equipment.

The specifications and tests of these cars are of interest and are given below. They combine the best practice of the car builder, the electric vehicle manufacturer and the storage-battery manufacturer.

SPECIFICATIONS

Chassis—Commercial Truck Company of America.

Capacity—Thirty-two passengers; 9000 lb., including body.

Tires—United States; 36 in. by 4 in. dual front, 36 in. by 4 in. dual rear.

Motors—Four General Electric 1032 E2W5; 60-volt, 32-amp.; 1200 r.p.m.

Drive—Four-wheel concentric gearing; ratio 12.14 to 1.

Bearings—Axle, Timken taper roller; motor, annular-type ball.

Springs—Silico-manganese, oil-treated steel.

Controller—Continuous-torque type, at base of steering column, four points forward, two reverse.

Brakes—Internal expanding, on all four wheels.

Battery Trays—Angle-iron framing for one battery as specified above, consisting of two trays provided with rollers.

Frame—Four-inch rolled-steel channel with angle-iron and gusset-plate tie members.

Axles—Steel forgings; deep I-beam construction, duplicate, interchangeable front and rear; rear-axle motor wheels arranged for anchoring in a fixed position to the axle.

Mileage—The chassis to develop a speed of 14 miles per hour, in accordance with the mileage rating of the Society of Automobile Engineers, with a load of 9000 lb., and to cover 35 miles with this load and 40 miles with a load of 6600 lb. (half passenger load) on 34 kw.-hr.

Battery—Edison storage battery; 72 cells G-14 type.

Rated capacity, ampere-hours.....	350
Capacity (normal charge), ampere-hours.....	399
Capacity (overcharge), ampere-hours.....	460
Discharge rate (five hours), amperes.....	70
Discharge rate (three and one-third hours), amperes.....	105
Average voltage (five-hour rate).....	1.23
Average voltage (three and one-third-hour rate).....	1.20
Normal charge rate (four and three-quarter hours).....	105
Weight complete battery, lb.....	2,660
Calculated consumption for the four-hour operating period (27.12 miles) on a normal charge, on the basis of 30 amp.-hr. per round trip of schedule, amp.-hr.....	360

The first two chassis to be completed were given trial runs to determine their operation. A course in Philadelphia was selected and the conditions of the tests were

conducted so as to approach as nearly as possible true operation of buses in service. The course was over a known distance of 3175 ft. (0.6 mile of city surveyors' maps) of hard asphalt of slight varying grades.

The maximum duty required of a battery on a single charge to maintain the schedule is a total of twelve round trips of 2.26 miles each; mileage, 27.12. The operating period of this part of the schedule is four hours;

TABLE I—VEHICLE TEST NO. 5, OCT. 11, 1917

Trip No.	TIME		Ampere-Hours	Net Ampere-Hours	Voltage
	Minutes	Seconds			
	4.39 p.m.		11	Started test	
1	9	5	22	11	89
2	9	40	34	12	89
3	9	30	45	11	88
4	9	25	57	12	87
5	10	5	70	13	86
6	9	35	82	12	85
7	9	45	92	10	84
8	9	15	105	13	83
9	9	20	118	13	82
10	9	35	129	11	81
11	9	35	140	11	81
12	9	26	152	12	80
13	9	37	165	13	80
14	9	37	175	10	80
15	9	35	188	13	79
16	9	37	200	12	79
17	9	22	213	13	78
18	9	15	227	14	77
19	9	20	240	13	77
20	9	45	251	11	76
21	9	50	265	14	75
22	9	35	278	13	75
23	9	15	291	13	74
24	9	35	305	14	73

Finished test, 8.49 p.m. Ampere-hours used in test, 294. Time out, 11 minutes. Actual running time, 3 hours, 59 minutes. Temperature: At start, air, 58 deg. Fahr.; battery, 100 deg. Fahr.; at finish, air, 58 deg. Fahr.; battery, 105 deg. Fahr.

TABLE II—VEHICLE TESTS, GOING AND RETURNING, WITH TWO BUSES

	Vehicle A	Vehicle B
Distance, ft.....	756.	756.
Time, seconds.....	35.8, 29.0	41.2, 34.0
Miles per hour.....	14.4, 17.75	12.5, 15.12
Average.....	16.07	13.81
Volts.....	89.0	77.5
Amperes.....	140.7	137.25
Weight, pounds.....	19,105	18,300
Watt-hours per 1000 lb.-miles.....	40.7	42.0
Kilowatt-hours per mile.....	0.78	0.77
Kilowatt-hours per 35 miles.....	27.3	26.9
Ampere-hours per mile.....	8.75	9.92
Ampere-hours for 35 miles.....	306.0	347.2

running time, twenty minutes per round trip, which includes a total of twenty-four stops. The battery is then withdrawn from service for a time sufficient for a complete recharge. The distance from end of route to charging station is approximately $\frac{1}{2}$ mile.

TEST CONDITIONS

The battery was completely charged at the chassis manufacturer's service station, placed into the battery compartment of the chassis, and with the total load

driven to the test course, a distance of approximately $1\frac{1}{2}$ miles. In this condition the chassis was run over the test course for forty-eight trips, a total mileage of 28.8. On each trip the vehicle made six full stops. Periods of acceleration, coasting and braking were carried out as in actual bus service. At the completion of this run the vehicle was driven to the charging station

From these readings the ampere-hours per mile and the kilowatt-hours per mile are readily calculated. The tests were run over a staked part of the above course of a distance of 756 ft. The vehicle was under full power for the entire distance from a flying start. Table II gives the record.

It is a matter of record that vehicles of this con-



ELECTRIC BUSES OF THE TYPE SHOWN AT THE RIGHT HAVE BEEN PURCHASED FOR STREET TRANSPORTATION AT RIO DE JANEIRO BY THE PEARSON ENGINEERING CORPORATION FOR THE RIO DE JANEIRO TRAMWAY & LIGHT COMPANY. THEY WILL OPERATE UNDER ROADWAY AND TRAFFIC CONDITIONS SHOWN AT THE LEFT

and the battery recharged at 105 amp. for four hours and twenty minutes. At the completion of this charge the loaded chassis was again driven to the test course and another test of forty-eight trips made under the same conditions as the first. At the finish of this second test run the vehicle had been operated for such a period and under conditions so similar to actual service schedule as to enable the performance of chassis and battery to be determined.

struction with the controller arrangement and the four-wheel, four-motor driving and braking will not skid under the most severe conditions of operation. During the above tests this was demonstrated under conditions of heavy rain and where the pavements were covered with fallen leaves. The chassis with the entire test load was fully braked when running at full speed, and the vehicle was driven around corners of 90 deg. street intersection. Furthermore, the chassis was



THE BUSES WERE SHIPPED FROM PHILADELPHIA TO NEW YORK UNDER THEIR OWN POWER. SEVEN TRIPS WERE MADE FROM PHILADELPHIA. BRIDGES AND VIADUCTS WERE MEASURED IN ADVANCE. VESTIBULES ARE SHOWN PACKED FOR FOREIGN SHIPMENT ON THE FIRST CAR, AND THE MAIN BODIES ON THE SECOND CAR, IN CRATES 10 FT. BY 10 FT. BY 20 FT.

Several tests were made of the buses before their acceptance. Table I gives the result of one of these tests.

The vehicle was driven over the known distance, and readings of volts, amperes and time were recorded. Readings were taken for both directions of travel of the above distance, to take care of any variations due to grades, and an average of these readings was taken.

driven through such an angle at full speed, with power off and brakes on, and in no instance was there any tendency to skid.

The writer is indebted to the Pearson Engineering Corporation, 115 Broadway, New York City, for the specifications and figures which are contained in this article.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

METER-TESTING PRACTICE OF SMALLER COMPANIES

How to Get Along Without a Precision Instrument
—Cause of Trouble in Rotating Standards
and the Remedy for It

A Minnesota company which feels that it cannot afford to purchase a precision meter by which to check its standard meter has developed a scheme for determining in a rough manner whether or not the accuracy of the standard is being maintained. Two good customer's type meters are mounted permanently at a carefully chosen location in the company's meter room and adjusted to run at as nearly 100 per cent accuracy, compared with the standard, as possible. The standard is checked against each of these meters at frequent intervals. So long as all three meters indicate no change the company considers it reasonable to assume that no inaccuracy exists in the standard meter. When there is disagreement, however, the standard is sent away to be checked.

The customer's type meters which are used to check the standard are kept running constantly on a very light load created by small lamps. This is done since it is thought that they will retain their accuracy better while running than if they are operated only occasionally. Experience has shown that very often the inaccuracies in the rotating standard meter can be traced to the cord which is attached thereto. Consequently this cord is renewed at frequent intervals.

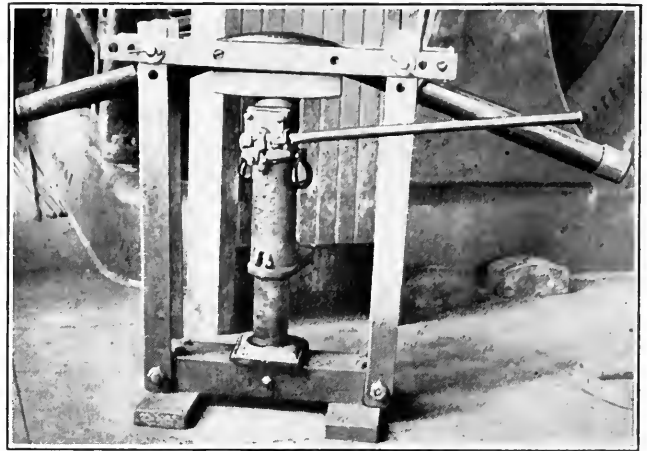
HOME-MADE CONDUIT BENDER SAVES TIME AND MATERIAL

Bends 20,000 Ft. of Cold Conduit in Many Varieties of Shapes Without Spoiling a Foot of Material

A simple but effective device for bending cold conduit has been developed by E. A. Phipps of the Rockingham County Light & Power Company, Portsmouth, N. H., and has saved considerable time and labor in the reconstruction of this company's power plant. As illustrated here, the outfit consists of a frame upon which a jack can be placed to press against a shoe conforming to the general shape of the conduit. Other shoes are provided at the upper corners of the frame, where they are pivoted so that they will adjust themselves to the curvature of the conduit. The effectiveness of the equipment depends chiefly upon the drawing effect of the shoes.

The outfit will bend any iron-conduit pipe from 1.25 in. to 4 in. (3.2 cm. to 10 cm.) or larger in diameter, using any make of jack on the market. The device is light, portable, easily operated by one man, and can be used in straightening as well as in bending conduit. It will make a 90-deg. bend without flattening the pipe considerably because the recess in the shoe immediately over the jack is relatively deep. Only one piece—the

central block—has to be changed in adapting the bender to different-size pipe. The frame occupies a space of only about 3 ft. (0.9 m.) high by 3 ft. (0.9 m.) long by 18 in. (45 cm.) wide. A bender of this type has been used at Portsmouth, where more than 20,000 ft. (6096 m.) of conduit, requiring every variety of bend, was



CONDUIT BENDER CAN BE OPERATED BY ANY TYPE JACK

necessary, without destroying a single piece of stock. Furthermore, a great saving was effected by not using the usual heating method. It is estimated that the machine easily paid for itself in making the first fifty bends.

EFFICIENT USE OF GAS FOR FUEL IN COAL-FIRED BOILERS

Large Combustion Chamber Needed for Complete Combustion of Gas—Good Construction Allows Boilers to Be Run at 200 per Cent of Rating

The desirability of gas for fuel because of its cleanliness was emphasized by L. A. White, superintendent of the Muskogee Gas & Electric Company, before the annual convention of the Oklahoma Gas, Electric & Street Railway Association. No stoking or cleaning of fires is required, and a number of boilers may be attended and a constant load maintained independent of manual labor.

There are many difficulties, however, in using gas for fuel. Combustion must be completed before the gases come in contact with the comparatively cool boiler tubes because the ignition temperature of the Marsh gas is 1233 deg. Fahr. This can best be accomplished by high boiler settings and large furnaces. The furnaces must also be constructed to prevent the flame from impinging on the tubes, and if this is done, boilers may be utilized for more than 200 per cent of rating without difficulty.

Mr. White said that most of the boilers at Muskogee were originally coal-fired, but when gas burners were installed the grates were covered with firebrick and the

burners placed in the furnace door. The flame was then directed against a checkerwork about 30 in. (76 cm.) from the end of the burner. This arrangement proved to be satisfactory as long as the boilers were not driven hard, but where the demands on the boilers increased the grates were removed, the ash pit lined with firebrick and the majority of the burners placed in ashpit doors. This doubled the size of the combustion chamber and increased the rating of the boilers. Theoretically the reason for driving the flame against the checker wall was to assist combustion by presenting an incandescent surface to the gases, which thus insured ignition and directed the hot gases against the heating surface of the boiler at right angles to it. The effectiveness of a square foot of heating surface obtained by this method should be about eight times that of a similar area arranged parallel to the gas flow. The factor of time is not accounted for in the theory, and the course of the gases is actually diverted and directed against the tubes, where the gas is cooled below the temperature of ignition and combustion arrested.

In operating a group of boilers without steam-flow meters it is possible inadvertently to drive one or more of the boilers beyond safe limits, owing to the condition of the burners either in lagging or leading boilers. The orifice of the burner sometimes becomes obstructed, thereby diminishing the flow of gas in one boiler. If this condition is not general, the load will naturally shift to the other boilers and a high gas pressure will be carried to offset the delinquency. "Scale is not always the cause of tube burning," said Mr. White, "for in 1911 a 500-hp. boiler was installed at Muskogee with twenty-two gas burners. The other boilers were of the same size and type but were equipped with fifteen gas burners. On the first night's run with this boiler operating on the same line with three of the fifteen burner boilers and pulling a 2000-kw. load, twelve tubes in the first row were burned out." A gas fire should burn with a blue flame and white heat, and the presence of a white flame indicates carbon monoxide. The only sure method of judging the efficiency of a furnace is with the Orsat apparatus, but without a collector for obtaining continuous sample or an automatic CO₂ recorder maximum efficiency is likely to be obtained only during the test.

PREVENTING SPONTANEOUS COMBUSTION IN COAL PILE

Laying Screenings Evenly and Subjecting Them to Heavy Rollings Eliminates Possibility of the Fires Likely in Loosely Made Piles

An interesting experiment has been carried out at the University of Illinois in stocking No. 6 Illinois coal mined near Georgetown, Ill. For several years it has been customary for the university to stock 4000 tons to 5000 tons of coal on the ground in piles about 12 ft. (3.7 m.) high, the coal being thrown from railroad cars onto the piles and distributed by scrapers. At times fires occurred in these piles.

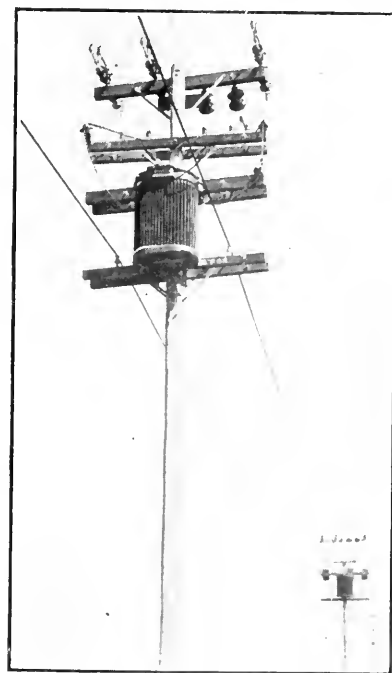
During the summer and fall of 1917 a pile of about 10,000 tons of coal was placed on an old tennis court which furnished a hard foundation. This coal was piled to a depth of 10 ft. (3 m.) or 12 ft. (3.7 m.) and surrounded on three sides by a light fence 7 ft. (2.1

m.) high. The coal was transported to the tennis court by means of a motor truck, and the entire surface of the ground was covered to a depth of from 2 ft. to 5 ft. (0.6 m. to 1.5 m.). This layer of coal was then rolled with a heavy roller to pack it down tightly and exclude the air as much as possible. The fence, of course, assisted in excluding the air around the edges of the pile. Plank roads were then laid over the top of the pile so that the motor truck could dump more coal on top of the layer which had been rolled. This process was repeated continuously until the pile was completed. According to H. H. Stoek, professor of mining engineering at the University of Illinois, this method of storing coal proved rather successful. While heating developed in a couple of places where other coal had been mixed with the screenings, the method otherwise proved entirely satisfactory. The cost of storing and reclaiming coal handled in this way averaged about 40 cents per ton.

TRANSFORMERS OF THE SAME BANK ON DIFFERENT POLES

Bank of Units Too Large for One Pole Placed on Adjacent Poles—Cut-outs on One Pole Connected to Other by Buses

Two or possibly three transformers of a bank can be placed on adjacent poles when the location of the transformers on the ground or on a two-pole platform is not feasible. The illustration shows connected in open delta two 2200-lb. (998-kg.), 50-kva. transformers that were too heavy for mounting on one pole. They are installed on a railway right-of-way where a



TWO-POLE PLATFORM ELIMINATED ON RAILWAY RIGHT-OF-WAY

two-pole platform was undesirable. All the cut-outs are on one pole with buses connected to the other transformer, as this is preferable to the installation of a pair of cut-outs on each pole. Line switches are shown in the photo, one placed on each side of the bank. As the bank is in a loop line it may be kept energized while work is done on the line on either side.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

TABULATION OF THE COSTS OF USING ELECTRIC TRUCK

Expense of Electrical Energy per Car Mile for
750-Lb. Truck at 3 Cents per Kilowatt-hour
Amounts to 0.8 Cent

Following is a record of a 750-lb. electric truck used
in ordinary city deliveries for thirty working days, pre-
pared from data supplied by the Electric Vehicle Sec-
tion, N. E. L. A.:

Days operated	30
Miles traveled	1,140.5
Kilowatt-hours used	319.5
Number of miles per kilowatt-hour.....	3.57
Greatest energy consumption for one day, kw.-hr.....	13
Smallest energy consumption for one day, kw.-hr.....	10
Average energy consumption for one day, kw.-hr.....	10.65
Shortest run, miles.....	33.5
Longest run, miles.....	46.5
Average run, miles.....	38.01
Greatest merchandise load (overload of 750 lb.), lb.....	1,500
Smallest merchandise load, lb.....	500
Average merchandise load (overload of 250 lb.), lb.....	1,000
Energy cost per car mile at 3 cents per kw.-hr.....	\$0.008
Energy cost per car mile at 4 cents per kw.-hr.....	0.011
Energy cost per car mile at 5 cents per kw.-hr.....	0.014
Maintenance (maximum estimate) including repairs and renewal of all mechanical and electrical parts, including tires, battery and painting of wagon, should not exceed per car mile.....	0.04

APPLIANCES TO OFFSET DAYLIGHT-SAVING LOSS

New Orleans Company Redoubling Sales Efforts
with the Result of Considerable
Additional Profit

"Daylight saving" will result in considerable loss in
revenue unless a vigorous campaign for broadening the
use of electric labor-saving appliances in the home is
pushed through, according to W. E. Clement, contract
agent for the New Orleans (La.) Railway & Light Com-
pany.

Realizing the need for overcoming the loss in light-
ing revenue, the commercial department of the New
Orleans company is redoubling its efforts toward the
sale of appliances. This campaign, instead of proving
an expense from a promotion standpoint, is actually
turning out to be a big money maker.

Vacuum-cleaner sales, on which there is a large profit,
show an increase over last year, Mr. Clement states, of
several hundred per cent; sewing-machine motors, 50
per cent; vibrators, 40 per cent, and miscellaneous appli-
ances, 182 per cent.

Foreseeing the necessity for boosting the sale of ap-
pliances, the manufacturers were called upon to supply
about 30,000 pieces of advertising matter showing sum-
mer electric goods, all of which are now being distrib-
uted by means of boxes placed in street cars. In addi-
tion, the company is using bill stickers, car cards and

a small amount of newspaper space. Fans especially
are being featured at present, it being foreseen that on
account of the extra hour in which business men will
be at home during the heat of the afternoon a great
demand for fans will result.

Extra tables are being placed in the salesroom carry-
ing miscellaneous electric appliances, with such season-
able articles as wicker lamps in great abundance, a
large sale being anticipated on this class of goods.

On the floor a special sewing-machine demonstration
has been arranged, and visitors to the office cannot fail
to be attracted by the sight of a young woman rapidly
running off summer goods on a machine in full sight of
passers-by.

TAXES WHICH AFFECT THE PUBLIC UTILITIES

Injustice of Subjecting Properties to Large Addi-
tional Burden of Expense Which They Cannot
Pass on to the Consumer

At the present time, when utilities are finding it so
hard, in spite of large gross earnings, to make both ends
meet, additional expenditures make it all the harder to
show any profit. Among such expenditures which have
been greatly enhanced by the war are taxes. There have
been some new taxes and some taxes have been in-
creased. In addition, the expense attached to mak-
ing out a tax report sheet is a very considerable
item. The injustice of the increase of taxes to
which utilities must submit without recourse to higher
rates was outlined by H. Spoehrer, secretary and treas-
urer of the Union Electric Light & Power Company, St.
Louis, Mo., before the Missouri Association of Public
Utilities at the recent convention. Mr. Spoehrer said in
part:

Supplementing the normal taxes we have had enacted re-
cently by each of the divisions of the government addi-
tional taxes to meet extraordinary needs, the accumulation
of which is becoming rather burdensome, especially since the
utility has not been offered the means with which to meet
these demands. There would, of course, be no cause for
complaint as to such taxes as are levied against all indus-
tries indiscriminately, provided that the sale price of the
utility's commodity were advanced and any additional tax
thus borne by the consumers as is the case in other indus-
tries, instead of reducing the earnings of the stockholders,
which with the utility company are already limited.

One of the cardinal principles of a public utility is the
avoidance of the practice of discrimination, yet legislative
bodies have no hesitancy in levying discriminating taxes
against utility corporations, notwithstanding the fact that
earnings of these companies are already regulated and lim-
ited.

Special taxes should, therefore, be eliminated. Under
this class I include such items as franchise taxes and gross
income taxes, which are not exacted of other industries.

The array of general taxes, federal, state and municipal,
now in effect presents the following:

First—The general property tax under which all tangible

property owned by the taxpayer, real and personal, is taxed at the rate of \$2.35 per \$100.

Second—Merchants' and manufacturers' license tax of \$1 per \$1,000 of sales or gross receipts.

Third—The federal income tax. This tax, originally 1 per cent of the net income of the corporation, was later increased to 2 per cent. In October, 1917, it was again increased, now amounting to 6 per cent of the net income of the corporation. Under this title also we may mention the 2 per cent normal personal income tax which the corporation pays on behalf of the holders of any of its bonds which contain a tax-free covenant.

Fourth—Ten per cent federal tax on undistributed income. This is a new tax, effective Jan. 1, 1917, and applies on the amount of earnings remaining undistributed six months after the end of each calendar or fiscal year.

Fifth—Federal capital stock tax levied at the rate of 50 cents per \$1,000, or one-twentieth of 1 per cent on the fair value of the capital stock of the corporation in excess of \$99,000. This tax will cost our company \$6,200 in 1918.

Sixth—Federal war excess profits tax. This tax varies, depending on the amount of earnings and the invested capital of the corporation. Since it is impossible for a public utility to derive excess profits from its business, this tax concerns us chiefly by the annoyance and time consumed in making the formal returns.

Seventh—Federal freight tax, a tax of 3 per cent on the amount paid on freight bills. This is a new tax, which we estimate will affect our company this year to the amount of \$6,150.

Eighth—Express tax of 5 per cent on amounts paid for express charges will amount to \$230 for our company in 1918.

Ninth—Federal tax on telegrams and telephone calls, at the rate of 5 cents per message on all messages costing over 15 cents, will amount to a tax of \$220 on the business of our company this year.

Tenth—May be mentioned, not perhaps distinctly as a tax, but as increased cost of mail service; the increase in postal rates is 100 per cent on post cards and 50 per cent on all except local letters.

Eleventh—Documentary stamp taxes, including those on issues of capital stock, will cost our company more than \$10,000 during the year.

Twelfth—State franchise tax of 75 cents per \$1,000 of the outstanding capital stock and surplus of the corporation employed in this State. This will affect our company to the extent of \$17,500.

Thirteenth—State income tax, amounting to one-half of 1 per cent of the net income. This peculiar law is now under test by an action brought by the St. Louis Chamber of Commerce questioning its validity.

Fourteenth—State-secured debts tax, a new stamp tax imposed by laws of 1917 on obligations at the rate of 5 cents per \$100 per year to the maximum of 25 cents per \$100, will affect us to a slight degree in the issuance of securities.

Fifteenth—State motor-vehicle license tax, which by the 1917 session of the State Legislature was increased 100 per cent. The increased burden on our company by this tax amounted to more than \$600 this year.

Sixteenth—Fees on security approvals. Though not an ever-present item of taxation, a complete list should include the fee of \$1 per \$1,000 which these utilities must pay to the Public Service Commission upon the approval of issues of stocks or bonds. We are not objecting to this tax, since it is applied to the maintenance of the commission, and it is probably fair that we help support the boss; but it may be pointed out that no other lines of business are taxed in a similar manner to support a regulatory body having at its principal purpose the limiting of the earnings of such business.

Seventeenth—Annual registration fees. Though practically negligible in amount and concerning us chiefly on account of the time and expense consumed in compiling the report, the annual corporation registration fee of \$5 constitutes another tax to which we are subject.

Eighteenth—City and county secured debts tax, levied by the counties and by the city of St. Louis, both as a county and a city, thus making this tax in St. Louis amount to twice the state tax under the same law.

Nineteenth—City motor-vehicle license tax, in amount equal to one-half the state tax. The total state and municipal motor vehicle license taxes added to the chauffeurs' license taxes paid by our company will this year be approximately \$2,400.

These, together with the franchise tax of \$117,500 and the 5 per cent gross income tax of \$190,000, make a remarkable total of twenty-one different taxes paid by our company in St. Louis. The enormity of this burden is more clearly perceived when it is stated that the aggregate total of all this taxation exceeds \$539,000 per year, amounts to 12.8 per cent of the gross receipts from the distribution of electricity in the city of St. Louis, and exceeds the total net income of our company for the year by more than 30 per cent. Thus it is seen that the federal, state and municipal governments, without having a cent invested in the enterprise, receive a greater amount out of the earnings of the company than is received by the stockholders who have furnished the entire investment. It must be remembered also that this is taxation to which we are subject while earning an income of a very small percentage on the total investment, a percentage which has been reduced to an "irreducible minimum," and without the application of excess profits taxes, since the realm of such profits is wholly strange to public utilities.

Neither does the amount paid in these taxes represent their actual cost to the utilities. The cost in time and labor consumed in preparing the data for the returns and the making of the returns themselves, together with other returns occasioned by these and other taxes, such as information returns under the personal income tax laws, has increased until the amount so consumed represents a heavy expense.

A list of the returns and reports occasioned by these various tax laws includes the following:

(a) To the federal government: (1) Income tax returns; (2) capital-stock tax return; (3) war excess-profits tax return; (4) monthly income tax return of personal tax withheld at the source; (5) annual return of information under income tax law on payments of \$800 or more to all employees and a large class of recipients.

(b) To the state government: (6) Income tax return; (7) franchise tax return; (8) annual corporation registration.

(c) To the local or municipal government: (9) Personal property tax return; (10) 5 per cent gross receipts return, made twice yearly; (11) merchants' or manufacturers' license tax return.

It is clear that all these returns and reports require a vast amount of statistical work.

In this review of our tax problems and burdens we do not mean to criticize all the forms of taxes or object by wholesale. Some of these taxes are both necessary and correct in principle and are, therefore, above reproach. What we wish to emphasize are the staggering proportions to which taxation grows by its cumulative effect, and especially to point out that with the load of necessary general taxation it is high time that special taxation discriminating against public utilities should be objected to and abolished. As before stated, the worst of these are franchise taxes, and in St. Louis, the 5 per cent gross receipts tax. The particular vice of this tax is that it imposes on the utility, and through it upon its patrons or consumers, a tax to obtain revenue which is used for general purposes and to the benefit of the whole public, including those who are not users of the service and, therefore, bear no share whatever of the tax.

These special forms of taxation should be eliminated, and in view of the present period of exceptionally heavy general taxation, due recognition should be taken by the commission of the needs of the utilities to enable them to meet the situation by a proper increase in rates charged for utilities' service.

Every public utility in the State is subject to this great load of taxation, with the possible exception of franchise and gross receipts taxes, depending on local conditions. The suggestion of rate adjustments is pertinent, therefore, especially in view of the important function of the utilities in this time of national need. Adequate earnings are obviously necessary to enable the utilities to operate with efficiency.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Characteristics of the Induction-Type Generator.—The inductor-type generator has come to be universally recognized as the standard type of generator for the 500-cycle, single-phase power supply of the modern wireless-telegraph stations. The principles of operation and methods of testing and predetermining the operating characteristics are discussed.—*Electrical Review*, April 27, 1918.

Improvement of the Turbo-Alternator.—An editorial comment on S. F. Barclay's paper, presented before the Institution of Electrical Engineers, which gives the relative advantages of solid and built-up rotors for machines of large output. In large machines the solid rotor construction has inherent defects which have not yet been eliminated. The larger the diameter or the greater the volume of the rotor, the more likely are the defects to become pronounced. Ductility varies considerably through the mass, and the heat treatment does not penetrate to the center of a large forging, nor is it uniform in the case of a hollow forging having walls of considerable thickness. A large forging can neither be tested nor inspected with the same degree of thoroughness as by the test and inspection methods in every-day use in the machine shops. Forgings are very difficult to obtain in large sizes as there are very few who could undertake the work. On the other hand, the built-up rotor has none of these objections as the plates are thin and no part is more than an inch from the surface. The construction difficulties of the built-up rotor are much greater. Outputs of turbo-alternators become restricted owing to insufficient cooling surface or ineffective cooling surface, and since the area of the cooling surface cannot be greatly increased, a means of improving its efficiency will have to be found before there can be any radical increase in the specific output. Improvements in the design and construction of the end bells—or, preferably, improved design and arrangement of the rotor winding of such a kind as to eliminate the end bells—would simplify the design. Without epoch-making discoveries the designer will have to be content with copper and its troublesome losses and defective mechanical properties. The magnetic properties, however, as well as the reduction of the specific loss in commercial iron, can be greatly improved.—*London Electrician*, April 5, 1918.

Lamps and Lighting

Lumens Versus Candles.—H. ARMAGNAT.—The candle-power unit in general use in the commercial classification of incandescent lamps does not respond to modern needs, and its meaning has been so changed in current phraseology that it has become necessary to substitute for it the unit of flux, which defines better the quantity sought. The author thinks that this substitution has met with stronger resistance in France than in other countries and makes a mathematical and

diagrammatic argument in support of the contention that the lumen should be adopted for the classification of lamps and the candle restricted to its precise sense as a unit of intensity.—*Revue Générale de l'Electricité*, April 27, 1918.

Glasses for Protecting the Eyes from Injurious Radiations.—W. W. COBLENTZ and W. B. EMERSON.—General characteristics of certain newly developed glasses used for protecting the eyes from injurious forms of radiant energy, especially the infra-red or so-called heat rays, are given. Because of the difficulty in reproducing the same color in different melts, no attempt is made to give specific data on the transmission for a given thickness of glass. These glasses under consideration are known as euphos, fieuzal, akopos and novi-weld. An appendix indicates which part of the radiation from a gas-filled tungsten lamp, a magnetite arc and a quartz mercury-vapor lamp is transmitted through various substances, thus showing in a condensed table the protective properties afforded by these glasses.—*Technologic Papers of the Bureau of Standards*, April 4, 1918.

Generation, Transmission and Distribution

Radiant Heat and Fire-Box Design.—JAMES T. ANTHONY.—The amount of heat absorbed by boiler surfaces due to radiation depends upon two things—first, on the area of the radiating surfaces; second, upon the temperature. If the firebox heating surface is increased without increasing the area of the heat-radiating surfaces or their temperature, there will be practically no increase in the amount of heat radiated. With coke or a hard coal that burns without any flame, the total amount of radiating surface would be equal to the grate area, so that increasing the firebox heating surface would have only little effect on the firebox evaporation. When using a highly volatile coal, however, the heat radiated from the fuel bed can be disregarded, for in this case the temperature and extent of the flames become the controlling factor. The flames, being interposed between the heating surfaces and the fuel bed, absorb the heat radiated from the fuel bed in addition to the heat being generated within the flames by the burning combustibles and radiate this heat to the surrounding heating surfaces. It is then apparent that increasing the capacity of the firebox and filling the added volume with flame results in increasing the radiating surface and the amount of heat radiated. The amount of flame in a firebox depends primarily upon the amount of combustible gas being driven off, the air supply and the volume of the firebox. With a fair grade of bituminous coal and ordinary firing methods, fully 50 per cent of the heat generated in the firebox is due to the burning of combustible gases above the fuel bed. In order to burn these gases completely it is necessary to have an excess of oxygen above the fuel bed, to mix the oxygen intimately with

the combustible gases, and to provide sufficient flame-way or combustion chamber space. If the mixture is not thorough and the quantity of oxygen is not sufficient, the gases will burn more slowly, the flames will be longer, and combustion is apt to be incomplete.—Extracted from paper read before the Central Railway Club, May 10, 1918.

Current-Limiting Reactances.—The desirable features that reactors should possess and the details of construction to fulfill these requirements are discussed.—*London Engineer*, April 12, 1918.

Installations, Systems and Appliances

Low Temperature Industrial Heating.—DWIGHT D. MILLER.—The operation, control and advantages of this type of heating are considered in the conclusion of the paper. A short discussion is presented of how the heating load is acquired and the advantages of electric cooking. The author states that the most important advantages obtained by the use of the heat of electric energy are that it can be generated in any quantity regardless of temperature and that it may be absolutely and exactly controlled. Many commercial processes can be carried on with the same accuracy and duplication of results as can be obtained in the laboratory, and many uncontrollable variables are eliminated. With the ordinary combustion-heating process a slight change in the humidity of the air or velocity of the wind will have a pronounced effect on the results obtained, whereas if electric heating is employed no effect is noted.—*Ohio Electric Light Association Monthly*, April, 1918.

Design and Operation of a Small Kjellin Furnace.—GEORGE H. STANLEY and W. BUCHANAN.—The authors point out that an induction furnace is somewhat similar to a single-phase, core-type alternating-current transformer subject to the limitation of non-sandwiched windings and a horizontal position of the secondary. Data on the cost of operating such a furnace are given as follows:

Scrap, 70 tons at £1.....	£70	\$339.50
Pig iron, 1½ tons at £20.....	30	145.50
Aluminum, 30 lb. at 2 shillings.....	3	14.55
Magnesite (calcined), 2 tons at £18.....	36	174.60
Miscellaneous stores	15	72.75
Repairs and renewals.....	15	72.75
Tools, etc.	5	24.25
Electric power	200	970.00
Cartage	30	145.50
Miscellaneous sundries	20	97.00
Salaries, wages and supervision fees.....	400	1,940.00
	£824	\$3,996.40
Per ton, nearly.....	14	66.50

—*Journal of South African Institution of Electrical Engineers*, September, 1917.

Experiments in the Electrothermic Production of High Temperatures.—JEAN ESCARD.—The author describes the mode of employment and the principal object of the chief laboratory ovens employed in practice, including ovens with resistant metallic plates or wires surrounding refractory tubes, arc ovens, arc ovens with resistance, and resistance ovens simply.—*Revue Générale de l'Electricité*, April 13, 1918.

Steel Fusion Welds.—When steel is welded by the aid of the oxy-acetylene blowpipe or the electric arc, the heating is very local and the grains become coarser. This is particularly noticeable with arc-welding, in which heating and cooling are more rapid. On the grain boundaries cementite appears, sometimes pearl-

ite. A microphotographical study of the welds brings out other interesting peculiarities, said S. W. Miller, proprietor of the Rochester (N. Y.) Welding Works, before the American Institute of Mining Engineers. The paper he presented was illustrated by a large number of photographs. In addition to the cementite spots, there are generally fine specks of oxide. Welding also seems to introduce gases—nitrogen and probably hydrogen—into the steel unless the welding rod—generally a low-carbon wire of 0.1 per cent or 0.18 per cent of carbon—contain manganese or vanadium. These constituents have the disadvantage, however, that they cause a slag to form which does not easily float to the surface. The burning and agitation of the steel also leads to a change in the carbon content. Electric welds further show peculiar fine lines or cracks which seem to be the sides of diagonals of squares. Miller has found, the author said, that they darken when boiled in sodium picrate, are more numerous with high-carbon wire than with low-carbon wire, and disappear after heating the specimen above 750 deg. C. and then cooling at certain rates. On the other hand, the lines widen in steps on prolonged etching, which would be compatible with their being lines of incipient fracture along planes of cleavage.

Electrophysics and Magnetism

Radiation from Systems of Electrons.—SIR J. J. THOMSON.—The author deals particularly with the phenomena which are generally discussed under the heading of "Roentgen Rays and Crystal Structures," though he does not use that expression. He says that the center of the disturbance is generally supposed to be the atom, whereas one really has to deal with two sets of gratings, that due to the arrangement of the atoms in parallel planes and that due to the grouping of the electrons of the atom. Each set of gratings has its own system of spots.—*London Electrician*, April 5, 1918.

Precharged Condensers in Series and in Parallel.—V. KARAPETOFF.—By "precharged" the author means that a condenser is charged from a source of direct voltage and then is used as a booster in series with this source to charge another condenser. By repeating this process a large number of times the second condenser is finally subjected to twice the voltage of the source. This is considered in series, parallel and network of condensers.—*Proceedings A. I. E. E.*, May, 1918.

Miscellaneous

Central Heating as a Means of Conserving Fuel.—F. G. CLARK.—The ideal system would utilize low-pressure steam from a steam electric power plant, which could be taken from the low-pressure stage of steam turbines through suitable regulating valves and be superheated by a suitable heat exchanger before passing into the street mains. The conditions which best suit this method of supplying heat are a closely built-up section of a city and a central location for the supply plant, which usually provides for a fan-like distribution system. As an economic proposition the central heating plant can offer to customers in a limited district a supply of heat for approximately what their coal would cost them, leaving a fair return on the central heating system investment.—*Toronto Electrical News*, May 1, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

TWELVE GOLF BALLS BRING IN THIRTY-FOUR HUNDRED DOLLARS

This Sum Realized for the Red Cross by Successive
Auctions of These Articles at Last Week's
Hot Springs (Va.) Convention

BY O. FRED. ROST

Member Electrical Supply Jobbers' Association

Boom! Boom! Boom!

While a number of murdering, brutalized sky pilots sent out by the "Beast of Berlin" were bombing hospitals back of the Allies' lines, were killing some of their own wounded along with those of the enemy and murdering nurses and Sisters of Mercy, a gathering of business men representing all sections of the United States quite unexpectedly made a demonstration which, when it finally ended, proved to have raised a substantial fund for repairing some of the damage caused by those murderers.

The members of the Electrical Supply Jobbers' Association had once more invaded the peaceful valley in the Virginia mountains where at Hot Springs the Homestead Hotel spreads itself along the mountain.

Although not many months previously it had donated a fully equipped ambulance to the American Red Cross, the association again voted a donation of several thousand dollars to this body. Just before adjournment a messenger brought to Franklin Overbagh a box containing twelve golf balls donated by the manufacturer as a prize in the golf tournament. No tournament having been scheduled on account of matters pertaining to the war requiring the greater part of the time, the golf balls were to be auctioned off for the benefit of the Red Cross.

Here was an opportunity to make good, and the suggestion that the golf balls be auctioned off separately, instead of as a lot of twelve, was readily carried out. Whoever made the suggestion surely did not know what was being started, for those balls, being round, kept right on rolling. From offers of \$25 for one golf ball the bids soared higher and higher until over \$100 was bid. Frank Price of Boston purchased the privilege of auctioning off the last ball and brought a record figure.

The twelve original purchasers of those most precious golf balls got together and as a body presented the twelve balls to Mr. Overbagh, and here Mr. Overbagh entered into his rôle as angel of the Red Cross, because hardly had the presentation been completed when up he jumped and asked, "Gentlemen, how much am I bid for these golf balls?" Friend Herstein lost no time in calling for eleven other members to form a syndicate of twelve to buy the balls at \$10 each. Three times the number responded to the call, and the balls went to the Herstein syndicate for \$120. Again they were presented to Mr. Overbagh, who immediately for the second time placed them on sale. Mr. Sackett duplicated Mr. Herstein's feat, and the Sackett syndicate bought in the balls. However, these wonderful balls

were not going to stop there, and with an ability for keeping on rolling never before displayed by any other balls on the links or off them they kept moving.

A meeting called right on the floor carried a resolution to offer \$150 for those golf balls in the name of the Dixie Club. Monopolies not being allowed under the Sherman law, the Erie Club rose to the occasion by also calling a meeting and raised the bid to \$175. Friend Bernardin, sole representative of the Missouri River Club, shouldered the responsibility of raising the bid to \$200 in the name of his club.

About this time the Dixie Club, having already splendidly supported its president in the Herstein syndicate, decided on a retirement for strategic reasons. President Bissell of the Lake Erie Club then took full possession of the balls through his club's bid of \$250.

As a reward for offering a motion which added several hundred dollars more to the already large fund, Mr. Garron was finally presented with the twelve golf balls, but though apparently stowed securely all in that little box, those balls really kept right on rolling.

The question came up as to who should make the presentation to the young lady of Red Cross fame, and in the bidding that followed Brother Bernardin of Kansas City secured the privilege with the highest bid.

The following morning \$1,510 was reported to have been collected. The news of the excellent collection had traveled quickly, and the proposed presentation of the money immediately took its place on the program for the day as being the most important event.

All the ladies wanted to be present and the manufacturers, though feeling rather slighted at not having been given a chance at the golf balls the night before, also condescended to be present. However, the fat bank rolls of some of the manufacturers had not been forgotten, and when the young lady was ready for the presentation, she also was ready with the golf balls, which had been once more donated for the Red Cross.

The first ball went at \$50, and with final bids constantly going higher, the last ball was knocked down to its fortunate purchaser for the small sum of \$202. In the brief auction the manufacturers had, through buying up the golf balls, raised \$1,527 for the Red Cross. However, the jobbers present were not going to be outdone by any means, and within a few minutes after the total derived from the manufacturers' auction had been announced the jobbers had got together and raised \$300 and some odd dollars more, making their total to the Red Cross fund upward of \$1,800. Total funds secured by the means of those twelve golf balls were nearly \$3,400, and if it had not been that other than golf balls are needed "over there" and electrical manufacturers and jobbers have an important mission in getting enough balls to the other side to bury the Kaiser, those golf balls would still be rolling and gathering in dollars for the greatest mother of us all—the American Red Cross.

GEORGE H. GUY'S SERVICE RECOGNIZED BY SOCIETY

New York Electrical Society Passes Resolutions in Recognition of the Thirty Years' Devoted Service of Mr. Guy

At the meeting of the New York Electrical Society on May 23 resolutions were passed as a recognition of the faithful and devoted service given by George H. Guy during his thirty years as secretary.

Engrossed resolutions passed by the nominating committee were presented by Edwin R. Katté, vice-president, to Mr. Guy. In these the committee sincerely and gratefully extended to Mr. Guy "our affectionate greetings and congratulations upon his long and faithful service, and our best wishes for the continuation of that service, and for his good health, his happiness and his prosperity."

A resolution proposed by T. C. Martin and seconded by Dr. C. O. Mailloux, senior past-presidents of the society, indorsing the sentiments expressed by the nominating committee, was passed.

The ticket for the coming year, nominated by the nominating committee, was announced as follows:

For president, A. L. Doremus.

For vice-presidents, Dr. E. G. Acheson, C. A. Benton, Philip Torchio.

For secretary, George H. Guy.

For treasurer, Thomas F. Honahan.

The following data are of interest as bearing on the fact that this is the banner year of the New York Electrical Society:

1. It has had during the year its largest membership increase, 519, bringing the aggregate membership up to 991.

2. The average attendance at its lectures has been 417, the highest but one of the twenty-two organizations in the Engineering Societies Building, and relatively to the membership the highest, and actually the highest of all electrical societies in the country. The whole of the eight meetings of the season have been devoted to war subjects.

3. The society has the largest bank balance it has ever had.

CONTROVERSY COVERING POWER DISTRIBUTION IN LOS ANGELES

Los Angeles Gas & Electric Corporation Seeks Injunction Against City to Prevent Construction of Paralleling Existing Lines

The Los Angeles Gas & Electric Corporation has filed injunction proceedings against the city of Los Angeles seeking to prevent the municipality from paralleling the company's power lines. The complaint states that the plaintiff is adequately serving the districts affected and that the city has entered competition to sell, "at a profit and for a price no less, electricity no better."

This is contrary to the existing laws, the application states, since no permit for competitive service has been secured from the State Railroad Commission. The court is asked to enjoin the city from further work on the paralleling system.

Birthday Tribute to Henry L. Doherty



The president of the Cities Service Company, a guest at a banquet in honor of his forty-eighth birthday, Grand Central Palace, New York, on May 15, made two announcements to the 300 present. One was that Mr. Doherty and his partner, Frank W. Frueauff, had decided to create a securities fund, the income from which will be applied to

scholarships for the sons of Doherty employees receiving salaries of \$200 a month or less. The intention, broadly, is to put these junior Doherty men through college, and then by placing them in the various Doherty training schools prepare them to carry on the organization work. The other was the launching of a proposed Doherty fraternity.



THE ASSEMBLED DELEGATES TO THE DEL MONTE (CAL.) CONVENTION OF

Public Policy on the Pacific Coast

Prompt and Efficient Action Necessary to Protect Utilities—Interconnection of Systems, Water-Power Legislation, Rates, Man-Power Reduction and Financial Help Are Immediate Problems

This gives some of the main points in the report of the public policy committee of the Pacific Coast Section of the National Electric Light Association. The report was presented by John A. Britton, chairman of the committee, at the meeting at Del Monte, Cal. on May 9 to 11. It is of timely and vital interest as a presentation of war problems.

TRUE to the traditions of old, the public utilities have, by their co-operative efforts with the government and its recognized agencies in all of the demands made upon them, given to the loyal people of the United States a different perspective in contemplating utilities as such, and it is strongly recommended by your committee that a bureau be established, to act in conjunction with national bodies organized for that purpose, looking to the distribution of a propaganda calling for a fair consideration of the rights of utilities, and that the old and time-worn spirit of antagonism be forever buried and forgotten, that the public may be brought to the realization that in these times of our troubles, common to all, the public utilities stand for all that the people stand for, and that under regulation the people are protected from profiteering by the utilities to a greater extent than the people are protected by the government regulation of all of the commercial industries and businesses; and we again pledge ourselves to that offer made at our last convention to the President of the United States.

Through the joint efforts of the Railroad Commission and the Fuel Administration there has been brought about in the State of California an interconnection of companies that it is safe to say could not have been accomplished otherwise than as a patriotic measure. It has thus afforded an appreciation of the economic advantages of centralization and unification and a great and potent saving of capital and of energy. The results of the bringing together of the companies

are to be found in the records of the Railroad Commission and display in a very forceful manner the sacrifices that were made of individuality to accomplish the greater good to the nation.

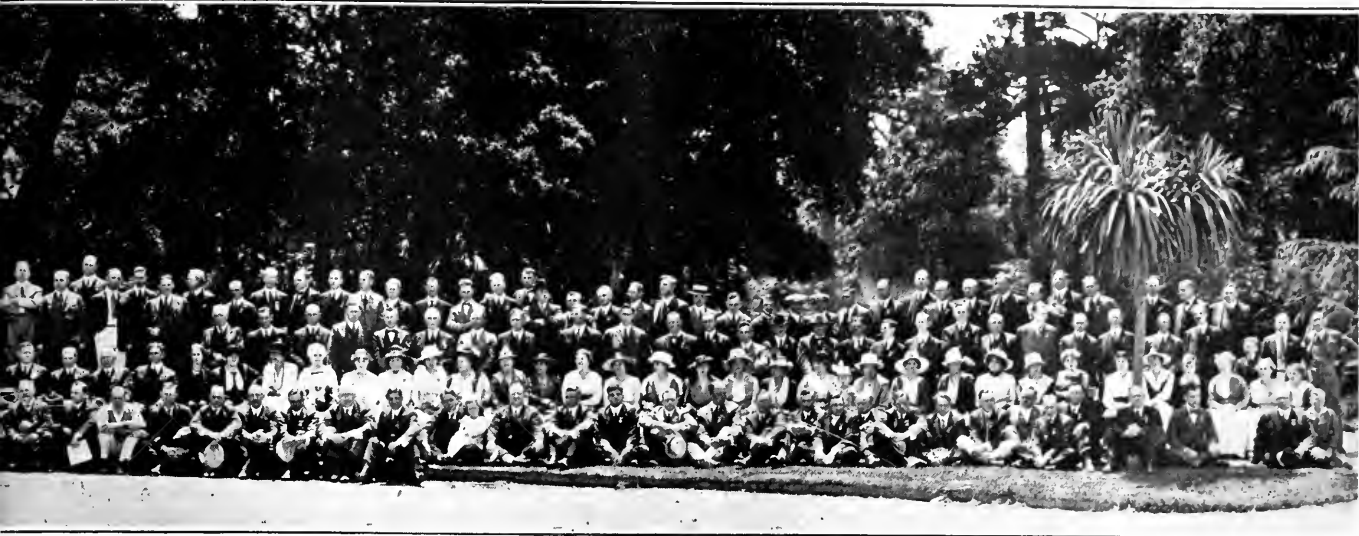
The Congress of the United States has now under consideration a bill for the leasing of public lands for power development. This bill, if enacted, will materially help to unlock the doors that for years have been locked and have kept away the maximum possible development.

Appeals to regulatory bodies were commenced during the year 1917 by companies which as long as it was possible forbore to apply for relief, anxious that their motives might not be misconstrued, and until it appeared that the capital invested in service to the public was facing absolute ruin if rates were not increased appeals for relief were not made. In most cases the increases granted on preliminary applications were largely temporary, as the rapid continued advances in price of labor and material could not be met by any action of rate-fixing authorities.

On the Pacific Coast the increased cost of oil has been the most potent factor in increasing the cost of service to public utilities. From October, 1916, to date, the base field price has risen from 35 cents per barrel to \$1.23 per barrel, and this has been all the more severe upon the electrical operating companies by reason of the greater demand made upon them for service and the lessened hydroelectric output.

Few stop to think that if the service of the public utilities throughout the country should stop the whole war program would instantly collapse. It follows that in so far as the efficiency of a public utility is impaired the war program is proportionately delayed and interfered with.

Congressional help, an attempt to give which is made in the recent act of Congress, while affording some relief in refunding obligations, does not, because of the



PACIFIC COAST SECTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION

short term of loans by the government and the added fact that loans must be made only for enterprises directly connected with governmental war activities, afford relief for permanent extensions to plants which cannot come into full earning power for years and which cannot be directly allocated to war-time activities.

The utilities must themselves take care of the future, and in no more certain way can this be accomplished than by being permitted to earn such return upon capital as will encourage the investor. At best the ability of the utilities to enlarge their facilities will during the progress of the war be reduced to a minimum unless this aid shall be forthcoming, and it is certain that without some constructive help from the state commissions there will be a curtailment of demands deemed to be purely essential in the furtherance of our nation's work.

We must find ways, and means to meet these demands and prepare ourselves for the day that is to come when with the embargoes now existing removed there will be a forward movement toward the realization of the dream of a State busbar—yes, even a national one—as the most economical to serve the needs of the people.

Withdrawal of man power has proved to be the most serious handicap to the fullest economical administration and development of utilities, not only in the loss of such trained men but in the necessity for the substitution for them of men untrained and unfitted by contact and environment to take up the burden of those who have enlisted in the ranks.

This labor situation is one which we must face with the greatest concern, not only in the immediate present because of the withdrawal of the effective man power, but in the future, with the probability of never again approaching the degree of efficiency that heretofore has characterized organizations like ours.

Your committee fully believes that if the general public, always fair in its final conclusion, can be made to feel the true force and effect of the participation of utilities in the service of the government and their unquestioned patriotism, then when questions arise between the utility and public greater consideration will be shown than has heretofore been the case.

Aside from the giving of service by the depreciation

of man power, the utilities have been called upon constantly to render aid and assistance to the various branches of the federal government. At no time has there been found lacking the necessary sacrifice of time and labor to make all of these governmental agencies effective, and the men of the public utilities have deemed it an honor to be classed as dollar-a-year men.

Perhaps one of the blessings in disguise due to the war has been the necessity brought home to the public utilities for economizing in all of their departments by the elimination of unnecessary operation and by reducing so far as they can, through automatic devices and otherwise, the necessity for man power.

The efforts made by the manufacturer, jobber and dealer at the last annual convention to secure recognition by the companies have been productive of results, and the trial now being given will demonstrate the effect of such co-operative work.

RESOLUTION ON WATER POWER

The following is the resolution reported by the public policy committee of the association on the water-power situation and adopted by the convention:

Whereas the future welfare of the public-land states depends upon water-power development to increase the location therein of industries to which cheap and constant power is a necessity and further to develop their agricultural possibilities; and

Whereas true conservation consists in saving that which is destructible, such as our forests and oil and coal deposits, and using that which is indestructible, our falling water, and

Whereas the immediate development of a potential power by water of not less than 100,000 hp. per year would bring arid lands into bearing, provoke the development of industries utilizing the hidden wealth of the public land states, and build up an empire in the West, and

Whereas the existing laws have prohibited the full development of the water-power of these States;

Now, therefore, be it resolved, that the Pacific Coast Section of the National Electric Light Association in convention assembled urges upon the Congress of the United States to enact at once such remedial legislation as will encourage development of the millions of horsepower now wasting to the seas, that true and not false conservation may prevail, and that the waste of fuels in generation of electric energy may be minimized:

Resolved further, that a copy of this resolution be forwarded by the president of this association to the President of the United States, to the Secretaries of War, the Navy and the Interior, and to Representative T. W. Sims.

POSITION OF DIRECTORS OF WAR FINANCE CORPORATION

Applications Are Made by Public Service Companies
for Loans Amounting in the Aggregate to
a Large Sum

Directors of the War Finance Corporation have authorized the statement that they have under consideration applications from many public service corporations doing business in various sections of the country for loans aggregating a large amount.

The directors of the War Finance Corporation do not feel that they have any authority under the law to make loans except upon adequate security, as required by the act, and they are convinced that the inability of a utility company to earn a sum at least sufficient to pay its fixed charges, taxes, maintenance and repairs is conclusive evidence of the inadequacy of its own obligation as security.

The directors of the corporation feel that the localities served by these various public-utility enterprises should not expect the War Finance Corporation to make advances to any utility company whose statement shows that it is in actual need of increased revenue. It is a matter for the local authorities to determine whether or not an increase in rates sufficient to maintain the enterprise as a going concern should be granted.

It is urged, therefore, that the proper authorities give prompt consideration to applications made by public utilities for permission to increase rates in order that the directors of the War Finance Corporation may know when applications for loans are presented by public utility corporations whether or not they will be able to give adequate security.

A supplemental statement indicated that the reference to increased rates was not intended to stop all negotiations for financing by such corporations. It is understood that the Capital Issues Committee and the War Finance Corporation will entertain propositions from public utilities companies and treat each application on its individual merits.

On May 28 the directors announced:

From the applications received by the War Finance Corporation there seems to be an impression in certain quarters that the corporation was specially designed to provide funds for meeting maturing obligations, particularly those of public utility companies. The law expressly provides that the corporation shall not make direct advances to provide funds to meet such maturing obligations, except possibly in some rare case which could clearly be brought within the "exceptional cases clause." Of course, the corporation will stand ready to lend its assistance to banks and bankers in proper cases where they have themselves made advances to war industries, whether for the purpose of meeting maturing obligations or otherwise, and direct advances in deserving cases that come clearly within the provisions of the law.

Holders of maturing obligations, whether of public utilities or of other concerns which may find themselves unable, because of temporary conditions, to meet their commitments punctually should consider whether, in the public interest, as well as their own, they should not co-operate by consenting to reasonable renewals. Public utility companies particularly, in co-operation with the communities in which they operate, should adapt themselves to the changed conditions brought about by the war.

No machinery has been specially provided for direct purchases of obligations of the public utilities, whether to meet maturities or otherwise, either through the War Finance Corporation or through any other governmental agency.

The situation of these public utility companies is, therefore, quite different from that of the railroads, where Congress has made specific provision for the purchase of their securities by the government in certain exigencies, yet even the railroads are expected, wherever possible, to meet their own maturities and to pay what the money is worth to accomplish that end.

It must be remembered that the railroads are under federal operation, and that their rates are subject to federal control, and that the government therefore is in a position to see to it that their charges shall be sufficient to meet the cost of the service rendered. In the case of the public utilities, however, neither their operation nor their rates are subject to federal control. Wherever the charges do not amount to adequate compensation for the services rendered, relief can be had only through the appropriate local authorities, and time is essential to enable the companies and the communities in which they operate to reach a satisfactory solution of this important problem. It is not a problem which can be disposed of by having the federal government through the War Finance Corporation assume the burden of financing the operations of these local companies, except in exceptional circumstances which may make it a matter of national importance that advances should be made.

The local authorities will no doubt respond as promptly as possible in cases where relief is needed because of changed conditions, as it is clear that the soundness and efficiency of public utilities are intimately connected with a vigorous and successful prosecution of the war.

Directors of the War Finance Corporation on May 22 approved the first loan to be made under the authority conferred upon them by the act approved April 5, 1918. The loan, which was authorized after a hearing of representatives of those interested, is for \$1,000,000, and will run for two years.

It will be made under Section 7 of the act, through two large banking institutions on the Pacific Coast, to the Northwestern Electric Company, Portland, Ore. The loan will be made on the notes of the bank, secured by first mortgage bonds of the company, supported by other collateral in accordance with the requirements of the act.

The additional power to be generated through the extensions and enlarged operations of the electric company will be used in connection with shipbuilding.

This loan being made through banks, the rate was fixed at 6 per cent per annum.

Applications for the issue of securities aggregating \$478,458,386 were considered by the capital issues committee of the Federal Reserve Board. The committee's existence ceased upon the taking of office on May 17 of the Capital Issues Committee created by the War Finance Corporation act.

New issues approved reached an aggregate of \$154,102,224. New issues for the same period last year were \$504,211,624, so that a comparative saving has been effected of \$350,109,399. This saving by action of the committee does not include the saving of \$19,865,000 effected through informal postponement for the period of the war, secured through the efforts of the committee or its agencies. In addition, however, there is an immeasurable saving caused by the wide publicity given to the committee's aims and purposes, which has discouraged at the very source issues clearly incompatible with the national interest.

The committee attributes this success to the splendid co-operation and loyal support it has received from state and municipal authorities, departments of the federal government, the leading stock exchanges, the American Bankers' Association, and the Investment Bankers' Association of America.

Detailed report made by the committee is as follows:

	Municipal	Public Utility	Industrial
Number considered	192	62	107
Number approved	140	60	78
Number disapproved	34	2	24
Number curtailed	18		5
Amount considered	\$86,878,512	\$172,069,605	\$219,510,269
Amount disapproved	19,791,665	6,000,000	39,900,000
Aggregate approved	\$67,086,847	\$166,069,605	\$179,610,269
Less "refunding"	21,392,312	125,860,284	111,411,900
Aggregate new issues	\$45,694,534	\$40,209,321	\$68,198,369
New issues last year, same period	108,952,865	107,504,075	287,754,684
Analysis of new issues ap- proved:			
Amount original applica- tions	\$65,486,199	\$46,209,321	\$108,098,369
Amount approved	45,694,534	40,209,321	68,198,369
Curtailement effected	\$19,791,665	\$6,000,000	\$39,900,000
Analysis of applications in- formally discouraged:			
Number	8	3	6
Amount	\$8,915,000	\$7,360,000	\$3,590,000

OFFICIAL PRIORITY ORDER ON POWER IN ILLINOIS

Illinois Public Utilities Commission Takes Steps to Conserve Remaining Central-Station Power for Munition Manufacturing

In the case of the Central Illinois Light Company of Peoria before the Illinois Public Utilities Commission for temporary suspension of the rules governing free extension of electric service lines, the commission has taken rather interesting action. In the presentation of the testimony it appeared that the Central Illinois Light Company has ordered and expects to obtain additional equipment for its plant before the coming winter, but that such equipment if obtained will not provide sufficient reserve capacity to enable the company to meet adequately the demands which it anticipates for service.

Under these conditions the company appears to be faced by the necessity of either refusing to supply those industries, which in its opinion are essential for the prosecution of the war, or of refusing to serve lighting customers, and it appears possible that in either event a discontinuance of certain portions of its service during the temporary periods of heavy loads may prove necessary. While the load which might be occasioned by additional lighting customers may not be a large proportion of the company's entire capacity, it certainly represents a large proportion of the capacity which is at the present time available for meeting the situation.

The commission, recognizing this situation, saw itself confronted with the problem of whether under these circumstances the needs of the war should be given precedence over the needs of private consumers, to whom the service represents only physical comfort which in most cases may be provided very nearly as well by other means. The commission took the position that, under the conditions existing in this case, ordinary patriotism demanded that the reasonable requirements looking toward the successful prosecution of the war should receive first consideration and that, following these demands, service required for private consumers should receive attention.

The commission therefore ordered the Central Illinois Light Company "to refuse to render electric service

to additional consumers except as hereinafter provided without first securing the specific approval of the commission," and to "refuse additional service to existing consumers except in cases where the maximum demands of such additional service will be less than 10 per cent of the maximum demand at present being served," and ordered further that "such increases to the amount of 10 per cent to such consumers shall not be furnished at times more frequent than every six months. The Central Illinois Light Company may render power service, including incidental lighting, to new consumers, or increase without restriction the service rendered to existing customers (except residences, stores or offices) who are in classes exempted from the order of the United States Fuel Administration issued Jan. 17, 1918, and subsequent modifications and explanations thereof, and may render service to such other consumers as shall secure from the United States Fuel Administration, the United States Food Administration, the United States Department of War or the United States Department of the Navy a statement that the products which it purposes to manufacture are necessary for the successful prosecution of the war."

The commission also ordered the Central Illinois Light Company to get in touch with other nearby public utilities with a view to securing power for interconnection and to make a survey of isolated plants which might be tied in with the system. The company was also authorized to demand deposits from petitioners seeking extension of distribution circuits.

Winning the War



"Don't you like your bill?"

"It is not so large as it might have been. The government has prevented runaway prices."

"My friend, it is now your turn to do your part. Are you teaching your men to burn the coal efficiently?"

PLANS TO FURTHER THE CONSERVATION OF FUEL

Federal Fuel Administration Arrangements Include Moving-Picture Lessons, Official Bulletins and Constructive Engineering Assistance

In connection with its work in promoting fuel conservation the Federal Fuel Administration recommends that a board of competent engineers be attached to the conservation committee in each state; also a corps of lecturers to arouse public interest and disseminate engineering information.

The Fuel Administration has prepared a fifty-minute film of moving pictures showing good and bad operation in the steam-boiler plant, methods of testing boilers, fuels, etc. These pictures will be available for each state in connection with its educational propaganda.

The administration is also preparing a series of official bulletins on engineering phases of steam and fuel economies. Some of these are now ready for printing. They will include:

1. "Boiler and Furnace Testing."
2. "Flue-Gas Analysis."
3. "Saving Steam in Heating Systems."
4. "Boiler-Room Accounting Systems."
5. "Saving Steam and Fuel in Industrial Plants."
6. "Burning Fine Sizes of Anthracite."
7. "Boiler-Water Treatment."
8. "Oil Burning."
9. "Stoker Operation."

In addition to this service, a list of competent engineers has been prepared in Washington for each state and is available for use of each local administration. As the work develops, still further constructive assistance is contemplated for helping owners to bring their plants up to a high plane of operation with due attention to both economy and efficiency.

NATIONAL RESEARCH COUNCIL HAS PART IN WINNING WAR

At a Meeting of the Engineering Foundation Dr. George E. Hale Tells the Objects and Accomplishments of This Body of Scientists

That every feasible means of research will be used in all branches of industrial engineering and science in order that the war can be efficiently prosecuted was made clear by Dr. George E. Hale, chairman of the National Research Council, before the May 28 meeting of the Engineering Foundation in New York. The three primary objects of the council will be the advancement, promotion and utilization of industrial research. This work will be carried out by leading industrial, military and naval engineers.

The Research Information Committee has been established in Washington, London and Paris for securing, classifying and disseminating technical information. It will develop contact with research laboratories abroad and send in reports of advances in science and engineering.

The Research Council is made up of two main branches—one devoted to the physics and latent sciences and the other dealing with engineering problems. These branches are headed by very eminent men in the respective fields. The engineering division

is subdivided into a number of committees each having its own particular field to cover.

Dr. Hale told of a few of the things that the council has done and of the important part that its study in geology, psychology, chemistry, facilitation of Patent Office work and assisting educational institutions has played. He told of a development made in nitrogen fixation by a student of the Massachusetts Institute of Technology that would reduce the cost of production considerably.

Dr. Hale commended the work of the Engineering Foundation and of the national engineering societies in establishing the Research Council on a war basis. He also read a letter sent to the council by President Wilson with reference to its work and the importance of its objects.

A HEATING APPLIANCE SECTION IS FORMED

Preliminary Meeting Held at Office of the Associated Manufacturers of Electrical Supplies, New York—Temporary Organization Effectuated

At a meeting at the office of the Associated Manufacturers of Electrical Supplies, New York, on Tuesday of this week manufacturers of heating appliances decided to form a Heating Appliance Section. The meeting was a preliminary one, and it will be followed by another at an early date at which permanent officers and committees will be elected.

F. D. Goode, Cutler-Hammer Manufacturing Company, presided as temporary chairman. Harry S. Mirrieless of Manning, Bowman & Company was temporary secretary.

SECTION MEETINGS OF THE ASSOCIATED MANUFACTURERS

Seven Sections Are to Meet at New London, Conn., from June 26 to 29—Board of Governors May Also Meet

Seven sections of the Associated Manufacturers of Electrical Supplies will meet at the Griswold Hotel, Eastern Point, New London, Conn., from June 26 to 29. The plan of holding the meetings in this way will greatly facilitate the work. The seven sections are:

Attachment Plug Section; chairman, H. W. Bliven, Harvey Hubbell, Inc.

Fuse Section; chairman, H. R. Sargent, General Electric Company.

Knife Switch Section; chairman, J. H. Trumbull, Trumbull Electric Manufacturing Company.

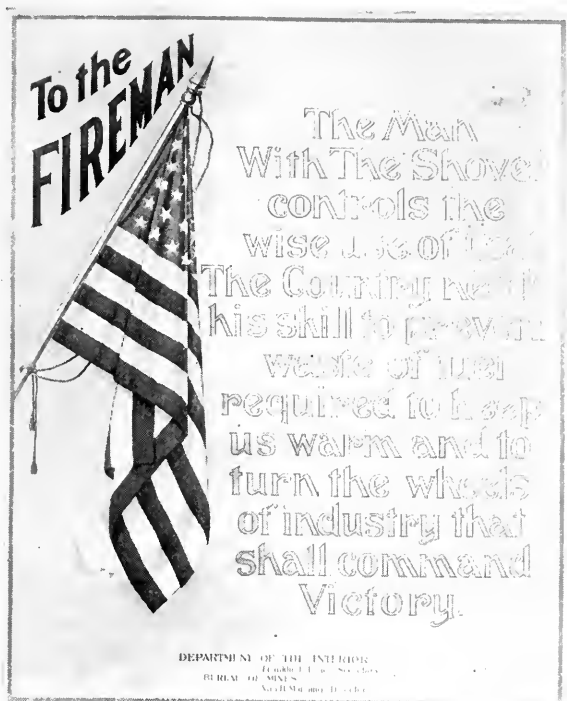
Lamp Receptacle and Socket Section; chairman, W. D. Steele, Benjamin Electric Manufacturing Company.

Outlet Box Section; chairman, F. W. Hall, Sprague Electric Works.

Panelboard and Switchboard Section; chairman, C. L. Eidlitz, Metropolitan Electric Manufacturing Company.

Snap Switch Section; chairman, E. Whitmore, Manhattan Electrical Supply Company.

The governors are much interested in these meetings and contemplate holding their June meeting during the same week and at New London. A large attendance is expected.



ARKANSAS UTILITY MEN HAVE PATRIOTIC MEETING

Food, Fuel, Red Cross and Thrift Stamp Activities
Claim Precedence Over Papers on
Technical Topics

Patriotism was the underlying theme of the eleventh annual convention of the Arkansas Association of Public Utility Operators at Hot Springs, Ark., May 21, 22, and 23. Ringing addresses were delivered by Hamp Williams, State Food Administrator; by J. F. Cristy, of the Jonesboro Water & Light Company, for the Fuel Administration; by George R. Wyant, assistant in the State distribution of thrift stamps; by Mayor J. W. McClendon of Hot Springs, and by George R. Belding, secretary of the Hot Springs Business Men's League.

The convention was not particularly well attended by operating men on account of the fact that in several of the principal centers of the State station loads have doubled in the last six months so that the efforts of every available man are required to maintain service. The realization of this situation caused the association to decide to postpone the convention, and notice to this effect was sent out about ten days before the date of the meeting. This notice was later countermanded by telegraph, however, owing to the storm of protest it developed from those who believed a convention should be held for the discussion of timely topics.

Among the technical papers and discussions the question of rate increases evoked greatest interest. A. Patterson of the Southwestern Gas & Electric Company summarized in a broad and general paper the situation in which operating costs are rising and revenues are remaining stationary. His paper was enthusiastically received. Discussion of it brought out that in Arkansas the fact that there is no commission makes the matter of advancing rates a local question in which each company has to be guided by local considerations.

Where a company has local existing franchise agree-

ments which control rates it was thought best to give the rate increases which were being asked for as much as possible of frank and open publicity. Attention was also called to the advantage of asking for a surcharge on lighting schedules and straight increase on power schedules in cases where the proposed raise in rates is given great publicity in order to lessen curtailment of service.

The following methods of increasing revenue prior to asking for a general increase in rates were also brought out: (1) Elimination of special contracts made long ago at low rates; (2) checking meters; (3) rechecking maximum demands, and (4) adding a fuel clause to existing contracts. Those who took part in the discussion were E. T. Selig, Harrisburg, Pa.; L. C. Spake, Chicago; J. S. M. Wharton, Helena, Ark.; A. E. Murray, Malvern, and S. E. Dillon, Hot Springs. At a later discussion of the same topic C. J. Griffith, Little Rock, urged the operators not to be backward in putting before the local regulatory bodies or the public such demands for higher rates as are necessary to maintain the properties. He also summarized the recent financial troubles of the Little Rock company. It had \$400,000 of gold notes coming due on Dec. 1, 1917. The financial situation made renewal of notes or receivership the only alternatives. Some additions were made to the issue so that the new loan amounted to \$600,000. This cost the company \$60,000. This is one of the reasons, he said, why the company is asking rate increases.

PROJECTED STATE UTILITY COMMISSION

The probability of Arkansas having a public utilities commission was also discussed. D. C. Green of Fort Smith said that it might be expected that either through a provision in the State's new constitution or by a special bill the Legislature would make provision for a commission at the session of the coming winter. He urged the central-station men to co-operate to get a public service commission law adaptable to the conditions of Arkansas and containing provisions for the indeterminate franchise and the certificate of convenience and necessity. The general sentiment of the convention seemed to favor commission rule rather than local regulation.

Other papers presented were on "Uniflow Engines," by F. M. Beeson of the Merkle Machinery Company, and on "Courtesy to Traveling Salesmen," by W. R. Herstein of Memphis, read by W. A. Munding of Memphis. These were not discussed.

Election of officers for the ensuing year resulted as follows: President, D. C. Green, Fort Smith; first vice-president, B. C. McKinnon, Eldorado; second vice-president, E. T. Leverett, Conway; secretary-treasurer, W. J. Thorp, Little Rock. The Class B members, the salesmen, elected as their officers: President, G. M. Ellis, district manager of the supply department of the General Electric Company, St. Louis; first vice-president, W. P. Holcombe, Maloney Electric Company, St. Louis; second vice-president, E. C. Brown, Ohio Brass Company; secretary-treasurer, C. C. Lewis, Columbia Lamp Division of the General Electric Company, St. Louis. The next convention will be held at Fort Smith.

A shorter name, the Arkansas Public Utilities Association, was adopted.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 1171 of this number.

Independent Electrical Contractors' Association of Greater New York.—On July 13 the Independent Electrical Contractors' Association of Greater New York will hold its annual meeting at Mitchell Park and Hotel, Grant City, Staten Island. Representatives from all branches of the electrical industry are expected to be present.

Electric Club-Jovian League of Chicago.—At the May 23 meeting of the Electric Club-Jovian League of Chicago Phil A. Grau, member of the Chicago Association of Commerce and the United States Chamber of Commerce, gave a very interesting address on "American Business and the War." W. T. White and C. M. Converse of White & Converse, electrical jobbers of Minneapolis and St. Paul, were present and spoke of conditions in that section.

Joint Meeting of Engineers in Chicago.—A joint meeting of the Chicago Sections of the American Institute of Electrical Engineers, the Illuminating Engineering Society and the Electrical Section of the Western Society of Engineers was held on May 27. F. A. Vaughn of the Vaughn & Meyer Company, consulting engineers of Milwaukee, who designed the new street-lighting system in that city, gave an interesting description of the novel methods of distributing energy to the street lamps that were used.

Inventors' League of the United States, Inc.—In a discussion at a recent meeting of the Inventors' League of the United States, Inc., at New York it was brought out that the function of the league is not to sell patents except those placed in its hands for exhibition to inquirers, but is rather to advise inventors how to protect their interests in various ways, as, for example, by having contracts with capitalists interested in their invention properly drawn. It was pointed out that the inventor is really the best one to approach manufacturers in behalf of his invention as he is more familiar with its merits than any one else.

A. S. M. E. Annual Spring Meeting.—As previously announced in the ELECTRICAL WORLD, the spring meeting of the American Society of Mechanical Engineers will be held in Worcester, Mass., on June 4, 5 and 6. Among the important papers to be presented will be "Converting a Factory for Munition Manufacture," "Fire Protection," "Training Labor for Shipbuilding," and "Oil Fuel in New England Power Plants." "Efficiency of Gear Drives" will be presented by C. M. Allen and F. W. Roys. "Electric Heating Molds" will be discussed by Harold E. White,

and A. A. Potter will deal with "Investigation of the Fuel Problem in the Middle West." The fuel conservation committee of the Engineering Council has arranged a practical discussion of fuel economy.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

War Conditions and Rate of Return.

—A decision of the Illinois Public Utilities Commission affecting gas rates of the Monmouth Public Service Company says in part: "The commission is of the opinion that in matters involving rate increases of a temporary nature due to abnormal conditions such as now prevail because of the present war the amount prudently invested in a public utility property should be given the most serious consideration when determining reasonable rates, for upon such investment common justice demands a fair return. It must not, however, be understood that the public should bear all the burden of the increased costs of labor and materials, but only its just proportion, for in times of stress such as those now confronting us each should make some sacrifices for the general good, and to this a public service corporation is no exception. . . . It may be conceded that petitioner is entitled to a reasonable return upon the fair value of the property devoted to the public service. What this fair return may be will vary under different circumstances and will depend upon local financial conditions, the hazards connected with the business, the nature of the service and other factors of more or less importance in specific cases. This commission has heretofore taken the position that financial rewards in public utility enterprises should be commensurate with the ability displayed in their management, and rates of return approximating 7 per cent have been frequently permitted in cases wherein the stewardship appeared competent. In the case at bar the record discloses that normal ability has not been displayed in the management of petitioner's gas property and the standards of service have not been complied with, and to assume that mediocre stewardship is entitled to the same rewards as capable conduct of affairs is to enunciate a doctrine at variance with the sum of human experience and with principles well recognized in the business world. Therefore, taking into consideration all the facts disclosed by the evidence in this case and for the purpose of arriving at increased rates, the commission is of the opinion a fair rate of return upon the value of petitioner's gas property may be considered as 6½ per cent."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Assessment of Both Stock and Personal Property.—A municipality cannot, in the absence of express authority, assess personal property of telephone companies, it being the policy of the State not to assess both the stock and the property, the Court of Appeals of Maryland held (103 A. 133).

Contracts Without Time Limit.—Where contracts fixing a rate "unlimited" in time have been entered into by public service companies, the State has the right through the Public Service Commission, notwithstanding the contracts, to inquire into and adjust the rate to a reasonable basis, according to the Supreme Court of Pennsylvania (103 A. 287).

Condition of Premises.—Where unguarded wires carrying a high voltage of electricity were dangerous, it was negligent to leave them unguarded, if they were so placed that a reasonable man would anticipate that they would cause injury to one rightfully on the premises, according to the New York Supreme Court (169 N. Y. S. 984). In an action for injury to employee, invited to defendant's factory upon a business in which both defendant and employer were interested, because of a shock from wires, evidence held not to support a finding that defendant was negligent in not anticipating that injury might result from the condition of the wires, unguarded either by material construction or by providing sufficient warning.

Contract Rights Under Charter.—The law provides that any company organized to build dams or to construct and maintain canals, etc., to carry water to any plant or power house where electricity is generated or to erect and maintain lines to carry and transmit electricity, etc., may appropriate as much private land as is deemed necessary for its pipe, poles, tanks, reservoirs, etc., as well as land overflowed. It was held by the Supreme Court of the United States (38 S.C.R. 244) that a corporation organized under the general laws to construct and operate a power system acquired by its incorporation no contract right protected from impairment by Article I, Section 10, of the United States Constitution to have the quantity of water available for development by it undiminished. If a power company by eminent domain or otherwise acquires riparian lands or specific rights in the use and flow of water from riparian owners, these constitute property acquired under its charter, and not contract rights expressed or implied in the grant of the charter.

W. A. Layman, president of the Wagner Electric Manufacturing Company, has been chosen to serve on the board of directors of Washington University.

S. B. Matson, assistant sales manager for the Marron Electric Company, Rock Island, Ill., has resigned his position and has gone to New York to prepare for Y. M. C. A. service overseas.

J. H. Van Brunt, president-elect of the Missouri Association of Public Utilities, is vice-president and general

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

David W. Brunton of Colorado, who was chairman of the war committee of technical societies, the formation of which was initiated by the Engineering Council, has been elected a member of the Naval Consulting Board.

Prof. L. J. Corbett, head of the electrical engineering department of the University of Idaho, has been commissioned a captain in the Engineer Reserve Corps and is now stationed at Camp Lee, Va. Professor Corbett has been at the head of the electrical engineering department of the university for the past seven years.

R. M. Hodgson, formerly associated with the Philadelphia office of the General Electric Company, has been elected a director and the vice-president and general manager of the Binghamton (N. Y.) Light, Heat & Power Company, succeeding P. A. Staples, resigned. Mr. Hodgson has also been elected the second vice-president and general manager of the Sayre Electric Company and will be in full charge of the operation of both companies.

P. A. Staples, vice-president and general manager of the Binghamton (N. Y.) Light, Heat & Power Company and general manager of the Sayre Electric Company, has resigned to become associated with Lewis A. Riley, 2d, mechanical and gas engineer, 103 Park Avenue, New York City. Mr. Staples became manager of the Binghamton property late in 1916, having been a few months previously transferred from the Sandusky (Ohio) Gas & Electric Company, where he was a vice-president, to Dover, N. J., as vice-president and general manager of the New Jersey Power & Light Company.

M. C. Turpin, formerly assistant to the manager of the department of publicity, Westinghouse Electric & Manufacturing Company, has resigned to enter federal service as assistant to manager, Technical Publicity Bureau, Ordnance Department. Mr. Turpin's work will be on the dissemination of information from the War Department to manufacturers through the medium of the trade press. Mr. Turpin is a graduate of the Alabama Polytechnic Institute and of Cornell University. After several years' experience in the construction and operation of central-station plants he entered the Westinghouse department of publicity in 1909.

Samuel Kahn, president-elect of the Pacific Coast Section, N. E. L. A., is vice-president and general manager of the Western States Gas & Electric Company, Stockton, Cal. Mr. Kahn was born Oct. 18, 1882, at San Antonio, Tex. He received his early education

at the San Antonio Public School and in 1898 entered the University of Texas, where he remained for two years, when he entered Purdue University, from which he was graduated in 1903 with the degree of bachelor of science from the School of Electrical Engineering. During the next six years he was engineer for the San Antonio Gas & Electric Company and the San Antonio Traction Company. From January, 1909, to May, 1911, he was



J. H. VAN BRUNT

manager of the St. Joseph (Mo.) Railway, Light, Heat & Power Company. He is a native of New Jersey. Twenty-nine years ago he purchased the street railway utilities in St. Joseph. Since that time he has been continuously in charge of that company and its operation in the street railway, light and power field.

J. E. Torrence, who has been manager of the Green (S. C.) branch of the Southern Public Utilities Company for the last five years, has resigned to enter the army.

W. E. Hewitt, formerly connected with the municipal light and water works of Douglasville, Ga., has been appointed superintendent of the municipal water and light plant at Sandersville, Ga., succeeding L. J. Porter.

C. H. Davis, general superintendent of the Marlboro (Mass.) Electric Company and manager of the Westboro (Mass.) Gas & Electric Company, has been appointed manager of the Westfield municipal gas and electric light works.

George W. Schmidt has been appointed chief engineer of the Northern Ohio Traction & Light Company's power plant at Akron. Mr. Schmidt began his career in the electrical industry in the mechanical department of the Union Electric Light & Power Company, St. Louis, where he remained for eight years. He was then appointed chief engineer of the power station of the company and served in that capacity for five and one-half years. Mr. Schmidt resigned from the company in St. Louis on March 1 to become connected with the Northern Ohio Traction & Light Company.



SAMUEL KAHN

general manager of the Union Light, Heat & Power Company of Fargo, N. D. In 1911 he became connected with the Appalachian Power Company, Bluefield, W. Va., as general manager, remaining until January, 1912, when he became assistant to vice-president of H. M. Byllesby & Company, with headquarters in Chicago and Tacoma, Wash. He continued this work until May, 1913, when he became vice-president and general manager of the Western States Gas & Electric Company, which position he has held continuously ever since.

Obituary

David Rankin Craig, who for some time conducted an electric supply business on Summer Street, Boston, died recently in his sixty-fourth year. Mr. Craig retired from business about nine years ago.

Edward Clarence Meier, president of the Heine Safety Boiler Company, died on May 7 at the age of forty-eight years. Mr. Meier was engaged from boyhood in the manufacture and sale of boilers. Upon the death in 1916 of his father, Col. E. D. Meier, who founded the Heine Safety Boiler Company, he became president of the company.

W. H. Carnahan, assistant treasurer of the Illinois Traction System, died at Champaign, Ill., May 18, at the age of sixty-two. He had been associated with William B. McKinley, president of that company, for forty years in various undertakings, and had been assistant treasurer of the Illinois Traction System and its component lighting and power companies for fifteen years.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

DETAILED FIGURES OF ELECTRICAL EXPORTS

Canada Takes Largest Amount, with United Kingdom Second, France Third, Italy Fourth and Brazil Fifth

Detailed figures on electrical exports for the fiscal year ended June 30, 1917, are published for the first time on the opposite page. These figures, which were compiled by the Bureau of Foreign and Domestic Commerce, show the exports of electrical goods by principal items classified according to the countries of import.

A study of the table shows that Canada stood first in consumption of American electrical goods with a total of \$9,926,311, United Kingdom (England, Ireland, Scotland) second with \$7,200,634, France third with \$4,244,252, Italy fourth with \$3,268,307, and Brazil fifth with \$2,351,210.

The total exports to South America were \$8,292,571.

Out of total exports of \$52,158,773, \$26,404,077 went to the allied countries of Great Britain (including Canada), France, Italy and Japan. Less than 50 per cent went to the remaining countries of the world.

LIMITATIONS PLACED ON EXPORTS TO ALLIES

Boilers and Tubes, Copper Wire and Cable and Carbon Electrodes Come Under Latest Ruling of War Trade Board

The War Trade Board announces that for the purpose of preventing the useless consumption of materials and labor in making articles for export which for the present may not be exported, and for the purpose of saving tonnage by prohibiting the exportation of articles which have not been recommended by the government of the country of destination as being necessary for its essential requirements, the War Trade Board has adopted the following additional rules and regulations with respect to the issuance of licenses to export any commodity to the United Kingdom, France, Italy and Belgium (excluding their respective colonies, possessions and protectorates):

On and after May 15, 1918, applicants, before filing applications for licenses to export any commodity to the above-named countries, must obtain thereon the written approval of the mission in the United States of the country to which the exportation is to be made. To secure this approval applicants should forward their applications, duly executed in triplicate, with proper supplemental sheets attached thereto, including Supplemental Sheet X-11 or X-12, as may be required, to the British War Mission, Munsey Building, Washington, D. C., for shipments to the United Kingdom; the French High Commission, 1954 Columbia Road, N. W., Washington, D. C., for shipments to France; the Italian High Commission, 1712 New Hampshire Avenue, N. W., Washington, D. C., for shipments to Italy, and the Belgian Commission, Room 202, Council National Defense Building, Washington, D. C., for shipments to Belgium.

Applicants will be required to agree with the War Trade Board not to purchase or acquire for export or take any steps in the process of producing, manufacturing or fitting for export the articles specified in the application until an export license has been duly granted.

Shippers of articles contained on Schedule A will also be required to agree that, after export licenses have been issued, they will not make any purchase or acquire for ex-

port, or take any steps in the process of producing, manufacturing or fitting for export, the articles specified in the application unless they first obtain the written approval of the War Industries Board.

Included under schedule A, among other things, are asbestos, high-pressure steam boilers, carbon electrodes, copper wire and cable and boiler tubes.

THE GOVERNMENT IS NOW RECOGNIZING THE JOBBERS

Inability to Obtain Priority Orders for Stock Replenishment Is Proving a Source of Embarrassment

Six months ago the electric supply jobbers were considerably worried because the government was not giving them more recognition when placing orders. Orders were more generally placed direct with the manufacturer notwithstanding the existence of a nearer supply in some jobber's warehouse.

Recent events indicate that this situation has changed materially in the meantime and that the government now recognizes the worth and value of the jobber. The government is drawing more and more on jobbers' stocks. In some regions almost the entire jobbing trade is in war orders, a large part of which are directly government orders.

The shipyards, railroads and army and navy departments now appreciate the value of having available stocks close at hand without having to wait for shipments from manufacturers.

The one great difficulty that is met is in the question of priorities. Government contractors can requisition jobbers' supplies on priority orders. Jobbers, on the other hand, do not have recourse to priority orders to replenish their stocks. Priority orders can be secured by the jobber only on orders for which the purchaser has a priority.

This latter situation frequently proves to be embarrassing when the jobber must take the customer's priority to the manufacturer. Had the jobber been able to replenish his own stock through priority orders the frequency of such cases would undoubtedly be eliminated.

WAR ABSORBS THE ENTIRE OUTPUT OF METAL CONDUIT

Shipbuilding Takes More Pipe than Was Originally Anticipated—Factories Are Behind in Their Shipments

Metallic conduit and conduit fittings are now in such a position that it is impossible to obtain deliveries without showing that the material is required for a project necessary toward the successful waging of the war. Manufacturers in order to secure pipe must show the ultimate use of the conduit. It will therefore be impossible, one of the manufacturers stated to a representative of the ELECTRICAL WORLD, for a contractor or jobber to secure new pipe after the present supply is exhausted, except for industrial purposes or such other purposes as are definitely linked up with the war.

The available supply of pipe is by no means sufficient to take care of the market. The shipbuilding program of the United States has taken a very large amount of conduit, much larger in fact than was previously anticipated. Fac-

DETAILS OF ELECTRICAL EXPORTS FOR FISCAL YEAR ENDED JUNE 30, 1917

Countries	Batteries	Dynamos or Generators	Fans	Insulated Wire and Cables	Interior Wiring Supplies, Etc., Including Fixture	Arc Lamps	Incandescent Lamps, Carbon Filament	Incandescent Lamps, Metal Filament	Meters and Other Measuring Instruments	Motors	Telegraph Instruments, Including Wireless Apparatus	Telephones	Transformers	All Other
Europe:														
Austria-Hungary		700	15	25				526					908	477
Azores and Madeira Islands														
Belgium	6,800	1,504	127	32,028	3,700			138	621	8,954	16,717	24,767	240	63,560
Denmark									75	263				12,535
Finland	32,383	159,877	107	1,964,546	40,386			8,406	2,001	387,204	2,000	31,807	29,075	1,583,460
France														
Germany	210	225	1,345	260	660		284	6,982	378	2,350		600		2,014
Gibraltar	1,894	1,107			111									22,723
Greece	369	290,907	242	36,571	31,618		24	31,078	21,250	216,124	141,472	230,329	46,067	1,512
Iceland and Faroe Islands														2,185,702
Italy	4,008	2,197		124,319	1,897			60	1,386	18,299	2,550	2,416	1,035	77,943
Malta, Gozo, etc.	28,925	168,812	591	463,314	11,640			311	1,834	73,605	5,106	88,307	46,619	824,484
Netherlands	998	2,174	444	9,644	1,748			1,010	8,848	1,801	4,126	134	2,582	56,405
Norway														
Portugal														
Roumania	8,496	6,453	3,197	353,943	41,181	62		6,377	41,125	261,458	83	236,675	101,295	820,630
Russia in Europe														
Serbia, Montenegro, etc.	13,703	106,998	3,183	234,003	17,962	2,002	372	8,600	47,568	205,215	1,749	29,196	38,594	444,383
Spain	8,538	17,359		29,432	133				1,150	10,916				88,497
Sweden				4,313	4,451					3,308				115,392
Switzerland														
Turkey														
United Kingdom:														
England	861,117	62,787	21,084	755,385	51,533	244		14,413	29,778	533,808	86,090	50,979	13,173	4,561,103
Scotland	63,389	510		3,561	961		116	98	35	20,510	8,220		44	58,286
Ireland								65		1,304		766		1,275
North America:														
Bermuda	1,193	11	37	2,526	1,679	15		1,014	195	561	43	503	290	8,813
British Honduras	3,347	12,135		600	1,321		344	1,420	31	1,082	337	277	132	6,574
Canada	1,046,788	426,027	97,158	180,175	308,914	3,521	86,710	460,936	248,505	1,286,067	50,359	213,092	219,597	5,298,462
Central American States:														
Costa Rica	3,376	2,512	67	6,650	2,172		1,192	7,008	55	10,594	50	1,260	7,026	27,482
Guatemala	4,376	1,961	274	4,231	5,254		2,028	13,788	613	3,438	530	787	2,162	20,240
Honduras	6,839	1,355	316	4,176	1,107		319	4,905	527	7,557	5,250	2,517	2,570	26,675
Nicaragua	3,229	1,792		2,409	534		183	2,035	426	2,800	2,800	199	348	11,972
Panama	25,895	5,477	2,592	224,817	25,339	142	792	55,194	7,245	33,393	2,578	7,072	15,178	298,620
Salvador	1,918	726	374	16,727	5,498	743	3,546	11,110	215	5,546	78	1,688	11,809	29,243
Mexico	58,521	51,091	16,969	188,824	39,096	1,250	16,604	167,621	17,088	107,451	13,953	19,058	51,196	400,093
Miquelon, Langely, etc.	798			120	27			70	115					682
Newfoundland and Labrador	24,061	4,658	181	24,220	5,514	127	937	23,419	2,474	18,538	10,380	1,754	4,273	63,004
West Indies:														
British:														
Barbados	1,508	905	7	1,338	122	93	171	369	4	387		2,050	51	5,278
Jamaica	5,471	852	607	6,613	1,641			1,750	24	3,643	425	1,323	111	16,815
Trinidad and Tobago	2,963	3,618	393	8,231	2,336		104	4,031	1,586	2,620	369	1,749	177	13,257
Other British	2,882	1,655	158	2,903	167		4	883	668	709	2	994		5,378
Cuba	144,300	228,653	23,590	495,005	116,100	2,603	10,245	272,668	71,865	289,483	14,508	189,895	103,252	980,599
Danish	319	257		4,623	114	194	25	256	515	421				774
Dominican Republic	4,396	5,363	201		3,556	100	157	10,549	1,933	4,233	1,512	5,913	1,320	36,344
Dutch	303		91	1,323	96			414	81			249	513	7,559
French	606	1,381		472	900		57	202	4	33			3	2,328
Haiti	1,201	5,893	29	1,563	497		685	2,702	13,861	437	100	883	1,079	5,084
South America:														
Argentina	81,330	23,855	30,374	222,318	61,537	402	6,987	215,756	157,820	103,840	5,081	27,572	24,503	760,252
Bolivia	648	89		3,346	489		67	2,455	272	5,702			1,157	13,647
Brazil	67,554	29,090	5,907	571,017	78,345	832	4,592	265,084	114,426	126,002	8,566	232,195	132,344	715,226
Chile	18,600	137,562	986	381,765	67,243	51	1,802	93,078	26,967	310,109	1,295	12,066	119,060	625,475
Colombia	11,744	16,616	1,361	42,232	8,918	35	765	40,710	3,317	22,600	12,259	20,031	11,210	116,688
Ecuador	3,163	7,731	1,481	10,932	5,645	823	4,643	6,665	3,371	12,178	285	20,508	1,711	32,672
Guiana:														
British	1,833	262	45	1,785	576	104	129	1,788	1,527	3,440		6,287		10,265
Dutch	343	100		823				55	2			76		811
French		2,705	96											225
Paraguay	30								682	83		152	2	558
Peru	9,605	53,181	586	76,847	10,382	361	8,223	21,437	6,416	50,062	751	8,037	36,227	143,464
Uruguay	14,622	5,548	25	65,148	13,736	61	372	53,759	9,300	12,516		2,345	1,976	91,188
Venezuela	20,758	11,496	339	32,924	7,876	160	39	29,862	1,565	20,621	227	8,592	7,710	102,972
Asia:														
Aden	35													
China	20,330	222,373	32,570	115,525	20,596		36	89,692	5,507	126,143	14,567	116,715	56,573	281,263
China, Leased Territory:														
Japanese		9,171	168	143					2,105	1,500		4,334	485	23,142
French														10
German														
Chosen	334	694		1,619	1,206			189	398	6,117		420	56	46,619
East Indies:														
British India	27,836	20,342	163,563	12,628	4,997			19,246	17,380	113,875	781	617	10,443	314,498
Straits Settlements	5,047	11,115	2,489	961	8,750		75	1,615	58	31,602				67,858
Other British	350	774	328		22			1,197		6,370		309		1,263
Dutch	23,947	10,749	1,175	206,586	1,325			2,280	3,158	9,052	2,680	28,508	15,009	98,664
Hongkong	439	1,135	22,083	1,010	1,193			4,210	10,749	14,762		12	3,023	16,330
Japan	7,816	245,164	8,015	23,661	27,571	347	736	3,728	48,054	195,188	26,331	118,383	10,885	1,018,694
Russia in Asia	117	66,163		4,270	25,202		795	3,074	10,338	298,567		9,851	34,912	390,525
Siam	5,117		4,517	3,956	2,477			1,212	387	4,244		3,338		17,613
Turkey in Asia														
Oceania:														
British:														
Australia	114,635	88,016	15,873	72,860	34,832	1,419	1,518	82,915	68,460	720,058	32	55,958	41,124	821,154
New Zealand	62,891	5,190	2,587	59,364	4,314	61	18	11,156	10,679	30,391	4,276	82,968	4,684	258,284
Other British	1,366	176		35						1,233				523
French	5,333	806	48	3,843	117		31	484	2	452	5	232	1,148	7,706
German	2,351			43						91				1,813
Philippine Islands	42,258	7,439	9,955	55,436	5,624		265	37,904	2,635	20,863	90,863	12,949	6,418	145,804
Africa:														
Belgian Congo												63		730
British Africa:														
West	72			1,054						5,723				3,089
South	45,782	3,406	2,905	28,303	960		1,421	24,867	9,307	97,372	1	601	41,050	203,758
East	602	400			358			5,725						3,213
Canary Islands	62				250				375					185
Egypt		5,471	1,540	1,399	56			2,880	894	11,600		69		2,935
French Africa								137						
Liberia														50
Portuguese Africa	593				66					2,452	3	4		6,431
Morocco												52		98
Entire globe	3,009,676	2,554,504	482,652	2,192,204	1,123									

tories are behind in shipments, but find themselves in no position to better the situation at present.

A number of cars are known to be on their way to different sections of the country, but local stocks cannot be benefited except when embargoes are raised. In such cases a carload or two generally get in, but this does not satisfy the local demands. It does, however, ease up conditions.

This situation in conduit came as a result of the manufacturers in the iron and steel industry pledging their entire output to the service of the government and our allies so long as required. The direct and indirect requirements of the United States and its allies, it is stated, are equivalent to between six and eight months' production. As a result commercial iron and steel for the moment are receiving no attention. This situation, of course, will continue as long as 100 per cent of the production is necessary for war purposes.

THE AUTOMOBILE MARKET FOR ELECTRICAL GOODS

Demand for Second-Hand Cars Creates New Market with Increased Demand in Spite of Curtailed Car Production

The curtailment of pleasure automobile production is of considerable importance to the electrical trade. It was but a year and a half to two years ago that many electrical factories supplied their entire output to automobile manufacturers. Early in 1916 certain wire factories in the East were known to be working day and night on wire for pleasure automobiles.

Automobile lamps, wire, batteries, starting and lighting dynamos, instruments and wiring devices and accessories are purchased in large quantities for automobiles. However, the demand for electrical equipment for this purpose has by no means fallen off proportionately with the curtailment of new car production. In fact, there are indications of an increase. Owners of second-hand cars are creating a market. Second-hand cars are in much greater demand and therefore are bringing better prices to-day than ever before, and the demand for electrical starting and lighting equipment for used machines is growing rapidly.

It is well known that lamp manufacturers are having difficulty in keeping up with the demand for automobile lamps. Local stocks are low and there are many complaints regarding the difficulty in obtaining a supply.

Battery manufacturers state that the demand is being maintained. In fact, one of the large Eastern producers of storage batteries for automobiles states that the sales during the month of May have been phenomenal and that as a result the capacity of its plant is being taxed to the limit. In spite of all efforts to keep production up to the demand, this factory is finding that it is becoming more and more difficult to anticipate deliveries with reasonable accuracy. The total sales of this concern to date far exceed those of the first five months of 1917.

MOVEMENT FOR ADOPTION OF A NATIONAL TRADEMARK

A Bill Now Before Congress Is Aimed to Defeat Piratical Methods of Local Merchants in Foreign Markets

A movement is on foot toward the adoption of a national trademark. A bill on this matter is now before Congress. The need for such a designation of American-made goods in foreign markets is owing to the "piracy of private trade in foreign markets," according to Chauncey P. Carter of the Bureau of Foreign and Domestic Commerce, who had an important part in drafting the bill.

American trademarks are frequently registered in a foreign market by some local merchant before the American goods are placed in that market. The American merchant then finds his own trademark useless, so far as he is concerned, in that country.

"If we had a national trademark, owned and protected

by our government, this American manufacturer," said Mr. Carter, "could outwit the pirate merchant by merely substituting the national trademark for his private mark on all shipments to that country."

COMMERCIAL BRIBERY MAY BECOME CRIMINAL OFFENSE

The Federal Trade Commission Urges Enactment of Law in Order to Preserve Free and Open Competition

The Federal Trade Commission has recently sent to both branches of Congress a communication urging "the enactment in the public interest, as an aid to the preservation of fair and free competition, a sufficient law striking at the unjustifiable and vicious practices of commercial bribery and that such law be so comprehensive as to strike at each person participating in any such transactions."

The Federal Trade Commission has found commercial bribery to be general throughout many branches of industry, and scores of complaints have been issued by it on that account. Fourteen states at present have laws prohibiting such practices, but they fail to reach the root of the evil and eradicate it—in fact, they are practically dead letters. The commission can only deal with commercial bribery as an unfair method of competition, having no criminal jurisdiction, and can deal only with one side, having no power to reach the receiver.

In its communication to Congress the commission states that it "has made considerable investigation of bribery of employees of customers as a method of securing trade. These bribes take the form of commissions for alleged services, of money and gratuities and entertainments of various sorts, and of loans—all intended to influence such employees in the choice of materials. It is evident that this inexcusable added cost is finally passed on to the consumers.

"Corrupt employees having the power to spoil and disapprove materials have been able to bid one salesman against another until in many cases they have extorted secret commissions, so-called, as large as 20 per cent of the value of the goods sold.

"In order to prevent a resort to a common method of corruption, it is recommended that the law should also prohibit the giving of any such gifts or other considerations to members of the agent's or employee's family, or to any other person for his use or benefit, direct or indirect."

WIRE UNAFFECTED BECAUSE OF RUBBER IMPORT RESTRICTIONS

Electrical Manufacturers Consulted by Government in Advance of Order Limiting Incoming Supply of Crude Materials

An order from the War Trade Board limiting the importation of crude rubber from overseas to a total of 25,000 tons from May 6 to July 31 is apparently not creating any discernible disturbance or concern with electrical goods manufacturers using this material in their finished products. Several leading producers of rubber-covered wire and cable, rubber insulators, etc., when asked if this action would curtail their output or have a tendency to increase prices, said that with the exception of rubber insulators, due to be advanced any day, no trouble was anticipated unless the restricted period was extended longer or indefinitely. Then there would be reason for anxiety.

Wire and cable manufacturers frankly state that rubber had been plentiful and cheap, and every company of any standing had certainly a three months' or more reserve stock of crude rubber on hand. In fact, it is reported that electrical goods producers had been consulted by the government regarding their supply of rubber before the action was taken. Therefore no one would be hampered or have legitimate or trade output lessened in any measurable degree. It is recognized that tonnage is needed more pressing in the prosecution of the war. Consequently no objection or harsh criticism is voiced.

The War Trade Board said in its notification that the "requirements for the production of goods for the United States and allied governments will be met in full. The remainder of the 25,000 tons will be allocated among the manufacturers of rubber products on the basis of their consumption in 1917."

Crude-rubber importers, on the contrary, are in a different frame of mind. A leading concern that has important dealings in crude rubber with the electrical trade was very much perturbed over the situation. The War Trade Board had sent out a questionnaire to the 175 importers of crude rubber, to which 174 responded. It was thus ascertained that on March 31 there were on order or in store 11,224 tons; engaged abroad or en route, 20,754 tons, with a further lot of 14,800 owned by Americans and intended for this market, making a total of 46,778 tons. It was further stated by this importer, who seemed to represent the sentiment of his branch of the business, that the annual (1917) consumption of crude rubber in this country was 169,000 tons. He therefore figured that the 46,000 odd tons in sight in no way could supply the normal demand.

The price of crude rubber established by the government May 8 is 68 cents a pound for upper refined, 63 cents a pound for first late (first milk), 62 cents a pound for red smoke sheets. The producers of electrical goods use all three grades in liberal quantities. Seven years ago Para rubber sold for \$3.85 a pound.

METAL MARKET SITUATION

Copper Stays at 23½ Cents and Zinc Prices Are Fixed Until Next September

As was foreshadowed in this department, the price of copper remains undisturbed. The price-fixing committee of the War Industries Board on May 23 recommended that 23.50 cents a pound in car lots and 24.75 cents a pound, the jobber's price to small consumers, be continued for seventy-five days. This period, which carries it up to August 15, was a slight concession only to the refiners and producers of the metal. The government was evidently satisfied that the profits accruing to the primary handlers of copper were sufficient. It is an open question now, outside of other considerations, whether wire products will be marked up, as was predicted. This advance was predicted on the so-called "sure thing" tip on the governmental increase in the price of copper. Tin is easier.

President Wilson last Saturday fixed the price of zinc for a period until next September as follows: Grade A—12 cents; freight free on board plant, 14 cents; sheet free on board plant, 15 cents. The prices are subject to the usual trade discounts and differentials in effect on Feb. 13 last.

The price was fixed under an agreement with the industry by which producers will not reduce wages. It will be the same for the public, the Allies and the government. The War Industries Board will direct distribution to prevent zinc from falling into the hands of speculators. Producers pledged themselves to exert every effort to keep up production and insure an adequate supply.

NEW YORK METAL MARKET PRICES

	May 20			May 27		
	£	s	d	£	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
Prime Lake	Govt. price 23.50			Govt. price 23.50		
Electrolytic	Govt. price 23.50			Govt. price 23.50		
Casting	Govt. price 23.50			Govt. price 23.50		
Wire base	26.25 to 26.75			26.25 to 26.75		
Lead, trust price.....	7.00			7.00		
Nickel, ingot	40.00			40.00		
Sheet zinc, f.o.b. smelter.....	Govt. price 15.00			Govt. price 15.00		
Spelter, spot	7.50			7.35 to 7.45		
Tin, Chinese*	\$1.03			\$1.02		
Aluminum, 98 to 99 per cent....	Govt. price \$32.10			Govt. price \$32.10		

OLD METALS

	Cents per Pound		Cents per Pound	
Heavy copper and wire.....	21.50	to 22.00	21.50	to 22.00
Brass, heavy	13.50	to 13.75	13.50	to 13.75
Brass, light	10.50	to 11.00	10.50	to 11.00
Lead, heavy	6.00	to 6.25	6.00	to 6.25
Zinc, old scrap.....	5.25	to 5.75	5.50	to 5.75

*No Straits offering. †In 50-ton lots; carloads, 32.10 cents per lb.; 10-ton to 14-ton lots, 32.20 cents per lb.

THE WEEK IN TRADE

WEEKLY it becomes more and more evident the extent to which the electrical trade is engaged in a war business. Purchases by the utilities are almost at a standstill. Contractors have little to do in the customary channels. New markets, such as shipyards and cantonments, are being opened and are assuming large proportions. New building is large, but it is of a character different from peace times. Shipyards, docks, army depots, arsenals, factories, etc.—these are the high spots of the building market, and the money being invested therein is running into unusually large figures. The demand for electrical goods is naturally keeping pace with this program. Priority orders are now the rule at the factories. Ordinary commercial business is fast disappearing. Even in such an article as fans it now appears that the government is going to become the dominant influence in the market.

Deliveries to government contractors are reported to be getting very much better. No such reports, however, are forthcoming from commercial customers.

Higher prices of 10 per cent on wiring material are the noticeable feature of the week. Other price advances occurred locally.

Further indications of price fixation were revealed a few days ago in the announcement of the government prices on zinc. Indications are that copper will remain for the time being at 23½ cents in spite of an attempt to obtain more.

With the draft board "work or fight" announcement this week labor supply in the useful industries, which include practically all electrical manufactures, ought to become more plentiful. As a result there should be fewer idle manufacturing facilities and somewhat increased production.

NEW YORK

Jobbers and distributors in this territory report a very satisfactory volume of business for the past week. Some concern is being expressed regarding future stock of staples. Factories have their order books pretty well filled for the entire line of electric requisites, and a suggestion of overbuying is derived from a look over the items filed. Under current conditions manufacturers are inclined to scale down the requisitions of some jobbers who are evidently endeavoring to get in their warehouses stocks greatly in excess of their normal requirements. Prices remain unchanged in nearly all lines. Deliveries are poor and uncertain.

Collections are said to be very satisfactory. Credit accommodations are gingerly accorded, particularly on new accounts.

SMALL MOTORS.—Fractional motors are by no means in strong supply. Manufacturers are several weeks behind on orders. The demand is and has been unusually active. No change in prices.

LAMPS.—Notwithstanding the heavy requisitions for standard sizes—beyond the most sanguine estimates of the manufacturers on government orders—the lamp producers are rapidly accumulating stock against future business. Orders are carefully scrutinized, however, and if jobbers are figuring on acquiring surplus stock against speculative contingencies they will be greatly disappointed. Only the regular requirements, beyond providing for a normal expansion of business, will be accepted. Deliveries are fair, with six weeks as the average shipping date. One order for 10,000 "mushroom" lamps was promptly turned down by a manufacturer on account of its peculiar specifications.

CONDUIT.—The market shows no marked improvement. Shipments from Pittsburgh and Youngstown, Ohio, factories dribble in by one and two car loads from time to time,

but no dependence can be placed on these arrivals when dates are considered. The demand is steady, jobbers and dealers exerting every effort to supply the consumer, whose impatience is gradually subsiding as manufacturing and shipping conditions become known.

HOUSEHOLD SPECIALTIES.—The movement of sewing and washing machines, ironers and tableware is brisk. Manufacturers are still behind on deliveries—about three weeks on the Western schedule. Prices are unchanged.

FLOODLAMPS.—On the larger sizes the factories are yet behind on filling orders, some of which represent sales of some magnitude. These are for government use, direct or indirect. Sixty days is about the delivery time on these goods. Some munition plants are sending orders for special colored glass. These the manufacturers would rather "pass up," but, being for war purposes, they are accepted with the best grace possible and promptly delivered.

CREDITS AND COLLECTIONS.—Collections have picked up at least 10 per cent during the past week. The "slow pays" are among the regulars, but being sound and above criticism no anxiety is expressed. Credits are held close to a straight line.

INSULATING TAPES.—The high price of cotton is affecting the cost of tapes. During the past year four advances were made, the latest of 10 per cent occurring a month ago. Varnish, oils, etc., used on cambric tapes are going up, and there is a possibility of another jump in price.

DRY BATTERIES.—A steady demand is reported, with the factories about even on filling orders and deliveries. Prices are stationary.

CHICAGO

The record of jobbers' sales for the first four months of 1918 shows a volume of business practically equal to that for the same period of 1917. There is some evidence, however, that some of this business has been due to unfilled orders carried over from last year and early in 1918. In the southwest portion of the Chicago district jobbers report a decrease in inquiries due to the government's attitude toward the expenditure of capital for even such purposes as small municipal lighting plants. From many sources are heard predictions of still higher prices. News that the United States steel gun plant is to be located in the Pittsburgh district gives promise of some business for the Central West soon. The one large central-station construction job in the Middle West now is the new station of the Kansas City Light & Power Company, to cost \$8,500,000. This work is still in the hands of the foundation builders. The only electrical work in progress is the underground system from the power station to distribution plants.

BOSTON

Business has been well maintained during the week, and credits are in pretty good shape. The central stations are doing a vast amount of war service work, and the industrial plants are constantly being mobilized for needs relating to military or naval activity. Good progress is being made on the government construction programs in this district, and many sales of electrical material to Uncle Sam are registered daily. The labor supply is getting scarcer and is causing jobbers, dealers, manufacturers and contractors no small amount of worry. Transportation conditions show some improvement, but emphasis is being laid by the railroads upon the vital importance of prompt unloading of cars as a war measure. Since winter there has been a slacking off in this which is making trouble. Prices of wiring materials advanced from 5 to 10 per cent last week because of the high cost of labor and porcelain. A vigorous coal-saving campaign is on in New England in anticipation of serious conditions next winter.

APPLIANCES.—Portable lamps and fixtures are very quiet at present, but there is a good market for flashlamps, dry cells, irons and wedding gifts. Some excellent displays of high-class tableware and smaller cooking devices are being featured in appliance showrooms.

FANS.—The rush movement of fans has not yet started among retailers, but any day is likely to bring heavy sales. Stocks are well prepared for eventualities, and liberal buying is anticipated from both industrial and residential users.

INDUSTRIAL ELECTRIC TRUCKS.—Purchases for government or related service are the feature of the market. Prices are firm and deliveries fairly good, considering railroad and raw material conditions. Minor development work is occasionally put through by manufacturers.

LAMPS.—Complaints regarding shortage of lamps are now seldom heard. The use of electric signs appears to be on the increase, but the reduction from last year's service is so marked that stocks do not appear to be suffering to any great extent.

WIRING MATERIAL.—Factory stocks are lower than normally, and little chance to build these up is noted. Very heavy government orders are being handled. Export business is developing under intelligent management. Labor is very scarce as regards fresh and reliable supplies. Porcelain shipments into the factories are now being handled to advantage in some cases by motor trucks instead of by rail, and it is reported that through the scheme of providing a return load for each truck costs are much lower than at first was anticipated.

MOTORS.—Not much change appears in the motor market. Prices are firm, and deliveries, while better on smaller sizes and standard types, show much to be desired in the larger units.

CENTRAL-STATION TESTING MATERIAL.—The domestic market is dull, though some inquiries are still coming in. There seems to be an opportunity here for some manufacturers, at least, to tie up with special government work.

ATLANTA

The volume of business in all lines is generally heavy. Although the sales in irons and heating devices have fallen off, these are offset by increases in other seasonal lines. The paucity of labor is becoming serious. Especially is this true for the unskilled class. The urgent demand by the government for unskilled labor at the coastal cities, together with the high rate of \$3.85 a day, has for the time stripped this section of the fill-in or floating element that has been available during the last few months. A general contract has been awarded by the War Department for the expenditure of \$25,000,000 at Charleston, S. C., covering the construction of warehouses, ammunition depots and terminal facilities.

CREDITS AND COLLECTIONS.—Information at hand indicates that jobbers are utilizing the trade acceptance more than ever, especially for sales made to outlying dealers. Jobbers' collections are not up to the standard of the last few months and a tight rein is being held. The contractors are not discounting bills as they did some time ago. There is very little change in the condition of manufacturers' collections, which have been maintaining a good record.

CONDUIT.—Both black and white rigid in sizes of $\frac{3}{4}$ in. and 1 in. is becoming very scarce. Local stocks are in worse shape than they have been in some time, and no immediate relief is in sight, with the exception of sales made for government purposes, which can be replaced through priority orders.

WIRING DEVICES.—Usual schedule material has advanced 10 per cent within the last week.

WIRE.—Rubber and weatherproof wire have also taken a jump of approximately 10 per cent.

FANS.—While a fan shortage is probable, replies to inquiries made to the jobbers apparently reflect the impression made by Eastern trade opinion. So far there is no visible shortage in this section. The season, however, is advancing slowly, and it is very hard to secure definite information on the local situation.

MOTORS.—A general advance of 10 per cent in the price of motors was registered, beginning the 18th. Isolated heavy buying tends to hold the volume of sales up to the figures of the last few months, but the uniform demand has

slackened perceptibly. Some improvement is noted in shipment promises of the larger ratings.

CHARGING OUTFITS.—Manufacturers and jobbers report an excellent business and increasing volume of sales. One manufacturer states that the sale of outfits in the Southwest is well up with the volume of business being transacted in the more populous northern sections of the country. Shipments are very satisfactory in comparison with other lines.

SEATTLE

General business conditions continue highly satisfactory according to both wholesalers and retailers. Business is as usual, in spite of the second Red Cross fund drive, in which Seattle territory more than doubled its allotment. Sales to shipyards and domestic sales maintained former high levels, although no particularly large sales were recorded. Further large power apparatus and equipment are anticipated in the near future from Tacoma, Gray's Harbor and Columbia River shipyards to care for projected improvements and enlargements. The market for large generators and larger-sized motors was comparatively dull during the past ten days. Schedule materials, wiring devices, wire, conduit, etc., used extensively by the government at the navy yard and cantonments and at shipyards, are going rapidly. Conduit especially is being turned over as fast as it comes in. Shipments are coming through more slowly, and the stock shortage promises to be acute unless promised shipments arrive. A slight increase in price on wiring devices was noted during the past week.

Possibility of receiving L. C. L. shipments in anything approaching satisfactory time is exceedingly remote. This condition applies to shipments within the State and Northwest as well as from the East. Cases are reported of two and three weeks consumed in receiving shipments from Seattle to Spokane across the State.

Construction immediately of new shipyards and enlargements to established plants indefinitely mentioned heretofore were announced last week. The Northwest Steel Company, Portland, will build an auxiliary steel yard covering 40 acres—four ways. A firm recently closed contracts with the Emergency Fleet Corporation for eight 8800-ton steel ships. The Heffernan Drydock Company, Seattle, plans the immediate establishment of a dry dock, machine, plate and blacksmith shops and outfitting wharves in Seattle. The Pacific Coast Steel Company, Seattle and Portland offices, will establish a five-hundred-thousand-dollar open-hearth furnace and rolling mill in Portland. The plant will have a capacity of 4000 tons per month. The Standard Concrete Shipbuilding Company will build a concrete ship plant near Tacoma. Active construction is promised immediately. Contracts for three scout cruisers and seven merchant ships have been transferred to the Todd shipbuilding plant, Tacoma. The division of transportation, Emergency Fleet Corporation, which looks after transportation of machinery, materials and supplies for steel and wooden shipbuilding, has opened offices in Portland. A residential construction program has been announced by the government for the navy yard at Bremerton, Wash., involving an initial expenditure of \$2,500,000 and ultimately \$5,000,000. One hundred and seventy-five acres have been commandeered, on which will be built 350 houses, two apartments and a 400-room hotel.

Unusual ice conditions in Bering Sea reported in dispatches from the north will necessarily delay shipments of electrical equipment and power apparatus to mines.

Mill and cannery shipments are being rushed to southeastern Alaska points, where they will be relayed into the interior. The acute labor shortage may be further aggravated by the administration's recent order that all men of registration age must work or fight. Shortages in shipyards, mills and factories allied in war work will be relieved, but other lines of business will be left in dire straits.

The supply of lamps in smaller sizes is slowly increasing with approach of summer. A shortage still exists in larger sizes, and automobile lamps are almost impossible to obtain. The demand for the latter is heavy. Flashlamp sales continue excellent, although sales are lighter with passing weeks.

SAN FRANCISCO

The electrical business showed no abnormal features last week, barring some excellent orders for wiring equipment for shipbuilding plants and several big pole orders.

Three steel grain elevators are to be erected in Knight's Landing, big bean-cleaning plants in Sutter and Yolo Counties, and the Union Construction Company is planning the erection of several plate shops in its Oakland Front shipyards. A reflection of the vast commerce with the Orient lies in the report that negotiations are under way by the Toyo Kisen Kaisha Steamship Company for the erection of a six-story office building in San Francisco. An unusual building item among the non-standard items for shipyards and packing plants is the proposed hundred-million-dollar addition to the "White House," one of San Francisco's largest department stores.

A group of Oroville men have announced plans for the erection of a new power-plant project on the Feather River, California, at an estimated cost of \$7,500,000, and the congressional commission appointed to finance industries considered essential to the conduct of the war will be asked to consider it. The plan calls for the construction of a dam 1160 ft. long and 650 ft. high to make a reservoir out of Bald Rock Canyon, giving a total of 1750 ft. capable of developing 166,000 hp.

It is announced that Vallejo will be furnished with a modern street-lighting electrolier system within the present year, and that the city engineers of Fresno will ask for alternate bids for such a system as supplied with cast-iron or concrete poles; that Red Bluff is ready to construct the first six-thousand-dollar unit of such a system, and that the town of La Habra in southern California will be thus equipped.

LAMPS.—Deliveries have slightly slackened during the past week or so. Sales are fine, agents are in good shape, and the business is in excellent condition.

MINIATURE LAMPS.—There are plenty of flashlight lamps, but the embarrassing shortage of automobile lamps still continues. Until new factories are built to cope with this ever-increasing demand, it will be impossible to fill stock orders, the manufacturers realizing that automobile manufacturers must be given preference.

FARM PLANTS.—The sale of farm lighting plants continues better and better, and it is announced that new improved plants with automatic regulation will soon be on the market. The excellent crop prospects will influence many sales for the fall, and the missionary work now being done in addition to present sales will then bear fruit.

TELEGRAPH MATERIAL.—A considerable call is reported for small relays and sounders, and especially for learners' telegraph instruments, due no doubt to the big demand for railroad dispatchers, and especially for radio operators for the navy. All the new vessels now being built for the Emergency Fleet Corporation will require new operators, and a proportionate number of operators must be secured for our ever-increasing navy. These instruments are used for practice by boys and men with such ambitions.

DISHWASHERS.—Although dishwashers have been sold in this district for at least three years past, the demand since the first of the year due to the shortage of household help is easily 1000 per cent over all previous calls. Deliveries are poor.

WASHING MACHINES.—The most popular article of sale just now is the washing machine, which can be had only in small sizes and in dolly styles. Machines of a size for average families are scarce, with no immediate prospect of better conditions. One manufacturer states that he is 3000 machines behind on this standard family size alone. Prices advanced about 10 per cent during the last of April, but this has not influenced sales one bit.

IRONING MACHINES.—The latest labor-saving electrical household device to come into its own is the electric ironing machine. Two prominent makes are being sold on the Pacific Coast and, as the sales reach considerable volume and require time payments by dealers, the representing jobbers are considering a form of financial assistance to them on such sales. The average household size complete with motor sells for about \$110 f.o.b. Pacific Coast.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 8 stranded.....	95.00
No. 6 stranded.....	115.00
No. 4 stranded.....	160.00
No. 2 stranded.....	205.00
No. 1 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil.....	List to + 15%
Coil to 1000 ft.....	List to + 10%
	No. 12 Solid
Less than coil.....	List to + 15%
Coil to 1000 ft.....	List to + 10%

Twin-Conductor

	No. 14 Solid
Less than coil.....	List to + 15%
Coil to 1000 ft.....	List to + 10%
	No. 12 Solid
Less than coil.....	List to + 15%
Coil to 1000 ft.....	List to + 10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil.....	+ 10%
Coil to 1000 ft.....	+ 10%
	No. 12 Solid
Less than coil.....	+ 10%
Coil to 1000 ft.....	+ 10%

Twin-Conductor

	No. 14 Solid
Less than coil.....	+ 10%
Coil to 1000 ft.....	+ 10%
	No. 12 Solid
Less than coil.....	+ 10%
Coil to 1000 ft.....	+ 10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	\$24.00 to + 10%
1/5 to std. pkg.....	19.80 to 8%
Std. pkg.....	18.75 to 2%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	12%
1/5 to std. pkg.....	20%
Std. pkg.....	44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots.....	.285	.295

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	\$0.40	\$0.40
12 to 50.....	.35	.35
50 to barrel.....	.3175-.3190	.3275-.3290
Barrel lots.....	.2875-.2890	.2975-.2990

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.....	List to \$82.50	\$63.75 to \$67.50
3/4-in. d. stp.....	\$82.50 to \$4.00	69.00 to 75.00
1/2-in. s. stp.....	List to \$110.00	\$85.00 to 90.00
1 1/2-in. d. stp.....	\$110.00 to \$112.00	\$92.00 to 100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip.....	List	\$63.75
3/4-in. double strip.....	78.25-78.75	71.25-71.75
1/2-in. single strip.....	List	\$5.00
1/2-in. double strip.....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60	\$60 to \$150
7/32-in.—	List	List	List
1/4-in.—	\$25.00-\$38.50	\$20.50-\$26.00	\$20.00-\$24.00
3/8-in.—	\$28.00-\$42.00	\$22.50-\$28.20	\$22.00-\$26.00

NET PER 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60	\$60 to \$150
7/32-in.—	List	List	List
1/4-in.—	\$36.00-\$55.00	\$25.00	\$22.50
3/8-in.—	\$40.00-\$60.00	27.00	25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
1.....	\$0.08 1/4
3/4.....	.08 1/2
1/2.....	.08 1/2
3/8.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37 1/2
2 1/2.....	.58 1/2
3.....	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	4% to 6%	7% to 10%
2500 to 5000 lb.....	6%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	6.8% to 8.9%	8.8% to 10.9%
2500-5000 lb.....	9.8% to 11.9%	11.8% to 13.9%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50
	600-Volt		
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	30%
1/5 to std. pkg.....	40% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	28% to 30%
1/5 to std. pkg.....	38% to 40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.....	\$5.00 to \$6.30
1/5 to std. pkg.....	4.50 to 5.25
Standard packages, 500. List, each	\$0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.....	\$6.25
1/5 to std. pkg.....	5.25
Standard packages, 500. List, each	\$0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt-B.....	100	\$0.30
60-watt-B.....	100	.35
100-watt-B.....	24	.70
75-watt-C.....	50	.70
100-watt-C.....	24	1.10
200-watt-C.....	24	2.20
300-watt-C.....	24	3.25
Round bulbs, 3 1/2-in., frosted:		
15-watt-G 25.....	50	.53
25-watt-G 25.....	50	.55
40-watt-G 25.....	50	.55
Round bulbs, 3 3/4-in., frosted:		
60-watt-G 30.....	24	.77
Round bulbs, 4 3/8-in., frosted:		
100-watt-G 35.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.....	List
Std. pkg.....	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	List
Std. pkg.....	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft)....	\$31.00 to \$33.30
Coil to 1000 ft.....	24.98 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft)....	\$29.00 to \$30.00
Coil to 1000 ft.....	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100.....	\$20.00
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CHICAGO

Net per 100.....	\$21.75
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200, S.E., 300, A.X., 1 1/2 4 S.....	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list....	30%	20%
\$10.00 to \$50.00 list....	35%	25%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list....	40%	35%
\$10.00 to \$50.00 list....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000,	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	4000
	5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85	\$30.70 to \$30.75	
1/5 to std. pkg.....	11.10	24.20	

CHICAGO

Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	4000
	5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85	\$30.75	
1/5 to std. pkg.....	11.10 to \$11.40	24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets.....	500	\$0.33
1/4-in. cap keyless socket.....	500	.30
1/4-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List to + 10%
1/5 to std. pkg.....	8% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.....	25% to 45%
1/5 std. pkg.....	23% to 42%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.40
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.....	List
\$10 to \$25 list.....	12%
\$25 to \$50 list.....	15%
	Low Grade
Less than \$10 list.....	10%
\$10 to \$25 list.....	20%
\$25 to \$50 list.....	25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.....	+ 5%
\$10 to \$25 list.....	10% to 11%
\$25 to \$50 list.....	14%
	Low Grade
Less than \$10 list.....	5%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List to + 10%
1/5 to std. pkg.....	8% to 15%
Std. pkg.....	25% to 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	List to + 20%
1/5 to std. pkg.....	List to 15%
Std. pkg.....	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....	List	List
\$2.00 to \$10.00 list.....	10%	5%
\$10.00 to \$50.00 list.....	20%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25%	20%
\$2.00 to \$10.00 list.....	25%	20%
\$10.00 to \$50.00 list.....	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List price.....	\$4.50 to \$6.00
Discount.....	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools..	\$0.44-\$0.44 1/4
No. 18, full spools.....	0.43- 0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools..	\$0.57 1/2-\$0.65
No. 18, full spools.....	0.50 1/2- 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14..	\$15.00	\$13.00-\$14.00	\$11.50-\$12.25
12..	23.25-\$23.60	19.96- 21.30	15.60- 19.35
10..	32.40- 33.20	27.66- 29.70	21.63- 27.00
8..	45.63- 45.70	38.66- 41.90	30.18- 38.00
6..	72.40- 72.93	61.71- 66.35	48.25- 60.30

CHICAGO

No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14..	\$18.00	\$13.00	\$11.50
12..	25.69-\$26.28	22.02-\$22.48	18.55- 20.93
10..	30.49- 36.54	27.91- 31.26	22.86- 29.23
8..	42.54- 51.57	38.99- 44.13	31.90- 41.86
6..	67.38- 88.38	56.15- 75.61	50.53- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$35.25 to \$36.85
25 to 50 lb.....	35.25 to 36.85
50 to 100 lb.....	31.25 to 36.10

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.....	\$30.00 to \$30.35
25 to 50 lb.....	30.00 to 30.35
50 to 100 lb.....	28.00 to 38.25

NEW APPARATUS & APPLIANCES

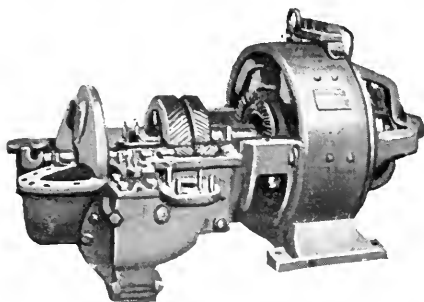
A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Small Geared Turbines

To drive small electric lighting outfits, exciter units for large alternators, or for direct mechanical drive, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a line of small geared turbines, constructed along the line of the larger turbine units, which give durability, ease of adjustment and high economy. These units especially meet the demand for lighting sets in the merchant marine service. They are manufactured in sizes from 15 kw. to 50 kw. for direct-current service and from 30 kw. to 50 kw. for alternating-current service. The turbines are made in 30 hp. to 100 hp. for mechanical drive.

The turbine operates at a speed of 7200 r.p.m. and is suitable for both condensing and non-condensing operation. It is built for normal operation on any steam pressure from 75 lb. to 250 lb. (5.3 kg. to 17.6 kg. per sq. cm.) and for non-condensing operation on any back pressure up to 20 lb. (1.4 kg. per sq. cm.). The generator is of the Westinghouse "SK" type, compound-wound, with commutating poles. The outboard generator bearing is supported by a single-piece bracket bolted to the frame. In this a steel shell lined with babbitt forms the bearing itself, and as it is pressed and pinned into place it may be readily removed or renewed in case of trouble. One of the special features of the unit is the automatic throttle valve, operated directly from the governor by means of a connecting rod. This valve is of the balanced type and very sensitive in operation, thus insuring a close speed regulation.

One of the latest refinements provided on very few small turbines is the



TURBO-GENERATOR LIGHTING SET FOR MARINE SERVICE WITH COVER REMOVED

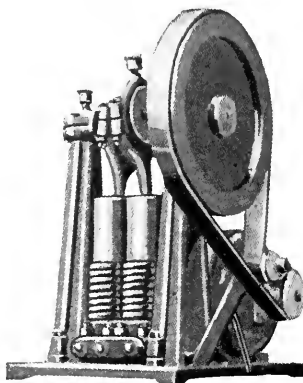
overspeed governor release. This is a simple device contained in a small hole drilled in the shaft between the pinion and the rotor, consisting of a cylindrical weight held in place by a coil spring surrounding it. In case the turbine should speed up to 10 per cent above normal speed, the weight due to

centrifugal force overcomes the spring tension and protrudes a short distance from its normal position. By so doing it comes in contact with a lug, which in turn is fastened to a lever, the movement of which trips the throttle-valve catch and allows the valve to be closed by a heavy coil spring.

This line of turbo-generators conforms to the Navy Department's specifications for ship service, being provided in this case with both steam and water-sealed glands and non-corrosive brass piping.

Two-Cylinder Motor-Driven Air Compressor

The Midvale Machine Works, St. Louis, Mo., is manufacturing a continuous-service air compressor suitable for garages. It is of the two-cylinder type, having plungers fitted with metal pis-



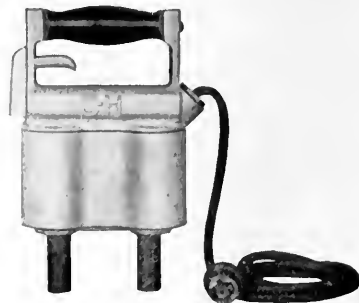
A 0.25-HP. MOTOR DRIVES THIS COMPRESSOR CONTINUOUSLY

ton rings. The compressor is equipped with an air filter that prevents any oil from entering the tire undergoing inflation. The machine has a capacity of 1.25 cu. ft. (0.038 cu. m.) of air per minute. It is equipped with an 0.25-hp. motor for either alternating current or direct current. Complete with cast base and flywheel, the machine weighs 150 lb. (68 kg.). The manufacturer claims that it will deliver an operating pressure of 100 lb. per square inch. (70 kg. per sq. cm.).

Completely Inclosed Hand Magnet

The magnetic coils, switch and connections of the C-H hand magnet are now covered by two aluminum castings. The upper aluminum casting forms the yoke cover, switch cover and handle support. The lower casting covers the coils and leaves only the soft iron poles projecting. The circuit to the

magnetic coils is closed and opened by means of a large trigger, mounted under the handle in the handle support, which operates a strong make-and-break switch concealed in the upper aluminum cover. The trigger is operated by the index finger. Pulling it toward the handle closes the switch.



DEVICE CONTROLLED BY TRIGGER

When slightly released the switch does not open, but when fully released the switch opens with a quick break. The magnet can be used effectively in plants such as those of metal dealers, smelters and refiners, iron and brass foundries, machinists, paint manufacturers, chemical works, paper mills, fertilizer plants, flour mills, enamellers, tanners, electroplaters, malt houses, hardware dealers, plumbing manufacturers, garages, fixture manufacturers, mathematical instrument makers and shipping departments of many factories. In the manufacture of spelter solder they are used to remove copper-coated iron and steel wire. Suspended with its two poles immersed in the liquid, the magnet will attract to itself any particles of iron or steel in the tubs in which paints, glazes, chemicals, etc., are mixed.

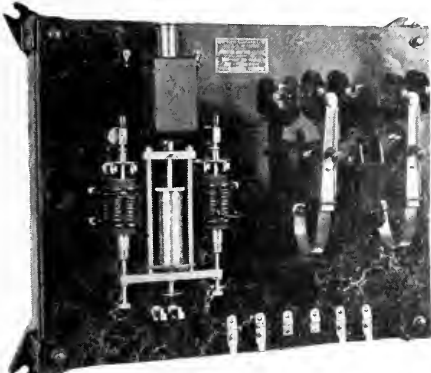
The device described above is manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., and is furnished with 5 ft. (1.5 m.) of reinforced cord and a standard C-H separable attachment plug.

Multi-Value Overload Relay for A.-C. Motors

Complete protection against overload is claimed for a multi-value overload relay which is being manufactured by the Monitor Controller Company of Baltimore, Md. The relay has trip coils in two legs of the circuit. In starting, the air gap in the magnetic circuits of these coils is opened to the point where it requires maximum current to trip the overload relay. The main magnetic switch then closes, and the air gap in the overload magnets slowly closes until at about the time the motor reaches full speed the cores are in the

proper position to trip at the current value at which the overloads are set. This makes it possible to set the overload trip with respect to the running load and thus gives complete protection against overload. The current at which the overload relay trips has one value for starting, another for running, and intermediate values during the starting period.

As the overload release may be set for the running load, it gives ample



"ACROSS-THE-LINE" STARTER FOR THREE-PHASE SQUIRREL-CAGE MOTORS

protection against single-phase running. In case one phase fails, the overload in the remaining phase is sufficient to trip the overload relay. The accompanying illustration shows the relay in connection with the main magnetic switch. This combination is known as type 1120 "across-the-line" starter for three-phase squirrel-cage motors.

Armored Corner Insulator for Feeder Cables

Feeder cables can be securely held on curves by the Pittsburgh-type corner insulators marketed by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. This insulator is provided with a special collar or retaining ring for use where the curve is slight and the cable likely to slip off an ordinary insulator. The collar has an extended lip which curves up around the cable and keeps it in the groove regardless of the angle at which the cable turns, thus eliminating the



NO TIE WIRES NEEDED FOR THIS CORNER INSULATOR

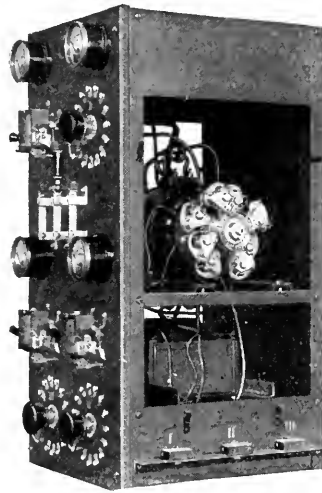
necessity for tie wires and saving time in erection. The collar is free to move on the insulator cap, so that after the insulator is screwed to the pin the collar may be turned until the cable seat is in the best position to support the cables.

For sharp curves the insulator can be used without this collar, as the deep side groove holds the cable firmly in position. These insulators are made of molded insulation surrounded by a

sherardized malleable-iron cap. They are made with a 1-in. (2.54-cm.) pinhold and are furnished in two sizes for feeders of 500,000 circ. mils and 1,000,000 circ. mils respectively.

Flexible Charging Outfit

Charging at a high rate without overheating the batteries can be obtained by means of a commutating rectifier that is being manufactured by the Stahl Rectifier Company, 1401 West Jackson Boulevard, Chicago. Three rectifying commutators with one-quarter of the sections dead produce pulsating currents, which, the manufacturers claim, allows charging at a high rate without overheating the batteries. Because of an independent regulator for each circuit these three circuits can be charged at any rate from 4 amp. to 12 amp. One circuit can be charging one line of batteries at a rate of 10 amp., another circuit can be charging at a rate of only 5 amp., and a third circuit can be



RECTIFIER WITH THREE COMMUTATORS SHOWN WITHOUT BASE

charging at an entirely different rate—all three operating at the same time. It is said that a minimum amount of energy is lost by the Stahl rectifier because the current from the main line is reduced by a transformer and not by resistance to obtain the desired voltage for the commutator. The rectifier model SX is complete with switchboard, voltmeter, ammeter and voltage regulators, all ready to connect up to the main line and batteries. The illustration shows the outfit, which comes mounted on a structural-steel base.

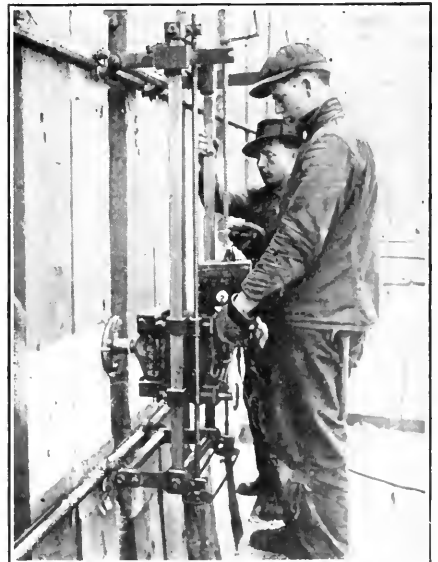
Electric Dubber for Ships

An electric dubber requiring only one operator, perfected and manufactured by Gray & Barash of Seattle, is said to be able to do the work of twenty men working with adzes. In effect, the electric dubber planes the interior and exterior sides of the frames so that a smooth and even surface is presented for the planking and sealing. This work heretofore has been done wholly by hand with the adze. The adze gives a surface of 65 to 70 per cent fair or

even; the electric dubber gives a surface 100 per cent even. As its name implies, this machine is a mechanical means for dressing off the irregular and uneven surfaces of the frames on wooden vessels preparatory to planking.

It employs a cutting member consisting of a rotating cutter head with the knives secured to the face of the head. This cutting head is mounted on the shaft of a specially constructed alternating-current motor running at a speed of 3600 revolutions per minute. The motor, through the means of ball and socket joints, has a three-point suspension within an adjustable carriage, mounted upon two bars which are transverse to the direction of travel. These transverse bars are supported at their ends by arms at one extremity of which are grooved wheels running on annular ball bearings. These wheels ride on the head of a standard 8-lb. (3.6-kg.) "T" rail. Two of the rails form a trackway upon which the dubbing machine is moved. The rails are secured to the surface to be dressed through some convenient means and are sufficiently light to be formed to the contour of the vessel and take the molded shape of the surface to be dressed, thereby determining the finished surface of the part to be dubbed.

The coarse adjustment of the machine is made through a rack and pinion arrangement on the supporting arms, the fine adjustment of the cutter head both as to elevation and angular position being secured through screws working through the three balls and socket joints. The lateral movement along the transverse bars is obtained by the two lead screws manipulated through a removable crank. Through this system of adjustable carriage members the machine is capable of universal adjust-



ELECTRICALLY OPERATED MACHINE CAN DO WORK OF TWENTY MEN

ment within a certain range of movements, enabling it to be operated in a horizontal, vertical or any other position intermediate or between these points.

Trade Notes

JOHN F. GOFFREY, manufacturer of coal handling conveyors, has removed his plant from Elkhart, Ind., to Chicago.

THE CENTURY ELECTRIC COMPANY of St. Louis, Mo., now has its Cincinnati sales office at 510 Traction Building, its Pittsburgh office at 1017 Bessemer Building, and its Chicago sales office at 902 Randborn Building.

W. E. HAWLEY, formerly connected with the George Cutter Company, of South Bend, Ind., in the switchboard department, is now with the Penn Electrical & Manufacturing Company of Irwin, Pa., manufacturer of switchboards and panelboards.

THE NATIONAL TRADE ACCEPTANCE BUREAU, Inc., of New York City, has started to issue the *Trade Acceptance Journal*, which takes for its motto "Sound credit rests on sound finance." The contents of the first (May) number are pertinent and informing. The publication office is 421 Nassau Street.

THE NAVY DEPARTMENT, Bureau of Supplies and Accounts, Division of Inland Traffic, Washington, D. C., under date of May 15, has issued circular No. 5 to navy contractors and navy shipping officers. The subject is recording the movement of carload shipments of certain United States government freight. Twelve different matters are covered in the circular, explanatory and descriptive of freight handled.

LE COMPTOIR NATIONAL BELGIQUE has issued a circular on the "economical reconstruction of Belgium." The organization will aid Belgian business and industries to replenish themselves with material "in the shortest time possible after the evacuation of the country by the enemy." Electric appliances are especially designated, among other articles, as a requisite in the wholesale building. Prices and copies of trade catalogs, specifications, etc., are requested by the Liège Social, 15 rue Louis le Grand, Liège, Belgium.

WASHING-MACHINE FACTORIES IN TORNADO.—The Maytag Company of Newton, Iowa, on May 21 was damaged to the extent of \$75,000 by a tornado. The top floors of this company, as well as that of the Automatic Electric Washer Company, Inc., were partly blown off. A corner of the One-Minute Manufacturing Company was also damaged, one workman being killed and about ten injured. The output of these electric washing-machine manufacturers is but slightly curtailed, and deliveries, it is stated, will be made as usual.

THE MECHANICAL APPLIANCE COMPANY of Milwaukee, Wis., has recently placed C. G. Tarkington in charge of its Washington office, at 1407 L Street N. W. Through this office the company is assisting the government and is in a position to render service to its customers in their relations with the government. Mr. Tarkington was graduated from Purdue University in 1901 and then entered the engineering department of the Cutler-Hammer Manufacturing Company, with which he was connected for a number of years. He was with the Chicago sales office of the Westinghouse Electric & Manufacturing Company for seven years.

THE ELECTRICAL ENGINEERING COMPANY of Chicago was incorporated last December under the laws of the State of Illinois to engage in the design, manufacture and sales of electrical devices, particularly specializing in moving-picture control apparatus, high and low tension transformers and coil winding. R. A. Connor, the president, was formerly connected with the Thordasson Electrical Company as general manager and designing engineer. J. H. Thompson, vice-president, was formerly connected with the same firm as sales manager. G. C. Jensen, secretary and treasurer, has served in several capacities with large central stations.

THE ORDNANCE DEPARTMENT of the United States Army, during April placed orders for the following electric goods with the companies named: Generating units, 4-kw. switchboards complete for 1332 artillery repair trucks, Universal Motor Company, Oshkosh, Wis.; miscellaneous wire and cable for United States filling plant, Simplex Wire & Cable Company, Boston; oil circuit breakers and lightning arresters, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; switchboards and equipment, General Electric Company, Schenectady, N. Y.; No. 10 AWG Colonial copper-clad weatherproof wire, estimated weight 250 lb., Standard Underground Cable Company, Pittsburgh, Pa.

THE LUX MANUFACTURING COMPANY announces that it has surrendered its premises at the Factory Terminal Building, Hoboken, N. J., to the United States government for the benefit of the War Department. The company is now located in its new building at 123-133 East Kinney Street, Newark, N. J. The new building permits an increased production of Lux lamps, and as the result the company says customers may expect better deliveries. Factory operations were not entirely suspended, as a part of the plant was installed before the Hoboken plant was closed down. The company expects to be running at full capacity within at least several weeks. Special attention is being paid to employee welfare at the new plant.

Trade Publications

FANS.—The Century Electric Company of St. Louis has issued a folder illustrating and describing alternating-current fans.

OFFICE EQUIPMENT.—The Manufacturing Equipment & Engineering Company, Boston, is distributing several booklets describing its lockers, drinking fountains, washbowls, etc.

SINGLE-PHASE MOTORS.—The Century Electric Company of St. Louis has issued a circular describing its single-phase motors and illustrating their application to various appliances.

HAND MAGNET.—A light-weight inclosed hand magnet is illustrated and described in publication No. 250, distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

STOKERS.—High-capacity stokers for higher volatile coals are described in a booklet issued by the Laclede-Christy Clay Products Company, St. Louis, Mo. The operation of these is given.

MOTORS.—Induction motors are described and illustrated in a circular being distributed by the Cleveland Electric Motor Company of Cleveland, Ohio. The type "M" motors are discussed.

FIXTURES.—Commercial lighting fixtures are described in the *Business Building Bulletin*, distributed by the Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago.

INDUCTION MOTORS.—The St. Louis Electrical Works, 4060 Forest Park Boulevard, St. Louis, Mo., has issued a bulletin describing and illustrating its induction motors of single-phase and polyphase type. The publication is known as Booklet 5.

SPEED CONTROLLERS.—Armature speed controllers, type R, of the Ward Leonard Company, Mount Vernon, N. Y., are described in a circular that this company has recently published. Prices are given for all sizes for controlling small motors.

ELECTRIC APPLIANCES.—The two-page advertisements to be run in the June 29 issue of the *Saturday Evening Post* are reproduced in a circular distributed by the Hotpoint division of the Edison Electric Appliance Company, Inc., 5660 West Taylor Street, Chicago.

BATTERIES.—Bulletin No. 169 has been issued by the Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia, describing its oil-switch batteries. Electrical descriptions are given showing the application of the storage batteries to switching apparatus.

HIGH-TENSION EQUIPMENT.—The Delta Star Electric Company, Chicago, is distributing bulletin No. 33, devoted to high-tension switching and protective equipment. This sixty-four-page bulletin has 309 illustrations and contains considerable technical information. Copies will be sent upon request.

ELEVATORS.—The Standard Plunger Elevator Company, Worcester, Mass., is distributing a bulletin describing its passenger elevators, freight elevators, baggage lifts, sidewalk lifts and hydraulic dumbwaiters, with automatic push-button control for all service. Typical installations are listed in the bulletin. An interesting photograph is reproduced showing a plunger 365 ft. long.

STORAGE BATTERIES.—The Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia, has issued Bulletin No. 170, describing and illustrating the "Exide" battery for portable signal service. Type KXS and type KCXS batteries are equipped with cases to which handles are attached, thus allowing easy handling. The several parts of the batteries are described and illustrated.

MOTORS AND GENERATORS.—The Crocker-Wheeler Company of Amper, N. J., has issued bulletins No. 183, 184 and 185, describing some of its electrical apparatus. Titles of these bulletins are "Motor Drive for Printing Machinery," "Direct-Current Lighting and Power Generators" and "Coupled and Belt Types of Alternating-Current Generators" respectively. Illustrations and electrical descriptions of the apparatus are contained in these bulletins.

New Incorporations

THE A. S. LAUFERTY COMPANY of Boston, Mass., has been incorporated with a capital stock of \$50,000 to manufacture telephone devices and apparatus.

THE STANDARD BATTERY MANUFACTURING COMPANY of Fort Worth, Tex., has been chartered with a capital stock of \$1,000 by Solomon Casseb, Samuel Greco and Adolph Barbeio.

THE ELECTRICAL EQUIPMENT COMPANY of Morgantown, W. Va., has been incorporated by Arthur Hall, Lester R. Gehagen, Earl E. Hall and others. The company is capitalized at \$25,000.

THE CONSOLIDATED ELECTRIC COMPANY of Taunton, Mass., has been incorporated with a capital stock of \$4,000. The directors are Edward R. Duolos, president; Berton T. Mowry, treasurer, and F. M. Mowry.

THE ELECTRIC KITCHEN CORPORATION of Brooklyn, N. Y., has been chartered with a capital stock of \$30,000 by J. H. Pawling, B. C. Sprague and H. A. Prefethen, 238 Fort Washington Avenue, Brooklyn, N. Y.

THE BURTON-POORE ELECTRIC COMPANY of Norfolk, Va., has been chartered with a capital stock of \$5,000 to do a general electric business. J. M. Burton is president, and E. S. Poore is secretary, both of Norfolk.

THE ARKANSAS BATTERY COMPANY of Little Rock, Ark., has been incorporated by W. P. Galloway, president and treasurer; J. W. Hamm, vice-president, and C. P. Pierce, secretary. The company is capitalized at \$9,000.

THE CARBON COMPANY of Union, N. J., has been chartered by Edward J. Simon, John T. Simon and Myrdon D. Grove of Weehawken. The company is capitalized at \$100,000 and proposes to manufacture incandescent lamps.

THE BOLTON-WECHTEL COMPANY of Brooklyn, N. Y., has been incorporated by H. J. Wechtel and W. C. Bolton, 261 Stuyvesant Avenue, Brooklyn, N. Y. The company is capitalized at \$20,000 and proposes to deal in batteries and auto accessories.

THE THREADLESS PIPE SETTING COMPANY of Newark, N. J., has been incorporated with a capital stock of \$30,000 to manufacture electrical appliances. The incorporators are Joseph G. Fenster, Samuel Lederman and Edward S. Schwartz of Newark, N. J.

THE BROCKMAN BROTHERS COMPANY of Greer, S. C., has been incorporated with a capital stock of \$5,000 to deal in plumbing materials, pumps and gas and electric lighting outfits, etc. The incorporators are J. O. Brockman and R. H. Bearden, both of Greer.

THE STANDARD ELECTRIC & ACETYLENE WELDING COMPANY of Montreal, Que., has been incorporated with a capital stock of \$10,000 to manufacture tools, machinery, implements, etc. The incorporators are Richard T. Henecker, Henry N. Chauvin, Hugh Wylie and others.

THE LIBERTY BATTERY COMPANY of Sacramento, Cal., has been incorporated by James S. Remick, Edward Farmer, Porter C. Anderson, C. E. Winters and C. E. Gass. The company is capitalized at \$10,000 and proposes to establish a general storage battery business and to do, all kinds of electrical work.

THE CLEVELAND ARMATURE WORKS, INC., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$2,000,000, to manufacture electric machines, generators and batteries. The incorporators are C. L. Rimplinger, M. M. Clancy and F. A. Armstrong of Wilmington, Del.

THE TECHNICAL DEVELOPMENT CORPORATION of New York, N. Y., has been incorporated by F. D. Hearn, J. A. Hanway and J. J. McCormack, 71 East Eighty-sixth Street, New York City. The company is capitalized at \$100,000 and proposes to manufacture and deal in electrical and mechanical equipments.

New England States

WATERVILLE, ME.—Plans are being prepared by I. W. Jones of Milton, N. H., for the construction of a new hydroelectric power plant at the works of the Lockwood Company in Waterville.

WYTOPITLOCK, ME.—The Springer Lumber Company is installing a new steam-driven pump and an electric generator.

BURLINGTON, VT.—The Queen City Cotton Company has awarded the contract for wiring and installing electric fixtures in 67 tenements to the Burlington Light & Power Company.

DANA, MASS.—The Dana Board of Trade is considering a proposal submitted by the Gardner Electric Light Company for lighting the town.

NATICK, MASS.—The Northways Motor Corporation, recently incorporated, has acquired a site of 30 acres in Natick on which it will erect a plant for the manufacture of motor trucks, tractors, special motors and passenger cars. The officers are: James F. Cavanaugh, president; R. R. Northway, vice-president and chief engineer; J. H. Walker, treasurer and general manager of the Walker-Wells Manufacturing Company and Amesbury Body Company, is chairman of executive committee.

WEBSTER, MASS.—The New England Power Company has petitioned the Board of Selectmen for a franchise to cross the highways in five places in Webster.

WELLESLEY, MASS.—Plans are being prepared by French & Hubbard, 88 Pearl Street, Boston, for the construction of an addition, 35 ft. by 45 ft., to the boiler house at Wellesley College.

LONSDALE, R. I.—Plans have been filed by the Lonsdale (R. I.) Company and contract has been awarded to the J. W. Bishop Company, 109 Foster Street, Worcester, Mass., for the construction of a new transformer building at its plant.

NEW LONDON, CONN.—The general contract for the construction of the new power house and machine shop at the submarine base for the United States government has been awarded to the Ewalt Construction Company, 161 Devonshire Street, Boston, Mass.

STAMFORD, CONN.—Contract has been awarded by the Stamford Gas & Electric Company to the Vuono Construction Company of Stamford for the construction of a new brick pump and screen plant and valve house at its works, to cost about \$10,000.

Middle Atlantic States

AUBURN, N. Y.—The Empire Gas & Electric Company has petitioned the Public Service Commission for permission to issue \$171,000 in bonds, the proceeds to be used for extensions and improvements.

BINGHAMTON, N. Y.—The Binghamton Cutlery Works has awarded a contract to the Binghamton Light, Heat & Power Company for furnishing electricity to operate the new plant of the company to be established by the cutlery company. About 150 hp. will be required for the initial operations.

BROOKLYN, N. Y.—Contract has been awarded by the War Department to the Turner Construction Company, 242 Madison Avenue, New York, for the construction of the new terminal on Second Avenue, between Fifty-eighth and Sixty-fifth Streets, South Brooklyn, to cost about \$10,000,000. The buildings will be equipped with cranes, hoisting and conveying machinery, etc.

BUFFALO, N. Y.—The International Railway Company is planning the construction of 8.7 miles of new track in Buffalo this year. The cost is estimated at about \$870,000.

CORNING, N. Y.—The Corning Painted Post Street Railway Company is contemplating the construction of an extension of its car line to North Corning.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until June 5 for new boilers and heating work for the new central heating and lighting plant at the Central Islip State Hospital. Drawings and specifications may be consulted at the hospital at Central Islip, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect. E. S. Elwood is secretary of state hospital commission.

CORNING, N. Y.—The bill granting the Lamoka Electric Water Power Corporation a charter has been signed by Governor Whitman. The company proposes to construct a large concrete dam across the Lamoka valley above Bradford to impound and store up the overflow from Lake La-

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

moka and Lake Wanita. This water will be carried in a large concrete tunnel to the shores of Lake Keuka, a drop of 390 ft. in 2 miles, there used to generate electrical energy at a plant to be located near Grove Springs. Electricity generated at the plant will be transmitted to Corning, Penn. Yan. Hammondsport, Watkins, Bath and other towns for commercial purposes.

JAMESTOWN, N. Y.—Plans have been prepared by F. A. Shoemaker, Builders' Exchange, Buffalo, for the construction of an addition to the boiler plant of the Art Metal Construction Company at Jones Street and G Avenue.

NEW YORK, N. Y.—The United Machine Works, 55 West Third Street, New York, it is reported, would like to receive prices on oil engines and generators. Alternating-current units, directly connected, from 100 to 500 hp., preferred.

NEW YORK, N. Y.—Bids will be received by W. W. Witherspoon, superintendent of public works, Capitol, Albany, until June 18 for installing electric wiring, lighting, power, battery-charging equipment and auto truck scales for Pier 6 East River, New York City. For details see Searchlight Department.

OLEAN, N. Y.—Bids will be received by Captain John A. Coffey, secretary to the State Board of Armory Commissioners, 158 State Street, Albany, until June 12 for construction, heating, sanitary and drainage and electric work in connection with the reconstruction and addition to the Olean Armory. Plans and specifications may be seen at the above office, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is State architect.

OTISCO, N. Y.—The Otisco Light & Power Company has petitioned the Public Service Commission for permission to construct and operate an electric-lighting plant in Otisco and also to take over the local electric plant, owned by Earl T. Harter.

SAYVILLE, N. Y.—Contract has been awarded to the E. J. Electric Installation Company, 221 West Thirty-third Street, New York City, by the United States government for the installation of a new electric floodlighting system at the local wireless station.

WATERTOWN, N. Y.—Plans are under consideration by the Northern New York Utilities Company, 137 Arsenal Street, for a new power development on the Black River, to cost about \$300,000. James Brownell of Strickland is engineer.

ELIZABETH, N. J.—The Dusenberry Motors Corporation of Elizabeth is contemplating building an addition to its plant, part of which is to be used as a motor testing department. The cost is estimated at \$90,000.

HARRISON, N. J.—Plans have been filed and contract awarded to Edward M. Waldron, 665 Broad Street, Newark, for the construction of a new building, 50 ft. by 100 ft., at the local plant of the General Electric Company.

JERSEY CITY, N. J.—The lowest bid for electrical work for the proposed new public school buildings Nos. 6 and 23, to cost about \$754,000 and \$780,000 respectively, was submitted to the City Commission by Hoffman & Elias, 549 Colbs Avenue, New York City, at \$11,189 and \$12,179 respectively.

NEWARK, N. J.—An appropriation of \$97,350 to be used for lighting, heating and power purposes for the various institutions throughout the county, covering a period from May 8 to Dec. 31, 1918, has been approved by the Board of Freeholders.

OGDENSBURG, N. J.—The boiler plant at the limestone quarry of the Wharton Steel Company was recently destroyed by fire. The structure will be rebuilt at once.

PHILLIPSBURG, N. J.—The Lapatoong Water Company, it is reported, is contemplating improvements to its system, including the erection of a pumping and power generating station.

POMPTON LAKES, N. J.—Plans have been completed for the construction of a new hydroelectric power plant on Corning Lake. The building will be about 40 ft.

by 65 ft. A bond issue of \$46,000 has recently been authorized by the Borough Council.

PRINCETON, N. J.—Plans are under consideration by the Borough Council for improvements to the electric fire-alarm system.

CHESTER, PA.—Plans have been filed by the Philadelphia Railway Company for the erection of a repair shop, at Penrose Ferry and Fort Millin Roads, consisting of two one-story structures, to cost about \$28,000. One of the buildings, 70 ft. by 78 ft., will be used for woodworking operations.

EASTON, PA.—The William Wharton, Jr., Company, has contracted with the Pennsylvania Utilities Company of Easton for energy to operate its new electric furnace. About 1500 kw. will be required.

ELWOOD CITY, PA.—Notice has been filed with the Public Service Commission by the Pennsylvania Power Company of an issue of \$9,000 in bonds, the proceeds to be used for improvements, etc.

ENOLA, PA.—Preparations are being made by the Pennsylvania Railroad Company to begin work on improvements and alterations in its local power plant and engine house.

PHILADELPHIA, PA.—Plans have been prepared by the Millin Chemical Corporation, Delaware Avenue and Tasker Street, for an addition to its boiler plant.

PHILADELPHIA, PA.—Plans are being considered by the Scott Paper Company, Seventh Street and Glenwood Avenue, for the erection of a fourth unit at its works at the foot of Market Street, Chester, to cost about \$250,000.

PHILADELPHIA, PA.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to Thomas Reilly, Seventh and Sedgely Streets, for the construction of the proposed power house and two transformer stations at the League Island Navy Yard, to cost about \$129,986.

SHAMOKIN, PA.—The school directors have decided to install an electric plant for lighting the high school, at a cost of about \$2,000.

SHARON, PA.—Work has been resumed by the Shenango Valley Electric Light Company on the installation of the new ornamental lighting system.

BALTIMORE, MD.—Preparations are being made by the City Council to begin work at once on the installation of new electric conduits, wires, etc., in Hollins Street, Hollins Market and Carrollton Avenue.

INDIAN HEAD, MD.—The War Department, Washington, D. C., is contemplating the construction of a plant to manufacture nitrates for naval explosives at Indian Head, for which an appropriation of \$9,150,000 will be made.

FREDERICKSBURG, VA.—Plans are being considered for the installation of a power plant and laundry at the State Normal School.

PEARISBURG, VA.—The Giles Power Company, recently incorporated with a capital stock of \$50,000, proposes to construct an electric plant to cost about \$30,000. The plans provide for the erection of an electric transmission line to connect Pearisburg, Narrows and Glenlyn, a distance of 15 miles. All equipment, it is understood, has been purchased. Bernard Mason is president, and L. C. Hale secretary and manager.

RICHMOND, VA.—Swift & Company, it is reported, are contemplating the construction of an addition to their local cold-storage plant, to cost about \$22,500.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 10, under specification 3028, for furnishing cranes for aero storehouses. For further information address the chief of bureau.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 10 for mechanical equipment, except lighting fixtures, for the United States immigration station at Boston, Mass. Drawings and specifications may be obtained at the above office or from the supervising chief engineer, room 137, Post Office Building, Boston.

WASHINGTON, D. C.—Contracts have been awarded by the War Department for the establishment of two picric acid plants, one to be located at Brunswick, Ga., and the other at Little Rock, Ark., to cost about \$7,000,000 and \$4,000,000 respectively. The contract for the Brunswick plant has been awarded to the Butterworth-Judson Company of New York, N. Y., and the Little Rock plant to the Everly M. Davis Chemical Corporation.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 11 for furnishing and installing lighting fixtures in the United States post offices at Bad Axe, Mich.; Basin, Wyo.; Chapel Hill, N. C.; Farmville, Va.; Forsyth, Ga.; Glasgow, Ky.; Hollidaysburg, Pa.; Kendallville, Ind.; Raton, N. M.; Rogers, Ark.; St. Peter, Minn.; Twin Falls, Idaho; Valparaiso, Ind.; Washington, Ga.; the new post office at Portland, Ore.; the post office and court house at Jasper, Ala.; and Las Cruces, N. M.; and the United States post office and custom house at Beaufort, S. C., and Newport, R. I. For details see Searchlight Department.

North Central States

APPLEGATE, MICH.—The City Council has purchased equipment for a municipal electric-light plant, which will be placed in the building of Garbutt Brothers.

DETROIT, MICH.—The Detroit United Railways Company will soon begin work on the construction of an extension to the Ford submarine chaser plant in Springwells.

DETROIT, MICH.—The water power of the River Rouge, where the great industrial projects, consisting of a large blast furnace, shipbuilding and tractor plant of Henry Ford, are being erected, it is announced, will be utilized to generate electricity.

HASTINGS, MICH.—Plans are being prepared by the Consolidated Press Company for the erection of a foundry and storage building, 130 ft. by 220 ft., a pattern building, 75 ft. by 150 ft., and a small forge shop. Frank Chase, Inc., industrial engineer, Chicago, Ill., has charge of the engineering and construction work.

HOMER, MICH.—The Homer Electric Light & Power Company is contemplating extensions to its plant.

KALAMAZOO, MICH.—The City Utilities Commission is considering remodeling the downtown ornamental lighting system. It is proposed to remove the arms from the lamp standards and place a single high-candle-power lamp on each post.

TEKONSHA, MICH.—The local electric-light plant was recently damaged by fire, causing a loss of about \$5,000.

AKRON, OHIO.—The Northern Ohio Traction & Light Company, it is reported, will soon begin work on the construction of an extension to its Belden Avenue line. The cost of the work is estimated at about \$50,000.

CANTON, OHIO.—The Canton Gas & Electric Company has petitioned the State Utilities Commission for permission to erect a high-tension transmission line along the right of way of the Chicago, Burlington & Quincy Railroad Company.

CINCINNATI, OHIO.—The Superior Electric & Manufacturing Company, manufacturer of electric generators and motors, has removed its plant from 610 Baymiller Street to a building at 118 West Third Street, where its present plant will be increased. Only a small amount of new equipment, it is understood, will be required.

CLEVELAND, OHIO.—Plans are being considered by the Wellman-Seaver-Morgan Company for the erection of a new power house, to cost about \$30,000. The proposed building will be 46 ft. by 97 ft., and will be equipped with steam-heating apparatus, electric-lighting, steam and power equipment.

CROOKSVILLE, OHIO.—The Central Power Company is extending its electric transmission line from Crooksville south to Bearfield Township, where a new plant will supply power for the Jones Coal Company. A branch line is also being erected to the mines of the New York Coal Company at Rose Farm.

NORWOOD, OHIO.—Bids will be received at the office of the auditor of the city of Norwood, corner of Elm and Montgomery Avenues, Norwood, until June 17 for \$15,000 in waterworks and electric light plant extension bonds, to provide funds for extensions and improvements to the waterworks and electric-light plant. W. R. Suhr is auditor.

CONNERSVILLE, IND.—The Rex Manufacturing Company, it is reported, has placed contracts for the installation of an electric plant of about 600 hp.

RICHMOND, IND.—The Board of Public Works has asked the City Council to appropriate \$55,000 for extensions and improvements to the municipal electric-light plant. The proposed improvements will include the construction of a dam and screen and the purchase of a new boiler.

TERRE HAUTE, IND.—The Buettner & Shelburne Machine Company is erecting an

addition, 47 ft. by 197 ft., to its plant, which will be used for the construction of electrical equipment for mining machinery. A number of lathes, drill presses and other machine tools will be required. Arthur Shelburne is general manager.

DEPERE, WIS.—The DePerre Manufacturing Company has revised plans for extensions to its boiler and structural shops, formerly the Lyons Boiler Works, and will increase the size of the addition to the boiler shop from 60 ft. by 100 ft. to 100 ft. square; the addition to the machine shop will be 32 ft. by 200, and the smithy 24 ft. by 40 ft. The foundry will be converted into a structural shop. Ward Clark is general superintendent.

MARSHFIELD, WIS.—The Council is considering a proposal submitted by the Wisconsin Valley Electric Company of Wausau for either leasing or purchasing the local electric-light plant.

MILTON JUNCTION, WIS.—An election will soon be called to submit the proposal to purchase the local electric-light plant to be owned and operated by the municipality. The purchase of the water-works system is also under consideration.

TURTLE LAKE, WIS.—W. L. Alban, architect, Endicott Building, St. Paul, has been engaged by the Board of Education to prepare plans for a new high school building, with manual training and domestic science departments, to cost about \$50,000.

CALEDONIA, MINN.—The right of way for an electric railway between Caledonia and Houston is reported to have been purchased. The officers of the Preston (Minn.) Light & Power Company, it is stated, are interested in the project.

ST. PAUL, MINN.—Plans are being prepared by Lambert Bassindale, architect, Capital Bank Building, St. Paul, for a hospital building and power plant for the Northern Pacific Mutual Beneficial Association in St. Paul, to cost about \$300,000. H. B. Smith, 203 Railroad Building, is president of the association.

DAVENPORT, IOWA.—The Muscatine Lighting Company has been granted a franchise to erect an electric transmission line in Cleona Township to supply energy to the Farmers' Electric Light Company.

NEOLA, IOWA.—Improvements are contemplated to the local municipal electric-light and power plant, involving an expenditure of about \$16,000.

ARCHIE, MO.—The Green Light & Power Company of Pleasant Hill is reported to be considering extending its electric transmission lines to furnish electricity in Archie.

MAYSVILLE, MO.—Improvements to the local electric-light plant, it is reported, are under consideration.

MARMARTH, N. D.—The local electric-light plant was recently destroyed by fire.

POLLOCK, S. D.—The installation of an electric-lighting plant in Pollock is under consideration. The Council is considering a proposal submitted by the Dakota Electric Company, which is planning to install a plant for its own use, to erect a larger plant and furnish electrical service in the town.

Southern States

HENDERSON, N. C.—The Henderson Box & Lumber Company would like to receive prices on the following electric equipment: One 150-hp. engine, one 150-hp. boiler and a 150-kw. generator, directly connected, switchboard and instruments.

CALHOUN, GA.—The Georgia Railway & Power Company has completed a new 66,000-volt substation in Calhoun and has also installed a 2000-kva. synchronous condenser at the Lindale substation.

MACON, GA.—The Chamber of Commerce has appealed to the City Council to have the ornamental lighting system extended from Broadway to the Terminal Station.

METTER, GA.—The City Council has recently purchased another crude-oil engine for the municipal electric-light plant.

CUTLER, FLA.—Contract has been awarded by the War Department, Washington, D. C., to the St. Johns Construction Company of Miami, for the erection of thirty buildings for the aero gunnery school for Signal Corps, including officers' quarters, barracks, mess halls and four steel hangars. The cost is estimated at \$300,000.

FLORIDA CITY, FLA.—The installation of an electric-lighting plant in Florida City is reported to be under consideration by De Berry Brothers.

ST. AUGUSTINE, FLA.—Work will soon begin on the construction of the Flagler Hospital under the supervision of Charles

Leyvrez of St. Augustine. The building will be equipped with electric elevators, silent call system, etc.

SARASOTA, FLA.—The City Council has engaged W. H. Glun, engineer, Sanford, to appraise the local electric plant, make surveys and prepare plans for improvements. The city is considering the construction of an electric plant to supply electricity for municipal and domestic purposes and to operate the waterworks; also to extend the water and sewer systems.

JENIFER, ALA.—Improvements are contemplated by the Central Alabama Coal & Iron Company to its local plant, including the erection of an additional hot blast stove, installation of complete electrical equipment, machine shop, etc.; the construction of additional washer at brown-ore mines adjoining furnace, adding 50 coke ovens to present battery of 100 at coal mine. The plant is operated by the Thomas Furnace Company.

LITTLE ROCK, ARK.—The Mutual Motors Company, Southern Trust Building, is planning to equip a plant for rebuilding motors. Shop equipment, including lathes, drill presses, battery-charging outfit, air compressor, small shop tools, etc., will be required. The cost is estimated at \$50,000.

VILLE PLATTE, LA.—Bids will be received by the city until June 4 for extensions to the municipal electric-lighting plant, including a 35-kw. alternator, building and line extensions, motor-driven pump, switchboard and transformer, moving and repairing one engine and General Electric generator. Specifications are on file at the office of A. C. Jones, Opelousas, La.

Pacific and Mountain States

LOON LAKE, WASH.—Plans have been prepared for the construction of a 100-ton concentration mill at the plant of the Loon Lake Copper Company, to cost about \$40,000. The plans provide for the installation of considerable electrical machinery.

SEATTLE, WASH.—The plant of the Vulcan Manufacturing Company has been purchased by the Frank Waterhouse Company, which proposes to expend several hundred thousand dollars to enlarge the property. Main engine castings, heavy overhead traveling cranes, cargo winches, shaftings, etc., are manufactured in the plant.

CORNING, CAL.—The Northern California Power Company of San Francisco has submitted a proposal to the Board of Trustees for the installation of an electric-lighting system in Corning.

KINGMAN, ARIZ.—Preparations are being made by the Schuykill Mining Company for the installation of a power plant to furnish power for its proposed 200-ton milling plant, now under construction.

PHOENIX, ARIZ.—Plans have been prepared by the Board of Managers of the State Hospital for the Insane for the construction of a power plant at the institution.

YUMA, ARIZ.—Plans are being considered by the Imperial Oil Mills Company for the erection of new electric light and power lines on the highways of Yuma Valley.

Canada

NEW WESTMINSTER, B. C.—Improvements and extensions involving an expenditure of about \$5,000 are contemplated to the municipal electric-light plant.

BARRINGTON, N. S.—The installation of an electric-light plant, to cost about \$8,000, in Barrington, is under consideration.

THEDFORD, ONT.—The Town Council is considering the installation of an electric-light and power system in Thedford.

Miscellaneous

HILO, HAWAII.—Plans are being prepared for the construction of a hydroelectric plant in the Kohala district on the property of Dr. Bond. The proposed plant will cost about \$20,000 and will supply electricity to the new girls' seminary and also to residents and factories in that district.

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until June 14 for furnishing the following supplies: Motor-generator sets, capstans, radiators, motor-driven pumps, motor trucks, etc. Further information may be obtained at the above office.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burrill, 8 West Fortieth St., New York. Annual meeting, Atlantic City, Oct. 8 and 9.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, W. J. Tharp, Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, September, 1918.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, A. H. Halloran, San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, M. C. Gilman, Toronto Electric Light Company. Annual meeting, Ottawa, Can., June 21.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL ASSOCIATION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

CONNECTICUT ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, George M. Chapman, Waterbury, Conn.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Cleveland, November.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavelly, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago. Meeting, Hot Springs, Va., May 30, 31, June 1.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga. Annual meeting, June, 1918, Tybee Island, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

Directory of Electrical Associations

Printed in the First Issue of Each Month

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, City College of New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual convention, Atlanta, Ga., Sept. 24-27.

OKLAHOMA GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION. Secretary, L. W. Morrow, Norman, Okla.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MASSACHUSETTS ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. E. Wilson, 263 Summer St., Boston, Mass.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

MISSOURI ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, H. C. Brown, 110 West 40th St., New York.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York. Convention, Atlantic City, N. J., June 13 and 14.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, Chicago, June 17 and 18.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Convention, Cedar Point, Ohio, July 10, 11, 12.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekun Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PENNSYLVANIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual meeting, June 19-20, Atlanta.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Banglebaugh, 703 First National Bank Building, El Paso, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Va.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, Green Bay, Wis.

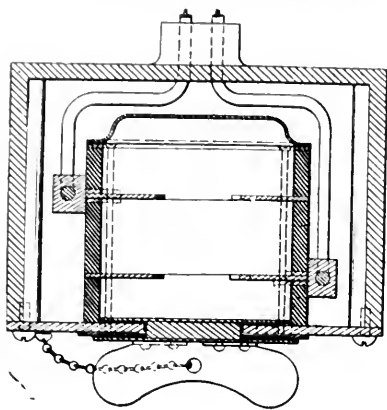
WISCONSIN ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

(Issued April 30, 1918.)

- 1,264,876. **AUTOMATIC TELEPHONE EXCHANGE**; Frank A. Lundquist, New York, N. Y. App. filed July 10, 1916. Improvements in the construction and operation.
- 1,264,933. **BINDING POST**; Fritz P. Mansbender, Brooklyn, N. Y. App. filed May 10, 1916. Holds a conductor of any cross-section.
- 1,264,988. **PROTECTIVE DEVICE FOR ELECTRIC UTENSILS**; Frederick E. Carlson, New Britain, Conn. App. filed April 13, 1917. Means for breaking the circuit in case the utensil becomes overheated.
- 1,264,972. **SPARK-PLUG TESTER**; Bernard A. Narveson, Grand Rapids, Minn. App. filed Dec. 26, 1916. Improvements.

(Issued May 7, 1918.)

- 1,264,889. **TELEGRAPHY**; William M. Bruce, Jr., Springfield, Ohio. App. filed April 27, 1916. For sending uniform electrical im-



1,265,163—Plug and Plug Receptacle for Electric Conductors

pulses of opposite polarity at the beginning and the end of a character.

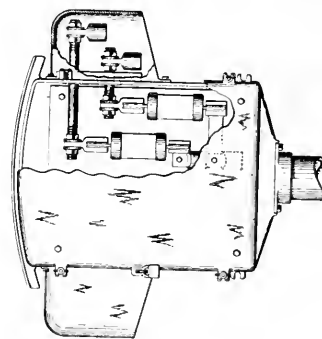
- 1,264,898. **ELECTRIC SWITCH**; Frank D. Clapper, Altus, Okla. App. filed Feb. 21, 1916. A combination switch for controlling one or more electrical circuits dependently or collectively.
- 1,264,931. **MAGNETO**; Otto Heins, New York, and Charles M. Wild, Springfield, Mass. App. filed Dec. 27, 1915. A bipolar armature co-operates with a four-pole field member to produce four ignition voltages per rotation.
- 1,264,933. **TIMER**; Frederick C. Hersee, Boston, Mass. App. filed April 19, 1917. Circuit closer used for controlling the flow-off current to the various igniters of a multiple-cylinder internal-combustion engine.
- 1,264,941. **CONTROL OF ELECTRIC MOTORS AND APPARATUS THEREFOR**; Pearl N. Jones, Pittsburgh, and James W. Welsh, Oakmont, Pa. App. filed July 17, 1915. Improvement.
- 1,264,943. **SYSTEM OF SELECTIVE ELECTRICAL DISTRIBUTION**; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed Nov. 20, 1912. Used with internal-combustion engines.
- 1,264,949. **METHOD OF PRODUCTION OF CYANOGEN COMPOUNDS**; Axel R. Lindblad, Ludyika, Sweden. App. filed June 1, 1916. Improvements.
- 1,264,974. **VULCANIZER**; Joseph H. Reeder, St. Louis, Mo. App. filed Sept. 7, 1917. Electric vulcanizer adapted to receive its heat from low-tension currents.
- 1,264,982. **MEANS AND METHOD FOR METERING ELECTRICITY**; Edmund O. Schweitzer, Chicago, Ill. App. filed Aug. 18, 1915. Inexpensive method and apparatus for accurately metering the consumption of electricity, and more particularly means for affording a satisfactory basis for payment to the central-station company by the consumer for electrical energy furnished to and consumed by him.
- 1,264,992. **MOTOR CONTROL**; Walter C. Strang, Yonkers, N. Y. App. filed Aug. 22, 1913. Automatically operated means for preventing the too sudden reversal of the motor.
- 1,265,000. **ELECTRICAL SYSTEM OF DISTRIBUTION**; William A. Turbayne, Niagara Falls, N. Y. App. filed Feb. 15, 1913. A regulating generator or booster is employed to control the division of load between the main source and the auxiliary source.

Record of Electrical Patents

Notes on United States Patents

- 1,265,017. **PUSH-BUTTON SWITCH**; James M. Wilson, Newark, N. J. App. filed April 1, 1915. For out-door use.
- 1,265,026. **HOOD LOCK**; James W. Alexander, Pittsburgh, Pa. App. filed June 14, 1917. For automobiles.
- 1,265,068. **METHOD AND APPARATUS FOR PRODUCING ALTERNATING CURRENTS**; Reginald A. Fessenden, Brookline, Mass. App. filed Dec. 2, 1914. Production of a wave form adapted for special purposes.
- 1,265,071. **INDICATOR FOR STREET CARS AND THE LIKE**; Charles Flint, Spokane, Wash. App. filed April 26, 1916. Operated by either the motorman or conductor of the car to indicate to the passengers thereof the various stations along the route.
- 1,265,163. **PLUG AND PLUG RECEPTACLE FOR ELECTRIC CONDUCTORS**; Otto Bahls and Theodore Siebert, Jr., New York, N. Y. App. filed Oct. 28, 1916. Reliable in action and thoroughly protected against accidental short circuits during insertion or removal of the plug.
- 1,265,184. **METHOD OF CONTROLLING ELECTRICAL POWER TRANSMISSION**; Herbert B. Ewbank, Jr., Portland, Ore. App. filed May 1, 1916. Improvements.
- 1,265,192. **PRIMING HEATER FOR AUTOMOBILES**; Robert C. Groh and Martin A. Hansen, St. Paul, Minn. App. filed Jan. 4, 1915. Improvements.
- 1,265,197. **ELECTROMECHANICAL TRAFFIC SIGNAL**; Henry W. Hawes, Lynn, Mass. App. filed March 2, 1917. Especially designed for use on automobiles, motor trucks and motor vehicles in general.
- 1,265,204. **METALLIC-FILAMENT LAMP AND PROCESS OF MAKING IT**; Herman J. Jaeger, Weehawken, N. J. App. filed July 27, 1917. Improvements.
- 1,265,213. **ELECTRIC WATER HEATER**; Otto A. Knopp, Oakland, Cal. App. filed June 7, 1916. Thermostatic electric water heater of cheap and rugged construction.
- 1,265,223. **ELECTRIC FUSE**; Israel Marcus, Winthrop, Mass. App. filed Nov. 27, 1916. A simply constructed fuse having a sight opening in one wall of the casing thereof through which it can be determined whether or not the fuse wire therein is broken.
- 1,265,225. **SEMI-AUTOMATIC TELEPHONE SYSTEM**; Talbot G. Martin, Chicago, Ill. App. filed March 3, 1911. Means are provided for automatically indicating to the operator the character of the line calling.
- 1,265,228. **TELEPHONE EXCHANGE TRUNKING SYSTEM**; Edward A. Mellinger, Chicago, Ill. App. filed Oct. 11, 1910. Automatic switches are employed for selecting trunks or other lines.
- 1,265,247. **MAXIMUM DEMAND INSTRUMENT**; George D. Pogue, St. Louis, Mo. App. filed May 12, 1916. For determining the maximum average demand made by a consumer during an interval of prescribed length occurring at any time during a fiscal period.
- 1,265,284. **SEPARATOR FOR STORAGE BATTERIES**; Ira C. Williams and Charles F. Williams, Muncie, Ind. App. filed Feb. 21, 1917. Means for separating the negative and positive plates from each other.
- 1,265,293. **ELECTRIC SERVICE BOX**; Carl H. Bissell and Harold P. Hastings, Syracuse, N. Y. App. filed Jan. 25, 1913. Especially applicable for housing the terminals, switches, fuses, etc., in branch circuits leading from the main circuit into a building or factory.
- 1,265,294. **ELECTRICAL APPLIANCE**; Carl H. Bissell and Elda G. Smith, Syracuse, N. Y. App. filed Aug. 7, 1914. Adapted for storage-battery-charging stations in railroad terminals and coach yards.
- 1,265,342. **ELECTRIC ARC WELDING**; Otis A. Kenyon, New York, N. Y. App. filed March 14, 1918. Improvements.
- 1,265,360. **PROCESS FOR PRODUCING ALKALI METALS OR THE LIKE**; Walter L. Morrison, Canonsburg, Pa. App. filed Aug. 17, 1916. Improvements.
- 1,265,361. **BURGLAR ALARM**; Emil Muringer, New York, N. Y. App. filed May 29, 1916. Improvements.

- 1,265,398. **AUTOMATIC TELEPHONE CENTRAL-STATION APPARATUS**; Alton E. Stevens, Providence, R. I. App. filed April 28, 1917. Designed to allow faulty or broken parts to be easily removed and perfect ones substituted.
- 1,265,428. **ELECTRIC SIGNALING CIRCUIT-CLOSING ALARM**; Ralph S. Clayton, Philadelphia, Pa. App. filed Jan. 28, 1915. Improvements.
- 1,265,433. **ELECTRIC HEATING UNIT**; Ransom W. Davenport, Detroit, Mich. App. filed Jan. 24, 1916. Improvements.
- 1,265,453. **METAL ELECTRODE USED IN ELECTRIC-ARC DEPOSITION OF METALS**; Ernest H. Jones, Canonsburg, London, England. App. filed Sept. 29, 1917. Improvements.
- 1,265,454. **IGNITION SYSTEM**; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed April 3, 1916. Combined with combustion or explosion engines.
- 1,265,455. **ELECTRIC FITTING**; George C. Knauff, Chicago, Ill. App. filed Dec. 9, 1915. Provides an electric fitting in which one of the wire terminals may be easily and cheaply connected to a conducting shell portion, and in which the juncture of the wire with the shell portion may be readily concealed.
- 1,265,472. **COMBINED BURGLAR OR FIRE ALARM**; Carey T. Matthews, Kennebec, N. C. App. filed July 14, 1916. Uses a plurality of signal devices having different signaling characteristics so as to distinguish, for example, between a fire alarm and a burglar alarm.
- 1,265,485. **ELECTRICAL FURNACE**; Hans Nathusius, Friedenshueette, Kreis Beuthen, Germany. App. filed Oct. 5, 1914. Designed for carrying out metallurgical processes for obtaining zinc.
- 1,265,513. **DASHBOARD LAMP SOCKET**; Edward S. Preston, Chicago, Ill. App. filed May 23, 1917. Improvements.
- 1,265,517. **INCANDESCENT LAMP SOCKET**; Jacob Ribaysen, Chicago, Ill. App. filed June 15, 1916. Improvements.
- 1,265,551. **ELECTROLYTIC APPARATUS**; Charles H. Thomson, Maryville, Tenn. App. filed April 7, 1917. For the separation of aluminum and other metals from ores by electrolytic action in a fused bath.
- 1,265,554. **ELECTRIC WATER HEATER**; Salvatore M. Valdes, San Antonio, Tex. App. filed Nov. 28, 1916. A device within a metallic shell or casing which does not come into electrical connection with the live wire of the circuit.
- 1,265,576. **ELECTRIC CUT-OUT**; Gilbert Wright, Schenectady, N. Y. App. filed May 5, 1915. Excessive current flow is brought about by overheating of a fusible member or body in consequence of such flow.
- 1,265,589. **TELEGRAPH SOUNDER**; Arthur W. Beauprie, Atlanta, Ga. App. filed Feb.



1,265,293—Electric Service Box

- 12, 1916. Capable of being operated by alternating current.
- 1,265,594. **DYNAMO-ELECTRIC MACHINE**; Seven R. Bergman, Nahant, Mass. App. filed June 18, 1917. Armature reaction is neutralized and the exciting flux of the machine is produced by a single field winding whose magnetizing axle is displaced approximately 45 electrical degrees from the magnetizing axis of the armature winding.
- 1,265,613. **ART OF ARC WINDING, HEATING AND THE LIKE**; Charles L. Coffin, Parks, Ga. App. filed April 5, 1916. So to utilize the heat of an electric arc to heat the material to be operated upon that an excessive rush of current is avoided, both at the commencement and throughout the heating operation.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN

Volume 71

New York, Saturday, June 8, 1918

Number 23

Favorable Position of Electric Public Utilities

FOURTEEN months of war finds the electric utilities of the country in a generally favorable position. While there have been slight handicaps in obtaining sufficient fuel and in financing extensions, not to mention maturing obligations, these troubles have been more or less common to all industries and are part of the price to be paid for liberty. Their weight, however, has not been sufficient to crush, and the sacrifice has certainly been worth while. Manifestly, in war times there must be pain and suffering, losses and personal surrender of conveniences and comforts, of income, of family and of friends. This is so apparent and so inevitable that one marvels at the frantic efforts of the unthinking and unpatriotic to stem the tide of national aspirations and impulses which will bear them on whether they will or not to final victory. Efficiency of production and of use must during war be absolutely insisted on. There must be no waste of men or of material, of labor or of product in the industries essential to the winning of the war, and the less essential industries must be converted to more essential industries as speedily as possible.

Ability to meet demands for power in spite of the irregularities of transport and high cost of fuel have served to establish the principle of central-station power production more firmly than ever, and the coal-zoning system will serve to accentuate its economies. Public utilities, owing to lack of equipment, of fuel and of money, have not always been able to take full advantage of all of the opportunities offered for increasing loads; but this is not altogether a misfortune. Viewed in a certain light, the difficulties of raising money have been advantageous and serve as a check to over-expansion. With the great power shortage that exists throughout the country and a fuel situation destined to become worse with time, the temptation to reach out after supposedly lucrative but in reality short-lived business would, with an easy money market, be hard to overcome.

The necessity for higher rates for electric service, especially for industrial work, is being very generally recognized by public service commissions and by the national administration as well. Not all companies will be able to obtain increases, but a rise in the cost of electric service to consumers will continue to be very general throughout the United States. It was only after a year of war that the necessity for higher rates became apparent in Great Britain, and increases were very generally permitted by the various municipalities throughout that kingdom. New equipment will be in-

creasingly difficult to get unless it can be proved that the generating apparatus is absolutely essential to the conduct of the war. The Fuel Administration is already on record as promising 100 per cent fuel to the central stations of the country, but this presupposes that the fuel will be used efficiently and that the electricity generated from it will be employed only for municipal, domestic and essential industrial purposes.

Owing to many circumstances, the financial outlook has caused some operators much concern. Observation and inquiry, however, fail to reveal any tendency on the part of the public or of the authorities to weaken the integrity of public service corporations or cause them undue embarrassment. It was erroneously supposed by many managers that when their maturing obligations became due or when they needed money for extensions it would only be necessary to certify to these facts before the War Finance Corporation, which would thereupon make the necessary advances. That the War Finance Corporation never had any such notion of its obligations has since become apparent to many managers. If the government requires electrical energy or extensions beyond the power of the utility to furnish, the particular branch of the government desiring the work may advance the necessary funds or the War Finance Corporation may in exceptional cases make loans on excellent security. However, many central stations supplying industries engaged in work both necessary and contributory to the prosecution of the war will not be able to obtain financial relief except through their own efforts. No money for unnecessary work can be obtained by any means.

The demands for electricity will undoubtedly become very much greater as the war progresses, and every facility for increasing the supply through interconnection of systems or other means not involving a greater outlay of fuel, equipment or money will have to be employed. The signs for favorable water-power legislation which will permit hydroelectric development were never so bright, and the disposition of the government is to frown on any further extension of isolated plants and to encourage the use of central-station service everywhere. The government itself is practicing what it preaches and is using public utility service wherever possible, even suggesting an increase in the size of central stations for that purpose. The prospect was never better, and the end of the war should find central stations more efficient as producers and distributors of electricity and more firmly established than ever.

Electric Utilities in the War Program

Taxing Their Facilities to the Utmost, Proving that They Are Highly Essential in War as in Peace, These Properties Have Received Recognition from President Wilson

THE electric public utility is one of the greatest factors in the mobilization of industries for war. Important as it was before the war in the home and industrial life of the nation, it is manyfold more impressive to-day as the source of dependable power for vital industries engaged in making munitions and other strict necessities of life.

Handicaps—and they have been severe in the last year—have not prevented the electric central stations of the country from rendering that uninterrupted service which is one of the main secrets of their usefulness in the economic life of the community.

Meeting demands which tax their facilities to the last kilowatt-hour of possible production in many cities, the managing officials and employees are straining every resource to avoid breakdowns and maintain the supply of energy unimpaired.

Within the industry the significance of the fact that the output has doubled since the beginning of the European war four years ago is generally appreciated, though there is naturally some wonder that the development has been so tremendous, but without the industry it is doubtful if the facts are understood or even known as generally as they should be.

A stabilized business like that of the central stations, involving enormous investment in proportion to the gross turnover, shows under normal conditions a gradual moderate rate of increase from year to year. As a rule this calls for additional investment in fair proportion to the additional business.

TESTED BY THE WAR

The grim fact of war destroys all precedents, and the electric central station, like all other industries, has been swept into the arena and tested by the rough economic forces which now control the world. It has developed greater production than ever before. It has proved beyond any question that it is in every sense essential to the life, health and comfort of the civilian population and to the successful production of munitions for the military forces. By close, intensive development it has made the utmost use of its generating and line capacity.

It is doubtful if before the war any one having responsible authority took the trouble to appraise the central stations of the country with respect to their value in military defense. Certainly, if military motives had controlled the nation, if industrial efficiency had been regarded as a first requirement, the development of central stations would not have proceeded on very different lines from those actually followed. In other words, the plain truth is that these properties, developed wholly upon ordinary commercial lines, were, because of the high degree of efficiency which they attained, in a position where they were immediately of value in the entire plan of military construction and mobilization.

That this is so may fairly be taken as a tribute to the engineering and managerial bases on which these

properties have been built. The American system of large volume output, concentrated production with great generating units, is admitted to be the best one. If it had required justification, which it did not, that justification would have been furnished by the readiness with which the industry met the stern demands of war time.

THE TRADITIONAL UNFAILING SUPPLY

The country is full of instances of service rendered to industries which are producing on an unprecedented scale because of the unfailing supply of electrical energy twenty-four hours a day. This quality of service could not have been rendered if it had not been for the traditional policy. The central stations have not only met the normal increase in demand in their communities, they have anticipated it, and therefore they had a margin in reserve when that margin may have been a powerful element in the successful conduct of the war against unscrupulous Germany.

Central stations are commercial organizations, engaged in business for a profit, and therefore their war work is part of their regular operations. But, lacking the same measure of control over their operations which is held by ordinary commercial institutions, they are feeling in keener degree as time passes the effect of the extraordinary influences resulting from the war. It is for this reason that they have been taking steps to lay the facts before the public and the constituted authorities.

Many properties must have relief in some way if they are to continue to earn a fair return on the investment. Costs are uncontrollable, and the obligation to render service is unavoidable. The regular merchant or manufacturer thinks little of raising prices under similar circumstances. What can the utility do?

HIGHER RATES NEEDED

Part of the extra cost of the utility has been absorbed through new economies, greater use of the property, etc. But when the margin of safety becomes smaller month by month and deficit looms in the background the central-station manager is impelled to take radical steps. So far has the principle of regulation been adopted that usually rates can be advanced only by approval of the state public service commission or when no complaint or investigation against such action develops before that body.

Under the present situation the serious needs of the utilities are receiving more consideration than ever before from those not directly responsible to owners of the properties. In many cases commissions have granted relief through higher rates or have refrained from proceeding against advances in schedules because they knew the critical character of the emergency.

The case of the utilities has received recognition in another quarter. When the President of the United States turned from his overwhelming burden of war



*Woodrow Wilson,
Liberty War President of the United States*

"It is essential that these utilities should be maintained at their maximum efficiency and that everything reasonably possible should be done with that end in view. I hope that state and local authorities, where they have not already done so, will, when the facts are properly laid before them, respond promptly to the necessities of the situation."



W. G. McAdoo,
Secretary of the Treasury

"It is obvious that every part of our industrial and economic life should be maintained at its maximum strength in order that each may contribute in the fullest measure to the vigorous prosecution of the war. Our local public utilities must not be permitted to become weakened."

responsibility to speak on their behalf, it was an act of conspicuous justice and courage. With Secretary McAdoo and Comptroller of the Currency Williams, President Wilson clearly appreciates the paramount importance of the utilities in the war program and the unescapable conclusion that they must be kept efficient.

NATIONAL COMMITTEE REPORT ON CONDITIONS

Coal Supply Situation in East Far from Satisfactory,
New England Anxious, Middle West
in Better Shape

A report of the National Committee on Gas and Electric Service, covering recent activities, says in part:

The Fuel Administration has found it necessary to modify the zoning system of bituminous coal distribution and will no doubt make other changes from time to time as conditions arise making these necessary. Among the consumers of the classifications named in preference list No. 1 of the Priority Board who are to receive coal in preference to any other individual or class of consumers, public utilities as a whole are listed.

Every effort is being made by the Fuel Administration to increase production and to secure for all public utilities sufficient coal to permit them to have a reserve for the winter. The situation in the East is far from satisfactory. New England is very anxious regarding future conditions and supply. The Middle West seems to be in much better shape, as we are advised that it is securing reserve stocks. This should go a long way toward carrying it through the winter if it can continue for the next few months to receive coal in the quantities shipped recently.

It is desired to urge all members to make every effort to secure as much storage coal as possible and as soon as pos-

sible. This is most important for the future success of their plants. Favorable reports issued from time to time should not lessen the activities of our member companies in securing coal for next winter. Nothing as yet has been decided regarding the cancellation of coal contracts made previous to Aug. 23, 1917.

In furtherance of the determination of the Fuel Administration to prevent the marketing of unclean coal, inspectors have been appointed to designated districts.

The committee has been very active during the last month with the Quartermaster and Ordnance departments in connection with furnishing details as to available power and in making contracts for the additional power required by these several departments.

The War Department in making contracts for electric service with the various electric light and power companies has found that conditions vary in different communities, and in order to avoid complications it contemplates having prepared a form of contract which will be satisfactory to both the public utilities and the War Department and which, it is hoped, will be in accordance with the regulations of the various public service commissions. The public utilities have presented for signature their forms of contract, authorized and regulated in accordance with the view of the public service commissions, and these have varied in numerous instances, as stated; hence the decision of the War Department to issue a uniform contract.

The matter of turbine deliveries to public utilities is becoming more acute all the time, and the War Industries Board finds it necessary practically to assign dates of delivery for the manufacturers in accordance with the importance of the needs of the utilities. While this is not intended as a commandeering process, it has been found necessary in order that the needs of the government for the various plants in construction throughout the country shall be taken care of as to power equipment.

The Interstate Commerce Commission has entered an order setting dates for hearings before Commissioner Aitchison in its investigation preparatory to revising time in accordance with the daylight saving law.



John Skelton Williams,
Comptroller of the Currency

"The continued and increasing efficiency of these corporations is important for the successful conduct of the war. This efficiency is not possible with present conditions."

Electricity Restricted in England

Practically All Central Stations in Areas Where Work of National Importance Is Being Done Are Controlled by the Government as to Extensions, Purchases and Service Connections

IN ORDER that central-station managers in this country may have some concise information on central-station conditions and restrictions in England, the ELECTRICAL WORLD, through its London office, has gathered some pertinent facts on the situation there.

There have been a number of regulations since the commencement of the war which have either directly or indirectly restricted the output of electricity. The first of these restrictions, under the defense of the realm act, was due to the Zeppelin raids. Under this act all external lamps, whether public or private, are extinguished excepting such as are required for the public safety and approved by the Commissioner of Police. Those lamps not extinguished must have all direct light cut off, the only light allowed to escape from the lamp being a diffused light on the ground. Lamps in dwellings, factories and other premises must be reduced in brilliancy and shaded by means of dark curtains so that no more than a dull subdued light is visible outside the building. Only sufficient light is permitted on the tramways to enable fares to be collected.

A slight relaxation in the lighting restrictions took place in 1917, but in the beginning of 1918 a further order was issued prohibiting show-window lighting entirely. This was due to the shortage of generating plant in the power stations and the need for economy in coal. The order also enacted that places of entertainment should not use electricity before 1.30 p. m. and should cease using electricity at 10.30 p. m. Hotels, restaurants and other similar establishments are prohibited from cooking meals between 9 p. m. and 5.30 a. m.

INCREASES IN RATES

Owing to large increases in the price of coal and other material, as well as to the increased wages paid to employees (the increases in the case of coal and wages being authorized or imposed by the government), the price of electricity throughout the realm has been substantially increased. This, of course, has caused consumers to economize further in the use of electric light.

The solicitation of new business has been practically abandoned because it is necessary to obtain permits for consumers' motors or wiring material and for new plant and mains for the generating stations. At present no permits can be obtained except for supply to munition factories or other works of national importance and no services costing over \$50 may be fitted without the approval of the government. It should be mentioned in this connection that underground distribution prevails for the most part throughout Great Britain.

Even before these restrictions came into force the extension of generating stations and of service connections was greatly hindered because of the extreme difficulty of getting goods from the manufacturers and the great shortage of labor.

The latest order, which restricts the consumption of electricity south of a line drawn from the Wash to the Bristol Channel, was promulgated on April 2, 1918.

Its issue became imperative in the national interest owing to the reduced output of coal arising from the shortage in means of transport and the withdrawal of large numbers of men from the mines.

The order provides that the consumption of electricity by any consumer for any purpose whatsoever must not be more than five-sixths of the amount used on the same premises during the corresponding quarter of the years 1916 and 1917, whichever was the greater. "Premises" means any place in which electricity is consumed, and any portion of the premises supplied by a separate connection is deemed to be a separate premise.

In no case is the consumer compelled to reduce his consumption below the quarterly amounts set out in the "schedule to the order," reproduced here, but if this did not exceed the amount in the schedule his consumption must not exceed his previous consumption in the same quarter of 1916 and 1917.

SCHEDULE TO THE ORDER

Quarter of the Year	Kilowatt-hours
March 25 to June 24.....	20
June 24 to Sept. 29.....	20
Sept. 29 to Dec. 25.....	40
Dec. 25 to March 25.....	40

Consumers who made any material alterations in their installations between March 25, 1917, and March 25, 1918, may apply to the utility company for an assessment.

If the consumer did not occupy the premises during the whole of 1917, the utility company will, on application, state what amount may be consumed during any quarter for which comparative figures are not available to the consumer. If dissatisfied with the company's assessment, the consumer may appeal to the Board of Trade.

The Board of Trade may grant licenses on special grounds exempting persons or premises from the provisions of the order, which does not apply to establishments controlled under the munitions of war act, 1915, or to hospitals or premises which are and were on March 21, 1918, bona fide nursing homes.

Additional restrictions applicable to hotels, restaurants, clubs and places of entertainment, also prohibiting the lighting of shop fronts, are set forth in the order.

Infringements of the order are summary offences against the defence of the realm act.

Each utility company is compelled to report to the Board of Trade any person whose consumption appears to exceed that permitted by the order. The indications are that the maximum amount of electricity that may be consumed for domestic and shop purposes will be definitely fixed shortly.

The restrictions on purchase of materials began to be felt early in 1916, when the Minister of Munitions by virtue of the powers conferred upon him under the

defense of the realm act issued certain orders restricting the purchase and use of certain classes of materials, chief among which were steel and copper.

UTILITIES ARE ESSENTIAL INDUSTRIES

Central stations were authorized to place ordinary orders other than for steel and copper under rules establishing this order of priority: (a) Repairs to existing industrial machinery but not the replacement of old machinery by new; (b) the maintenance of reasonable stocks of materials for approved contracts; (c) export orders properly certified; (d) contracts necessary for the conduct of the war; (e) other contracts certified as important in the national interest. In the case of large orders for generating equipment application is to be made to the Ministry of Munitions for a special permit. Special permits must also be obtained for the purchase of steel and copper.

The supply of electricity by most of the London companies has been certified by the Ministry of Munitions under Clause 9 (1) (d) of the munitions of war (amendment) act, 1916, to be essential to the conduct of the war. These utilities are subject to the regulations of the ministry as regards recruitment of employees and execution of orders, but are in a stronger position than those industries which are uncertified, which as regards protection of employees from military service must rely on appeals to tribunals.

The indispensable employees of the "certified" undertakings are protected under a schedule of protected occupations issued by the Admiralty, War Office and Ministry of Munitions.

Central stations desiring turbo-generators, motors, boilers, switch gear, etc., must obtain a permit from the ministry before the material can be purchased. There is a severe restriction on the manufacture of watt-hour meters, and a special permit for the purchase of new meters is necessary.

There are five existing grades of priority in force at present, namely, P.1, P.2, P.3, P.4, P.5. Generally, new plant equipment is bought under P.4 certificates, and for stores and other similar materials nothing higher than a P.5 certificate is issued.

Central stations in large metropolitan districts like London have special authority from the ministry for the issue of priority certificates for material and work necessary for maintaining their stations. These certificates are as follows:

(a) Class A P. 4, authorizing the purchase of materials and work necessary for any urgent repair necessitated by an occurrence in the nature of a breakdown to maintain existing running machinery and plant. A copy of the order has to be sent to the ministry, and if the classification for the work is queried notification will be given by the ministry to this effect within seven days.

(b) Class B P. 5, for repairs and materials for repairs to maintain in working order the existing plant and customers' installations. No new units of machinery, however small, even in the nature of replacement, to be ordered under this permit. This permit does not cover requirements for new meters, cable required for use outside the power station, lead or articles composed wholly or partly of lead. A report of all material purchased under this ministry permit must be sent in monthly.

Severe restrictions are enforced on the use of lead-sheathed cables, and a special ministry permit, which is only issued for war work or work of real national importance, is necessary in each case for their purchase. Generally speaking, the ministry eventually

grants permission for the purchase of lead-sheathed cables for extra high-voltage working and also, in many cases, for high-voltage working, although almost invariably the ministry first requests the use of cables without lead covering. Permission to purchase lead-covered cable for low-voltage working is granted in very exceptional cases only.

SERVICE CONNECTIONS

The Ministry of Munitions raises no objection to additional connections being made, subject to the utility's compliance with the following conditions:

(1) That it has adequate generating plant capacity available.

(2) That no lead-covered cable is used on the connection.

(3) That the cost of connection (including any mains extensions) to be borne either by the utility or by the consumer does not exceed £10 (\$50).

(4) That the utility forward to the director of electric power supply at the end of each month a list of consumers connected during the month, giving name, address, purpose (*e.g.*, private house, ironmonger's shop or paint manufacturer), kilowatts installed and cost of connection.

Where additional power is required the utility is requested by the ministry to give this information:

(1) Whether it is willing to undertake the work.

(2) The amount of power to be taken.

(3) The present load on the power station.

(4) Length and size of cable, quantity and specification of other articles and materials required for the job, and whether the same are in stock.

(5) Margin of available plant in power station.

COAL SITUATION

Practically all extensions of supply have been limited to those required for war work. The demands, however, have been so great that the majority of public supply undertakings have largely increased their output.

A consideration of great importance has been that of fuel economy, and power users generally have been much more disposed to use the public supply than to generate their own power on account of increased difficulties in obtaining coal.

The coal transport problem has led to restrictions being imposed in the south of England, but up to the present no restriction on coal consumption has been applied in the north, where the coal fields are situated. It appears, however, that restrictions may become necessary on account of the large reduction in the number of men working in the coal mines, and in such case no doubt consideration will be paid to the fuel consumption of the various plants, and, other needs being equal, the most inefficient will be shut down.

Other restrictions foreshadowed include a considerable reduction in tramway and electric railway services, including the underground services of London, and the rationing of London in coal next winter on a much lower scale than in the past. It is proposed to extend rationing to the greater part of England.

The power companies which supply wide industrial areas have taken a very large part in meeting the war demands. Munition factories have been erected in all parts of the country, and existing works have been converted, with the aid of the public supply, from their normal trade to war work with a minimum of delay.



War Expansion of Washington's Utilities

Needs of Government in New Public Buildings and at Camps and Cantonments Are Being Met Before Wants of Private Consumers, and Even Steam Heat Is Furnished as a War Necessity

THE Potomac Electric Power Company is doing its full share to aid in winning the war and, in line with this endeavor, has been obliged greatly to expand its equipment and facilities to meet needs brought about by the erection of many additional government buildings in Washington and the establishment in and around the capital of many camps and cantonments. The company, of which J. C. McLaughlin is general manager, now has nineteen substations, of which two were erected in the past year. Many of the others have been increased in size, and the company is now building still another, which will make twenty in all. The electricity generated is used as far as Bluemont, in the mountains of Virginia, and as far as the heart of Baltimore.

ENLARGEMENT OF STATION

As was made necessary by the general increase in business and by anticipation of a still further increase, the company installed a new 15,000-kw. unit in January, 1917, at the main plant, Benning, D. C., and then placed an order for an additional 15,000-kw. unit, which is promised for delivery July 5, 1918. To take care of this additional equipment it has been necessary to extend the turbine room, to build a new boiler room, and to place an order for delivery July 1, 1918, for four Babcock & Wilcox boilers of 1000 hp. each. The company is also erecting two new reinforced-concrete stacks, 205 ft. (62.48 m.) high and 12 ft. 6 in. (3.8 m.) in diameter, each one large enough for four 1000-hp. boilers. Anticipating still further demands, the company is now negotiating for a complete duplication of these boilers and another 15,000-kw. set.

Some of the nineteen substations in use serve the Washington Railway & Electric Company, of which system the Potomac Electric Power Company is a corporate part, but most of the war expansion of the power com-

pany has been for the purpose of serving government needs for heat, light and power in new government buildings in Washington. It is interesting to note that some of this service is steam heat. As a consequence of the necessity for serving the government first, the power company has been obliged to delay serving private customers; but there is very little if any complaint on this score in Washington, as the power company has always been on the best of terms with the Washington public, enjoying an enviable reputation among public service companies, and, in addition, the Washington public is well trained to the idea that the government must come first in these war times.

Most of the company's expansion has been accomplished without meeting many obstacles, except in the matter of finance, a difficulty common to most public utility corporations recently. The officials of the power company have had the advantage of working closely with government officials, however, on expansion needs, and are now endeavoring to be of assistance in solving some of the problems which are coming up in connection with the housing of war workers in Washington. The company is preparing to furnish steam heat for this housing, when the sites are finally decided upon, and if these sites shall be in the neighborhood of Fourteenth and B Streets, as is expected, it is said to be practically decided that the company will furnish steam heat from its plant in that neighborhood. This will be done at a great saving for the government, for the steam heat will be furnished at a cost much less than would be involved if the government were obliged to put up heating plants and produce heat.

SUPPLYING NEW GOVERNMENT BUILDINGS

When the new government buildings in the section of the city which lies southwest of the White House were erected it was necessary for the power company to

purchase ground in that neighborhood and erect a building, at Eighteenth and D Streets, known as Substation No. 19. This station is rated at 2000 kw. and serves the buildings of the Council of National Defense, the United States Fuel Administration, the United States Food Administration, the War Trade Board and one of the great ordnance buildings. The company also installed a 500-kw. rotary in the substation owned by the government at Sixth and B Streets, N. W., where there are additional ordnance buildings, the construction department of the army, etc. In addition to the 500 kw. in this government substation, the government is to install two additional units of 500 kw. each at its own expense, and the company is to operate the substation and furnish the energy.

For the new Army and Navy Building at Nineteenth and B Streets, which in point of ground space will be the largest office building in the world, the government is erecting a substation and will install two 750-kw. units to be operated by the government, the energy to be furnished by the power company. All these units will probably be tied in with the company's through-wire Edison system.

For the company's Substation No. 10, on I Street between Fourteenth and Fifteenth Streets N. W., the company has ordered one 1350-kw., 250-volt rotary; for the company's Substation No. 13, on Sherman Avenue N. W., the company has ordered one 1250-kw. frequency-changing set; for the company's Substation No. 12, at Thirty-third and K Streets N. W., the company has ordered one 750-kw., 2400-volt frequency-changing set, and the company has installed in its substation at Fourteenth and B Streets N. W., known as No. 16, one 1000-kw., 250-volt generator set. Last December, owing to the increased demand for energy, it was necessary for the company to start up its old reciprocating plant at Fourteenth and B Streets N. W. This has a rating of 3500 kw., made up of 250-volt generators, and from it 1800 kw. is furnished to the railway company.

The Bureau of Engraving and Printing, the work of which, notably in the printing of the Liberty bonds, has greatly increased as a result of the war, has ordered and is installing a 500-kw. rotary converter to help take care of increased energy furnished by the power company. The new Navy Department annex building, now being erected on the site of the old Arlington Hotel, at Vermont and I Streets N. W., will be supplied by the company's Substation No. 10, rated at 1350 kw. The new Treasury Department annex, now being erected at the corner of Pennsylvania Avenue and Madison Place, next door to the Belasco Theater, in which the War Risk Insurance Bureau is to be housed and which will be connected with the main Treasury building by a tunnel under Pennsylvania Avenue, will also probably be supplied from the company's Substation No. 10. At the Bureau of Standards there is an increased load due to war demands, and it has been necessary for the power company to order a 350-kw. rotary converter to care for this.

When the daylight saving act went into effect the company's peak load dropped about 7000 kw. It is expected that the company will get that back again when time changes back to the old basis—Nov. 1. The company is obtaining equipment in anticipation of this increased load. Its estimated expense for improvements and additions contracted for last year and being in-

stalled now amounts to \$1,250,000. With the new 15,000-kw. equipment this item will run \$300,000 more. In addition, the underground conduit expense alone will amount to an additional \$100,000. The company's station output has increased 20 per cent. A new source of revenue is found in the fact that the company has contracted to furnish to the government from its plant at Fourteenth and B Streets N. W. steam heating to the extent of 3000 to 4000 boiler-hp. It is intended to heat the new Army and Navy Building, at Nineteenth and B Streets N. W., with steam, as well as the government office buildings being built on Four and One-half and Sixth Streets.

SERVING OUTLYING POINTS

The company is supplying service to many out-of-the-way places, as well as to Fort Myer, Va., where the officers' training camps and other training camps are located; to American University Park camp, where engineers are being trained; to the Washington Steel & Ordnance Company, opposite Alexandria, Va., on the Potomac River, where shells and other munitions are made; to the Washington Navy Yard, where naval guns are made; to the sea-plane hangars on the Eastern Branch of the Potomac River; to the Washington Barracks, where engineers are trained, and to the Army War College, on the Potomac River; to the high-powered radio station at Arlington, Va.; to the Camp Meade cantonment, between Baltimore and Washington; from the Bennington station through the Washington, Baltimore & Annapolis Electric Railway to Annapolis; to Mount Vernon and Alexandria through the Washington & Virginia Railway, and to Bluemont, Va., in the mountains, through the Washington & Old Dominion Railway. Some of these points are 100 miles (160.9 km.) apart.

Government Still Calls for Technical Men

An urgent call for high-grade technical men and operatives to fill war positions in industrial establishments is made through the Civil Service by the United States Army Ordnance. Salaries ranging from \$1,600 to \$6,000 a year will be paid the men who qualify. Chemists and chemical engineers, men experienced in the manufacture of gas—mechanical engineers on high-pressure apparatus—engineers to take charge of power houses and foremen of machine shops are needed. Persons of military age accepting appointment will not avoid the obligations of the selective service law.

The Army Ordnance in issuing its call for these men is insisting on one point. No applications will be accepted from government employees or employees of firms or corporations engaged in contracts for the government or its allies unless written assent to such application is given by the head of the establishment that might be seriously handicapped in its war work by the loss of the man.

Power-house engineers will be paid \$1,800 to \$2,400 a year while working for the Ordnance Department. Supervision of operation of water-tube boilers, condensers, pumps, steam turbines and alternating-current and direct-current generators and motors are among the duties of these men. Machine-shop foremen with salaries from \$1,800 to \$2,400 also are wanted by the Army Ordnance. Ten years' experience as machinists—three years in a responsible supervisory capacity—is required.

War Conservation of Power and Light

Interconnection of Generating Systems, Elimination of Duplicate and of Uneconomical Plants, Maximum Use of Water Power and Careful Watch of Machinery in Factories Planned by Fuel Administration

BY CHARLES E. STUART

Chief of Power and Light Division, United States Fuel Administration

GENERAL plans have been laid for the conservation of light and power by the Bureau of Conservation of the United States Fuel Administration, of which P. B. Noyes is director, and these plans will be carried out by the power and light division. They will be developed under the following subdivisions:

1. Elimination of uneconomical isolated plants.
2. The application of the "skip stop" to railways and the regulation of car heating and lighting.
3. Economy in utilization of power and light in factories.
4. Utilization of excess water power and interconnection of power systems.
5. Limiting the production of power to the most efficient plants available.
6. Economy in the refrigerating and ice-manufacturing industry.

A brief statement with respect to each of these subdivisions follows.

The plans will be carried out through the co-operation of the following:

First—A force of engineers organized and stationed with the Fuel Administration at Washington.

Second—The engineering department of the United States Geological Survey.

Third—The power division of the Council of National Defense.

Fourth—A state fuel engineer attached to the office of the state fuel administrator, to supervise the activities in his state.

Fifth—The Public Service Commissions and state regulatory bodies.

Sixth—The chambers of commerce and similar representative business bodies.

Seventh—Volunteer engineers throughout the country.

The following gives the scope of the subdivisions:

ELIMINATION OF UNECONOMICAL ISOLATED PLANTS

The individualistic way in which fuel is now consumed in cities is not efficient. A ton of coal burned in a large central station will produce at least four times as much electric power as if burned in the average small plant, and if centralized burning could be introduced to a greater extent the amount of fuel required could be reduced without reducing in any way the ultimate production of light and power.

It is sometimes the case that in buildings where there are electric plants and where exhaust steam is utilized in the heating of the building and in furnishing hot-water requirements central station service can be adopted without a loss of money and at a saving in fuel.

As a rule it may be stated that where no extensive heating system is operated in conjunction with the generating plant such a plant can purchase power at a great fuel saving and with a possible reduction in power

cost. In other cases it would be more economical, from the viewpoint of fuel saving, to utilize central-station service in conjunction with isolated electric plants.

It is the duty of the Fuel Administration to devise means for securing a curtailment in the use of fuel in ways which will impose a minimum of hardship. It is believed that there are many plants not only in New York but throughout the entire country which could, at least temporarily, shut down their own electrical machinery and purchase power from others at a financial advantage to both and with a considerable saving in fuel.

The Fuel Administration believes that if even a comparatively small proportion of the plants throughout the country which could save fuel in this way at a profit to themselves would do so, it would prove a tremendous help in meeting the fuel situation with which the country is confronted and in winning the war.

While it may appear that the interests of the central station are being benefited to a large degree, such is not of necessity the case. In some cases central stations may be shut down. In any event any connection between a central station and a building or a manufacturing plant that is affected will of necessity be for the period of the war only or through the period where the coal situation is critical. The machinery of the isolated plant can be readily preserved through this period of necessity. Under these circumstances the heavy expense attendant upon the making of the connection by the central station may completely offset, or even more than offset, any profit which could be expected of such a load through a short period.

APPLICATION OF "SKIP STOP" TO RAILWAYS AND REGULATION OF CAR HEATING AND LIGHTING

One of the most promising methods by which we are securing economy in the use of fuel throughout the country is by the introduction of the "skip stop" system on the electric railways of the various cities.

With the present practice of having cars stop on signal at any street corner, there are usually from twelve to fourteen stopping points per mile. With the "skip stop" system, properly applied, these are reduced to not more than eight per mile in the business districts, six per mile in residence districts and four per mile in the open country. With the number of stopping points decreased in this way, a saving of from 10 to 15 per cent can ordinarily be effected in the power and hence in the fuel required, while at the same time the average speed of the cars is increased, without any increase in the maximum speed, and the service thus improved. Since this measure secures economy in fuel not only without handicapping the service, but with an actual improvement, it is obviously an extremely desirable type of conservation measure.

Our plan is to secure the adoption of the system by

voluntary co-operation between the railway companies and the various municipal authorities or state commissions and to bring about this co-operation through the federal fuel administrators for the several states. These administrators are all men of influence in their communities, and so far we have found in every case that a request from the state administrator to the proper authorities was all that was necessary to secure permission for the introduction of the system as a conservation measure during the war. With permission thus provided for, the railway companies have all been glad to adopt the plan.

Through our efforts, through the independent efforts of various local administrators or through the efforts of certain railway companies themselves, the "skip stop" system has been adopted, or is about to be adopted, as a coal conservation measure in Detroit, Washington, Baltimore, Brooklyn, Cincinnati, Columbus, Dayton, Toledo, Indianapolis, Evanston and South Bend, Ind.; Newark and the other cities of New Jersey, New Haven and all the other cities of Connecticut, and in Oakland, Berkeley and Alameda, Cal.

The Connecticut Company has reported a saving in fuel of 10 per cent for its New Haven lines, and reports indicate saving in the other places at rates varying from 3600 tons per year in Columbus to 21,000 tons per year in Detroit.

Various schemes for reducing car heating have been contemplated, but as yet no definite plans have been formulated.

ECONOMY IN UTILIZATION OF POWER AND LIGHT IN FACTORIES

The United States Fuel Administration is requesting, as a means of accomplishing power and light conservation in manufacturing and industrial establishments, the appointment by the management of a shop committee, composed of those best suited for the purpose and in size or number suitable to the size of the plant, one member of this committee to act as its chairman. The committee is to be active with and have charge of all details in the operation of the plant that would in any way contribute to economy in fuel or the things which fuel is used to produce and to report weekly to the management or head of the plant. It is also suggested that this committee be changed from time to time, so that the spirit and interest in this work may be maintained.

It is not the purpose arbitrarily to outline in detail the method for doing this work, but rather to suggest in a general way, leaving the details and adaptation of the plan in the hands of the manufacturers interested, as we realize that conditions in different plants and character of manufacture as well as organization will have a bearing on the size, character and details of the committee, which must be suited to the particular case under consideration.

As typical illustrations of possible waste and opportunity for conservation, we mention the following:

1. Lights being unnecessarily burned.
2. Lamps of too high candlepower.
3. The elimination of carbon lamps in favor of tungsten lamps where practicable.
4. The elimination of arc lamps and substitution of nitrogen-filled lamps, which are from two to three times as efficient.

5. The restricted use of sunlight owing to dirty windows.

6. Operation of motors when machinery is idle.

7. Excessive sparking, heating or erratic speed of motors.

8. Improper alignment of shafting.

9. Grouping of machines so as to operate motors or engines as nearly loaded as possible.

10. Staggering of operations so as to maintain as flat a load curve as possible.

11. Slipping belts.

12. Dry bearings.

13. Overheated or underheated parts of plant.

14. Excessive drafts due to lack of proper protection about openings of doors, windows, elevator and staircase areas.

15. The reduction of elevator service or the application of a "skip stop" to it.

16. The testing of power circuits for relationship of capacity to load carried.

17. The paralleling of power circuits.

We also suggest that the work of this committee be conducted in such a manner as to provide records of savings, which could be incorporated in reports and information desired from time to time as to the progress of this work.

The War Industries Board and the United States Fuel Administration are laying particular stress on the assistance that can be rendered by industries in economizing in the use of fuel and power. For the purpose of recognition of the individual service and interest of the members of committees, the government will designate and identify them with a button or badge which will be furnished by the United States Fuel Administration.

The endeavor to bring about conservation by the above means is well under way in several sections of the country. Reports which have come in show savings in fuel ranging from 10 to 34 per cent.

UTILIZATION OF EXCESS WATER POWER AND INTERCONNECTION OF POWER SYSTEMS

A method of fuel conservation which promises a certain amount of immediate relief and at the same time opens up a field with almost limitless possibilities for future development is the interconnection of the present power systems of the country and the consequent utilization of considerable excess water power which is at present available.

In many parts of the country duplicate transmission systems exist, serving practically the same territory. An interconnection between these systems for the mutual exchange of energy would in many cases result in marked economies. In other cases the lines of a power company which derives all or nearly all its energy from water power may extend very close to the lines of another company which uses coal to a large extent for the generating of power. Since no company is so fortunate as to be operating with a 100 per cent load factor, there are necessarily times during light load when the water-power company is forced to allow unproductive water to flow over its dam. At such a time a great saving in fuel would be effected were the two companies tied together and the load on the steam station transferred in part or entirely to the water-power plant. Numerous hydroelectric companies have for a long time

been carrying out this idea within their own systems, where the bulk of their power is derived from water, and at the same time they maintain a steam reserve to carry their load during low-water periods.

In some cases these system interconnections would involve a considerable expenditure of both time and money, in which event they would not be subject to immediate aggressive action by the administration but would be held in abeyance as possibilities for future consideration and development. In a great many instances, however, very considerable savings can be effected with a minimum of delay and expense, and it is along these lines that the first efforts will be most energetically directed.

LIMITING THE PRODUCTION OF POWER TO THE MOST EFFICIENT PLANTS AVAILABLE

We have been able to locate nearly 500 instances throughout the country where there exists in one form or another a duplication of power production and supply. In other words, there are communities where two or more central stations are furnishing electrical energy with systems paralleling one another.

In certain instances the results of such a condition are not serious, and in many cases they are probably unavoidable. Our investigations so far, however, have proved that a very large percentage of these situations offer an opportunity for large fuel conservation.

We find very often that an arrangement can be made at little or no expense whereby paralleling systems might be connected and the entire load supplied from the more economical station. In some cases possibly the combined load of both systems would be greater than could be handled by the more economical station. In such case as much load as possible should be carried by the station having the highest efficiency and the remainder taken by the other.

ECONOMY IN THE REFRIGERATING INDUSTRY

In co operation with the joint commission on refrigeration which was organized to assist the government during the war, the power and light division is planning to get in touch with the entire ice industry and to introduce a number of proved economies in the operation of ice and refrigerating plants.

A number of suggestions have already been made by the commission and by individuals connected with the industry. One plan that possesses merit and has possibilities of considerable fuel saving is that of allotting a definite amount of coal to individual plants, depending upon the size and type of plant, such allowances being based upon a reduction of 10 to 15 per cent of the average present fuel consumption. This will make it necessary to adopt many simple measures of economy that are now being overlooked.

Another possibility is that of producing white or opaque ice at a fuel saving of 5 to 20 per cent. This is accomplished by eliminating the power that is usually used for agitation in raw-water plants and for producing distillate in distilled-water plants, both of which are merely means of producing a transparent product. This is possible of adoption in many territories.

A further line of effort which will be productive of considerable economy, and one that was successfully applied last winter, is that of operating during the winter season only the most efficient plant or plants, as the particular case requires, in communities where

during the summer season all plants are required. This can be done and the individual business of each manufacturer will not be interfered with, as the arrangement provides that the operating plant or plants will sell at wholesale rates to those manufacturers whose plants are temporarily closed down. This arrangement also produces a saving in ammonia, and for this reason it was applied last winter at the request of the Food Administration.

In general, as regards the program outlined above, other important measures of conservation will be effected as follows:

First—By the closing of plants or the consolidation of plants there will be rendered available skilled men who are vitally needed in the many war industries of this country. Provisions are now completed whereby men with such training will be assisted in obtaining profitable work suitable to their ability.

Second—In many parts of the country there exists at the present time a power shortage. The interconnection of systems, the diversity factor of these systems considered, will render available additional quantities of power. The Council of National Defense is examining all communities where there is a surplus of power, having in mind the possible establishment in such communities of industries.

It may be stated that the conservation efforts of the Fuel Administration along the above lines are being directed so as best to serve the interests of all with a minimum of inconvenience and cost and with the object of making the coal supply that is available go as far as possible, so as to prevent the necessity of further drastic measures such as those of January.

It will be patent to every reader that in the face of a great potential shortage it would be criminal for the Fuel Administration to neglect obvious means of fuel saving such as those outlined above and equally criminal for the individual plant owner to refuse or defer co-operation which may have as a direct result a loss in production of war materials or which may jeopardize the health of many families through shortage in coal supply. The administration believes it should not be necessary to resort to the issuing of orders for the adoption of these conservation measures, but is relying, as in the past, upon voluntary action by those concerned and does not wish to enforce the measures where the saving in fuel would result in hardship to the owners not commensurate with the public benefit.

In this spirit the Fuel Administration invites co-operation, whether the question be one of interconnection, of operating plants at maximum efficiency or of temporary closing down of plants. We invite suggestions and criticism of a constructive nature from all sources.

Government Depending on Utilities

At a district meeting of the Ohio Independent Telephone Association in Columbus President Frank L. Beam, Mount Vernon, advised members to ask for fair service rates and to give full publicity to their costs and expenditures, so that the public may know and understand the reasons for any addition to the rates that may be requested. The government and all its branches, he said, are depending upon public service companies to an almost unbelievable extent.

The Manufacturers and the Central Stations

Makers of Electrical Supplies Have a Very Direct Interest in the Growth of the Power Houses—War-Time Conditions Make Co-ordination of Effort and Standardization of Material More Important than Ever

MANUFACTURERS of electrical supplies are following with keen interest the great activities and rapid development of central stations under the pressure of war conditions. Their own operations are affected by the volume of business of central stations and the progress of these properties. However, the manufacturers of supplies meet also a large demand from other classes of customers, and at present one of the most important of these is due to the war necessities, direct or indirect.

Conditions at this time, as well as the prospective situation, are of such vital importance to different branches of the industry that A. W. Berresford, president of the Associated Manufacturers of Electrical Supplies and vice-president and general manager of the Cutler-Hammer Manufacturing Company, was asked to discuss them for the *ELECTRICAL WORLD*, with particular reference to the relation between the condition of the manufacturers and the central-station industry.

DEMAND ON CENTRAL STATIONS AND THEIR RESPONSE

Mr. Berresford spoke of the remarkable enlargement in the demand upon central stations for power and commented on the equally remarkable showing which the central stations had made in meeting this demand. He expressed the belief that this increase in power consumption was not along the lines which it would follow under normal conditions, but, on the contrary, was due to the abnormal expansion of industry in mechanical lines consequent on government demands, and that in all probability a larger portion of the increase was being employed for industrial application than is normally the case. This condition seemed to indicate large potentialities of growth for the future, in that after the war there would be a direct reduction in demand of this nature and a consequent excess in the production of power which the central stations must immediately seek to utilize by building up new sources of business. The amount of excess power available will naturally depend on local conditions, since certain of the industries will undoubtedly be able to maintain their present consumption in peaceful pursuits, but to assume the present rate of production and consequent consumption of power would be the reverse of conservative. The result will be the resumption on an actual scale by the central stations of solicitation of power contracts, the intensive development of household appliance sales and a campaign for business of all classes that can be handled profitably under the load conditions present and with the result of stimulating the demand for the necessary material and exercising a direct and expanding influence on the business of contractors, jobbers and manufacturers.

Mr. Berresford expressed the belief that there could be no better time for co-ordinating the various branches of the electrical industry and that the probable future requirements make it highly important that the interests of the different divisions be brought

closely together so that co-operative action might be taken. He pointed out that the manufacturers, by reason of their three organizations and the bond of union established by the Electrical Manufacturers' Council, were in admirable position to co-operate and indicated that through the council, or through some similar agency, the various branches of the business could be brought into more intimate contact and the problems which are common receive the necessary consideration.

STANDARDIZATION OF MATERIAL

In the matter of standardization of material, in which the National Electric Light Association is interested, Mr. Berresford stated that the interest of the manufacturer was identical with that of the central station, the jobber and the contractor, and that much could be accomplished by co-ordination of effort. It should be understood, however, that no one element can effect the desired result and that the interest and the point of view of the actual user of the goods must be consulted. The standardization of a device implies the elimination of a number of forms to which the customer has become used and the substitution therefor (and in some cases at a disadvantage) of the ultimate form agreed upon. This can take place only as rapidly as the customer is willing to accept the change, and the goods can be offered to the customer only as rapidly as the manufacturing program and the condition of jobbers' and contractors' stocks permit.

He expressed his appreciation of the value of the suggestions made by the National Electric Light Association, but felt that more rapid progress would probably result if the association would refer direct to the manufacturer devices which it felt were most important for standardization and most amenable to such treatment, which process would not require detailed consideration from the National Electric Light Association beyond the compilation of the needs of its member companies. The manufacturer could then determine what was possible and could submit his conclusions to the standardization committee of the National Electric Light Association.

MANUFACTURERS READY TO CO-OPERATE

Mr. Berresford had no hesitation in stating that the Associated Manufacturers of Electrical Supplies would be glad to work toward a solution of the problems presented and expressed his confidence in the ability of that association to obtain careful consideration by experts of the particular devices under discussion and to arrange for the meeting of such experts with the National Electric Light Association committees interested, and he further expressed the belief that a similar co-operative attitude would be taken by the other manufacturers' associations. Mr. Berresford believed that, in spite of the depletion of forces due to military requirements, the present time would be an excellent one to take up this work. He felt that this

depletion was more than offset by the development of the manufacturing organizations toward co-operative consideration of questions of this nature.

In speaking of business conditions as they affect the manufacturers of electrical supplies, Mr. Berresford drew attention to the amount of material needed by the government to the production of which the plants and machinery of such manufacturers was suited and commented on the fact that up to the present the electrical manufacturer had, to a large extent, permitted the machine shop rather than the electrical shop to provide the bulk of this material. He insisted that from both the patriotic and economic standpoint it was incumbent on the electrical manufacturer to see that his due proportion of this work came to him, so that, while doing his duty as a citizen in the present crisis, he might still maintain his organization and cope with conditions which would arise on the cessation of hostilities.

The character and amount of such work which can be taken in each shop can be determined only by the individual manufacturer after a study of the conditions at home and in Washington, and the work can be obtained only by the intelligent expenditure of personal effort at Washington in the presentment of his facilities and claims. There are two facts which should not be overlooked by the manufacturer in considering this work and determining the minimum profit basis on which he can afford to accept it—namely, that for the bulk of this detail manufacture no financing is required except the buying of such minor additions to machinery as may be necessary, and that practically no additions to material inventory are involved. Furthermore, after a manufacturer has satisfactorily produced goods for the government, the tendency is to keep him at work, and even if a manufacturer fails to obtain a second contract immediately after completing the first one, he is still in favorable position on the records at Washington as having produced goods and as competent to handle more business.

Readers of the *ELECTRICAL WORLD* are familiar with the work of the General War Service Committee of the Electrical Manufacturing Industry, which is serving as a connecting link between the government and the different groups of electrical manufacturers, and whose particular function it is to place before the government the ability of the industry to produce material which is essential for the prosecution of the war.

Mr. Berresford believed that the work of the war service committees should not be expected to take the place of an individual manufacturer's presentation to the government of his own capability. He felt that the best results could be obtained only by the personal effort of the manufacturer himself operating under the advice of the General War Committee.

Mr. Berresford furthermore expressed the belief that if the manufacturer did not follow the course indicated he would find that, while he might not be relegated to the class of non-essential industries, such percentage of his production in normal lines as was not needed at this time would in effect take this classification and that the influences which are being brought to bear must tend toward a corresponding diminution of production to the amount actually necessary and a consequent reduction of his organization and working force to the minimum required to make this production, whereas the pros-

perity of the country, as a whole, as well as the individual industry, demanded the operation of full capacity of all plants possible and is a fundamental in the maintenance of the morale of the people, our business position and our financial ability to make loans and pay taxes.

If the plants are maintained in operation, intelligent study will indicate the direction in which the character of the product can be shifted and this policy will prevent ruin of any industry. The government cannot afford, and does not desire, to interfere with the operations of any manufacturer beyond what is actually necessary to insure the output of war material. It can, however, only lay down general laws which shall govern, and it is the duty of the individual so to adapt his operations to these laws and the changed conditions as to maintain his condition of profitable operation substantially unimpaired.

Red Cross Bandage Output Increased Ten Times by Electricity

At the Boston (Mass.) workrooms of the New England surgical dressings committee a machine is now in service which has a capacity of 50 yards (45.7 m.) of gauze bandages per minute, an electric drive being a feature, as illustrated herewith. The machine was de-



MAKING BANDAGES WITH ELECTRICITY'S AID

signed by J. A. Butler of the Industrial Service & Equipment Company, Boston, and easily will turn out ten times as much work as the usual staff of four persons can perform by hand. The machine will produce two sizes of folded bandages, one 4 in. (10.16 cm.) and one 3 in. (7.62 cm.) wide, and the number of cutters of dressing stock is varied to suit the convenience of the local workers. In operating the machine one worker feeds the material through the outfit and the others devote their time to cutting and packing. A Singer sewing-machine type motor of about 1 7-hp. rating, operated by 110-volt direct-current energy from the Boston Edison mains, runs the unit. The bandages are folded eight or four times as desired. Recently the Boston chapter of the Red Cross had a rush order of dressings to prepare, and the work was done on this machine in four days, 2000 5-yd. (4.5-m.) gauze rolls being made up. By hand the work would have taken at least three weeks with the local staff then available.

In League with the Government

How Central-Station Executives Are Assisting the Nation in Solving Local and National Problems and Safeguarding the Country's Electric Service Despite Handicaps

VARIOUS aspects of a central-station executive's war service, including the work of gas and electric utility representatives at Washington, were touched upon at a recent hearing before the Massachusetts Gas and Electric Light Commission by President C. L. Edgar of the Edison Electric Illuminating Company of Boston. In an informal way, Mr. Edgar outlined his own connection with the work. In August, 1916, he was appointed by Secretary Daniels an associate member of the Naval Consulting Board, and with others was asked to make an inventory of the manufacturing concerns of Massachusetts. This work was organized with C. H. Hodskinson of the Boston Edison company as secretary and treasurer and occupied about a year. All the manufacturing concerns in the State were communicated with, their machinery and products were listed and consideration was given to the possibilities in the way of changing over products in case of war. The work was done under the direction of N. S. Gifford, now manager of the Council of National Defense. When the latter organization went into effect the work Mr. Edgar and his associates had been doing for the Naval Consulting Board was automatically turned over to the Council, under Howard Coffin, who had charge of this class of work for the defense board.

War was then declared, and Mr. Coffin called into conference some of the leading men in the gas and electric utility fields, those of electrical affiliations from New England being Mr. Edgar and Henry G. Bradlee of the firm of Stone & Webster. By an informal vote Mr. Edgar was made chairman of the advisory committee, and at a later date the committee organized with offices in the Munsey Building, Washington. It has since been actively at work advising the government and has invariably refrained from anything commercial. In fact, Mr. Edgar pointed out, when the toluol situation came up and it was found that one or two of the committee were interested in that product, they resigned, as they did not wish to embarrass the committee in any way. Before long the committee was drafted to assist F. S. Peabody, who was Dr. Garfield's predecessor as fuel administrator. The work of the committee in-

creased to a point where additional assistance was needed, and this was furnished by the United Gas Improvement Company, Philadelphia, the New York Edison Company, the Philadelphia Electric Company and the Boston Edison company, Mr. Hodskinson being loaned by the last company for one or two months.

With the growing acuteness of the coal situation, the time came when it could not be handled by the routine purchasing department of the Boston company for its own service, and for two months Mr. Hodskinson devoted his entire attention to this question. James J. Storrow, federal Fuel Administrator for New England, has stated openly that Mr. Hodskinson helped him probably as much as anybody in Boston. The Boston company loaned 7000 tons of coal on one occasion to the Maine Central Railroad, when it was practically out of fuel, and kept the Boston City Hospital going for two days, all of this being due to the work done by Mr. Hodskinson at Washington and Newport News.

Later Mr. Edgar was appointed a consulting electrical engineer of the Bureau of Mines, Prof. L. P. Breckenridge of New Haven, Conn., being chairman of the committee of engineers which

aids both the Bureau of Mines and the federal Fuel Administration. Mr. Edgar served on a committee which was asked by the War Department last winter to obtain 80,000 hp. in steam turbines for government nitrate-plant service, the necessary units finally being borrowed from the central stations of the country. Two months ago the government found it necessary to establish another war plant of 100,000 kw. for service in connection with the Du Pont interests, and Mr. Hodskinson was called into the case to assist in obtaining the necessary units. A 30,000-kw. unit ordered by the Boston Edison company and another ordered by the Boston Elevated Railway were taken over by the government. Others built later will replace them.

With regard to letting the Boston Edison generating unit go to the government, Mr. Edgar said: "I acquiesced, as far as we were concerned, because I thought the government officials were justified in taking it. I thought it was needed more by the government than by us."



C. L. EDGAR

Mr. Edgar has been almost every week in Washington for many months, doing work entirely outside that of the Edison company. This work has been almost entirely in consultation with other companies to see what could be done to help the government. D. S. Boyden, assistant to the electrical superintendent of the Boston Edison company, has been of much assistance to the New England Fuel Administration and has prepared various questionnaires for it. Mr. Edgar said that both he and Mr. Hodskinson were getting overwhelmed with war work, and accordingly Sidney Hosmer, head of the Boston Edison construction bureau, has been assigned to give his whole time to war service questions and has lately been in Washington for this purpose. Mr. Edgar is constantly being importuned along different lines for assistance, recently having been called up by telephone on a Sunday morning and asked to release a condensing unit to government service. The company did not give the turbine and condenser equipment outright to the government, but postponed deliveries, rearranging the orders with the manufacturers so that the material now being collected can be put into the machinery which the government needs for more important work, the central-station machinery to be put together a few months later. "I do not want to make a stump speech," said Mr. Edgar, "and am not going to do so, but I think I am justified in saying that 90 per cent of my thought the past year has not been with the Edison company but with the work of the government. I was told by my directors when the war started that I might have a year's leave of absence, but I thought I could do better service along the line in which I have been working. I thought I would be of more use to the community and to the country by dabbling in a lot of things, as I have, rather than by cutting loose and giving my entire time to one thing."

Mr. Edgar said he was in sympathy with what the government is doing relative to plant correlation and control, although in some cases it is difficult for the companies to accommodate their operations to meet the demands of the army officers in charge of the local situations, as at Niagara. Mr. Edgar stated that he proposed to play the government's game despite the handicaps which it may impose. All these activities bearing upon control of utility administration bear upon the question of regulation and support the company's general contention that the present is not the

time to subject the companies to such a rate inquiry as is proposed in the Boston Edison case now before the commission. One of the problems to be discussed at the forthcoming Atlantic City Convention of the National Electric Light Association is the possibility of reducing some of the labor shortage of the central stations through rendering bills every two months. Other war problems will be discussed at this time, and Mr. Edgar said that at the next hearing he expected to make a more detailed statement bearing upon the company's contention that for the period of the war the rate inquiry should be suspended.

ENGLISH RESTRICTIONS ON ELECTRICAL PURCHASES

Applications to British Ministry of Munitions for Priority Certificates to Buy Apparatus Must Show Energy Supply Conditions

Applications to the British Ministry of Munitions for priority certificates to permit the purchase of motors and other electrical apparatus now have to be accompanied by a certificate from the chief engineer or manager of the public service undertaking concerned. This certificate is to state:

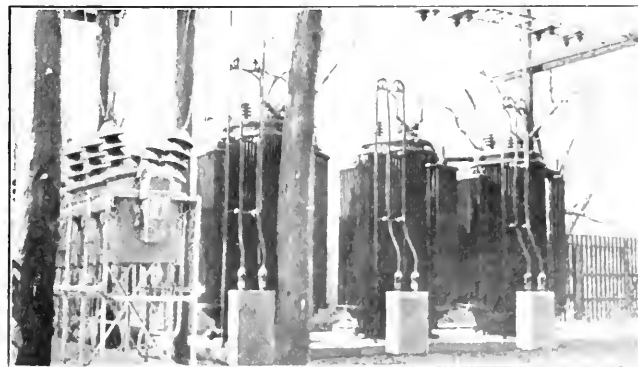
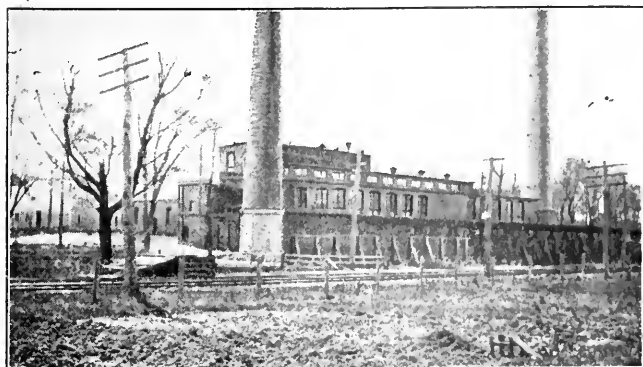
1. That adequate generating plant capacity is or is not available.
2. That no additional cost or material is involved in connecting the premises to the mains (including substation equipment, if any), or
3. Where expense is involved the material and apparatus to be provided and the cost thereof, and whether lead-covered cable is necessary or not. Where lead-covered cable is deemed necessary, the voltage of the current transmitted should be stated.

Applicants should, whenever possible, also obtain the written support of the government department interested in their manufactures, and forward a copy of same.

The purpose is to reduce the demand for energy—other than that used for urgent war purposes—supplied by the public service undertakings and the time occupied in making inquiries.

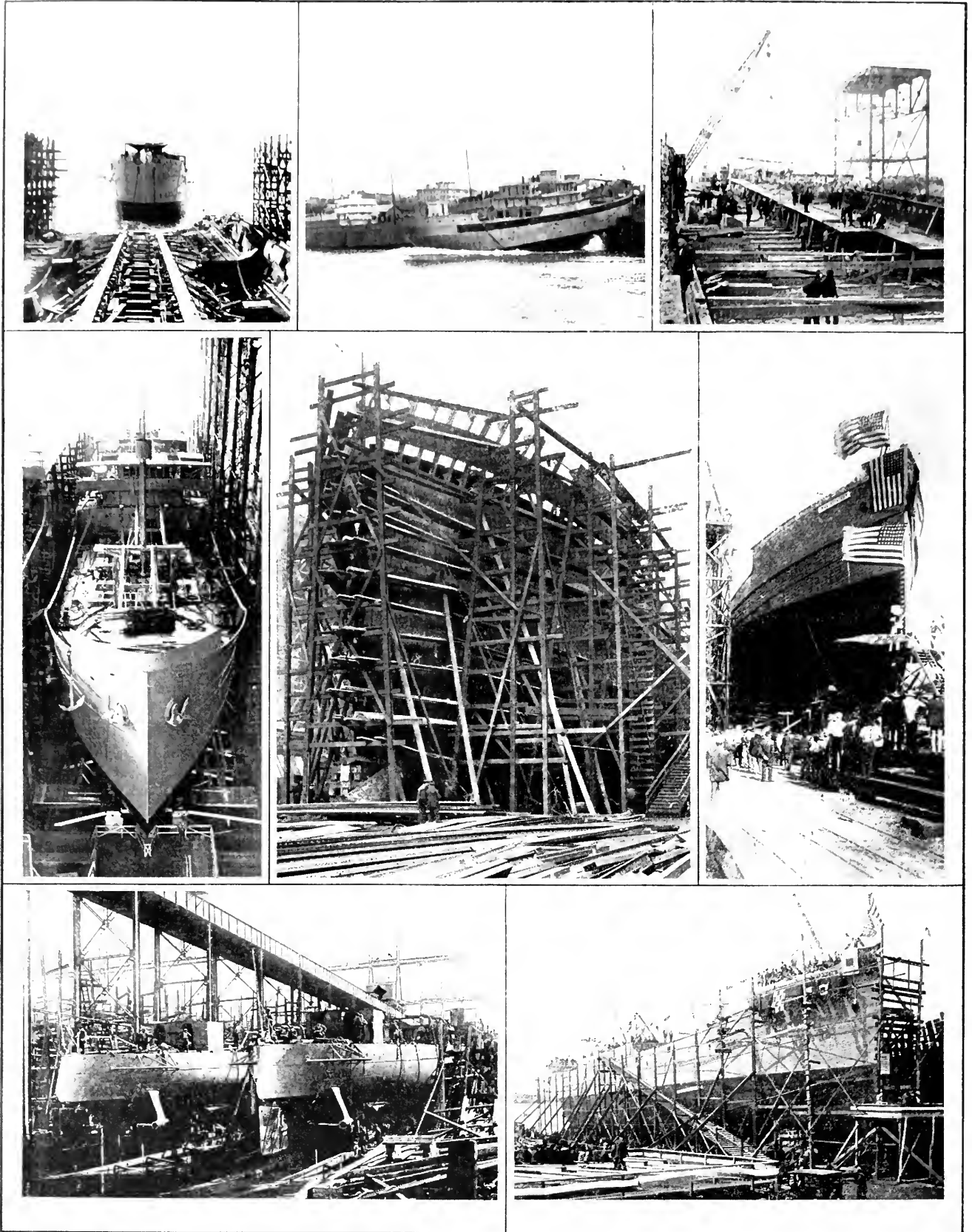
New restrictions relating to electric converter plant have also been issued by the British Ministry of Munitions. Applications under this order are to be made to the director of electric power supply in the Ministry of Munitions.

Backing Up the Fuel Administration



A 4000-kw. outdoor substation (at right) supersedes a 3364-kw. Attleboro (Mass.) steam plant (at left), saving fuel and a freight rate of 60 cents per ton on coal through interconnection with the Providence (R. I.) central station.

Ships Are as Important as Guns



The largest shipyard in the world fills all its power requirements from central-station sources, and so does the

smallest. It matters not whether the ships are built of wood, concrete or steel, electricity is used in the erection of all.

What Commissions Are Doing on Rates

Action Taken by Various Public Service Commissions Regarding Increases Sought or Made on Account of Higher Operating Cost—Views as to Duration of High Expense Ratio

As the result of a survey of the broader aspects of tendencies of electric rates in the war crisis, the *ELECTRICAL WORLD* will present several articles. This, the first one, will be followed by others in later issues.

WAR problems have thrown a new and burdensome responsibility upon the public service commissions of the various states which have thorough regulative statutes.

Put into office by the public, intrusted with a clear obligation to both the consuming public and the supplying utilities and their security owners, these bodies face a critical test, if not a grave crisis, in the history of regulation. They hold great and unavoidable authority over the electric properties and the consumers in their relations toward each other. How they are exercising this authority, whether they have a full appreciation of the changing conditions due to the war, is of vital concern for the future of regulation.

Under the pre-war conditions the electric utilities followed generally the practice of reducing rates and building up large volume of output. Now that conditions of cost and demand are influenced powerfully by war requirements, many utilities find that a partial reversal of practice is necessary to preserve their financial integrity unimpaired.

That the commissions are alert to the possibilities of the altered economic situation is shown by replies to inquiries made by the *ELECTRICAL WORLD*. They want to know the facts and apparently they are not unwilling to regulate rates upward when the facts so justify.

HOW WISCONSIN DECIDES

Among the state commissions the deliberations and conclusions of the Railroad Commission of Wisconsin have been followed with care from the beginning because of the standing of the men who have composed its membership and its staff.

Harold L. Geisse, the secretary, writes to the *ELECTRICAL WORLD*:

"We have authorized a number of electric utilities to increase rates for limited periods subject to review by the commission at any time, on account of the showing of increased cost of operation. In connection with this, however, it should be said that the commission does not consider the increased cost of operation in and of itself as a justification for increasing rates. The application in each of these cases is judged with reference to the extent of the emergency which has been caused by the increased expenses, and if an emergency does not exist, or if the conditions of the utility for years past has been so good that it can be expected to carry a part of the burden for a time, the commission would not be disposed to authorize emergency relief. This would not in any way, of course, prevent the utility from bringing a case in the regular order of events, not under the emergency statute.

"In some cases the rate increase has been applied to all classes of customers, and in others to only such

classes as were receiving the lower rate and in whose rate the coal component was a relatively large part.

"The number of applications has not been large. An increase was granted:

"To the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company of 0.31 cent per kilowatt-hour for all energy above 1000 kw-hr. per month.

"To the Eastern Wisconsin Electric Company, Sheboygan, 0.25 cent per kilowatt-hour for all energy except the general lighting.

"To the Eastern Wisconsin Electric Company at Fond du Lac, 0.5 cent per kilowatt-hour for all service.

"To the Wisconsin Traction, Light, Heat & Power Company at Appleton, Neenah and Menasha an increase was granted which had the effect of eliminating all energy steps of less than 8 mills.

"There have been one or two other minor increases in the case of small plants.

"Not many of the electric utilities have as yet filed applications for authority to increase rates, although those acted upon involved some of the larger companies in the State.

"We have been proceeding in the hope that the abnormal condition would be corrected, and accordingly have granted increases only for limited periods. However, it seems to us very doubtful if these conditions will actually be corrected to anything near normal for at least several years."

COAL THE DOMINANT FACTOR IN MASSACHUSETTS

The Massachusetts Gas and Electric Light Commission has had to take no action upon electrical rate increases since last summer, first, because no rates fixed by the board have so far been increased; second, because no statutory complaint of the actual increases put into effect by electrical utilities has been received. In the absence of these causes for investigation and decision, rates established by utilities go into effect without review by the commission in any formal way.

About forty announcements of increases have been received from electric utilities or gas companies' electrical departments and twelve from municipal plants. Almost all of these have been increases in power rates. A careful study of the titles of these announcements of increase, as summarized by the commission's office, shows that the most general increase is about 0.5 cent per kilowatt-hour on power rates ranging say from 4 to 6 cents, and that a rough approximation of these increases would be about 10 per cent.

No exact average can be deduced from the tariffs filed, however, as in some cases the discounts are altered; in others the blocks of energy at stated rates have been changed; in others minute fractions of a dollar represent the advance in energy price corresponding to changes in the price of coal, and, again, certain special rates, like window lighting and flat-rate residence lighting, have been modified or abolished. In some cases the power rate increase is as low as 5 per cent. Very little evidence of organized opposition to the

electric rate increases appears to have materialized.

One advance in lighting rate, from 8 cents net to 8.5 cents per kilowatt-hour (Seekonk), is reported, but so far the commercial lighting rates have been practically untouched.

About ninety-three electrical utilities are under the supervision of the board, and from 40 to 50 per cent of these have established some electrical rate change calculated to yield increased revenue to the company.

Present conditions affecting rates appear to be largely in the nature of a war emergency, with the increased cost of coal a dominant factor therein.

WHAT MICHIGAN THINKS OF COSTS

Cassius L. Glasgow, chairman Michigan Railroad Commission, writes:

"Most of the utilities in this State are operating under franchises granted by the municipality in which they are located and which control the rate. In two or three instances complaints have come to this department, and we have recommended that they be taken up with the local authorities to see if an adjustment could not be made, even temporarily, during the war.

"In one instance a village has made complaint to this department and hearing has been had thereon, and the public utility has been permitted to charge an increased rate both for private and public lighting and to add power service. This has not been limited to the duration of the war owing to the fact that a reconsideration of this rate may be had at any time upon the application of either party.

"It is our opinion that the things which contribute to the expense of operating public utilities will never so decrease in price as to permit them to operate under the old schedules successfully. However, we believe, where during the duration of the war they have been permitted to name a rate which would produce a reasonable return based upon present expense of operation, that when after the war these expenses will somewhat decrease, naturally the public will demand a like reduction in the rates."

SEVENTY PENNSYLVANIA COMPANIES ACT

H. E. Ehlers, chief of Bureau of Rates and Tariffs, Public Service Commission of Pennsylvania, says:

"It is not the practice for utilities in this State to make application for increases in rates, as the public service company law provides that changes in rates may be made by the filing, publishing and posting of the changes, giving thirty days' notice, when the changed rates automatically become effective on the effective date fixed. Such rates are at all times subject to investigation upon complaint.

"For your information I wish to state that approximately seventy companies have filed increases in rates to become effective this year. A number of the increases have been filed as effective for one year, or during the period of the war."

STATUS OF CASES IN VIRGINIA

Alexander Forward, commissioner of the State Corporation Commission of Virginia, writes:

"Necessary increases in cost of operation are considered favorably, and it may be in some cases entirely, for the purpose of authorizing increased rates.

"In regard to what classes of rates are increased, this would depend largely upon the relationship of rates

between the different classes, but in most of the cases recently passed upon by us all rates of the electric utility were revised.

"We have approved increases in some seven or eight instances during the past year, have not rejected any applications relating to electricity and have two cases now pending.

"Our records show that forty-nine utilities of this character operate in this State, so that at present only about 4 per cent of them now seek higher rates.

"In regard to the present general conditions, particularly as to operating costs affecting electric utilities, we feel that this condition is temporary, and in authorizing increased rates, unless cause is shown to the contrary, it is our custom to limit the increased rates so as to expire on some future date, subject, however, to further hearing at some later time."

HOW RHODE ISLAND VIEWS CONDITIONS

From information obtained by a representative of the ELECTRICAL WORLD from the Public Utilities Commission of Rhode Island the following is stated:

Increased cost of operation of course would be a factor in the determination of the commission in case exhaustive rate proceedings were instituted; but no formal hearings have been required of late for the reason that there has been no statutory opposition to the increases effected.

It may be assumed that the commission would not approve any grossly discriminating increases in class rates, its policy being rather to permit such generally fair advances as are justified by the present conditions. A particular rate may be altered, as in the institution of the minimum charge on residence lighting installations lately placed in effect in Providence, but this does not mean that the other consumers were penalized.

In general, the electric companies informed the commission in making recent advances that they expect to meet about half the increased cost themselves through more efficient operation, looking to the consumer to bear the other half of the increased costs in the shape of higher rates.

About twelve schedules of rate advance have been received and allowed during the last six or eight months. Very roughly, it may be said that the advance in power rates is of the order of 20 to 25 per cent, and in lighting rates in the vicinity of 10 per cent. In Rhode Island, both power and lighting rates have advanced synchronously. No proposed advances have been rejected and none are now pending.

Practically 100 per cent of the electric utilities under the supervision of the commission have sought increases and obtained them. Owing to centralized management some of these schedules have been filed and put into effect by groups, as in the utilities controlled and operated by the Narragansett Electric Lighting Company and the Stone & Webster organization. The companies have worked in harmony with the local authorities and publics, showing them the need of an increase, and the public has generally appreciated the situation.

It is the view of the commission's chairman, W. C. Bliss, that the present operating costs and conditions of electrical utilities are in considerable degree of an emergency character, but it is not expected that there will be a rapid return to former levels of cost at the close of the war as regard coal and labor expense.

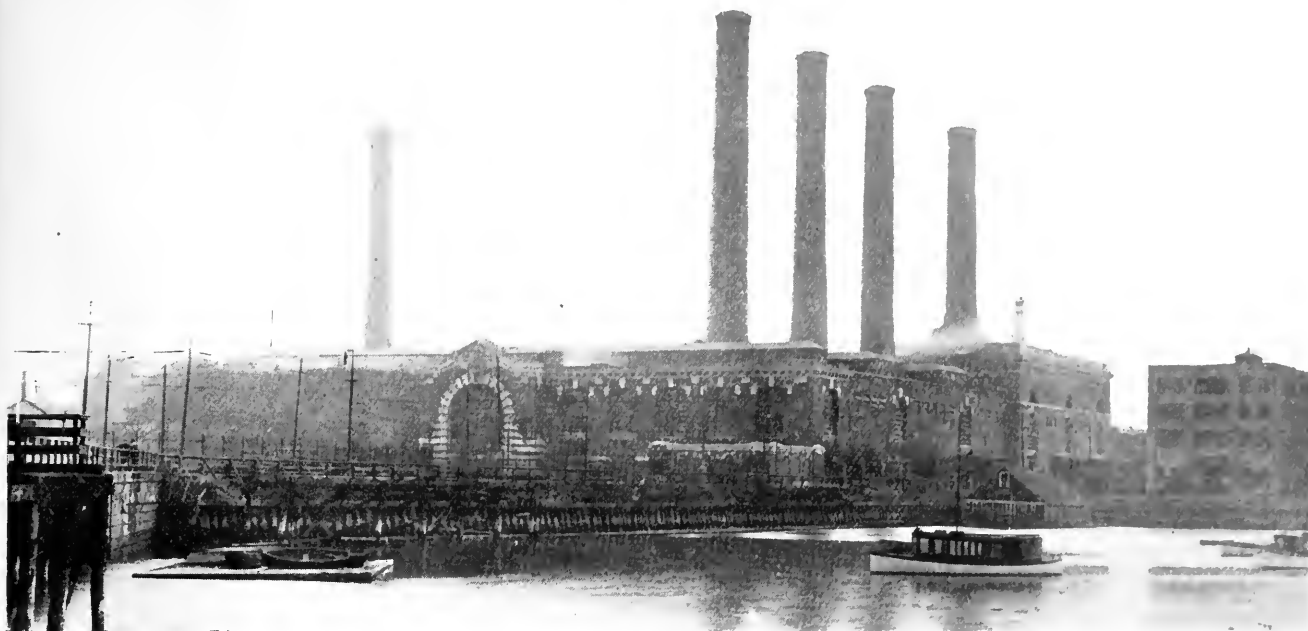


FIG. 1—105,000-KW. L STREET STATION OF THE BOSTON EDISON COMPANY, WHICH WOULD BE INVOLVED IN INTERCONNECTION

Benefits Possible from Interconnection

Analysis of Conditions in Eastern Massachusetts—Possibilities of Higher Efficiency, Reduced Investment and Operating Expenses per Rated Kilowatt, and Releasing Equipment for New Business

FIFTY thousand kilowatts in plant equipment can be released on central-station systems north and south of Boston, Mass., by a comprehensive development of the interconnection plan, according to L. L. Elden, electrical superintendent of the Edison Electric Illuminating Company of Boston, who addressed the New England Central Station Power Engineers' Association recently. It is estimated that this benefit could be realized within a few months, so far as the engineering side of it goes, and with an outside expenditure of about \$2,750,000. The improvement in load factors in the local plants would result in greatly increased efficiency of operation, permitting the less economical stations to be shut down for at least a large part of the year and saving coal on a substantial scale.

Mr. Elden's conclusions have been reached as the result of personal studies of the load conditions in the eastern Massachusetts district and his knowledge of the benefits of interconnection as developed in various parts of the country.

Prior to 1914 most interconnections were between plants under the same management or control, the objects being to secure greater efficiency and to conserve reserve capacity. One of the best examples of interconnection is the system of the Pacific Gas & Electric Company, in which steam and hydroelectric plants are operated jointly and with maximum efficiency. It is estimated that about double the present investment would be required if the plants now tied together in this system were not operated under a single control. Other important interconnected systems are operated by the Southern Power Company and the Mississippi River Power Company. In the Montreal district five large companies are operating steam and hydroelectric

plants under one control and with marked advantages. The New England Power Company and the Turners Falls Power & Electric Company are interconnected in New England with good results, and the Public Service Corporation of New Jersey is planning a transmission trunk line of state-long dimensions, into which seven or eight large steam plants will feed, reducing independent reserve capacity and saving fuel. The government is planning to build a large plant at the mouth of the mine in Pennsylvania for transmission of electricity to munition plants in the Philadelphia and New Jersey districts.

BETTER LOAD FACTOR IS ONE BENEFIT

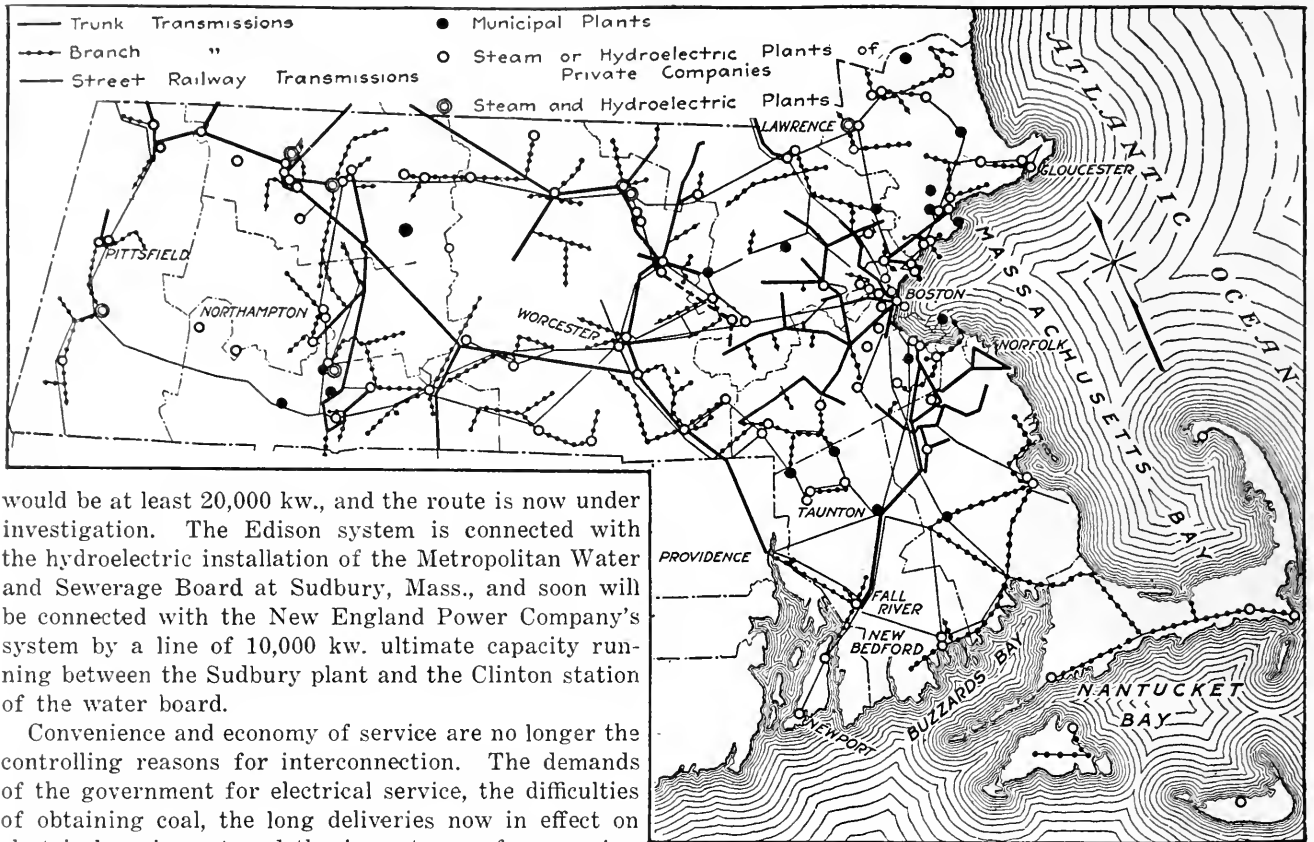
An improvement in load factor generally follows interconnection. The more economical plants can be operated at their maximum efficiencies, reducing costs and investment charges and giving a better diversity factor. Thus, 10,000 kw. can be sold out of the combined reserve of two plants with the following characteristics when interconnected: Plant A, five 10,000-kw. units, maximum load 40,000 kw., spare capacity 10,000 kw.; Plant B, three 10,000-kw. units, maximum load 20,000 kw., reserve capacity 10,000 kw. Interconnection gives a constant reserve of 10,000 kw. for whichever plant requires it, safeguarding the service of each plant as well as before, since coincident peaks are not likely to occur. The combination of 80,000 kw. capacity in two adjacent interconnected plants may easily give an available excess capacity of 25,000 kw., a difference of ten or fifteen minutes in the peaks being sufficient to release this maximum capacity. In such a case 10,000 kw. can be held in reserve and 15,000 kw. sold for new business. The percentage of spare capacity is larger.

smaller plants and the benefits of interconnection are great even in stations of very moderate size.

NEW ENGLAND INTERCONNECTION OPPORTUNITIES

Within the last eighteen months considerable work in tie-line construction has been done in Massachusetts. The Malden-Salem-Revere line (described in the ELECTRICAL WORLD of Sept. 1, 1917) is giving excellent service, and there will shortly go into operation a tie line between the Revere plant of the Suburban Gas & Electric Company and the Edison Electric Illuminating Company of Boston, with a capacity of 3000 kw. There is now under consideration by the New England Power Company the construction of a 66,000-volt transmission interchange line to extend from some suitable point to the L Street station of the Boston Edison company, in South Boston. The capacity of this line

area was about 50,000 kw. and the sum of the peak loads was about 40,000 kw. Owing to the non coincidence of peaks, there would be a total spare capacity of 20,000 kw. through interconnection, excluding any tie line to the Boston Edison station and plants serving traction lines in the districts reached by the trunk line. All these central stations were developing about 70,000,000 kw.-hr. per year, the average coal consumption being 2.84 lb. (1.28 kg.) and the range from 2.27 lb. to 6.4 lb. (1.25 kg. to 2.88 kg.). Assuming an average of 2 lb. (0.9 kg.) per kilowatt-hour, which could be attained by the improvement of station load factors resulting from interconnection, 28,000 tons of coal could be saved in a year by interconnection, and at \$8 per ton this would represent an annual saving of about \$225,000. On the basis of \$80 per kilowatt, the saving in capacity resulting from interconnection would repre-



would be at least 20,000 kw., and the route is now under investigation. The Edison system is connected with the hydroelectric installation of the Metropolitan Water and Sewerage Board at Sudbury, Mass., and soon will be connected with the New England Power Company's system by a line of 10,000 kw. ultimate capacity running between the Sudbury plant and the Clinton station of the water board.

Convenience and economy of service are no longer the controlling reasons for interconnection. The demands of the government for electrical service, the difficulties of obtaining coal, the long deliveries now in effect on electrical equipment and the importance of conserving reserve capacity are most influential. The government has taken possession of the second 30,000 kw. turbo-generating unit ordered by the Boston Edison company for its L Street station extension, on the ground that the federal authorities have a more immediate and pressing use for this machine than its purchaser.

About eighteen months ago Mr. Elden made a comprehensive study of the possibilities of interconnecting the principal central-station systems north and south of Boston, tying these into the Edison system, and it is known that the ratios obtained prevail to-day. An outline of the investigation made by Mr. Elden is accordingly presented.

The plan involves, on the south of Boston, the establishment of a trunk line interconnecting the Boston Edison plant on tidewater at L Street, South Boston, with various local generating plants through appropriate taps or branches. In 1916 the capacity of the local central stations in the general southern Massachusetts

FIG. 2—INTERCONNECTIONS IN MASSACHUSETTS THAT ARE RELEASING EQUIPMENT FOR NEW BUSINESS

sent \$1,600,000, which would thus be available for handling additional service as required.

If existing rights-of-way could be utilized in connection with this plan, which seems probable, the cost of such line construction or reconstruction as might be required, including local substation work, would probably not exceed \$1,250,000. The principal source of delay would be in obtaining the substation equipment needed for comprehensive development. Allowing fixed charges on this work at 15 per cent, there would be a saving of at least \$75,000 in fuel alone, entirely ignoring labor economies. It appears that at least six plants could be shut down in the local territory a part of the year, and the bulk of the load would be handled by the larger and more efficient interconnected stations. The 1918 output of the stations in the area under consideration is estimated at about 100,000,000

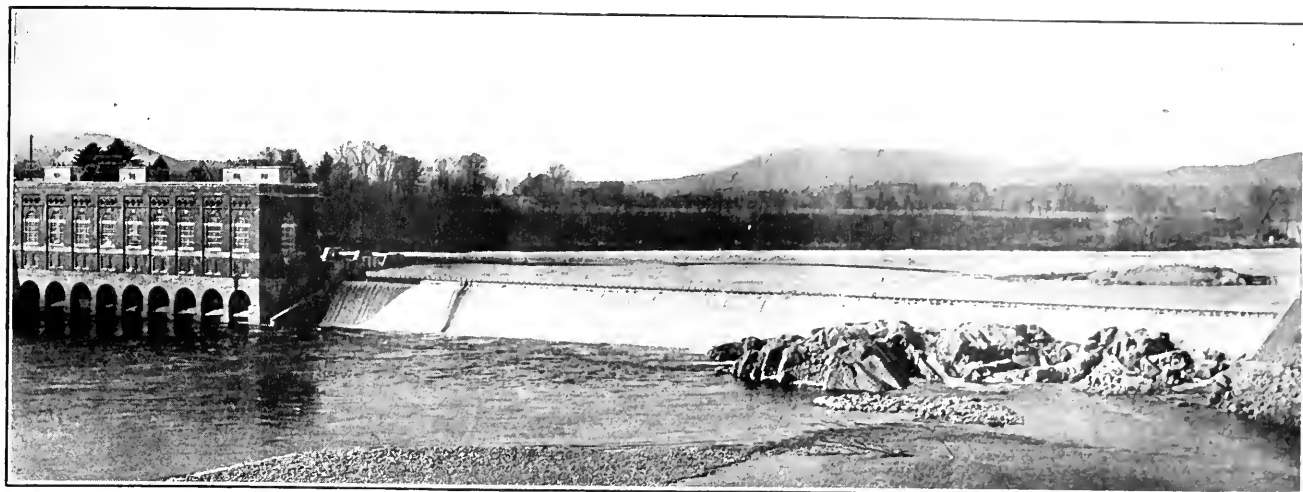
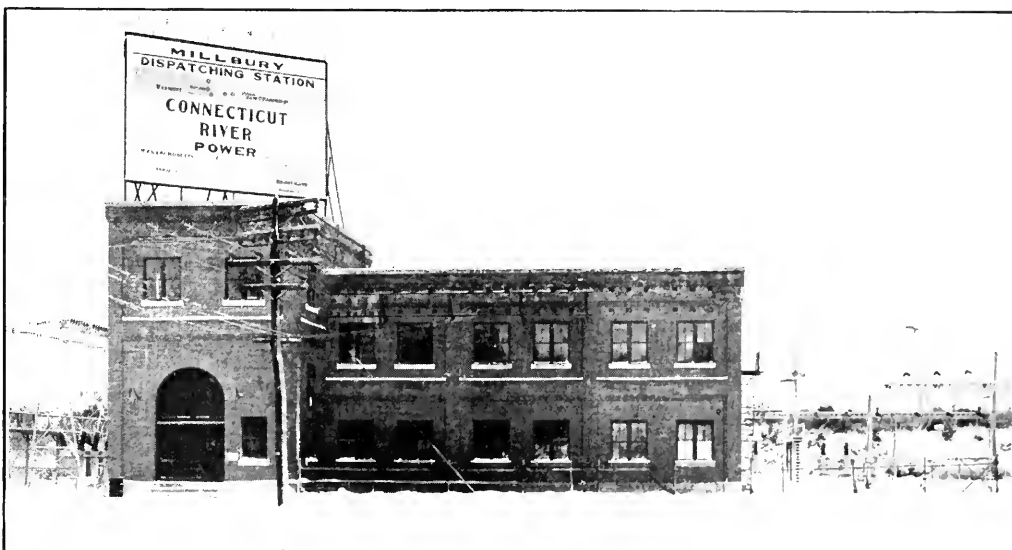
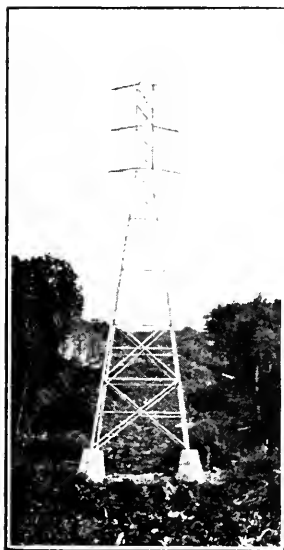


FIG. 3—20,000-KW. VERNON CENTRAL STATION, NEW ENGLAND POWER COMPANY, ON CONNECTICUT RIVER



FIGS. 4 AND 5—TRANSMISSION-LINE TOWER, EASTERN MASSACHUSETTS ELECTRIC COMPANY, AND DISPATCHING HEADQUARTERS, NEW ENGLAND POWER COMPANY

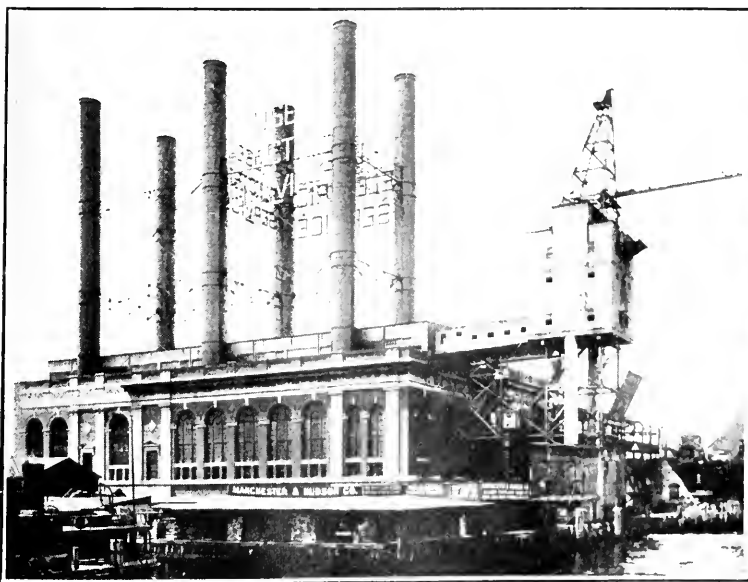


FIG. 6—NARRAGANSETT ELECTRIC LIGHTING COMPANY'S 80,500-KW. PROVIDENCE STATION

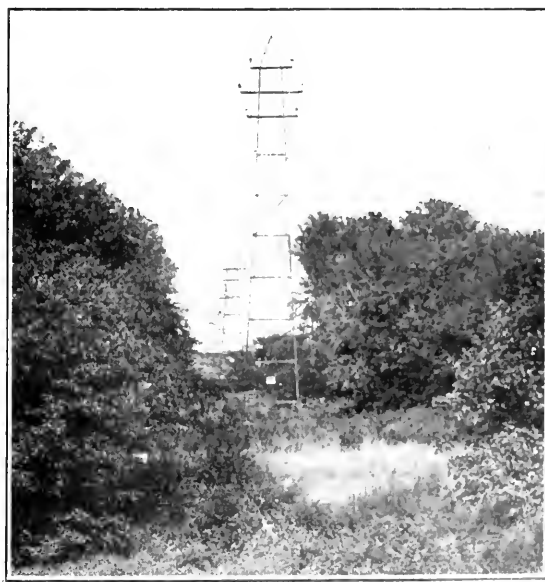


FIG. 7—INTERCONNECTION LINE RUNNING NORTH OF THE CITY OF BOSTON

kw.-in. and the financial return on such an interconnection plan would be far better, Mr. Elden said, than on many electric power developments proposed.

On the north of Boston, in 1916, there was a total generating capacity of 84,000 kw. in the central stations between the Boston system and southern New Hampshire. The combined peak loads were 58,000 kw. The average coal consumption was 3.09 lb. (1.39 kg.) per kilowatt-hour, and by interconnection it is estimated that a saving of 42,000 tons of coal could be realized per year. The construction cost of the necessary trunk tie line would be about \$1,500,000 at the outside. The fixed charges and upkeep of the line, at 10 to 12 per cent, would not exceed \$150,000 to \$180,000 annually, and at \$8 per ton the coal saving would be double this amount. The interconnection would presumably include about sixteen stations. The coal consumption of a representative group of these ranged in 1916 from 2.69 lb. to 13.34 lb. (1.21 kg. to 6 kg.) per kilowatt-hour. At least six plants probably could be discontinued, and for eight months of the year half a dozen or thereabouts of the larger plants would handle the load. The value in generating capacity rendered available for other purposes through interconnection is estimated at \$2,400,000, or about 30,000 kw.

The entire interconnection plan, it is estimated, would therefore save at least 50,000 kw., representing an investment of about \$4,000,000 and an annual reduction of coal consumption amounting to at least 70,000 tons. A conference between engineering and legal representatives of the various companies should be able to arrange equitable terms of financial interest and the operating arrangements would be comprehensive and not over-difficult. The cost of the new construction might be met by pooling of company interests, but probably a more satisfactory method would be by the formation of a company to handle the interconnection program, each company then contributing to a sinking fund a proportion of its savings based upon its kilowatt-hour output. With coal at \$5 to \$6 per ton the investment could be wiped out in less than ten years and all the differences between fuel at these prices and at from \$6 to \$8 per ton would be compensated for by the larger output of the systems grouped about the tie line. A single-circuit tie line would meet the conditions in view of the fact that the associated plants would feed into this line from the ends and from intermediate points. Finally, there would result from such interconnection, with scientific operation, not merely coal saving but a reduced generating cost which ultimately might properly be reflected in lower rates for electric service.

New Headquarters Offices for New England Power Company

The New England Power Company has begun the erection of a new headquarters office building at 35 Harvard Street, Worcester, Mass., to replace the building destroyed by fire in March. It will have a frontage of 42 ft. and a depth of 70 ft. and will be of brick construction. The general offices will be on the first floor, and executive offices, drafting and engineering rooms will occupy a second story. There will be a repair shop in the basement. The temporary office of the company is at 26 Howard Street. S. C. Moore is general manager.

GOOD LIGHTING HELPS

IN WINNING THE WAR

By Decreasing Accidents and Spoilage and Increasing Production Electric Lighting Is Doing Its Part to Hasten Victory

MUCH has been written concerning the tremendous value of electricity in the successful prosecution of the war, and almost always, when linked up with the central station, it has been the electric motor that was referred to. To be sure, the application of electric power to America's industries has made it possible to continue production in many plants and to augment greatly the output in others.

However, though perhaps less apparent, yet the lighting of a plant is none the less important. In no small measure have the Allied armies in Europe been able to put up such a good fight because of the quality of electric light in the munition and allied plants. Guns, ammunition, food, clothing and all the other necessities for our fighting forces are needed in quantities. Quantity production in this sense means maximum production, and this means working day and night. Light, therefore, and good light, is a necessary adjunct of our army and navy.

With this thought in mind, the ELECTRICAL WORLD canvassed a large number of the leading manufacturing and industrial plants in the United States in order to show as concretely as possible the value of good lighting. In all of the plants electric light in one form or another is employed. In a majority of the reports it was stated that new lighting systems had recently been installed, and in not a few cases it was stated that different forms of lighting were continually being tried out in order to get the best artificial lighting arrangement possible. It was particularly noticeable that manufacturers are changing from the inefficient carbon lamp to the tungsten lamp, and particularly the gas-filled unit.

Another frequent change noticed was from arc lamps to tungsten incandescent lamps. There were also a number of instances of change from mercury-arc to tungsten lamps.

The reports showed a disposition to depart from the use of bare lamps, and in quite a few cases it was reported that lamp candlepower was considerably increased. Instances were also noticed of changes from clusters to single lamps.

BETTER SPIRIT OF LABOR WITH GOOD LIGHTING

Manufacturers were asked in cases where changes in lighting had been made whether there was any noticeable effect on the workmen. In most cases no effect was noticed, but this cannot be taken at its face value. Manufacturers generally are sold on the benefits of good lighting and do not take the trouble to investigate the effects for the sellers. In a large number of instances, however, it was noticed that the workmen showed a better spirit and went at their work in a happier frame of mind when the lighting conditions were improved. The efficiency of employees was also better.

One factory making molded insulation on changing from carbon and arc lamps to tungsten and gas-filled lamps with reflectors noticed an increased output of the benches of 75 per cent. A sugar mill changing from carbon to tungsten lamps with reflectors noticed an in-

crease in output of the night shift of 20 per cent, besides eliminating bad batches of sugar.

The great value of lighting to-day is its effect upon labor and therefore upon output both in quality and quantity. In this connection a superintendent of one of the largest explosives plants in the United States said to the *ELECTRICAL WORLD*:

"Since in our munition plants we are operating night and day, the question of lighting is an important one. In fact, one must have good lighting in order to keep up our production, avoid accidents and produce better esprit de corps."

Labor to-day, notwithstanding statements by organized labor to the contrary, is very scarce, and, what is more, the indications are that it will be worse before it gets better. There are any number of shops suffering from labor insufficiency—shops where every minute of occupied labor counts in the production of necessities.

Consequently the element of man-hours assumes an importance not previously known. An accident, with the resulting loss in time by one or more operators injured, is no longer a dollars and cents proposition but rather one of output—the output of goods so sorely needed by the nation and its allies. Besides, when an accident occurs it is not only the injured who lose time. The psychological effect on the other workers is such that considerable time is lost and a large part of the day's output of those near the accident is lost through spoilage due to nervousness.

ACCIDENTS DECREASED

It is apparent, therefore, that anything tending to decrease industrial accidents has a very real value in helping to win the war. That lighting is in the category of an accident preventer is evident from the replies received by the *ELECTRICAL WORLD* in its canvass.

In one plant a new system of lighting so reduced the number of accidents that the company decided to carry its own insurance. A company engaged in the manufacture of zinc concentrates states:

"We have a remarkably small number of accidents, although more than 1000 men are employed. We attribute part of this to adequate lighting, which is in line with the safety first idea."

A leather manufacturer states: "Improved lighting naturally lessens accidents, particularly around elevators and machinery."

A statement from a plant milling low-grade copper is to the effect that "Light exposes danger. Good lighting is insurance against accidents."

Another copper-concentrate plant says: "We believe that better lighting has done its share in reducing our accidents more than 50 per cent."

Not only does better lighting prevent much of the loss of time resulting from accidents but also that resulting from poor health. With good and adequate lighting it is possible to keep the plant cleaner and more sanitary and to reduce eye strain and headache.

That good lighting helps to build up esprit de corps seems undebatable. The men are happier, take more pride in their work and in the appearance of the shop, and generally do better all around when the light is good. It also undoubtedly has its effect on keeping labor turnover from going higher. It is very doubtful if a few cents more wages will tempt skilled men from a plant that is well lighted to one that is poorly lighted.

PRODUCTION INCREASED AND SPOILAGE REDUCED

There seemed to be a unanimity of opinion regarding the part good light plays in increased production, although there were no figures to substantiate the opinion. However, it had been noticed in many plants that the men start work more promptly in the mornings and work up nearer to quitting time. Less loafing has been noticed in plants that have installed better artificial lighting. As one manufacturer put it, "A poorly lighted mill makes the men sleepy and production suffers." One or two others instanced men going to sleep in dark places where the lighting was poor. In each case, however, this practice was eliminated by the installation of a better lighting system.

Spoilage and repairs are elements to be considered in any production program. The reduction of the former has a twofold significance to-day. It reduces production and also reduces the available amount of raw materials. Anything, therefore, which tends to lessen spoilage has a place in the war program.

Manufacturers seem unanimous in expressing their convictions that better artificial lighting means less spoilage. A statement from a copper mill is to the effect that good lighting "is a necessity in cutting out excessive waste of copper through the tails." A manufacturer of glazed kid states that better lighting has "lessened to a considerable amount the number of mistakes."

Another angle is brought out by the general manager of a rubber plant who states that good lighting "helps the inspection department to throw out more bad pieces which otherwise would get shipped to customers to send back." The other side of this situation is, of course, the lessening of the burden on transportation systems by just so much.

A manufacturer of motors points out that good lighting reduces spoilage very much where the workman is working to micrometer dimensions.

A sugar-mill operator states that "good lighting reduces spoilage to a minimum in our case. It used to be quite a frequent occurrence to add cane juice to the ocean brine because of the overfilling and consequent overflowing of juice tanks, a thing that has been reduced through better lighting to practically nothing. The splashing and spilling of the massecuite about the centrifugal driers has been reduced to a minimum, thus making for less spoilage and a cleaner plant. While exact figures of the saving thus brought about cannot be given, it is safe to say that the saving pays for the whole lighting system in one season. The saving in lubricants due to the reduction of spillage amounts to 25 per cent."

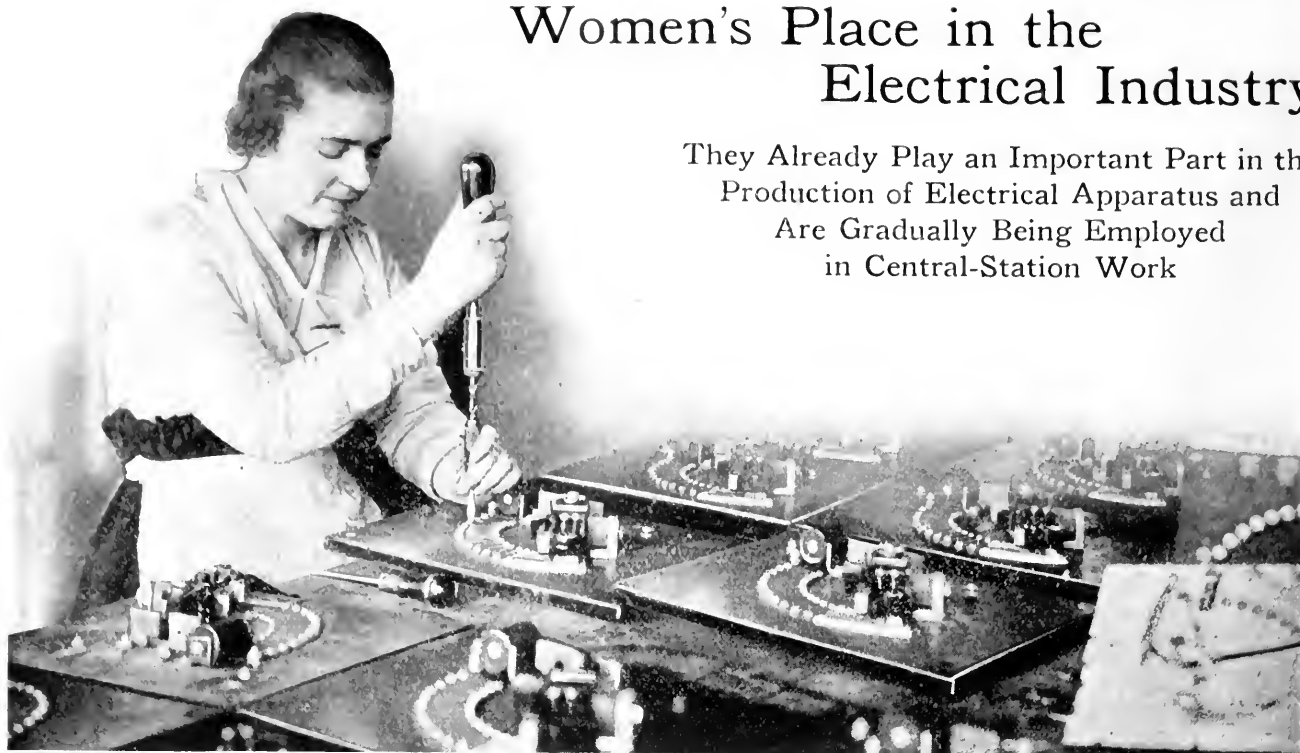
A tire manufacturer states that unless lighting for inspection is of the best tires that should be rejected for defects are passed up.

In a number of cases the value of good lighting in making repairs was mentioned. Mention was also made of the fact that good lighting made it possible to catch irregularities in a machine operation sooner than would otherwise be the case.

There is a unanimity of opinion therefore among manufacturers on the value of good artificial lighting. That it is playing a by no means insignificant rôle in winning the war is evident. The results of better lighting can be seen in increased output, fewer accidents, reduced spoilage and steadier labor.

Women's Place in the Electrical Industry

They Already Play an Important Part in the Production of Electrical Apparatus and Are Gradually Being Employed in Central-Station Work



FOURTEEN months ago almost to a day the United States entered the great world war. In that short time American industry has come to experience many radical changes. The change of greatest importance perhaps, because of the influence that it will have on human progress long after the war is over, is the utilization of that which is at hand in place of that curtailed or shut off by the war. Substitutes have been found that frequently give better results than the materials formerly employed.

Not only has substitution been made use of in the matter of raw materials but also in the labor that fabricates these raw materials into the finished product. The draft and the enlistments into the army and navy and other government work have taken millions of men out of regular employment. Industries new to this nation, such as shipbuilding and munitions manufacture, have drawn on the labor supply for hundreds of thousands of others. In addition, conditions brought about by the war have caused the manufacturing plants to increase considerably in number, facilities for production and output.

The demands of the war and of industry have therefore placed an unprecedented strain on the labor supply. Nor could this strain be relieved by the importation of labor from abroad. The war had virtually shut off our former supply of unskilled immigrant labor. Europe, however, with its experience gained through the three years of war prior to the entrance of the United States into the conflict had found a solution—woman. While the employment of women in industry was no new idea to American business men—history shows that women were employed in winding magnets as early as 1862 and that the Western Electric Company began employing women for coil winding in 1873—still industrial managers were reluctant to introduce women into factories on work formerly done by men. This has been in spite of the published records of English

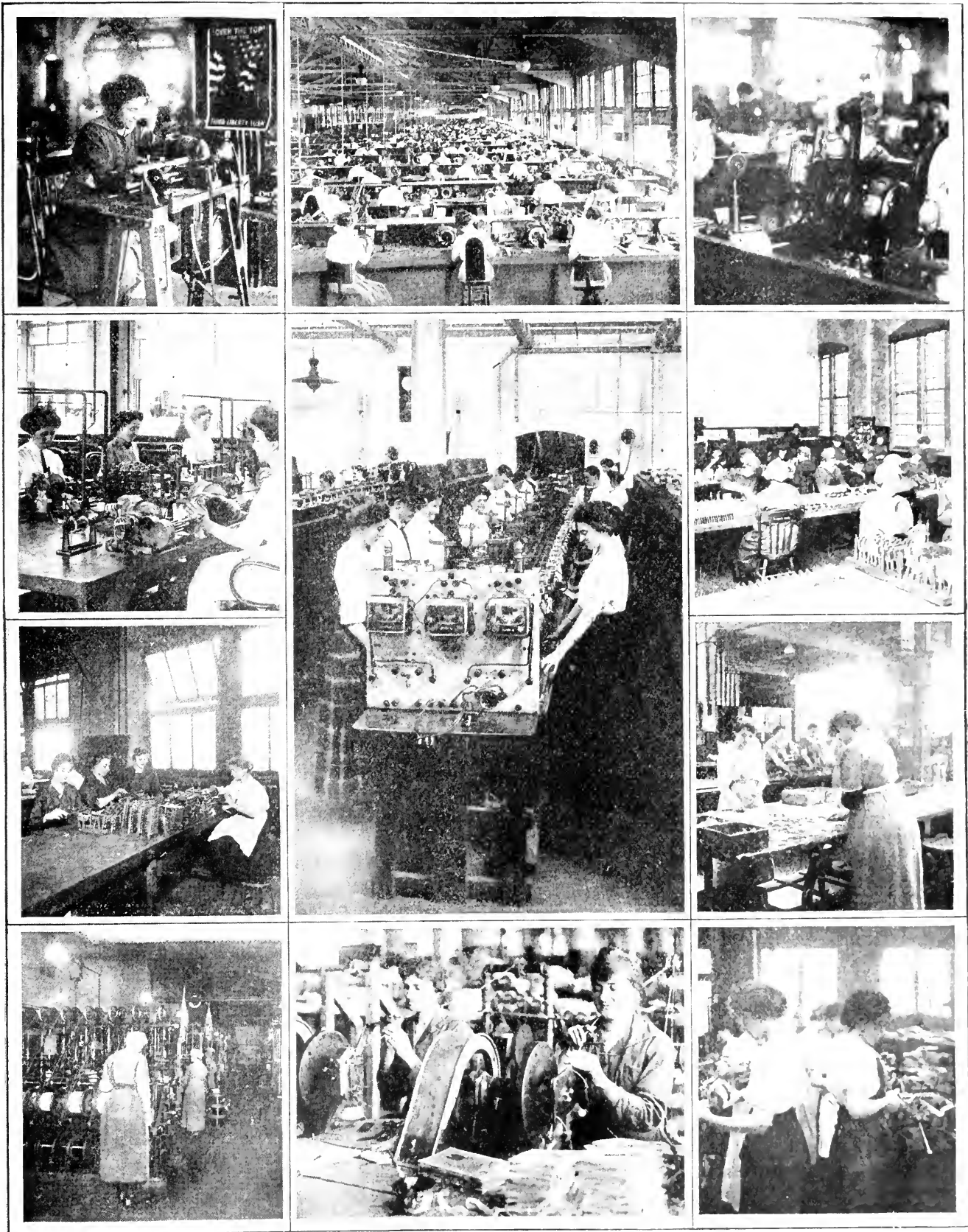
producers showing the quantity and quality of woman's work.

Nevertheless, the problem of a deficiency of male labor faces the nation. As the war progresses this situation naturally will become more acute. The government through its most recent draft proclamation of "work or fight" recognizes the need for more men in industry. This is the true situation in spite of frequent statements emanating from organized labor that there is no scarcity of male labor.

Recognizing that an insufficiency of male labor does exist and that as a result female labor must be substituted more and more, a representative of the *ELECTRICAL WORLD* has in the past two months made a personal investigation of the employment of women in a number of electrical manufacturing establishments. This study has been made in order that the entire industry might have an analysis of the experience of the plants visited.

While it was manifestly impossible to visit every electrical manufacturing organization, nevertheless, the products of the factories in which the investigation took place represent almost the entire line of electrical materials now on the market. The products include motors, generators, transformers, control apparatus, meters and instruments, fans, lamps, wire and cable, insulation of many kinds, molded and porcelain insulators, storage batteries, ball bearings, turbines, all kinds of wiring devices, high and low tension protective equipment, lamp guards, switch boxes, panelboards and other standard electrical equipment.

In much of this work, of course, women have practically always been employed. Lamp manufacture, for instance, employs, roughly speaking, 80 per cent female labor. Coil winding has largely been done for years by women. A considerable part of meter manufacture and assembly has been done by women, although the last few months has seen more of the operation in



NUMBERS OF WOMEN ARE NOW EMPLOYED IN THE MANUFACTURE OF ELECTRICAL GOODS

Reading left to right, the pictures show the following operations: Winding rheostat coils; motor-coil winding; armature winding; meter armature winding; testing meters; lacquering switch parts; knife-switch assembly;

mica building; wire braiding; making field coils; tapping. In all of these operations women are doing satisfactory service, and their field of employment continues to grow.

meter manufacture done by women than formerly. Much of the small work in wiring device fabrication has been done by women.

HOW EMPLOYMENT OF WOMEN IS GROWING

Since about September last, when the first draft was called, all of the plants visited, with two exceptions, have begun in a small way, increasing gradually, to employ women in what was formerly considered as man's work. In one of the exceptions the management of the plant, being unwilling to employ women, turned in its necessity to old men—men who formerly, because of their years and infirmities, would have no place in factory production. The results in this case have been very gratifying to the management of the plant.

In very few cases have women been employed to take the places left vacant by experienced men. In the majority of cases women have replaced young men and boys. In many instances employers said that they had had this change in mind for a long time and that the war simply hastened their action. Much of the work is described as really woman's work—it is small, light and of quantity nature and by no means physically fatiguing.

Women have replaced male labor at the present time for the sole reason that it was impossible to obtain male labor in sufficient quantities and at the wages offered. The writer has one instance in mind where a boy yet to have his first shave entered the employment department of a New Jersey factory looking for work. Asked what he had been getting, he said \$32 a week. This is but one instance. Boys of sixteen and seventeen are now demanding and getting from \$18 a week up. There is sufficient labor applying for work, but in large measure it is either undesirable or else of the floating kind looking for higher and exorbitant wages.

Women of all kinds are applying for work. They are being drawn from other industries, from the servant class, and to a slight extent from the store and office. A large number of teachers are entering factories because of the wage inducement. The home also is furnishing a number of women. Girls who never worked before are now seeking employment. In many cases some male member of the family has gone to war and the girls have of necessity had to go to work. There are a number of married women whose husbands are in the army or navy who are seeking employment. Finally there are large numbers of girls going into factories whose father or mother or some friend works in one and urges them to do so.

HIGH TYPE OF WOMAN ENTERING INDUSTRY

Generally speaking, the type of girl going into industry is a high type. Many have been impelled to this action through patriotic motives—the wish to do their bit. There are instances, however, where the general average of women seeking industrial employment has been lower. In each case where this condition was met a study was made of the locality and the labor competition in that district. Without exception it was found that where the average type was lower industry had already drawn heavily on the female labor supply and that the cream had long been absorbed. Now, with still greater need for female labor, it is but natural that a lower average type is being accepted. When

so many industries are bidding for a certain class of labor it is not possible to pick and choose as formerly.

On the other hand, in districts where there was little or no competition the type of girls coming into industry now is as a rule somewhat better than formerly. It probably can safely be said that in districts where there are a number of plants engaged in the manufacture of munitions in which women are employed at very attractive wages the general average of women seeking industrial employment will be lower. Where this condition does not exist the average will probably be higher.

Employers speak well of the quality and quantity of woman's work, and not a few express their surprise that such good results could be accomplished in such a short time. In those factories visited they have been found, on whatever work employed, to be fully as efficient as boys and frequently more so. As a rule, the women do not have so large an output as grown men.

WOMEN MORE DEPENDABLE THAN BOYS

Women are more punctual and steadier than boys. They do not loaf so much on the work. The tendency of women to absent themselves from work, which has been so prevalent in offices and stores where a regular weekly wage is paid, has been regulated in the factory without difficulty through the time or piece rate system of compensation.

It is generally felt by those employing women that they must be placed on light work only. The best results with women so far have been obtained on light work and quantity production. While it is generally believed that women to be of any use should do the same thing day in and day out, there are instances where girls are running two or three different kinds of machines interchangeably as needed. In only exceptional cases do the women set up their own machines or grind their own tools. Helpers are employed for this work. Girls are not inquisitive about their machines. In some ways this has proved advantageous, for boys with an inquisitive turn of mind have caused considerable damage to valuable machinery.

OLD IDEAS OF PHYSICAL ABILITY ARE CHANGING

Some of the old ideas regarding the physical limit to woman's work are now giving ground under the stress of conditions. Women are being put on work to-day that two years ago factory superintendents would have thought to be too heavy. They are winding heavier coils and running machines that need greater exertion. In every case investigated the results justified the action.

There is one point made by most factory superintendents that is borne out by European experience. That is the matter of training. Superintendents and foremen hold that for women to be a success in the factory the training must be very careful and thorough. Women, it is claimed, will not use their heads on factory work. They will simply do as they are taught. If well taught, their work will be well done. Production will be greater and better in direct proportion to the exactness of the training. Sufficient time therefore must be allowed and the instructors must be competent and patient. They must understand women and be able to bring out the most in them.

Some trouble was expected by employers from male

labor, because of the introduction of women. None, however, has developed in those plants visited. The men appreciate the fact that there is a shortage of labor and that the employment of women was a necessary measure. In most factories the men are very kind to the female operatives and go out of their way to help them.

While the wages in almost every case are lower than those received by the replaced males, there has been no complaint so far from organized labor. However, this wage matter will probably adjust itself before the conclusion of the war. Women are already making demands, and employers fully expect in the long run to have to pay equal wages for equal work.

As regards turnover, the same condition exists as was spoken of in connection with the type of women employed. Where there is little competition the female

turnover is very small as compared with the male. Where there is competition, especially from plants engaged on war contracts, the female turnover is as great as, and in some instances more than, that for men. The turnover resulting from marriage is not so large as might be expected.

Women have been employed as a war measure not only in manufacturing but also in other branches of the industry. A number of central stations are known to be experimenting with them in different positions formerly occupied by men. In the meter, billing and collection and in the sales departments particularly women are being tried out.

In subsequent issues of the ELECTRICAL WORLD this subject will be gone into in more detail with special reference to instruction, welfare work, wages, factory changes involved, turnover and legislation.

Central-Station Employee Relations

Faithfulness of Employees During War-Time Stress Due to Foresight Displayed by Managements in Establishing Welfare Work Years Ago—Accident Insurance and Profit Sharing Play Their Part

BY FRANK A. FARNSWORTH, JR.

THE fact is more urgent than novel in any sense that the present is a time of increasing uncertainty in the labor field. The war, with its tremendous claims on overseas interest, has, so far from drawing attention from problems at home, been a means, and a potent means, of bringing this labor question more sharply to the fore. So true is this that consistently with patriotic ends the question undoubtedly is uppermost in the minds of industrial leaders the country over.

While the central-station industry, with its far-reaching ramifications, lays no claim to great foresight in this direction, it can safely include itself among the number that have foreseen to some degree and acted accordingly. The co-operative idea to which reference is made has worked out in this case successfully and with growing momentum, assuming one aspect here and another there, as local conditions determined, but everywhere instilling collective confidence that has reacted in industrial strength and steadiness.

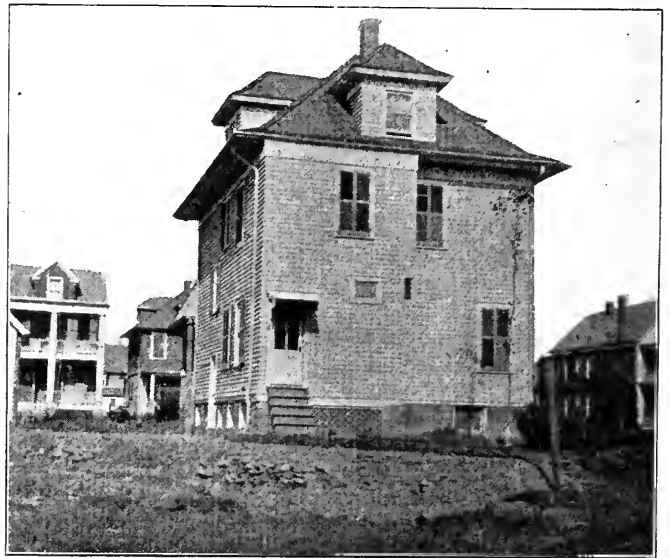
It has long been felt in central-station circles that any suggestion of charity or philanthropy should be avoided in the establishment of relations between employees and their employers. On the contrary, a man-to-man attitude has been in force, in the sense that the employee shall earn his compensation both in the performing of work and in the rendering of service. This last presupposes, of course, continuity of work, together with a degree of devotion that affects not only his own efforts but the tasks of those about him. To insure this devotion and continuity the industry, especially during the last decade, has adopted a series of measures each of which will be described briefly.

INSURANCE AGAINST ACCIDENTS

Second to no other in importance in this series is the insurance of employees against accident, together

with the use of every known device for accident prevention. It has been the belief in the industry that the cost of all industrial accidents due to other than deliberate misconduct or gross carelessness should be borne by the employer, who, moreover, assumes full responsibility for the rapid restoring to health of the injured employee. His wages are continued during the interval, and the cost of all medical treatment is met by the company. Should a man be partially incapacitated for life he is put to work at some duty suited to his competence. These and other provisions in the same spirit have been applied throughout the industry as a whole, and needless to say have done incalculably much to foster reliance in one's company and devotion to its interests. Such methods were effective, for example, in the New York Edison Company long before local industrial conditions called for the passage of the workman's compensation act. While compelled to readjust its practice to conform to this act, the New York Edison Company has since contented itself with nothing less than making up the difference to the employee between the compensation prescribed by law and the full compensation paid him before its passage, provided that the employee conscientiously follows out the instructions of the company's physicians.

With regard to accident prevention, the same company has adopted a course thoroughly typical of the industry in general. To such an extent has the protective sheathing of parts been carried in the New York stations that the probability of accidents is reduced to a minimum. Not only do voltage numbers, "hold off" signs and other such announcements confront the employee at every turn, but when work is to be done in installing or in connection with high-tension apparatus the issuing of notices, the preparing of sketches and the making of records at each single step preclude trouble all but absolutely. Systematic inspection



TYPES OF EMPLOYEE HOMES BOUGHT THROUGH THE NEW YORK EDISON SAVINGS AND LOAN ASSOCIATION

tion and the providing of hand rails, rubber mats and rubber gloves are effectively seconded by the distribution of operating rules with which every man is required to familiarize himself. By way of a final safeguard, and one perhaps as essential as all the others, the company in question maintains a technical school for employees which aims not only at the imparting of technical skill but at the development of mental alertness and accuracy of judgment. Such means taken for his protection have not failed to promote

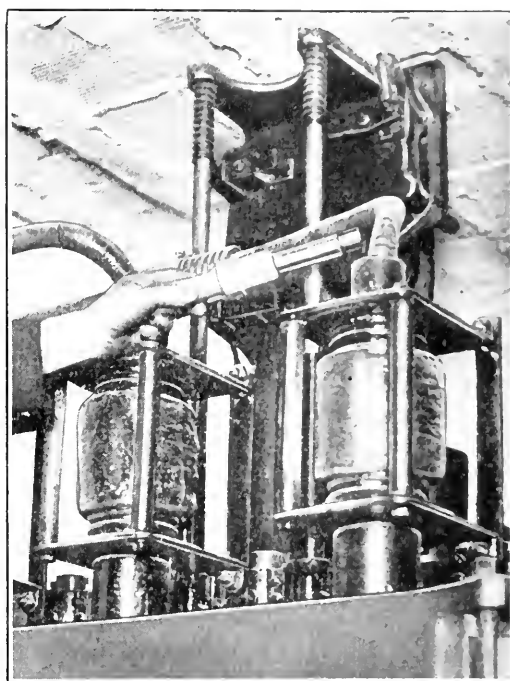
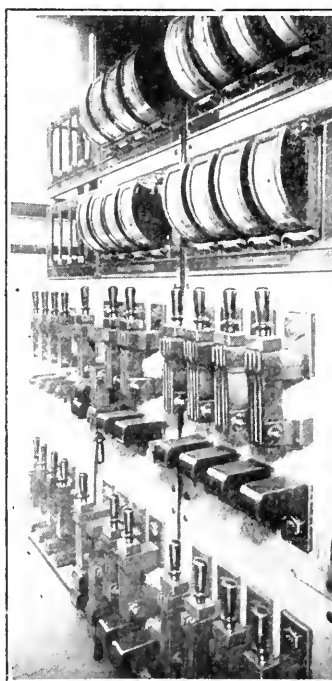
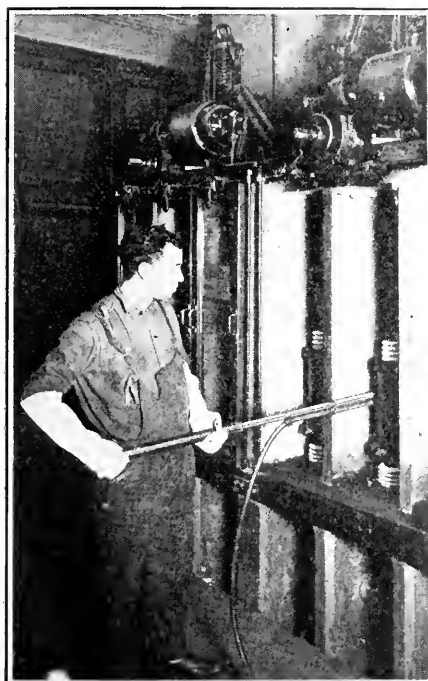
in the employee both a confidence in his surroundings and a trust in the organization of which he is a part.

While accidents at times occur despite every precaution humanly possible, industrial sickness as commonly known is practically absent. However, ordinary sickness applies here as elsewhere and has offered a further scope for co-operative interest. With this in view, benefit associations have in general been established throughout the industry. Aided by the em-

ploying company, these have followed a successful and practical development. Owing to such means, the old custom among employees of "passing the hat" whenever it was necessary to raise money for the funeral expenses of a fellow employee or when his dependents were left without means has been done away with. The general opinion has prevailed that with the assistance of the employing company these co-operative societies can contribute approximately 50 per cent of the wages of an employee when sick at a cost of approximately 1 per cent of his wages; furthermore, that a death benefit of from \$300 to \$500 can be paid with a weekly contribution ranging from 10 cents to 15 cents.

Among many such associations in the industry that of the Southern California Edison Company is the

tions in general, and the age prescribed for the receiving of an annuity on a basis of permanent service is, roughly speaking, sixty-five years for a male employee and sixty years for a female employee. The term of continuous service in the organization is approximately ten years. The cost of such annuities is contributed by the individual company as part of the annual cost of labor. Obligation to pay the annuity ceases only in the event of the employee's breaking voluntarily the continuity of the term. This naturally does not apply in case the employee is laid off temporarily through no fault of his own. A break of this sort is looked upon rather as an interruption. Such, broadly speaking, are the pivotal considerations on which the plan rests and on which it has succeeded in helping labor to rely in the central-station industry.



EMPLOYEES ARE OBLIGED TO USE RUBBER GLOVES, SWITCH GUARDS, ELECTROSCOPES AND OTHER SAFETY APPLIANCES PROVIDED BY THE COMPANY

most recent to be reported. This company, it seems, has volunteered to collect the assessments through its payrolls, turning the amount so collected over to the treasurer of the fund, and also to advance money to the fund in case a loss has to be paid before the assessment can be collected. The average cost of the amount of insurance agreed upon has been a little less than 44 cents a month and compares favorably with any class of insurance obtainable anywhere. The fact that no item of expense of any sort is charged against the fund makes it possible to give the beneficiary every cent contributed. It has further been an unwritten law to pay benefits with the utmost promptness. What this particular fund is doing in removing the distractions of worry and necessity is reflected in many similar associations in as many companies under whose patronage and with whose help such benefits are made possible.

SERVICE ANNUITIES

An exceedingly forceful factor in the advancement of confidence and loyalty is the provision of service annuities. The practice prevails among central sta-

The service annuity plan of the Edison Electric Illuminating Company of Boston illustrates a concrete working out of the idea. This plan specifies that "any male employee who shall have reached the age of sixty-five years and who shall have completed fifteen or more years of continuous active service (the age for female employees is sixty years) shall at his or her request or at the discretion of the committee be retired from active service with a service annuity." The Boston plan goes on to provide that "any male employee who shall have reached the age of sixty years and who shall have completed twenty or more years of continuous active service (the age for female employees is fifty-five years) shall at the discretion of said committee be retired from active service with a service annuity." Any employee who shall have completed thirty or more years of such service can, under this arrangement and irrespective of age, be retired at the committee's discretion with an annuity.

The amount of this annuity to be paid each year is 1 per cent of the average annual pay of the employee during the last ten years of active service multiplied by the number of years of service. It is provided,

however, that no service annuity shall be less than \$300 a year. With this surety ahead of him the employee cannot but feel at home and secure as a central-station man.

SHARING PROFITS WITH EMPLOYEES

What the Southern California Edison Company has adopted in the way of profit sharing may be cited briefly as showing what a prosperous unit of the industry is doing to promote in this way the cohesion of capital and labor. The cardinal features of the plan are as follows: On due authorization the company last August issued \$2,500,000 of its common capital stock, and all employees were given an opportunity to subscribe under carefully worked-out conditions. These conditions were as easy as consistent with conservative financing, and permitted an employee to subscribe for shares of par value equal to not more than ten times his monthly salary. Such subscriptions are paid for by deductions from monthly pay checks of a sum equal to $7\frac{1}{2}$ per cent of the past month's salary and credited to the purchase price of the stock. Subscribers are also credited with all dividends which accrue from the date of subscription, and these dividends apply as payments on account of the profit sharer's stock together with the $7\frac{1}{2}$ per cent deducted from his salary. When payments have been completed stock certificates are issued, and thereafter checks are mailed to stockholders as dividends are declared. If they wish, profit sharers of course can pay as much more as they desire upon their stock, the $7\frac{1}{2}$ per cent having merely been decided upon as the limit of deduction. At the price which the stock was and is bringing to employees, the interest is equal to practically 8 per cent, or more than double what can be obtained from savings deposited in any sound institution. After a trial of six months this plan has amply justified its inception. It may be said, in fact, that a general plan of this nature advocating profit sharing through the ownership of stock on the part of the employees has become an all but prevailing policy in the industry.

A still further provision whereby the central-station employee is drawn sympathetically to the industry and markedly to his immediate organization—a provision looking to confidence in the concrete and economic sense—is that of the savings fund. The idea, which was included some years ago as part of the industry's public policy, aims to encourage thrift among employees, not alone as a resource in emergency but even to the degree of home ownership. The two outstanding features in the general project were and are a guarantee by the company of the security and safe return of the funds and the affording to employees of every convenience in making their deposits. Under the conditions it was felt that more than the ordinary savings-bank rate of interest could usually be paid.

Though the savings association of the New York Edison Company may possibly not be more effective in its field than similar associations in central-station companies in many parts of the country, special reference may be made to it here inasmuch as the very latest figures are at hand. This association was started in 1912 and within five years had distributed to its membership \$69,554 in dividends. This item alone for the past year amounted to \$26,962, while the

money deposited in the same year aggregated \$285,882. The smallest deposits have been acceptable, and the way has been made easy for every member of the company to save something, however little. By way of illustrating share earning, mention may be made of the first installment series, of June, 1912. The dues paid on a share in this series amount to \$67, and these in turn have earned \$12.83 in dividends, bringing the present value of the share to \$79.83. To continue through the list would be to meet at every point results emphasizing the benefits of such membership.

A word has already been said regarding the desire to make employees a home-owning class. With this in view, bond and mortgage activity has marked the association from the start. During the past year this activity has brought about total loans numbering 129, with a value of \$392,000.

Installment mortgages can be carried for \$10 monthly on each thousand dollars loaned—half of the charge, or the portion representing dues paid, operating continuously toward the reduction of the principal sum. These loans may be made either for the purchase or building of homes, for the transfer of existing mortgages or for home improvements. In every instance the association stands ready to render the greatest aid with respect both to the loan itself and to the preliminary details. In the case at least of this association all expense of operation is borne by the company. That the expense involved in clerical work is in itself a very considerable item and one that otherwise would appreciably reduce the dividends now possible is seen in the one fact that 80 per cent of the members pay their dues in weekly installments.

With figures immediately available, mention may be made in this connection of a highly popular and successful insurance privilege of which four-fifths of the employees of this company have availed themselves. The type of insurance offered is what is known as the "group term," the amount of the primary offer being \$250, to which \$100 is added gratuitously by the company in case of death. The fee under this plan is 65 cents a quarter, or 5 cents a week. Policies more substantial in amount up to \$1,000 may be taken out by any employee without physical examination, provided he does so within one year after his entering the organization. The policies in this case may be of any sort a man may care to take, and the fees are at the regular standard rate.

THE SOCIAL SIDE OF WELFARE

Much might be said, and of a most interesting description, regarding other helps which the various companies in the central-station industry afford their employees, with emphasis particularly on the social side. Indeed, any discussion of employee clubs and clubhouses would require an article of itself. However, enough perhaps has already been pointed out to show that exceedingly much has been done by the industry to infuse the human element into its employee relations and eliminate unfortunate infelicities and misunderstandings that stand in the way of cohesive co-operation. This infusion and this elimination, which have so long been the aim of those who have sought and striven for happier conditions for their fellow men, may in truth be said to be realized in this industry and stand out even in these troublous times.

Avoiding a Preventable Loss

Soot and Its Effect on Heat Transfer Through Boiler-Heating Surface — Relative Steam Consumption of Mechanically Operated Soot Blowers Versus Hand Cleaning — Effect on Coal Pile, Labor and Maintenance Cost

DURING recent years the boiler room has gradually emerged from a position of secondary importance to a primary element in the cost of power generation. Boilers have been growing in size, combustion rates have increased, and greater loads per unit of steam-making surface are being carried. With the operating conditions becoming more severe and fuel cost high above the normal level of years past, closer scrutiny is being given to all factors affecting economy.

LOSS FROM SOOT FORMATION

Of all the preventable losses, that caused by the formation of soot on the fire surfaces of the boiler is perhaps the most troublesome. Cracks in the setting may be detected and the leakage of air into the setting may be stopped. Proper insulation will reduce radiation, and scale on the water surfaces may be eliminated to a large extent by the use of pure or softened water. The formation of soot and ash, however, is universal and continuous as long as there is an active fire under the boiler. Depending upon the degree of combustion and arrangement of the setting, the quantity of soot varies and its character differs with the fuel, but there is no stopping of its formation. Even if conditions were ideal and combustion complete, a heat-insulating coating composed largely of ash would form on the tube surface.

As a rule the soot found in boilers is not pure soot or carbon. It contains a varying proportion of ash, so that the color may be light gray, red, brown or black where conditions are particularly unfavorable to good combustion. In coming from the furnace the soot particles are more or less plastic and readily adhere to the metal surface of the tubes. Unless the deposit is quickly removed the carbon on the tubes near the fire will burn out in part, fusing the various ingredients into a hard coating which increases rapidly as the gas temperature rises because of the insulation of the tubes. In water-tube boilers it is not uncommon to find on the heating surface near the fire hard clinker-like formation, in some cases bridging the tubes. Even with efficient and frequent cleaning it is practically impossible to keep the lower tubes near the fire entirely free of this slag-like formation. Further back the soot does not contain so large a percentage of ash. It is usually darker in color and the formation is not cemented together. Loose deposits rest on all retaining surfaces, such as the upper portions of the tubes.

With all kinds of fuel, then, there is formation of soot. Anthracite contains a low percentage of volatile matter, but may run high in ash, so that the deposit is largely the latter constituent and is usually of a light powdery character. With bituminous coal, high in both volatile and ash, there is a large percentage of carbon in the soot, particularly if the furnace conditions are not favorable to good combustion. In waste-heat boilers deposits of fine powdered dust carried along with

the gas are to be found, and even with oil fuel there is some formation of soot. Owing to excellent combustion the quantity is small, but as the deposit is pure soot of high insulating value, its removal is important from an efficiency standpoint. The soot evil also extends to the economizer, the deposits resembling the boiler soots. Because of the lower temperatures the formation is more profuse and its interference with heat transmission relatively greater as the difference in temperature between gas and water is less.

It has been commonly stated that next to loose wool loose lampblack or soot is the best insulator known. In this respect it is ahead of hair felt and is more than five times as effective as fine asbestos. All this may be true, but boiler soot is not all lampblack. The varying percentages of ash and the density and structure of the deposit will naturally affect the insulating properties. Besides, the coating is not evenly distributed, so that part of the surface at least will be comparatively clean. If the maximum heat transfer through the boiler tubes is to be maintained, however, all of the heating surface must be kept clean, and this is particularly true where boilers are forced over normal rating, as is the practice in modern plants. If the soot is allowed to remain, another bad feature is the formation of carbonic and sulphuric acids, which act on the metal of the boiler, causing leaky tubes and general deterioration that will shorten the useful life of the boiler. It is quite evident, then, that soot must be removed if the best results are to be obtained, and the question at issue is the easiest and most efficient method of doing this.

METHODS OF REMOVING SOOT

For this purpose there are the hand lance and the mechanical blower. The former, consisting of a rubber hose and nozzle, was the first device to be used. It is, of course, very simple, and the initial cost is small. Two men are required to operate it—one at the boiler to handle the nozzle and the other at the steam valve. The work is naturally hot, dirty and disagreeable, and on a medium-sized boiler it takes from twenty to thirty minutes. Usually there are not more than one or at most two blowings per day of twenty-four hours. The lance is inserted through dusting doors in the setting, and there is no opportunity for the operator to see the result of his work. Unless he is conscientious beyond the average the surface may be poorly cleaned and some sections be neglected entirely. Usually the lance does not reach all of the heating surface, the area covered being determined by the kind of dusting doors, the width of alley space at the side of the boiler and the range of the lance due to the angle of the dusting door. Another objection commonly advanced against hand blowing is the fact that when soot is blown across the tops of the tubes it strikes the battery wall and tends to pile upon the far tubes, contrary to the argument that the draft will carry it off.

Moreover, there is the additional objection of large quantities of cold air being drawn into the setting during the period the steam lance is in operation. This means less efficient combustion.

Labor is another item entering into the comparison. The mechanical blower requires but one man, and the time of blowing is, say, one-fourth as long, so that the

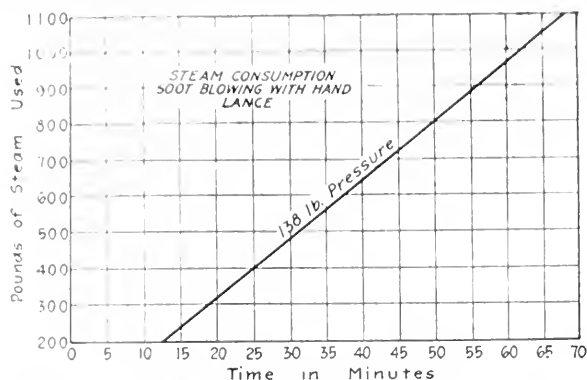


FIG. 1—STEAM CONSUMPTION WITH HAND LANCE

ratio is eight to one. With very large boilers it may be considerably higher. Local conditions, size of plant, etc., determine whether the saving in time will be sufficient to dispense with the services of employees retained for this work.

Objections offered to the mechanical blower are initial cost, running from 5 to 10 per cent of the cost of the boiler, the burning out of the elements exposed to the hottest gases direct from the furnace, and warping. The objection last named, warping, has always been a serious problem. It is a well-known fact that metal begins to warp long before it reaches a temperature that will cause corrosion or burning of the metal. For that reason it is necessary to construct the element so that it will have strength to resist the warping; for as soon as this action begins the element will be thrown out of line, it will bind in the bearings and the operator will be unable to turn it.

The initial cost is comparatively small when compared to a 5 per cent saving in the fuel bill, the reduction in labor and the convenience of operation. Destruction of the elements near the fire has been obviated to some extent by the use of special metal having high heat-resisting qualities and by so placing the elements that they are protected from the direct heat of the furnace when in the non-operating position. Corrosion, due to back suction of the boiler gases into the blowing elements, has been reduced by the use of special air valves, and special precautions have been taken to drain the piping system of the blower to prevent condensation being forced out onto the heating surface to interfere with soot removal and to corrode the metal. These various improvements, better placing of the elements and nozzles of improved design have so perfected the mechanical blower that, according to reports from numerous users, the services rendered are excellent and the maintenance charges are comparatively small.

While users of the mechanical soot blowers realize that they are getting better heat transfer, that the flue gases are lower in temperature and that the boiler efficiency has been improved, there is a lamentable lack of specific data showing the saving actually effected and the average cost of maintenance. The blowers have

been installed. They are giving satisfaction. The boilers will carry more load, and it is known that the flue temperatures are considerably lower than previous to the installation. During the first two or three years of use repair parts are required occasionally. Depending upon the service, the average life of the blower is at least five or six years. The labor of blowing has been reduced, and as the work is less arduous, it is performed more frequently and with better results.

Such was the gist of replies from a large number of power-plant owners and engineers to whom inquiries had been sent by the ELECTRICAL WORLD concerning the saving in fuel and labor effected by the installation of mechanical blowers, the cost of maintenance and the degree of satisfaction the blowers gave in service. The substance of some of the replies, more specific than others, is presented in the following:

The Iowa Falls Electric Company has equipped three Edge Moor water-tube boilers of the four-pass type with soot blowers. Two of the boilers were rated at 410 hp. and the other at 550 hp. The boilers had previously been blown by hand, and the work required the full time of one man at a cost of \$850 per year. In the company's opinion it took a remarkably good man to stand up beside a hot boiler and blow every tube. Frequently some of the tubes were missed, and the result was a reduction in efficiency. Besides, a man could not hold a hose carrying 175-lb. (12.3 kg. per sq. cm.) steam pressure. It had taken the company two months to get all of the old scale off the tubes caused by blowing them with wet, low-pressure steam. The principal advantage of the mechanical blower in its estimation was the fact that full boiler pressure could be used and that better results were obtained. Since the installation of the blowers the services of the man previously mentioned had been dispensed with, and the firemen were blowing the tubes twice on every shift. The saving in coal was placed at 15 per cent. The blowers had been in service one year, and the maintenance expense had been the cost of 1 pint (0.47 l.) of oil to lubricate the swing joints.

The Iowa Railway & Light Company of Cedar Rapids

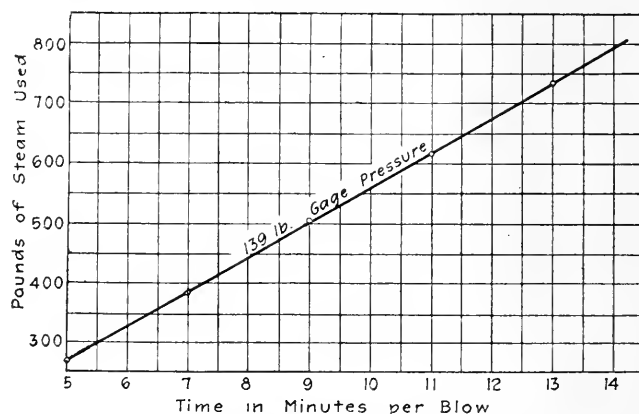


FIG. 2—TOTAL STEAM REQUIRED FOR PERIOD BLOWER IS IN OPERATION

had installed mechanical soot blowers on twenty-nine Edge Moor water-tube boilers during a period extending from 1909 to 1918. The company knew that the blowers were a great help both in labor and economy, but could give no definite figures. It had been found that the blowers would not keep clinkers off the first row of tubes. Here was a chance for improvement.

In the plant of the Indianapolis Light & Heat Company fourteen boilers, ranging in size from 500 hp. to 800 hp., were equipped with mechanical blowers. If properly operated, the blowers saved approximately 15 per cent in fuel and labor. About $12\frac{1}{2}$ per cent of this saving was attributed to higher boiler efficiency and $2\frac{1}{2}$ per cent to a reduction in labor cost. The maintenance had been approximately \$5 per installation per month.

The Richmond Light & Railroad Company had blowers on ten 606-hp. B. & W. boilers, equipped with Taylor stokers. The maintenance on the blowers, which had been installed from one to two years, had been practically nothing. The company had no accurate data to show the saving in coal and labor, but was satisfied that the blowers were a good investment.

The Edison Electric Illuminating Company of Brooklyn had in use blowers on seventeen B. & W. boilers averaging 650 hp., and forty-five additional units were being installed. Installation work had begun in November, 1916, and no definite figures as to fuel saving are available, as the majority of the boilers were

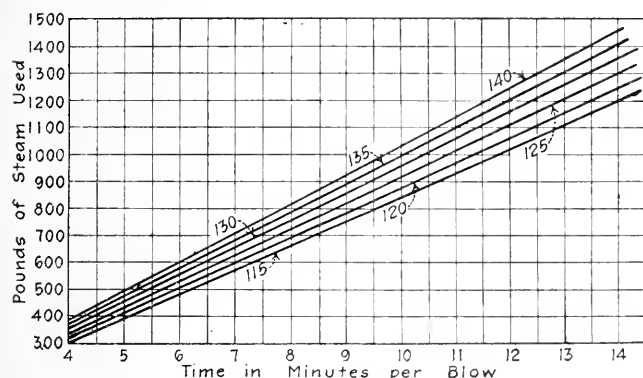


FIG. 3—STEAM CONSUMPTION OF 2-IN. BLOWER FOR VARIOUS PRESSURES

still blown by hand. In the opinion of the operating engineer there was no question that the boilers were much cleaner by the use of the mechanical soot blower, and as a result a saving in fuel must result. When all of the soot blowers were installed, the labor saving would eliminate the services of five men and would amount to about \$13 per day.

Soot blowers on 4900 hp. of Stirling boilers are in use at the plant of the Indiana Railways & Light Company of Kokomo, Ind. No tests have been made to determine the percentage of saving. Cleaner tubes so clearly indicated a saving that the question had not been analyzed. It had been their experience that the soot blower complete had to be removed in from five to six years.

Four 750-hp. Bigelow-Hornsby boilers in the plant of the Salem Electric Lighting Company of Salem, Mass., had been equipped with soot blowers in 1915; five blowers were installed on 280-hp. Heine boilers in the plant of the Rockland Light & Power Company of Nyack, N. Y., in 1914, and in the same year a 600-hp. B. & W. boiler of the Malden Electric Company of Malden, Mass., was equipped with a blower. In the plant first mentioned the saving in labor was \$675 per year, in the second plant \$411 per year, and in the Malden plant the labor saving was undetermined. Blower repairs in the three plants had been negligible. In the opinion of the engineering manager controlling the three prop-

erties there was no question that there had been a saving in fuel on all the boilers equipped with mechanical soot blowers, as it was possible to clean the tubes twice in twenty-four hours so that the heating surface was maintained in much better condition. No exact data were available.

The Central Hudson Gas & Electric Company of Poughkeepsie, N. Y., had equipped six of eight Stirling boilers with mechanical blowers. These blowers were much more effective than the compressed air they had previously used, and there was a considerable reduction in labor.

Installation of soot blowers on two 400-hp. Heine water-tube boilers in the plant of the Chester Valley Electric Company of Coatesville, Pa., in the year 1911 had resulted in a saving in the operation of the plant roughly estimated at 5 per cent. The above figure was considered conservative and was divided into 1 per cent in labor and 4 per cent in fuel. The maintenance charges, which had been small, were placed at \$100 in seven years.

With blower installations on two 350-hp. Heine boilers and two Stirling boilers for several years, the Texas Power & Light Company placed the cost of upkeep at \$5 per blower per year. A saving in fuel of approximately 10 per cent was estimated over hand blowing.

The public lighting plant of the city of Detroit had installed soot blowers on two 685-hp. Stirling boilers on April 21, 1916. To clean the soot from two 400-hp. Stirling boilers by means of a steam hose from ladders required the labor of two men for about three hours. With the mechanical blowers the battery of two 685-hp. boilers was cleaned by one man in one-half hour, the ratio being twelve to one in favor of the mechanical blower. So far there has been no maintenance expense.

One of the large central-station companies of the country has equipped fifty-five boilers with mechanical soot blowers. These blowers are of competitive types, and a few of home manufacture. Fifteen of the installations have been made on Stirling boilers rated at 2365 hp., that operate between bank and about 200 per cent of rating. On overload the temperatures are high and the conditions severe, so that it has been found necessary to assist in the further development of the blowers. To clean one of the large boilers by hand requires twelve to fourteen hours' time with two men operating. These men receive 38 cents per hour, so that the labor cost for hand blowing averages about twenty-six hours of 38-cent time, or just under \$10 per 2500 boiler-hp. per twenty-four hours.

With soot blowers installed two men blow a boiler in about one hour. They blow each boiler three times per day, so that the total labor cost approximates \$2.30 per 2500 boiler-hp. per twenty-four hours. Thus the labor item is reduced to less than one-fourth, and the boiler has the advantage of three cleanings per day. The job is much better done, and no useless air is admitted through open doors. The effect of this factor will be appreciated when it is noticed that it takes from twelve to fourteen hours to blow one of the boilers by hand.

To clean one of the big boilers with a mechanical blower requires about 3500 lb. of steam per blow. Three operations per day would require about 10,500 lb. (4762.7 kg.) of steam per 2500 boiler-hp. every twenty-four hours.

The maintenance charges on soot blowers had not been separated from certain other somewhat similar costs, but it was estimated that soot blowers properly installed could be kept in good operating condition with a maintenance expenditure of not over \$200 per 2500 boiler-hp. per year. The average charge had been higher than this, but it was due to the fact that certain parts as originally designed and installed had given out frequently and had to be replaced. Owing to imperfect methods used for measuring flue-gas temperatures accurate data were not available to indicate the thermal advantage obtained from the use of soot blowers. It was believed safe to assume, however, that mechanical soot blowing maintained a flue-gas temperature about 30 deg. to 40 deg. lower than could be maintained with hand blowing, and unless the latter operation was completely and conscientiously done, the difference would be more nearly 80 deg. to 100 deg. less.

PRACTICAL SUGGESTIONS FOR ECONOMY IN USE OF FUEL

By Using High-Grade Coal at Peak Time Poorer Coal
Can Be Utilized at Other Periods Without
Increasing Boiler-Room Investment

BY P. B. JUHNKE

Chief Load Dispatcher Commonwealth Edison Company

THE ever-increasing fuel requirements of this country entailed by the immensely increased industrial requirements focus the engineer's attention on a subject not generally considered heretofore. It is the burning of lower-grade fuels without greatly increasing the boiler-room investment.

The steaming value of a given coal is within certain well-defined limits a function of the size of the coal; likewise, the price of coal is dependent on the size selected, screenings being rated lowest in value. While their test B.t.u. value may be equivalent to that of any given coal, their steaming value in boiler rooms is considerably lower than similar screened coal. However, as screenings will always be a necessary by-product in the coal industry and as 90 per cent of the time they are sufficient, they constitute the logical fuel for central stations.

Burning the lower grade of fuel exclusively, however, requires additional boiler-room equipment over what would be required with the more expensive screened coal for a given steaming capacity. The additional investment required is vitally important to central-station companies, whose loads have the familiar sharp peaks, during which time alone the development of maximum capacity is necessary.

A decided step in the direction of economy of both boiler-room investment and high-grade fuel has been made by the Commonwealth Edison Company in its principal generating stations during several peak seasons. The fuel ordinarily burned is not quite sufficient for the development of maximum capacity during the winter evening peaks, and is supplemented in these periods by higher-grade fuel, to permit maximum output. This is done by storing the more suitable coal on the floor and during the peak supplementing the stoker firing of lower-grade fuel by hand firing of the higher-grade fuel in the proportion of approximately fifty-fifty. Such practice permits good combustion of the

entire supply and enables the stations to carry their rated full load and more at the most critical time of the daily load, something that would be scarcely possible were the hand firing of high-grade coal not resorted to.

This scheme of developing full load, however, is not altogether free of objections. First, it requires that a large amount of coal be stored on the boiler-room floor, a poor place for coal according to modern conceptions. Second, it requires a large amount of help to store and shovel the coal into the stoker, and this help may be difficult to obtain and is quite expensive.

To overcome these difficulties a scheme has been adopted at the Fisk Street station which has proved quite satisfactory. High-grade coal is kept in one bunker out of every group of sixteen, and the corresponding boiler is kept banked at all times except during peak loads. A traveling bucket movable by a crane is filled from this bunker to supply high-grade fuel to any other hopper requiring it. This arrangement has reduced the labor expense considerably.

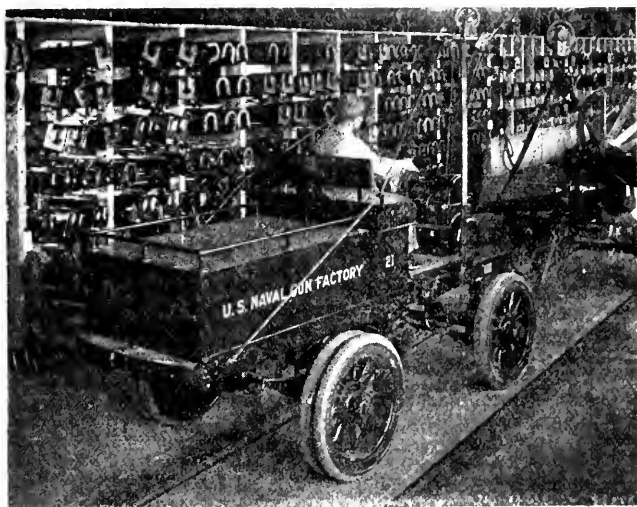
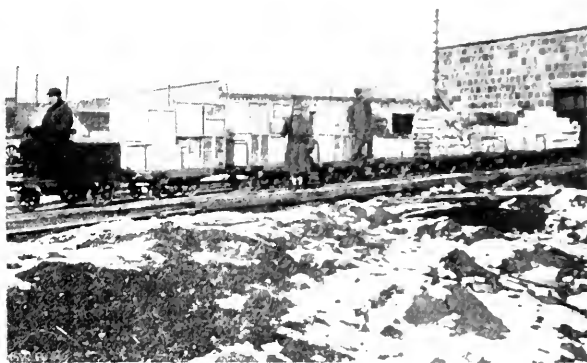
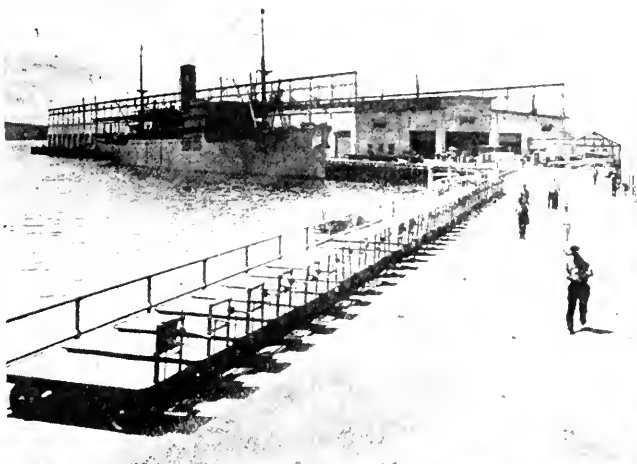
Despite the aforesaid difficulties connected with this method of supplementing low-grade with high-grade coal when required, the underlying principle seems good enough to demand special consideration from designers who look to the fuel situation ahead. Provision for auxiliary high-grade coal bunkers that will be large enough to meet the increased demands during peak periods has been made in a few stations, but it might be advisable for all future stations. The capacities of such bunkers need hardly exceed 5 per cent to 10 per cent of the ordinary bunker capacity. Perhaps one or more central bunkers with chutes to a number of stokers would be desirable, but the method of storing and distributing the coal is mostly a matter of detail arrangement.

It is not difficult to imagine conditions which will give additional economic importance to providing auxiliary bunkers for peak coal, conditions which will affect operating costs as well as investment cost. When they obtain, such an arrangement will recommend itself still more forcibly and is likely to show a decided saving both in the outlay for investment and in operating costs.

To state offhand the saving effected in dollars and cents is somewhat difficult, as location, the price of coal, cost of boiler equipment, and the like, are factors entering into the matter. Outside of the auxiliary coal bunkers, very few other changes will be necessary to adjust the fuel to the load conditions. With such an arrangement one precaution would have to be taken—to prevent waste of the higher grade coal, it being much easier to burn. With hand firing the difficulties connected with burning the higher-grade fuel serve as a good brake against this tendency in human beings to make things as easy for themselves as possible. But even at the worst it would not be a grievous problem for modern types of generating-station executives to solve.

In all events, the conservation of high-grade fuel is an important matter. This suggested development is not only a method of offsetting higher coal prices and effecting economies, but may be a necessity dictated by the anticipated post-war activity and commercial rivalry between the nations trying to restore the sadly depleted accumulations of decades.

Industrial Trucks in War Service



Shipyards, ammunition factories, army depots, khaki cloth mills, arsenals and other war plants all have had their work speeded up by the electric truck. Thousands of these ve-

hicles are now in use, thereby releasing men for employment in other occupations where labor is much in demand.

Economical Use of Copper

Does It Pay a Company to Maintain on the Pole Line, in Anticipation of Additional Load, Copper Wire That Remains Idle or That Is Not Working Sufficiently?

BY P. O. REYNEAU

Distribution Engineer Detroit Edison Company

WITH the increased price of copper and the unreliable deliveries brought about by the war the most efficient possible use of wire becomes a vital problem in many places. It becomes necessary to take stock and make the available wire in the warehouse and on the line go as far as possible. In many instances very radical changes are necessary.

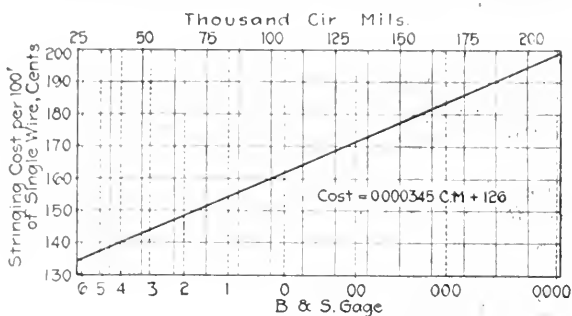


FIG. 1—AVERAGE WIRE-STRINGING COSTS FOR POWER LINES

Many of these changes are not good engineering or good economics fundamentally, but they are forced upon operating companies by absolute necessity. In order to keep as nearly as possible on the right track it becomes imperative to analyze the situation critically and determine in so far as possible the relative value of all the factors entering the proposition, especially those that can be gaged in a concrete manner. Therefore the object of this paper is to attempt to suggest a way of handling the copper in distribution systems as they exist to-day.

As a starting point we can consider any distribution system of the present day and look at it critically, studying its load conditions and its saturation in various parts. There are all kinds of systems—good, bad and indifferent. Some have been built up without a clear concept of the underlying fundamentals of good distribution. Their growth has often been affected mostly by physical conditions, the laying out of streets, the regulations imposed upon operating companies by state, county or city governments. Each superintendent has developed his distribution system according to methods that seemed to fit in best with the conditions at the time of building, changing these methods as outside influences made it necessary to do so. Even where the best talent has been used for designing the system and where no expense has been spared to keep up with the latest improvements, it is very often true that those in charge have been so busy operating the old and putting in the new equipment that they have not had time to stop and look their distribution system over to realize how time has changed their conditions. For these reasons we shall find nearly everywhere that some wire is not working at all though it is probably charged, that other wire is working far be-

low its full rated load (determined by economical considerations and modified by its relative location and use in the system), and finally that some wire is overloaded, thereby causing losses greater than those allowed under economical operation. These conditions are usually natural ones; they are the result of unforeseen conditions such as unexpected or abnormal growth or decline of load.

It is not the purpose here to deal with overloads except by suggesting that idle wire could well be used in many cases to relieve them. The problem which will be considered can be summed up in one question: Does it pay to maintain on the pole line, in anticipation of additional load, copper wire that is idle or that is not working sufficiently? A question of such broad character cannot be answered with a yes or a no without any qualifications, but concrete information can be presented which should assist good judgment in approaching perfection.

In the first place, if the wire will not be put in service in its present location it is self-evident that it should be removed to the warehouse at the first opportunity and put up again as soon as needed in another location. The interest and depreciation on the wire is a net yearly loss while it is not being used. If it were in the warehouse as a part of the stock which must necessarily be kept on hand, the necessity of purchasing the same amount of new wire would be eliminated. If it were giving service on some line it would be earning a return on the investment. Even where the insulation is so far destroyed that the wire has only junk value its sale will permit the purchase of a certain amount of new wire. It should be noted that the expense incurred in taking down the wire will practically always be very small compared with the cost of

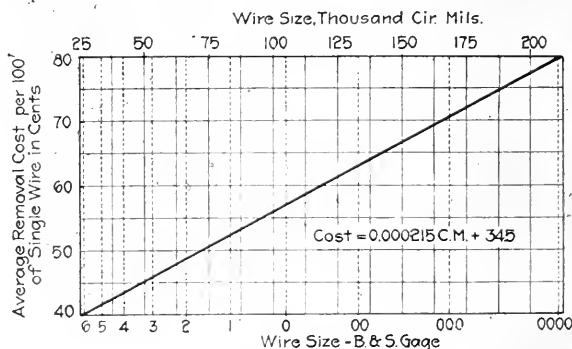


FIG. 2—AVERAGE EXPENSE OF REMOVING PRIMARY CIRCUITS

the wire. It should also be noted that the first cost of installation of the wire (possibly from 10 per cent to 60 per cent of the original cost of the wire) is a net property loss when the wire is removed. This loss to property really exists just as much whether the wire is up or down; the net loss of leaving it up remains the interest and depreciation yearly charge on the wire.

*Assisted by C. E. Mowrer.

In many cases it is impossible to determine definitely that lines will never be used again. When this is so it would be wise to hesitate about removing any wire from the lines unless forced to it by necessity. In order to make the proposition more definite, however, let us consider that a certain amount of wire is idle on the pole line at present but that it will be put to work

To reduce the cost of wire to a curve, the average weights per 100 ft. were plotted against wire size (Fig. 3). As the wire depreciates only in so far as insulation is concerned, the annual depreciation rate will be $6\frac{2}{3} \times$ (insulation weight \div total weight), if the copper market is stable, assuming the life of insulation to be fifteen years. Curves for this ratio are plotted against wire size in Fig. 4. Finally, by combining the several curves and their equations, an equation and curve was found, as shown in Fig. 5, that expresses the relation desired.

The expressions for each relation and methods of combining them to give the final equation are shown in the following. It should be noted here that interest was taken at 6 per cent and the cost of copper at 30 cents per pound (13.6 cents per kg.). Other values can be substituted in the equation. For a more general solution it would be desirable to carry these factors through the equations to a final one where any value could be substituted, but this procedure would have complicated the final equation too much for this discussion.

Solid Wire

Years = (stringing cost + removal cost) \div total annual fixed charges

Circ. Mils

$$\text{Stringing cost} = 0.000345 + 126$$

$$\text{Removal cost} = 0.000215 + 34.5$$

$$\text{Total} = 0.00056 + 160.5$$

$$\text{Cost of wire/100 ft.} = \text{cost/pounds} \times \text{weight 100 ft.} = 30 \times (0.000356 \text{ circ. mil} + 4)$$

$$\begin{aligned} \text{Cost of wire in place} &= \text{original cost} + \text{stringing cost} \\ &= 30(0.000365 \text{ circ. mil} + 4) + 0.000345 \text{ circ. mil} + 126 \\ &= 0.01068 \text{ circ. mil} + 120 + 0.000345 \text{ circ. mil} + 126 \\ &= 0.011025 \text{ circ. mil} + 246 \end{aligned}$$

$$\text{Interest/year on investment} = 0.06$$

$$\text{Depreciation/year on investment} = 0.067(3.4 \text{ circ. mil}^{-0.219})$$

$$\begin{aligned} \text{Interest and depreciation/year} &= 0.06 + 0.067(3.4 \text{ circ. mil}^{-0.219}) = (0.06 + 0.226 \text{ circ. mil}^{-0.219}) \\ &\text{in per cent} \end{aligned}$$

$$\begin{aligned} \text{Annual fixed charges} &= (0.06 + 0.226 \text{ circ. mil}^{-0.219})(0.011025 \text{ circ. mil} + 246) \\ \text{Years} &= (0.00056 \text{ circ. mil} + 160.5) \div [(0.06 + 0.226 \text{ circ. mil}^{-0.219})(0.011025 \text{ circ. mil} + 246)] \end{aligned}$$

$$\begin{aligned} \text{Years (solid)} &= (0.00056 \text{ circ. mil} + 160.5) \div (14.75 + 0.00066 \text{ circ. mil} + 0.00249 \text{ circ. mil}^{0.751} + 55.6 \text{ circ. mil}^{-0.219}) \\ &\quad (1) \end{aligned}$$

Stranded Wire

Years = (stringing cost + removal cost) \div total annual fixed charges

Circ. Mils

$$\text{Stringing cost} = 0.000345 + 126$$

$$\text{Removal cost} = 0.000215 + 34.5$$

$$\text{Total} = 0.00056 + 160.5$$

$$\begin{aligned} \text{Cost of wire/100 ft.} &= \text{cost/pounds} \times \text{weight 100 ft.} \\ &= 30 \times (0.000385 \text{ circ. mil} + 4) = (0.01155 \text{ circ. mil} + 120) \end{aligned}$$

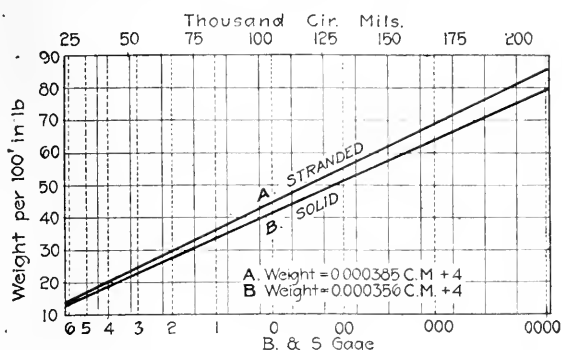


FIG. 3—AVERAGE WEIGHT PER 100 FT. OF TRIPLE-BRAID WEATHERPROOF WIRE

some time in the future. In this case the time during which the wire will be idle is the determining factor in the study of economy.

A. If the idle line is taken down and used and no new wire is bought, the following costs are involved:

Removal cost from old position.

Stringing cost of new wire.

Interest and depreciation on wire for length of time before it will need replacing in old position.

Cost of stringing new wire in old position at end of that period.

B. If the old line is left up and new wire bought to build present extensions, the costs involved are:

Stringing cost of new wire.

Interest and depreciation on old wire left up idle.

Interest and depreciation on new wire.

Equating the cost of operations A and B and solving for the time gives that length of time in years where the costs involved in leaving the line up idle and buying new wire to fill present needs just equal the costs involved in taking it down and restringing it. In other words, if the line is to remain idle longer than this period of time, it will pay to remove it at once and then replace it when necessary. If the line must be replaced sooner than this time, it would not pay to take it down. Several factors enter into both sides of the equation and may be eliminated from the calculations,

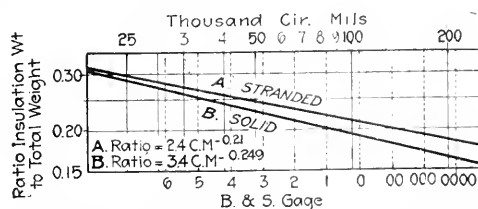


FIG. 4—RATIO OF INSULATION WEIGHT TO TOTAL WEIGHT FOR TRIPLE-BRAID WEATHERPROOF WIRE

leaving the following as active terms: (1) Removal cost from old position, restringing cost in old position; (2) interest and depreciation on new wire.

The method of procedure is as follows: Wire stringing and removal costs per 100 ft. (30.5 m.) of single wire have been obtained from available data, these costs being plotted against wire size in Figs. 1 and 2.

Cost of wire in place original cost stringing cost
 (0.01155 circ. mil + 120) +
 (0.000345 circ. mil + 126)
 0.011895 circ. mil + 246
 Interest year on investment 6 per cent 0.06
 Depreciation year on investment 0.067 (2.4 circ. mil⁻¹)
 Interest and depreciation year 0.06 +
 0.067 (2.4 circ. mil⁻¹) = (0.06 + 0.1608 circ. mil⁻¹)
 Annual fixed charges = (0.06 + 0.1608 circ. mil⁻¹)
 (0.011895 circ. mil + 246)
 14.75 + 0.00071 circ. mil +
 0.00191 circ. mil^{0.79} +
 39.557 circ. mils^{-0.21}
 Years (stranded) = (0.00056 circ. mil + 160.5) :
 (14.75 + 0.00071 circ. mil + 0.00191 circ. mil^{0.79} +
 39.557 circ. mils^{-0.21}) (2)

Curves obtained by substituting various sizes of wire expressed in circular mils in equations (1) and

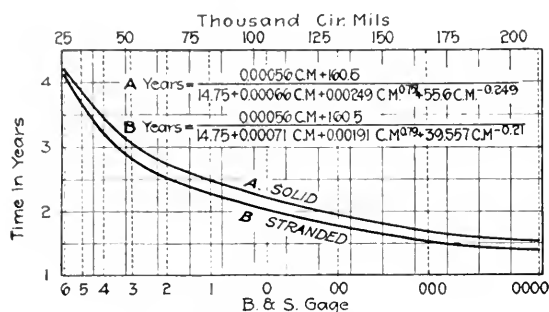


FIG. 5—WHEN IT PAYS TO TAKE DOWN IDLE WIRE

If the line is to remain idle longer than the period indicated it will pay to remove it at once and replace it when necessary. If the line must be used before this time it would not pay to take it down.

(2) are given in Fig. 5. They apply to only one general case where one given size of wire is replaced on the same pole line with the same size of wire, there being a time interval between the removal of the first wire and the installation of the second. There are naturally a great number of possible combinations of various sizes of wire being replaced by various other sizes, and for each case data and curves could be obtained. This one general case can only suggest what could be expected in all the others.

In this discussion there remains to be considered the economy of replacing with smaller wire large wire that is not loaded sufficiently. Here again curves could be obtained to show the length of time at which the interest and depreciation of the large wire would equal the interest and depreciation on the small wire plus the cost of installing and removing the large wire. It has been attempted here to indicate by one concrete example what is the correct point of view to take with regard to the working efficiency of copper wire on distribution systems, to furnish some definite assistance to the good judgment that is necessary for successful handling of all matters dealing with the future.

CONCLUSIONS

The curves of Fig. 5 tend to lead to the conclusion that not enough attention has been paid to the removal of wire when it is not effective in distribution systems and that a greater over-all efficiency would probably be obtained by doing away with idle wire or wire not working sufficiently. It is obvious that under present conditions, with the price of copper far above the

average price formerly paid for the distribution system as a whole, and probably higher than it will be in the future, the removal of wire as suggested above is far more profitable than if all wire had been and would be purchased at the same price. At the same time it should be noted that a uniform price of copper at 30 cents was assumed in plotting the curves; thus the above gain was not taken into consideration and the proposition was not made so general as it could be.

DUCT SPLICING SAVES SHORT LENGTHS OF CABLE

How Splice Diameter Is Minimized—Tests Indicate Practicability of Splice—Extent to Which Duct Splices Are Used

BY J. B. NOE AND A. RABE
New York Edison Company

THE financial loss due to inability to utilize short lengths of cable is a serious one to all companies operating underground systems of distribution. These lengths are constantly accumulating owing to withdrawal of old cable necessitated by changes and replacements of existing circuits. Large companies doing a great deal of underground work keep these lengths and eventually can utilize them by matching in with new construction, but this involves keeping on hand a large quantity of slow-moving stock, tying up investment and often using valuable space for storage. Smaller companies usually are obliged to scrap their short pieces of cable, often at only a fraction of the original cost.

It has long been the practice to splice the shorter lengths of small cables, such as arc-light and main cables, to make up lengths that could be used, but a joint such as is usually made in large high-tension and low-tension feeders would be too big to draw into the standard-sized duct. It has doubtless occurred to many underground superintendents, however, that if a small enough splice could be made in such feeders much of

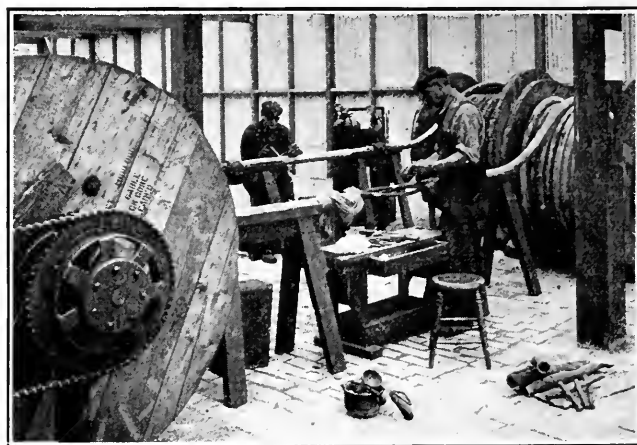


FIG. 1—DUCT SPLICES IN THE MAKING

The splice in the foreground shows the staggering of the individual conductor joints employed to minimize the diameter of the joint. In the background a man is lead-burning a split sleeve to the sheaths of two cables that have just been joined. Note small diameter of splice compared with cable.

this slow-moving or waste cable could be utilized. This possibility is of especial interest at the present time owing to the high cost of metals, difficulty in obtaining cable deliveries and desirability of releasing as far as

possible the full capacity of the cable factories for the manufacture of materials directly useful in the prosecution of the war. In view of these facts the long experience of one of the large lighting companies in the development and use of duct splicing may be of interest.

HOW SPLICE DIAMETER IS MINIMIZED

The underground department of this company made such a splice in November, 1904, joining two sections of three-conductor, 250,000-circ. mil., 6600-volt cable. The diameter of the splice was kept down by staggering the joints in the three conductors, making a joint 24 in. (71 cm.) long, over which was placed a split lead sleeve slightly larger than the original cable, soldered at the seam and wiped to the cable sheath at the ends. This joint was made by drawing in the first section, making the splice in the manhole, and then resuming the pulling, drawing the splice and second section on into the duct. This original duct splice remained in service without failure for several years and when finally withdrawn for some cable changes was opened and found perfect.

Prior to 1911 no great difficulty was experienced by this company in utilizing short lengths of feeder cable, the large amount of construction work continually in progress providing a comparatively ready outlet for such material. In this year, however, the size of the standard high-tension feeder was increased from 250,000-circ. mil. round conductor to 350,000-circ. mil. sector, all new cable purchased being of the latter size. As a result large quantities of the smaller-size cable began to

ever occurred in any of these splices or on any of the more than 600 duct splices made on various cables.

During the next few years very extensive changes in the underground cable system due to starting up a new generating station provided an ample outlet for released cable, but in 1915, the accumulation of short lengths again becoming critical, serious attention was turned to the duct splice. Before adopting it as a permanent policy for all types of cable, tests were conducted to determine:

First—Mechanical strength, both of the spliced sleeve and the spliced conductor, as compared with the strain put on them in installing and withdrawing the cable under the severest duct conditions.

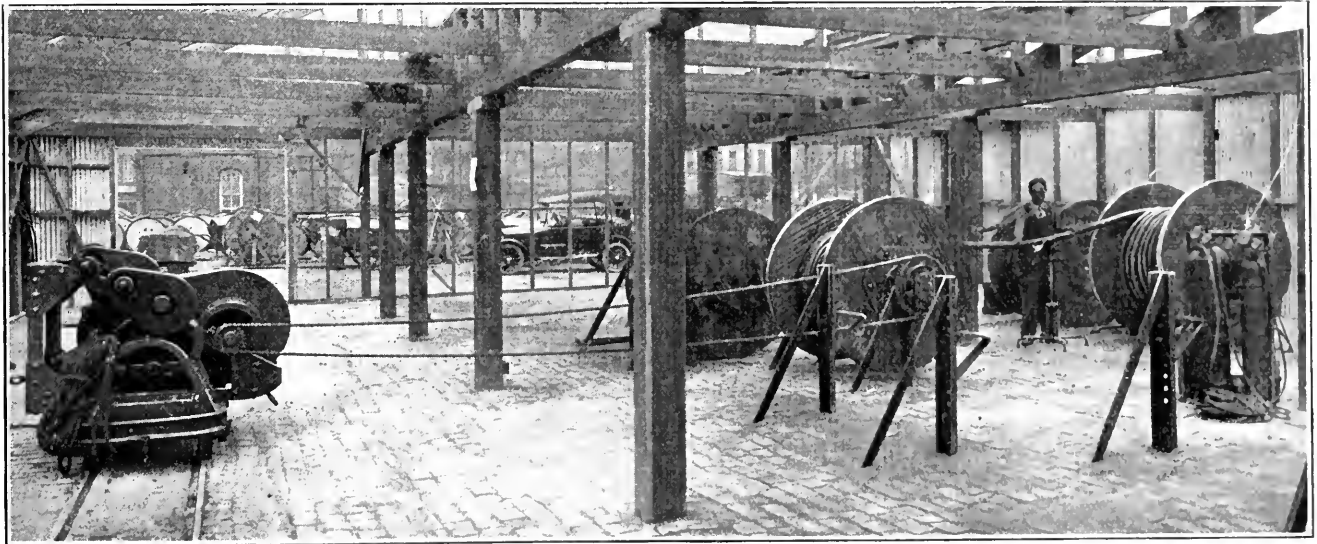
Second—Dielectric strength of the duct splice after it had been subjected to the strain of installation.

Third—Heating in the duct splice due to heavy loads.

All of these tests showed the duct splice as made up to be superior to the body of the cable.

A decided improvement was made at this time by "burning" on the lead sleeve instead of using solder. This made the joint as flexible as the rest of the cable, and as the spliced lengths could be put upon reels without fear of cracking, it became the practice to make the joints in the cable yard instead of in the manhole, effecting a very great saving in cost. At odd times and on rainy days the short pieces were spliced up to make sections of such lengths as could be easily matched.

During 1916 a duct splice was developed for two-conductor, 1,000,000-circ. mil low-tension concentric



GENERAL VIEW OF CABLE-SPLICING HOUSE

In this room short pieces of cable are spliced into continuous lengths and reeled for future use. At the left is a carriage bearing a geared-down motor which may be connected with any reel

in the house by sprocket and chain. Note gas tanks for burning cable sleeves and V-shaped mirror under cable by which inspector can examine physical conditions of all sides at once.

accumulate in the stockyard, it being impossible to match in the short lengths of old cable as parts of new feeders as had been the previous practice.

In the same year the proposed addition to the system of about twenty-five high-tension service connections offered a tempting opportunity for the use of this cable, provided that it could be spliced up to make such lengths as could be used in existing subway. Duct splices similar to the one made in 1904 were successfully utilized, and all these connections, involving the use of more than six miles (9.7 km.) of feeder, were made, using this old cable exclusively. Not one failure has

cable with three pressure wires. Large quantities of slow-moving stock of this type of cable were thus made available for immediate use.

Among the various types of cable on which the duct splice has been used, two deserving of special mention are triplex 350,000-circ. mil, 25,000-volt armored submarine cable and single-conductor 2,500,000-circ. mil low-tension cable with pressure wires. Of the first type three 910-ft. (277-m.) reserve lengths were made available for immediate installation as four 610 ft. (186-m.) lengths by cutting and splicing. Of the latter type 2100 ft. (640 m.) left dead in the subways by

The starting of a new substation were salvaged and are now installed as direct feeders to a new large customer.

Some idea of the amount of cable transformed from scrap or very slow-moving stock to actual service may be gained from the fact that the company previously referred to has to date a total of 211,569 ft. (approximately 64,460 m.) of duct-spliced cable of various types, representing a value of approximately \$380,000. Practically all of this material is now installed.

SPlicing DONE IN CABLE HOUSE

The work of making these special splices was at first done in the cable yard, temporary tarpaulin shelters being erected for protecting the exposed ends of the cables from rain, snow or whatever necessary. As the work assumed larger proportions it was decided to erect a building with special facilities for handling the reels expeditiously and with a minimum of labor. A narrow-gage track enters this building from the point where the reels are delivered by truck and runs the entire length of one side. The reels are placed on small cars running along the track, from which they can be delivered to any of the six splicing stations. At each

of these stations are two specially designed cable racks to hold the reels, the splicing being made between the racks. An electric motor with suitable speed control has been mounted on a car, and by means of a sprocket and chain connection can be used to reel or unreel cable on any of the racks. Only one man is required for this work instead of the usual gang of four or more. A convenient system of piping makes easy the connection of the oxy-acetylene outfits used for the lead burning at each of the splicing stations, thus avoiding a multiplicity of tanks.

Very little expense for material was incurred in the equipment of the splicing house. Much of it was rescued from the scrap heap, and some, such as the rails of the narrow-gage railway, was purchased from contractors at practically its scrap value.

While it would not be necessary for all companies using cable to prepare such an elaborate plant for duct splicing as the one described, it is obvious that all companies generally can adopt with great advantage the practice of making such duct splices to save considerable cable material that would otherwise be scrapped or kept in slow-moving storage.

Central-Station War Service

Analysis of Power Load of Representative Company Shows that More than 90 per Cent of the Energy Delivered to Motors Is for War Material Production—Nine Routings for Power Supply to Industrial Plants

UNTIL the war is over nothing like a full account of what the modern central station is doing to help win the great conflict for democracy and liberty can be prepared for publication; but when the inside story becomes known the entire electrical industry will be proud of its record. War to-day is a conflict between entire nations and not only a series of campaigns against armed enemies. An organized, efficient producer and distributor of electrical energy is therefore one of the most valuable resources of a community engaged in the manufacture of munitions and other supplies for war use. More and more, industry is going upon a war basis, and steadily the demand upon the central station increases in this connection. In some cities the supply of power to war customers is now so large a part of the business that the management of the local central station has comparatively little time for the consideration of any other outlets for his plant capacity, if, indeed, he is not looking anxiously into the future and wondering how and when he will be able to secure additional equipment to meet forthcoming war industrial requirements and whether, when such equipment is installed, the supply of fuel will be sufficiently continuous to enable him to give 100 per cent service.

President Wilson and other officials of the government have gone on record on behalf of the central station's essential service, and many of the leaders of the industry appreciate to the full the important part the electric utility company is playing in efficient war material production. Many central-station employees, however, scarcely realize the scope and variety of this service or the close connection between the way in

which they do their daily work and the "carrying on" of the country's war activities. For this and other reasons it is of interest to examine the war service work of a central station in the East now supplying energy to a city of about 200,000 population and which recently through its power sales department made a survey of the so-called "war load."

This investigation was undertaken last December as the coal situation became more and more threatening, and was primarily intended to anticipate curtailment of power, especially to factories not engaged in war material production. The following questionnaire was sent at this time to the company's larger power customers:

"In order that we may have on hand a record of companies doing government work, will you please send us the following information:

"Government Contracts.—(1) Contract numbers; (2) date; (3) material; (4) percentage of factory output.

"Government Sub-Contracts.—(1) With whom (name and address); (2) contract number and date; (3) sub-contract number and date; (4) material; (5) percentage of factory output."

The response was very gratifying, for practically every questionnaire sent out was returned with the desired information, thus showing the hearty co-operation of the manufacturers, who realized only too well what a shut-down of their power would mean.

These questionnaires were classified by the power sales department, and a complete survey was made of all power customers of the company. The customers were divided into the following classes:

1. Factories devoted to war industries.
2. Factories devoted to war essentials and public necessities.
3. Non-war industries.

Under Class 1 were placed all customers who are actually engaged in war work, such as manufacture of ammunition, ammunition trucks, gun platforms, gun-mount parts, shell tools, torpedo equipment and other ordnance; textiles, such as tent tops, blankets, army woolens, and equipment for the emergency fleet, including machine manufacture of all kinds. Practically every department of the government was being supplied with material from these different factories.

Under Class 2 were included such war essentials as meat and provision factories, wholesale food producers, public utilities such as telephone, telegraph and gas companies; public schools, daily papers and the necessary lighting for police protection in the city.

Under Class 3 were included such non-essential industries as those of wall-paper manufacturers, printers, department stores, brewers and liquor sellers.

These classified data and the connected load of each customer were taken from the latest available records of the central station, and the kilowatt demand (fifteen-minute) was taken from the demand-meter record of each customer. Whenever there was any doubt as to the classification of a power user his load was placed in the lower class. This assured the central station of a conservative estimate of the power output for government work, enabling each case to be taken up individually in case of curtailment.

RESULTS OF CLASSIFICATIONS

The results of these classifications may be summarized as follows:

Class	Number of Customers	Hp. Connected	Percentage Connected Power
1	129	20,598	67.9
2	185	6,780	22.4
3	154	2,941	9.7

From this it appears that 90.3 per cent of the total connected power load is devoted to war industries and war essentials. Forty-seven representative factories in Class 1 have a total arithmetical demand sum of 9994 kw. and a connected load of 17,620 hp. This is an average of 376 hp. per customer, with a demand per customer of 0.568 kw. per horsepower connected load.

In Class 2 seventeen representative customers, with a total connected load of 3692 hp., have an arithmetical demand sum of 1677 kw., an average connected load of 217 hp. and a demand of 0.454 kw. per horsepower connected.

In Class 3 eight representative customers, with a total connected load of 1168 hp., have an arithmetical demand sum of 522 kw., with 146 hp. average connected load and a demand of 0.447 kw. per horsepower connected.

This indicates that the factories devoted to war work are pushing their mills harder than those on the so-called non-essentials.

Inasmuch as 74 per cent of the total station output is power and 90.3 per cent of connected power load is devoted to war work or the war essential industries, it follows that 67 per cent of the total station output is devoted to the war industries.

On the basis of the above classification, the average monthly output devoted to war work is 3,100,000 kw.-hr. out of a total of 4,000,000. The latter includes

power, commercial, residential and street lighting. The installed capacity of the station at the time of the survey was about 40,000 kw.

This plant, like many other central stations, is so tied in with other reliable and interconnected sources of power that an adequate supply is assured at practically all times. In the city where the above analysis was made there are no less than nine different routings by which power can be supplied to the customers in the event of a partial shut-down of any of the substations. In other words, the power service of this company has as many lives as the proverbial cat!

Preliminary studies of the individual loads in these war industry plants indicate that the diversity factor is between 1.5 and 2. In some cases the load conditions are unusually good.

It is significant that this station, in negotiating at present for additional power loads, finds upon a conservative estimate that 89.5 per cent of the new "prospects" are devoting their energies to war industries.

Based on an average isolated mill-plant fuel consumption of 4.5 lb. to 5 lb. of coal per horsepower-hour, this one central station is saving the country and its allies about 3500 tons of coal per month in supplying power to war industries alone, and through its interconnection with other systems not only is the service safeguarded, as mentioned above, but the use of fuel within the various connected plants is kept down to economical limits. Although over sixty employees of this company are with the colors, the foregoing data prove that not all the patriotic service of the central-station personnel is being performed in uniform. The priority rights of the central station in the matter of fuel, equipment and material supply are very much in evidence in the face of such facts as the foregoing. The central station is doing its part splendidly in the great cause to which the uttermost resources of the civilized world are being summoned and dedicated, and every faithful employee shares in the honorable performance of this high and responsible duty.

Tungsten Patent Suit Dismissed in England

A reserved judgment, dismissing the appeal of the British Thomson-Houston Company against an order of the Court of Appeal confirming the judgment of Justice Astbury in favor of Durham, Ltd., has been delivered by the House of Lords of England. The issue was whether a patent for the treatment and working of metallic tungsten was valid.

The main object of the patent on which the present action was brought was to manufacture the filaments by drawing the tungsten in the form of wire.

The Lord Chancellor was unable to read the words "the metal in a coherent form" as meaning tungsten which had been subjected to appellants' preparatory process as described in the specification.

Appellants further asserted that the application of heat, especially of continuous heat during the process of working, showed invention and was good subject-matter. There could be no subject-matter in the application to tungsten of the old process of working under heat. The claim was merely for subjecting the metal to the action of heat while it was being worked, and the operator was left to find out by experience what were the necessary precautions.

War's Influence on Central-Station Selling

Changes in New-Business Methods Forced by Prohibitive Cost of Extensions—Getting More Business from Existing Customers—Eliminating the Carbon Lamp and Furthering Use of Appliances

THE great war has brought many influences and counter influences through the past year that have affected central-station policy and practice in many ways. In no department, however, have these war-time conditions been more far-reaching in their contact than in the field of selling. The national concentration on the winning of the war has begun to warp the daily lives of all the people and is naturally reflected in their dealings with the central station. As they react to their increased prosperity or greater caution in the face of the uncertainties of the times, the central station feels it promptly. The industry, therefore, has step by step been adjusting itself to each new factor in the market, working carefully to maintain a balance between the present higher costs and physical restrictions in doing business and the natural desire to render service to the utmost.

The first great change which the war demanded came in the matter and manner of taking on new business. The steadily mounting cost of copper and other materials soon reached a point where the expense entailed in making an extension to connect a new consumer was more than the business was worth. At the same time conditions in the money market made it practically impossible to finance any further investment of the sort, and as a measure for the conservation of capital there has been a general embargo declared against new business. The degree to which it has been necessary to apply this restriction has, of course, varied widely with conditions in the city.

PROVIDING POWER FOR WAR INDUSTRIES

Naturally, the most pressing obligation is to provide the power needed for industrial uses so essential to the winning of the war. Whenever there has been so great a demand that the capacity of the station has been hard pressed, active measures have been taken to protect the vital industries at all cost. In Seattle, Wash., Worcester, Mass., and several other cities the co-operation of local manufacturers was actively secured and a better distribution of the load effected through slight changes in the hours of starting and quitting and other rearrangement of the power uses. In Springfield, Ohio, a meeting of the leading local business men and manufacturers was called, at which the central station laid the matter before them and said: "Here is the power that we can provide. How shall we apportion it among you to best advantage?" In the face of the practical impossibility of securing additional station capacity without conflicting with the government's huge need for electrical machinery of every kind such measures have been very helpful.

Even where the capacity has been safely available the prohibitive cost of extensions has been met by requiring the customer to finance the cost himself. The Cleveland Electric Illuminating Company, for instance, established a form of contract under which the customer advanced the cost of construction, and the normal cost,

that is to say, the cost as of July 1, 1914, is returned to the consumer in periodic payments. This plan has been applied with varying details by many companies, some restricting all new business to locations along existing lines and others further holding it down to loads of definite characteristics. The Commonwealth Edison Company of Chicago and the Public Service Company of Northern Illinois petitioned the Utilities Commission to suspend the rule covering extensions for the period of the war. All the subsidiary companies of the Eastern Power & Light Company and General Gas & Electric Company announced to the public that as a war conservation measure no further extensions or connections would be made. These cases are typical.

With this general policy in force the selling effort has resolved itself into the development of more and better business from existing customers, both through the sale of household heating and power appliances to residence consumers and more motors to the industrial field; and in both directions the war itself has actively created market. The higher costs of living in these times and the growing scarcity of domestic servants have wrought a revolution in the attitude of the average housewife and her husband toward investing in modern home efficiency equipment. A good example is reported from Elmira, N. Y., where two large local industries advertised for women and within a few weeks took several hundred out of domestic service. This meant that hundreds of housewives were suddenly obliged to do their own work, and there came an immediate demand upon the central station for all kinds of electric household appliances to help them do it. The growth in power business, of course, has been tremendous owing to the general speeding up of industries all over the country under the impulse of war work.

Under these conditions there has been great opportunity for awaking the public to the value of electric service for saving time and labor in the home as well as in the factory, but not all central stations have taken advantage of the situation to build up the load along existing lines. Campaigns for the sale of cleaners and washing machines and other appliances where held have been particularly productive.

STRAIGHTENING OUT THE PRICE POLICY

The outstanding feature of this whole merchandising movement by central stations, however, has been the almost universal straightening out of the policy of price. Under the influence of the times it has been possible to increase prices without fear of the public misunderstanding the reason for it. Higher costs are forcing higher prices in all lines, and the revision of resale schedules necessitated by the raising of the manufacturers' list has brought to many companies the opportunity to bring an end to cost selling practices which had been robbing them of proper profits in the past. The old idea of embracing almost everything the customer required under the head of service, and looking

to the sale of energy to pay for it, has been made more difficult under war conditions.

As a result, a much healthier condition has been developed in the field of merchandising. The urgency of the need for holding down investment and decreasing the expense of maintaining the new business department has demanded more profit from sales and has gone far to rectify the old mistaken policy of selling goods too cheaply in order to get them on the lines. In addition many companies have instituted charges for all work done by troublemen on the customer's premises. In Rochester, for instance, when a man goes out on a "lights out" complaint, a charge of 25 cents is made for the call plus the retail price of the fuses installed, provided, of course, that the trouble was in no way the fault of the company. All this has greatly improved the position of the central station in its purely business dealings with the public, placing its scale of compensation more nearly on a basis of value received.

Over-long periods and easy-payment terms formerly offered in the sale of appliances have also been corrected in some cities at the same time. Also, as in New Orleans, the work of eliminating the carbon lamp has been taken up under the plea for war-time efficiency, and a most successful effort made to convert all consumers to the use of tungsten lamps. This, of course, is particularly timely. The idea appeals to the public as a further way to save and at the same time offers an immediate benefit to the central station by reducing the cost of lamp renewals. In Houston, Tex., an annual saving of about \$700 has been effected in this way. Such campaigns, supported by the sale of tungsten lamps at list, have been found well worth while.

This practice of pricing lamps at list, by the way, has been steadily growing under the influence of the times, and bids fair to continue to spread. In connection with this educational effort to extend the use of tungsten lamps many utilities have advertised broadly the need for conserving power and urged the public to exercise care in the use of light, turning off all lamps when not in actual use.

THE EVER-PRESENT LABOR QUESTION

One of the first reactions from the war affecting the central station was, of course, the labor situation, and this has brought a difficult problem which is being met in many ways. The sales department staff is usually composed of young men, and the number of these salesmen who have left to join the national forces has been large. There has been a tendency not to replace these men but rather to curtail the work of the department and save that much expense, and in fact often companies have transferred the members of their commercial departments to fill other jobs elsewhere and in these cases have practically discontinued all selling work. They feel that at this time they can better afford to drift with the current of their growing business and save the cost of salesmen's salaries. A practical alternative, however, has been applied in other cases by shifting the selling force onto a commission or salary-plus-commission basis, under which each man can prove himself self-supporting and therefore profitable. The Doherty companies have been operating on this plan for some time, and under the stimulated demand for appliances sales and profits have grown.

The profitableness of sales activities has been fur-

ther increased by the fact that the men have been concentrating along existing lines in the effort to fill up the valleys of the load by selling more motors and appliances to present customers. This work in many cases has taken the form of special campaigns on the high-priced motor driven appliances, like the washing machine, the dish washer and vacuum cleaner, which, while adding little to the load, pay a generous profit.

SMALL ECONOMIES BEING SOUGHT

But this is only one of the broad problems of administration where, under the spur of urgency, chances for new efficiencies in the operation of the business side of the central station have been discovered. The need has been to get along with fewer men and save as many dollars in as many ways as possible. Combination companies have found that they could save by having both gas and electric meters read by the same man, by billing for both on the same card, by having the same wagon set both meters, and, in short, eliminating duplication right down the line in its dual relations with the customer. Delayed meter-reading cards have been introduced which the reader slips under the door when he is unable to gain access to the premises, asking the consumer to indicate on a printed dial the reading of his meter. This saves many second calls. Systematic canvasses have also been made of all installations where more than one meter is in use, and many cases have been found where a single meter would suffice. This has not only restored a meter for service elsewhere but has brought a saving in the entire routine, from the reading to the paying of the bill.

It is in these innumerable small economies that the best results have been obtained in tuning up the system to a higher efficiency. The use of women and old men for meter reading has been tried out most successfully. Schoolboys have been adopted for delivering bills in Sandusky, Ohio, after very careful experiment, and their use is spreading—as is the use of women bill deliverers. This frees man-power for other work and at the same time cuts the cost appreciably. By changing over from the end-of-month to continuous meter-reading system it has also been possible to do the work with fewer specialized employees, and in Leavenworth, Kan., they are successfully trying the experiment of having the customer apply for his own bill when he comes to pay the money during the discount period. It is believed that this will reduce the cost and detail of bill delivering to a very small minimum. These and other measures for reducing delinquency and short-cutting the detail of reading, billing and collecting have received attention everywhere and have borne good fruit in small economies. A general appeal to the public to pay bills promptly in consideration of the times has brought response in almost every city.

The past year of war, therefore, has been a period primarily of business housecleaning among the central stations. Not only has the dead stock been brought out of storeroom corners, bargain-priced and sold to turn this dead investment into coin, but all those small details of administration system left in normal times to run themselves have been gone over with a fine comb with such results as have been enumerated. Matters of interrelationship with the local contractors have received a growing consideration, and in many cases a better degree of working harmony has been effected.

Present Status of Brass Melting—II*

Relative Merits of the Different Types of Electric Furnaces That Are Now Upon the Market—Only Two of These Have Been Found to Be Suitable for Use with Alloys That Are High in Zinc

BY H. M. ST. JOHN

Commonwealth Edison Company

Four types of electric furnaces are in commercial use for melting copper alloys. Of these only two are suitable for use with alloys high in zinc. One, the vertical-ring induction furnace, operates at high efficiency, but is somewhat limited in its application and not sufficiently flexible for general foundry use. Within its limited range it appears to be giving very satisfactory results. The indirect-resistance, indirect-radiation furnace is less efficient and has a lower rate of production in proportion to its holding capacity, but is more flexible and better suited to general foundry use. Neither of these furnaces can be classed as altogether satisfactory, but each is serving a useful purpose.

The indirect-arc furnace is in use for melting alloys which contain small percentages of zinc and those which contain no zinc at all. It is more efficient than the indirect-resistance furnace and, within its field, more flexible than the induction furnace.

The direct-arc furnace is being used to a limited extent in melting copper alloys which contain no zinc. Present conditions make its use profitable in some cases, but its continued application for this purpose is not assured.

THE obvious method of reaching a high thermal efficiency without overheating an alloy is to generate heat in the metal itself by the passage of an electric current through it—either by a direct resistance furnace, in which electrical contact with the metal is made through electrodes, or by means of an induction furnace, in which case the metal forms a complete circuit for the flow of an induced electric current, without the use of electrodes. In either case it is practically necessary to establish the circuit through molten metal previously melted in some other furnace.

The "pinch-effect" direct-resistance furnace was the first type in which this principle was utilized. Virtually all of the heat is generated in the molten metal temporarily occupying channels or tubes. The main portion of the metal, occupying the furnace chamber above, is heated by contact with the hot metal, and solid metal added to the bath is melted by the same means.

The stirring action of the moving streams of metal is vigorous, and the temperature of the main portion of the bath rises uniformly. There is no difficulty in restraining the vaporization of zinc, and, in fact, it may be said that the metallurgical requirements of any single alloy are almost perfectly fulfilled.

Generation of heat in the metal itself, where its presence is desired, is theoretically ideal from the standpoint of efficiency, since no part of the furnace is any hotter than the metal, and wall losses are reduced to a minimum. With this type of furnace, however, the massive metallic electrodes require a considerable water cooling. Consequently a large quantity of heat escapes from the furnace, and the thermal efficiency is much lower than it would otherwise be. Considerable difficulty has also been experienced in constructing satisfactory transformers for use with the extremely low voltages and high currents required. So far as is

known to the writer this furnace is not now used extensively.

The next step in the development of electric furnaces was the application of a similar principle to the induction furnace. In this the use of electrodes and troublesome transformers is avoided, since the furnace serves as its own transformer. The generation of heat takes place as before in the resistor channels, and the same vigorous circulation of metal results. Whether this action is due primarily to the pinch phenomena or to a motor effect resulting from the flow of current through the continuous molten resistor is open to question. It is difficult to tell where one phenomenon leaves off and the other begins.

The thermal efficiency of the induction-type furnace, operating, as it does, without electrodes, is very high, probably higher than that of any other electric furnace ever tried out for copper-alloy work. Its metallurgical characteristics are also excellent. It offers a perfectly steady, uniform load at a power factor which is satisfactory, at least in the relatively small sizes so far built, the largest requiring a 60-kw. input and pouring 600 lb. of metal per heat. In larger sizes there might be trouble with low power factor, as is so frequently the case with large induction furnaces.

The induction furnace is in commercial use and is said to be giving satisfactory results. It has, however, pronounced limitations which are partly inherent in its design and partly remediable. Its small size is one disadvantage, but it is probable that somewhat larger sizes can be successfully built. So far it has not been found practicable to use the furnace with alloys high in lead, because that metal has a tendency to penetrate minute cracks in the lining of the resistor channels, causing short circuits. The remedy for this is the development of a lining especially suited for use with lead.

LIMITATIONS OF INDUCTION FURNACE

The more serious limitations of the furnace are its lack of flexibility in changing from one alloy to another and the practical necessity of operating it continuously, never allowing the furnace to cool oftener than once a week. The length and cross-section of the resistor channels are especially designed to accord with the electrical resistance—in the molten state—of the alloy which is to be used. These same resistor channels cannot be employed with another alloy of widely different resistance, which, accordingly, requires the installation of new channels of properly modified design. In changing from one alloy to another, even if the resistance is approximately the same, it is necessary to pour the furnace clean and start with a molten charge of the new alloy, melted in another furnace.

The linings of the resistor channels stand up very well under continuous use but deteriorate rapidly un-

*See article by same title in June 1 issue.

der the daily heating and cooling of ten-hour-day operation. This can be obviated by maintaining over night sufficient power to keep the channels filled with molten metal, which, of course, results in some addition to the cost of operation.

The limitations mentioned tend to prevent the use of this furnace in commercial foundries, which melt a wide variety of alloys and do not work nights, but form no bar to its use in yellow-brass rolling mills, to the purposes of which it seems well suited.

There has been proposed a new design of induction furnace which would not be subject to the foregoing limitations. In this type a spark gap and an arrangement of condensers connected in series and in parallel are used in the primary circuit of the furnace, which operates at about 10,000 volts and some 15,000 to 20,000 cycles. The secondary of the furnace consists of a crucible or melting chamber with electrically conducting walls. The metal within the crucible also carries part of the secondary current, to a minor degree when it is first charged in the form of solid pieces, to a much greater degree when it becomes molten. The primary circuit is arranged around the melting chamber and is separated from it by suitable refractory and heat-insulating walls. The furnace is, in a sense, an eddy-current rather than an induction furnace, since no iron cores are used and the metal itself, lying in a circular pool, completely short-circuits what, in an induction furnace, would be called the secondary circuit. This unique arrangement is made possible by the exceedingly high frequency used.

According to last accounts, this furnace had been built only in very small sizes, capable of pouring not more than 45 lb. (20.4 kg.) of metal per heat. There is no apparent reason why the metallurgical characteristics should not be good, and the construction of the metal-containing portion of the furnace is desirably simple. It is obviously unnecessary to use molten metal in starting the furnace. Any alloy or even non-conducting material, such as glass, can be melted without changing the furnace design. The furnace is suitable for intermittent operation and need not be kept hot overnight.

ARC FURNACES

Next to the methods already described the most direct way of applying heat to the metal is by means of a heat source outside but in direct contact with the bath. The direct-arc furnace is the only type which utilizes this principle.

The application of direct-arc furnaces to copper alloy melting has been rather limited. One or two furnaces designed for steel melting have been tried, but no new type of direct-arc furnace has been developed for this specific purpose. No furnace of this general type has ever succeeded in satisfactorily melting yellow brass or other copper alloys containing an appreciable percentage of zinc. The high-temperature heat source in direct contact with the bath overheats the metal in its immediate vicinity and always causes excessive loss of zinc.

With copper alloys containing no zinc conditions are somewhat different, since lack of uniformity in heating is less likely to result in serious loss. In a direct-arc furnace of small size it has been found possible to melt a copper alloy containing as much as 15 to 20 per cent lead with less loss than is commonly the case with the

same alloy in fuel-fired crucible furnaces. In larger furnaces the greatly increased rate of heat input supplies heat to the metal in the neighborhood of the arc more rapidly than it can be conducted away to more distant portions. As a result the surface of the metal becomes overheated while other parts of the bath are still much below the desired temperature.

ADVANTAGE OF DIRECT-ARC FURNACE

The direct-arc furnace has the advantage of simplicity and high thermal efficiency. Its design has been more highly developed and perfected than that of most other electric furnace types. Since it is so widely used in the steel industry, several reliable and readily available furnace designs are on the market. It is very doubtful, however, if any direct-arc furnace deserves wide application for melting copper alloys. Its use is limited to only a few of the common alloys, and, if large units are employed, the metal loss, even with these alloys, is likely to be serious. Small units are more satisfactory in this respect, but are subject to the disadvantages of lower efficiency, higher fixed charges and higher operating costs per ton of metal produced.

Such direct-arc furnaces as are now in use in this field—and there are a few—hold their place by virtue of their simplicity, their elimination of crucible cost and their high rate of production, at a time when these qualities are at a premium.

The intensity of heat application to the metal is lessened somewhat by using an arc between two or more independent electrodes above the bath, heating the latter by direct radiation. This is the principle of the usual type of indirect-arc furnaces. The arc does not come in direct contact with the metal, and the latter forms no part of the electric circuit. It is apparent that in this type of furnace the surface of the metal is not so seriously overheated as in the direct-arc furnace, but such overheating as exists is, nevertheless, too severe to permit the use of such furnaces in melting yellow brass. The indirect-arc furnaces can be used economically with alloys containing 5 to 10 per cent of zinc, possibly as high as 20 per cent, but certainly not for higher values.

The design of the indirect-arc furnace is invariably somewhat more complicated than is the case with the direct-arc furnace, and its thermal efficiency is not so high, but in the melting of copper alloys it can be economically used in large units and seems to be in general a more satisfactory tool for the purpose.

Several indirect-arc furnaces are now in use in this country for melting copper alloys which contain small percentages of zinc or none at all. In a new type of indirect-arc furnace the metal, as soon as it becomes molten, is agitated by rocking the furnace mechanically, in order to avoid overheating of the surface layer. In this way non-uniformity of heating is largely rectified, and it is possible that alloys high in zinc can be melted without excessive loss. The furnace has received a comprehensive commercial test, the results of which will be published soon. This type gives considerable promise of success and should be applicable to a wide field of alloy melting.

INDIRECT RESISTANCE FURNACES

Resistance furnaces which do not utilize the metal itself as an electric resistor may be grouped in three

classes: (1) those which radiate heat directly to the metal, similar in principle to the indirect-arc furnace; (2) those which radiate heat to the furnace roof and thence to the metal by reflection and secondary radiation; (3) those which deliver heat to the metal by conduction through a refractory wall.

Heating by direct radiation is the most desirable of the three from the standpoint of efficiency. For this purpose it is practically necessary to support the resistor above the bath in some manner, and this has never been done successfully in furnaces of any size. In small furnaces it has been possible to utilize this principle and to melt brass satisfactorily without overheating the surface of the metal to an undesirable degree, since, as compared with an arc, the resistor has a large area and operates at a much lower temperature. At the same melting speed the application of heat to the metal is more uniform but the efficiency is somewhat less.

MECHANICAL DIFFICULTIES PREVENT COMMERCIAL USE

This type of furnace is applicable to the melting of yellow brass but is not in commercial use because of the mechanical difficulties involved in its construction. The possibility of its eventual use depends upon the development of a resistor material which is at once highly refractory, homogeneous, mechanically strong at high temperatures and possessed of a fairly high electrical resistance at the working temperature of the furnace.

The second type of indirect resistance furnace named ranks next in order of thermal efficiency. In this design a refractory wall separates the resistor from the metal, although not necessarily in contact with the metal, and the major portion of the heat is radiated from the resistor to the furnace roof, the latter acting as a secondary heat source which reflects and radiates part of the heat which it receives to the bath beneath it. The heat has to travel a rather long path, and much of it is lost by the wayside. As a result the furnace is not so efficient in principle as those previously discussed. In order to stimulate a reasonably rapid flow of heat the resistor element must be much hotter than the roof, and the roof, in turn, much hotter than the metal. Thus the possibility of a high rate of production depends upon the use of a resistor capable of operating at a temperature very much above that of the metal, even at the pouring point. The furnace roof must be exceedingly refractory, and the brickwork in the immediate neighborhood of the resistor must be even more refractory than the roof.

This furnace, in common with other indirect resistance furnaces, has another disadvantage, somewhat minor in character but worth considering, which does not exist with direct-resistance furnaces, nor to any great degree with arc furnaces. The heat storage of the furnace is large and the stored heat is at a higher temperature than that of the metal. Consequently, the temperature of the metal will continue to increase after power has been shut off so that the metal must be poured promptly when it has reached the desired pouring temperature in order to avoid overheating.

This is the only form of indirect resistance furnace which has been used commercially for melting copper alloys. In its present form it is simple, reliable, easy to operate and can be used for practically any alloy, with either intermittent or continuous operation. Its metal-

lurgical characteristics are excellent, with the single exception that it is somewhat difficult to secure thorough mixing. It is also especially suitable for melting alloys high in zinc. However, its production rate is not rapid and it is not so efficient as the types of furnaces already described.

A similar type of furnace exists in which a combination of arcs and resistance elements is utilized, all radiating heat to the furnace roof, which, as in the furnace just described, serves as a secondary heat source. The use of arcs makes possible a considerably higher power input, more rapid melting and probably a slightly more favorable efficiency, provided that a sufficiently refractory roof is used. A very high efficiency cannot, however, be expected from this type of furnace. Certain difficulties in furnace design have been encountered which have so far postponed the commercial use of this furnace. It has been under test for some time, but the results obtained have not yet been made public.

The least efficient method of transferring heat from its source to the metal is to force it through a refractory wall, even though this wall be that of a clay-graphite crucible, a mixture which has a fairly high heat conductivity. Theoretically, the least undesirable arrangement under these conditions is to inclose the resistor in the refractory wall or to use the wall itself as a resistor. In the latter case the wall must be separated from the metal by an insulating layer to prevent short-circuiting. It is not an easy matter to make this insulation permanent, so this factor has been a serious source of difficulty. A resistor inclosed in a refractory wall tends to reach excessively high internal temperatures, and no material, satisfactory in other respects, has yet been found which will not destroy itself under these conditions. Another troublesome difficulty results from the ease with which most resistor materials unite chemically with the furnace refractories at high temperatures, thereby destroying both themselves and the refractories. Some two or three furnace types have been designed to make use of this principle, but they have been collectively unsuccessful. At present there is no real activity along this line.

CRUCIBLE FURNACE LOW IN THERMAL EFFICIENCY

Finally, it is possible to melt brass in a crucible by means of resistor elements which surround but do not touch the crucible. Perhaps the most perfect results, from a metallurgical standpoint, can be obtained in this manner, but the thermal efficiency is at a minimum, and in any case the electric crucible furnace lacks most of the secondary advantages upon which the electric brass-melting furnace must depend in part for its successful use. In cases where perfection of metallurgical results is by far the most important consideration it is possible that an electric crucible furnace can be employed profitably, but, so far as is known to the writer, no commercial installation of this kind exists.

So far as thermal efficiency is concerned, the crucible furnace takes its place at the bottom of the list. Its energy consumption per ton of metal produced is about three times that of the induction furnace. One or two attempts have been made to improve the efficiency but owing to the facts just stated its development has been discontinued.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Elementary Principles of Continuous-Current Armature Winding.—F. M. DENTON.—A continuation of the article classifying and explaining the nature of the various classes of continuous-current armature windings. The symbols used to designate the various windings, the choice of type of winding, effect of re-entrancy, definitions and winding rules are given in this section.—*London Electrician*, April 5, 1918.

Generation, Transmission and Distribution

Iron Wire for Transmission Lines.—W. T. RYAN.—The author deals with the cost of conductors and the relative advantages of iron and copper, quoting Kelvin's law for maximum economy. He points out that there is difficulty in determining the relative advantages of iron and copper on alternating-current circuits because the alternating-current resistance varies widely with the current and grade of wire. For long extra-high voltage lines aluminum is sometimes cheaper than copper. The Germans are reported to have discovered an alloy of zinc which combines ductility and toughness with fair electrical conductivity. In some cases they have even used iron wire covered with a double coating of varnish instead of the ordinary form of insulated wire. The article includes several curves.—Paper read before the Minnesota Electrical Association.

Transmission-Line Practice; Construction and Costs.—LIEUT. E. T. DRIVER and E. V. PANNELL.—The chief problems of engineering at the present day are economic ones. The different factors which affect cost in transmission-line work may be briefly summarized as follows: (1) Right-of-way, (a) easements or purchase, (b) clearing; (2) surveys and engineering; (3) material, (a) tower steel, (b) conductors and ground wire, (c) insulators, (d) hardware and equipment; (4) labor, (a) distributing material, (b) digging holes, (c) erecting, (d) setting insulators, (e) stringing wire and cleaning up; (5) interest; (6) contingencies. These factors are discussed. The article includes two charts showing metal costs.—*Toronto Electrical News*, May 1, 1918.

Installations, Systems and Appliances

Operating Features of Motor Drive in a Bakery.—The application of electricity for industrial cases and use for central-station service is coming more and more into use in various industrial plants. It is apparent that in a bakery the cleanliness and regulating features that can be had by the use of electricity are very great advantages.—*Electrical Review*, May 4, 1918.

Relation of Load Factor to Operating Cost of Electric Drive.—D. R. SHEARER.—Some of the factors which govern electric rates are the maximum demand for a specified period of time, the time during which the peak occurs, the time duration for the desired class of ser-

vice, the actual amount of electricity consumed over a stated time, and the power factor of the load if alternating current is used. All of these factors may be determined mechanically. The economies of different methods of drive, the questions to be considered in applying electric drive and an example of economy from rearrangement of motor drive are taken up.—*Electrical Review*, May 4, 1918.

Wires, Wiring and Conduits

Substitutes in the German Electrical Industry.—An article in *Engineering* gives some interesting particulars of the substitutes being adopted by the German electrical industry, as disclosed in a paper read before a meeting of Swedish Electricity Works representatives by M. T. Husberg. Early in 1914 copper, rubber and other raw materials were commandeered by the German government. The shortage in copper and its alloys has perhaps caused the greatest difficulty. Efforts have been made to substitute zinc for copper, and drawn wire of this material, which is relatively abundant, has been produced by a special squirting process at 500 atmospheric pressures. The brittleness and sensitiveness to change of temperature have, it is said, been much reduced, and it has been employed for busbar conductors of various kinds and even for machine windings. Aluminum and its alloys, although the supply available is limited because of extended use for airplane construction and other munition purposes, are also being employed, especially in the form of alloys, such as "electron" (10 per cent Al, 90 per cent Mg), "magnalium" (90 per cent Al, 10 per cent Mg) and "duralumin" (91 per cent Al, 9 per cent Cu). These alloys are used largely for busbars and castings where non-magnetic material is required. The shortage in rubber, cotton, jute, oil, asbestos and mica has also been pronounced. Paper has been used as a substitute and refined rubber residues substituted for rubber proper, while a substitute for ebonite is found in an artificial product of phenol and formaldehyde. For overhead conductors iron is chiefly used and special regulations are proposed for composite conductors (e.g., galvanized steel with an outer layer of zinc). Overhead lines of zinc alone are not likely to be used. Machines with substitute metals naturally have a relatively low efficiency, the efficiency of direct-current machines with zinc windings and iron commutator being given as 50 per cent, while transformers with zinc windings are credited with 60 per cent. Recently aluminum has been more generally used for machine windings, but even so an efficiency about 20 per cent below that of a machine of similar type with copper windings is experienced.—*London Electrician*, April 12, 1918.

Electrophysics and Magnetism

Sustained Short-Circuit Phenomena and Flux Distribution of Salient Pole Alternators.—N. S. DIAMANT

With the ordinary field forms met with in practice, the resultant flux wave under sustained short circuit will be extremely distorted because of the low voltage obtained under such conditions. The fundamental of the B curve of the field is reduced so much by the armature reaction that the higher harmonics assume a predominant part and become several hundred per cent of the sustained short-circuit fundamental. The flux distribution at various power factors is considered, and results of investigations to determine the direct component of armature reaction and the resultant flux distribution under sustained short-circuit conditions are given. The author thinks that the words "sudden" and "sustained" seem suitable for specifying the kind of short circuits applied, but the great difference between these two important and complex phenomena of sustained and sudden short circuits should not be lost sight of in any consideration of the subject.—*Proceedings A. I. E. E.*, May, 1918.

Units, Measurements and Instruments

Determination of the Degree of Uniformity of Bars for Magnetic Standards.—RAYMOND L. SANFORD.—Concrete magnetic standards, consisting of straight bars of magnetic material selected and prepared with a view to obtaining the maximum degree of homogeneity, are of very great value in magnetic testing. A method of determining their uniformity is described and curves are given showing the distribution of magnetic induction and leakage for various bars. The observations show the degree of magnetic uniformity that may be expected in ordinary test bars as received. Uniformity curves for a number of characteristic cast-iron bars are given and normal induction curves taken with the permeameter test coils over the different regions of the iron are illustrated.—*Bulletin of the Bureau of Standards*, April 6, 1918.

Study of Electromagnet Moving-Coil Galvanometers for Use in Alternating-Current Measurements.—ERNEST WEIBEL.—This instrument can be used very advantageously with iron in the fixed coil, which results in a marked increase in the strength of the magnetic field, so that the induced current is sufficient to effect satisfactory performance. The equation of motion, effects of reactance, determination of constants and disturbing torques are given in the theoretical section of the paper. In the construction and performance section the general design is discussed and also four separate types of galvanometers. The instrument is better than a vibration galvanometer and equal to the best direct-current moving-coil galvanometer. It also gives satisfactory performance at low frequencies.—*Bulletin of the Bureau of Standards*, April 6, 1918.

Miscellaneous

Heat Transmission of Building Materials.—A. C. WILLARD and L. C. LICHTY.—An investigation to determine the coefficients of heat transmission of standard building materials for exterior walls has been completed at the engineering experiment station of the University of Illinois. The tests were conducted according to the so-called "hot-air-box" method, the boxes being built of the material to be tested and of such size as to insure conditions similar to those found in actual practice. The heating was done electrically so that the input of heat could be controlled and accurately measured. The

materials tested included various sizes of plastered tile, magnesia board, cork board, wood, concrete, brick, glass with and without an air space, sheet asbestos and asbestos board. The degree to which the transmission coefficients of the various materials are affected by variations in air velocity, by humidity and by the use of air spaces in the wall is discussed, and the results of the tests are given in detail.—*Bulletin 102 of the Engineering Experiment Station of the University of Illinois*.

Electric Welding in Shipbuilding.—In the discussion on Capt. James Caldwell's paper on "Welding Systems," recently read before the Institution of Engineers and Shipbuilders in Scotland, various speakers especially well informed on the subject referred in definite terms to progress in electric welding as applied to shipbuilding. O. A. Payne, whose remarks had been prepared with the sanction of the Director of Naval Construction, gave the results of experimental work carried out at Portsmouth on plate connections in which there were riveted joints supplemented by runs of welding and plain electrically welded joints. One of the findings was that a plain butt V weld is quite as strong as, or stronger than, the best riveted joint attainable, whether riveted by hand, hydraulic or pneumatic machine, in double or treble rows. The general result of the experiments is that the Admiralty has accepted electric welding in full confidence as a shipyard method having great potentialities. When it is considered that the cost of an electrically welded joint is even now not much in excess of a riveted one, and that the process enables the output per man to be vastly increased—an important factor under existing circumstances—it is seen to be time that electrical welding be placed upon an approved basis in British shipyards, so as to be available at the slipway, dock side or the refitting berths. It can be used first on work of minor importance, such as calking, attaching fittings to water-tight bulkheads, etc., in order to gain experience in handling apparatus. Next it can be used to construct bulkheads flats, etc., with laps partly riveted and partly welded, proportionally reducing the connecting rivets. Finally, when full confidence in the use of the plant had been obtained, electric welding can be substituted to a large extent for the present laborious process of riveting, with great resultant gain.—*London Engineer*, April 12, 1918.

Tests on Oil Switches.—In an appendix to a paper by Dr. C. C. Garrard, read before the British Institution of Electrical Engineers, some interesting tests on the speed of operation of oil switches are reported. A number of tests were made by means of a rotating drum with a pencil mechanically connected to the moving portion of the switch. At the bottom of the drum two traces are made, one by a tuning fork vibrating at a rate of fifty times per second and the other by a marker connected across the trip coil. The latter exactly indicates when the tripping circuit is completed, and the tuning fork gives a time scale. The effect of the oil on the speed is very small, and with the spring in action the contacts separate at the rate of 4.7 ft. (1.43 m.) per second. After this velocity has been reached it remains practically constant during the rest of the movement. Without the oil the initial speed is 3.6 ft. (1.09 m.) per second, and if the spring is not used the speed recorded is not so great as this.—*London Electrician*, April 12, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

PROGRAM FOR N. E. L. A. ATLANTIC CITY CONVENTION

Arrangements Now in Final Shape, and Sessions
Will Be Crowded with Vital Papers,
and Discussions

Arrangements for the war convention of the National Electric Light Association, to be held at the Hotel Traymore, Atlantic City, on June 13 and 14, are in final shape. The program is of direct importance and value to the electric utilities in their effort to use all resources and abilities to give service to the government.

The prospective program in detail follows. One or two other interesting items may be added:

FIRST SESSION

Thursday, June 13, 9.30 a. m.

Welcome to the city, Mayor Bacharach.

Presidential address, John W. Lieb.

Report of the treasurer, W. H. Atkins.

Report of the secretary, T. C. Martin.

Report of the membership committee, Walter Neumuller, chairman.

Reports of the national sections.

"Relationships Between the Government and Our Industry," discussion opened by Alex Dow, Detroit.

"War by Civilians," Arthur Wright, London, England.

SECOND SESSION

Thursday, June 13, 2.30 p. m.

Report of National Committee on Gas and Electric Service, George W. Elliott, secretary, Washington, D. C.

Report of National Committee on Public Utility Conditions, P. H. Gadsden, chairman, Charleston, S. C.

Report of public policy committee, W. W. Freeman, chairman, Cincinnati, Ohio.

Symposium on labor problems, participated in by Loyall A. Osborne, Washington, National Labor Board; D. H. McDougall, Toronto, president Canadian Electrical Association; Dr. Schuyler S. Wheeler, Ampere, N. J., president Crocker-Wheeler Company; James T. Hutchings, Rochester, N. Y., Rochester Railway & Light Company.

THIRD SESSION

Thursday, June 13, 6.30 p. m.

Informal dinner in the main dining room, Hotel Traymore, at which addresses will be made by Oscar T. Crosby, United States Treasury Department; P. B. Noyes, United States Fuel Administration; Samuel Insull, chairman Illinois Council of National Defense; Arthur Williams, federal Food Administrator for New York City; E. W. Rice, Jr., president General Electric Company, and W. W. Freeman, president Union Gas & Electric Company, Cincinnati.

FOURTH SESSION

Friday, June 14, 9.30 a. m.

Flag Day exercises.

Appointment of nominating committee.

"The Coal Situation," general discussion led by Past-president Herbert A. Wagner; "The Utilization of Water Powers as a Measure of Coal Conservation," Philip Torchio, New York Edison Company.

Technical Section subjects: (a) "Cable-Carrying Capacity Increase," (b) "Cable Reinstallations," (c) "Aerial

Cables," (d) "Female Employment in Laboratories," (e) "Extension of Testing Schedules," (f) "Increased Output from Existing Apparatus," (g) "Increasing Capacity of Overhead Distributing Lines," (h) "Interconnection and Power Requirements of Atlantic Seaboard District."

"Hydro-Turbine Efficiencies," W. W. Nichols, vice-president Allis-Chalmers Manufacturing Company, Milwaukee.

FIFTH SESSION

Friday, June 14, 2.30 p. m.

Vehicle Section subject, "The Electric Vehicle as a War Measure," James H. McGraw, New York City, president McGraw-Hill Company.

Commercial Section subjects: (a) "Results of Daylight-Saving Law," Preston S. Millar, New York Electrical Testing Laboratories; (b) "Peak Equalization," R. R. Young, Newark, N. J., Public Service Electric Company of New Jersey; (c) "Stimulating Appliance Sales," John G. Learned, Chicago, Public Service Company of Northern Illinois; (d) "Selling United States War Securities," T. I. Jones, Brooklyn, N. Y., Edison Electric Illuminating Company of Brooklyn.

Accounting Section subjects: (a) "Radical Accounting Practices," William Schmidt, Jr., Baltimore, Md.; (b) "Accounting Education," Fred R. Jenkins, Chicago, Ill.

Report of committee on memorials.

Report of nominating committee.

Election of officers.

SIXTH SESSION

Friday, June 14, 8.30 p. m.

"Emergency Construction for the War Department in United States," Col. Peter Junkersfeld.

"Emergency Shipbuilding at Hog Island," Past-president W. H. Blood, Jr.

Frank W. Smith, chairman of the hotel committee, 130 East Fifteenth Street, New York, urges delegates who have not yet secured hotel accommodations to communicate with him at once in order that arrangements for them may be made.

LIGHT LESS IN NEW YORK FOR ENEMY AIR RAIDERS

Experiment Made at Suggestion of the War Department Because of the Submarine Activities
of the Hun

New York city experimented with partly darkened streets on the night of June 4 as a precaution against possible bombing by aircraft from a German submarine. Electric signs and other commercial lights, except street and dwelling lighting, were out. The experiment was ordered by the police department at the suggestion of the War Department. United States aviators flew over the city to determine to what extent street lighting alone would guide enemy aircraft. As a result of the observations, these aviators recommended a reduction in street lighting on Fifth Avenue, Broadway and some cross streets. Their recommendations were put into effect and further observations followed.

NEED FOR CONSERVATION OF TECHNICAL ENGINEERS

Engineering Council, in Address to Secretaries of War and the Navy, Voices Alarm at Waste of Technical Training

An address to the Secretary of War and the Secretary of the Navy by the Engineering Council voices the alarm of technical engineers in every branch of the profession who are taking part in the war activities of the army and navy at the unfortunate waste of technical training caused by the drafting and enlisting of engineers for regular service with little or no regard for their technical attainments. These technically educated and experienced men are essential to the successful conduct of the war and cannot be replaced. There is continuing evidence that America is repeating in some measure England's mistake of sending technical men into the ranks when they should be carefully conserved for special duties in the fighting forces or on the technical staffs.

These facts have been forced upon the attention of engineers who have been co-operating with the government through the Naval Consulting Board, the National Research Council and the Engineering Council. To these organizations requests have constantly been made for engineers, chemists and other technical men for a great variety of military services. Thousands of names have thus been furnished to the government departments and bureaus. The Engineering Council especially has devoted attention to this personal work through its committee, known as the American Engineering Service, which has available classified lists of approximately 25,000 engineers and unclassified lists of many more. It is from these lists, directly or indirectly, that most of the names have been selected for war service.

The total membership represented by the organizations which constitute the Engineering Council or are co-operating with it in this service is approximately 50,000. Already from 10 to 15 per cent of the members of these several organizations are in the uniformed services of the country, and it is safe to say that a large majority of their remaining members are in the government civilian service or otherwise directly or indirectly engaged in the war. Engineers do not seek to avoid fighting, but earnestly desire to be given opportunities for fighting and other services in which they can be most effective and which cannot be performed by others.

It is known that, through the committee on classification of personnel in the war service exchange of the War Department and in some other ways, efforts are being made to counteract the tendency toward the loss of our technical men in the ranks of the army and navy. It is believed, however, that these efforts are insufficient and that they should at once be supplemented by other stringent measures dealing with the subject in the draft boards and recruiting stations.

In view of the foregoing, the Engineering Council, created to provide means for united action and to speak authoritatively for its member societies on all public questions of common interest to engineers, has offered the following resolution:

Whereas technically trained engineers are indispensable to the army, the navy and the war industries, in the Engi-

neering Corps, the Ordnance Bureau and the Signal Corps, in aviation, submarine and tank service, in shipbuilding and in many other assignments; and

Whereas, through draft and otherwise, many of these unreplaceable men have been and are being diverted so that their special qualifications are not being utilized, be it

Resolved, that, in the opinion of the Engineering Council, technically trained men of all ages should be enrolled and conserved for technical duties and special efforts should be made immediately by the War and Navy departments to find and record such men among drafted and enlisted forces and to assign them to places in which their special qualifications are needed, and be it further

Resolved, that the Engineering Council offers to assist the War and Navy departments in locating and classifying such men, if its assistance be desired, provided these departments will give the necessary facilities for collecting information about engineers now in the army and navy or whose names are upon the selective draft lists.

These resolutions are offered solely in a patriotic spirit of helpfulness, writes Alfred D. Flinn, secretary of the Engineering Council, in transmitting the address.

INDIANAPOLIS COMPANIES

ASK MORE RELIEF IN RATES

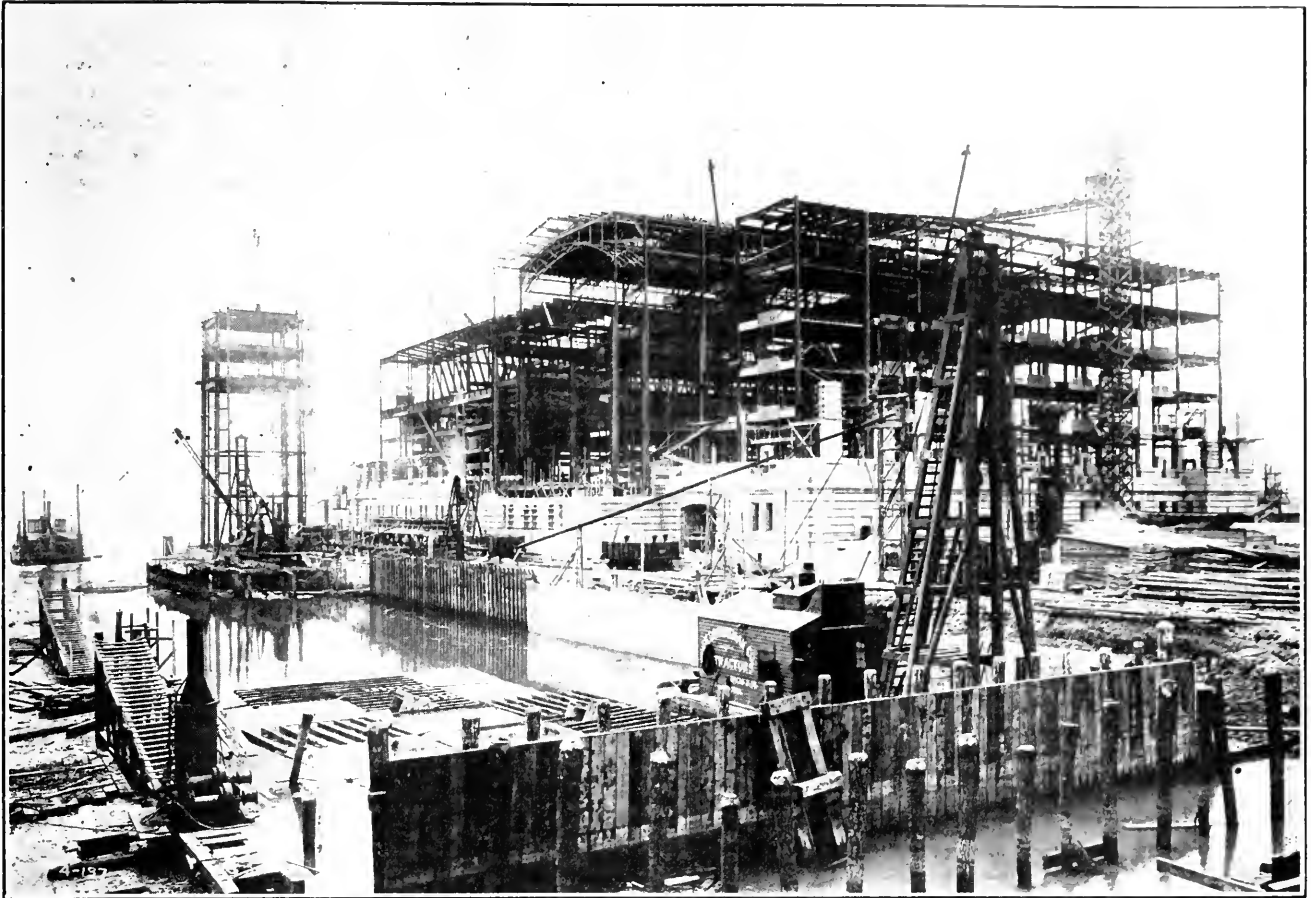
Two Properties Join in Petition to the Indiana Public Service Commission for New Authorization

The Indianapolis Light & Heat Company and the Merchants' Heat & Light Company of Indianapolis have petitioned the Indiana Public Service Commission for authority to add new surcharges to all bills for electrical energy, beginning on July 1. The two companies have been operating since last September under an order from the commission which allowed as a war emergency measure the addition to all bills of 5 mills for each kilowatt-hour of energy consumed. This first relief will expire June 30. The petitions, which the two competing companies filed jointly, have been set for joint hearing on June 17, 18 and 19 by the commission. One of the petitions says:

Petitioner represents and shows that since the filing of its said petition and the entry of the order made thereon there have been additional increases in the cost of coal, labor, material, taxes and other elements entering into the cost of the production and distribution of electric energy, and petitioner is of the opinion, from its experience and from extensive investigations made, that it will not be possible during the continuance of the war to purchase either coal, supplies, materials or labor except at prices greatly in excess of prices prevailing at the time of filing its said petition and the entry of the order made thereon, and that its taxes, both local and federal, have been greatly increased since said time and may be subject to still further increase.

Petitioner says that as a result of the foregoing increase in costs it has suffered serious loss in net revenue and will continue to suffer still greater losses which threaten to and will result in the curtailment of present service and the inability to finance necessary extensions and additions if sufficient temporary relief is not given in such a way as to return to petitioner the difference between the prevailing excessive prices and the normal prices upon which its existing rates and charges are based. That, as a temporary expedient to relieve the financial distress following the extraordinary prices as aforesaid and to make possible necessary betterments and extensions and prevent the curtailment of services, your honorable commission is requested to authorize petitioner to add to each bill rendered by it for all electric service furnished by it a surcharge sufficient to return to it the difference between the present excessive prices and the prices upon which its existing rates and charges are based.

Chester Station of the Philadelphia Electric Company



Philadelphia is in the very center of the country's war activities. The greatest shipbuilding plants, the largest munition works and other war industries are located there.

These all use the service of the Philadelphia Electric Company, and W. C. L. Eglin is rushing work on the company's new Chester station to provide 60,000 kw. more this fall.

NEW YORK EDISON RATES TO HOLD NOW

J. W. Lieb Shows Effect of Higher Costs and Reduced Gross Business Upon the Operating Income

At a hearing on June 3 before the New York Public Service Commission, J. W. Lieb, vice-president and general manager New York Edison Company, said that in spite of higher operating costs an increase in rates will not be asked at present.

Mr. Lieb said that the doubts and fears expressed by the company nearly a year ago in relation to a steady increase in the cost of manufacture had been realized. He added:

Our revenue has suffered a considerable decrease due to the reduction in rates, while our output has been actually less than last year. Our expense account has shown a steady increase as compared with last year in the price of coal and labor, and, in fact, in supplies of every description concerned with articles of consumption and those needed in repairs and maintenance.

Our records show that for the four months ended April 30, 1918, as compared with 1917, our operating income has been reduced from \$3,624,723 in 1917 to \$2,683,069 in 1918, a total of \$941,654 in the four months. Net income, therefore, suffered a serious decrease. What the future may have in store for us it is difficult to predict. In fact, with the rapid changes which are taking place we can only express our doubts and anxieties.

The loss in our operating revenue is not entirely accounted for by the reduction in the maximum rate from 7½ cents to 7 cents which went into effect July 1, 1917. It is disquieting, to say the least, that the reduction in the quantity of energy sold was from 223,061,388 kw.-hr. for the first four months of 1917 to 213,513,941 in 1918, a reduction in the output in excess of 4½ per cent.

The increase in operating expenses in 1918 and 1917 is a reflection of the increased cost of coal, of labor, supplies and taxes, and, with the exception of coal, the future price and efficiency of which is at this time problematical, these higher costs will continue, and possibly in an increasing ratio throughout the year. We believe that these conditions would justify the company in going back to the 8-cent rate. At the same time it is not absolutely certain that the decreases in output will continue for the rest of the year.

The present situation is one of extreme doubt and uncertainty. We do not desire to come before the commission at this time and announce our decision to restore the 8-cent rate. We believe that probably the best solution would be a continuation of the present arrangement with the commission, maintaining the status quo for another six months, and reserving such rights as we have under the present arrangement.

The commission agreed to this. The agreement affects practically all points in Manhattan and the Bronx and applies also to the United Electric Light & Power Company.

The company also announced that while it would continue to furnish lamps, it would be compelled to charge for them, and that the prices would be in line with the general increases made by the manufacturers.

WAR SERVICE WORK OF THE ELECTRIC POWER CLUB

Manufacturers of Power Apparatus, Meeting at Hot Springs, Va., Consider Questions Touching Service to the Government

War service and other matters related intimately to war conditions occupied much of the interesting program at the annual meeting of the Electric Power Club at the Homestead, Hot Springs, Va., on May 30 to June 1. The attitude of the manufacturers of power apparatus and of the government was the subject of discussion at special sessions to which all such manufacturers were invited, whether they were or were not members of the club.

As a representative of the government, Walter Robbins, chief of the power equipment section of the finished products division of the War Industries Board, showed the tremendous and fast-increasing scope of the nation's war mobilization. Robert K. Sheppard, chairman of the General War Service Committee of the Electrical Manufacturing Industry, outlined the spirit in which its work is being done and the patriotic need of the devotion of every resource to the one aim of winning the war. In addition, the address and remarks of C. L. Collens II, the president, and of others made plain the desire to give the fullest measure of support in the paramount cause.

PRESIDENT COLLENS ON STANDARDIZATION

At the opening meeting President Collens called attention to the permanent importance of the work of standardization, with which little was done last year because members gave their time to the war program. He said that standardization, however, had been the main work in the past and that it must still be a very important part. The handbook of standards is still far from complete and omissions should be supplied as the work can be done.

In his address at the meeting last fall Mr. Collens recommended that if possible the work of the club be broadened to endeavor to correct any bad practices in the industry, promote equitable competitive relations, and place the industry on a sound economic basis. He still feels that this ought to be undertaken, especially if it is done in full co-operation with a government agency. The club activities should be broadened so as to include commercial standards as well as the character of work done in the past.

President Collens then reviewed orders, rulings, etc., of the Federal Trade Commission affecting other industries, but which he felt were instructive as indicating the trend in the gradual development of properly defining what unfair competition is and the classes of bad practice which should be eliminated. Among these were the question of quality, so that there should be no room for misunderstanding by the public; contracts giving rebates based on volume of business, especially if contingent on the customer's refusal to deal with others; giving something to influence purchases; discrimination as to price, as in making prices very low or below cost in competitive territory.

Another point is the Federal Trade Commission's desire to compile statistics by industries. Mr. Collens believes with the commission that this is a function of the government and that the manufacturers should aid.

The possibilities of foreign trade under the Webb law should also be considered, added President Collens.

It was voted to remit the dues of all members in the national service.

At the evening session on May 30 reports were presented by the standing and standardization committees. A. H. Timmerman, chairman of the standardization committee, said that the fact that every one is working under the pressure of war conditions has materially handicapped further progress in standardization. Notwithstanding this, however, some excellent work has been done and the work should be continued.

Upon recommendation of the standardization committee it was decided to appoint as a sub-committee a safety committee to draw up safety rules. This committee will be entirely distinct from both the Underwriters' Laboratories and the Bureau of Standards.

Changes to classify the rules on dielectric tests, recommended by the committee on fractional-horsepower motors, were approved.

The general engineering recommendations committee presented the report of the conference committee of the American Institute of Electrical Engineers and the National Electric Light Association, making additions to the method of terminal marking on transformers. This was adopted, to go into effect not later than June 1, 1919.

Some discussion took place over the question of packing for foreign shipment, which has been taken up by the government from the point of view of saving ship space. It was also brought out, in connection with a reference to the bulletin issued recently by the General War Service Committee of the Electrical Manufacturing Industry, that the companies are making strenuous efforts to reduce tin consumption.

WORKING WITH THE WAR INDUSTRIES BOARD

At the first "war service session" on May 31 Walter Robbins, before taking up in detail the work with which he is in direct touch because of his position in the War Industries Board, gave a comprehensive picture of the great organization which has been developed to handle new governmental activities incident to the war, showing how bureaus had been expanded and new agencies created to deal with the large problems.

Mr. Robbins illustrated by one chart the general classification of purposes demanding preference treatment and by another the interrelations of the various divisions and committees of the War Industries Board.

The War Industries Board uses the committee form of operation, or conference system, which has been found to give the best co-ordination and results.

In showing the way in which the government necessities become greater and greater Mr. Robbins spoke of the pledge which the steel manufacturers have given, as follows:

For myself, my corporation or my firm, I pledge the prompt production and delivery of the largest possible quantity of material in our departments that is or shall be required by the United States government for the necessities of itself and its allies, and agree that all other lines of our business shall be subordinated to this pledge, and all this in accordance with the request of the War Industries Board.

In answer to a question, Mr. Robbins said that the zone system which is now under consideration was designed to facilitate the distribution of new needs to in-

dustries now operating on the less essential types and to facilitate the distribution of materials without useless transportation from district to district.

In general, the advice of Mr. Robbins is that each manufacturer begin now to satisfy himself that the work which he is doing is essential to the war. Every manufacturer should have his business so classified that he would know that which is essential or "non-essential" or in a middle class.

Robert K. Sheppard then told of the activities of the General War Service Committee of the Electrical Manufacturing Industry. He mentioned specific instances in which service has been given to the government and outlined the general attitude and purposes of the committee.

Speaking as chairman of the war service committee of the Electric Power Club, President Collens said that the power apparatus manufacturers co-operated with the War Industries Board some time ago in making a canvass which indicated that there were 15,000 motors



C. L. COLLENS, II

in stock in the country, and the disclosure of this fact eliminated the apparent shortage which existed at that time. The war service committee of the Electric Power Club has also assisted the General War Service Committee in organizing the power apparatus manufacturing branch of the industry into groups. Since the original organization of these groups four others have been added, electro-medical apparatus, radio apparatus, electric furnaces and electric welding. Organization of a group for electric storage battery manufacturers is now in a preliminary stage.

It is hoped to extend this, said Mr. Collens, so that in the end the electrical manufacturing industry will be organized 100 per cent. The effort will be to develop the efficiency of the group committees so that the general committee will be largely executive.

It was announced by Mr. Collens at the evening session on May 31 that the board of governors, after considering the reports on war service, had some preliminary recommendations to offer until more definite advice can be given. Each manufacturer should endeavor to determine as business is received into what class it falls regarding the war. Three classes of business are recognized as essential—direct government orders, indirect government orders, and work of exceptional or national importance which, while not directly

touching the war, is of great public interest and essential to public welfare.

It would be desirable to get a definite idea of the purposes for which apparatus not of these three classes is intended. If the order as received is not covered by a priority certificate, a written statement should be secured from the customer showing to what purpose it is to be put.

It is also recommended by the committee, added Mr. Collens, that manufacturers prepare immediately to tabulate data regarding needed raw materials, such as sheet steel, castings, bar steel, tool and alloy steels, copper wire, adhesive tapes, mica, fabrics, babbitt, solder and varnishes. Information should be prepared showing consumption last year and rate of monthly consumption now. As the nature of the business requires that power apparatus be manufactured for stock, there will have to be some agreement or guarantee that products will be reserved for essential war work.

It is desirable, Mr. Collens said, that each manufacturer study his own situation and if possible increase the percentage of his war work. Foreign orders should not be taken unless the necessary export license is secured.

F. S. Hunting and J. C. Hobart discussed the question of labor shortage and the employment of women.

S. L. Nicholson described experiences in transportation and embargo matters. A representative of the War Industries Board, T. C. Powell, is authorized to act to grant relief to manufacturers in these matters.

REPORT ON TRADE ACCEPTANCES

Mr. Hobart presented a report as chairman of the committee on trade acceptances, recommending the use of this system and showing the national economic advantages which make it especially desirable under war conditions. The report was adopted.

The first business at the concluding session on June 1 was the presentation of a report on handling freight claims, prepared in the secretary's office.

James Burke presented a paper on "Economies in Building Motors During the War." He urged full exchange of information and experience between manufacturers and every other form of effort to assure the largest possible economies of material and labor while the war lasts.

Dana Pierce, Underwriters' Laboratories, Inc., spoke on standards for control apparatus with reference to accident hazards. He asked the co-operation of the club in the preparation of standards which the Laboratories have been requested to compile for the National Workmen's Compensation Service Bureau. The matter was referred to the board of governors, which will act on it.

Dr. M. S. Lloyd, Bureau of Standards, spoke on the importance of the safety work.

H. F. Stratton, chairman of the cost accounting committee, reported that the club, as at present organized, does not include representatives who are specially concerned with cost accounting. The committee feels that the industry would be benefited by stabilization of cost accounting and recommends enlargement of the functions of the club.

O. F. Stroman delivered an address on "Variations in Manufacturing and Commercial Cost," with diagrams. He showed a method of determining the ef-

feet on manufacturing costs of market changes in basic costs.

J. C. Hobart, member of the war service committee, reported on fuel supply and conservation. He indicated the shortage in production below consumption demands and urged that every one inspect his methods of burning fuel.

F. M. Kimball, W. A. Layman, J. C. Hobart and S. L. Nicholson were elected directors. At the ensuing meeting of the board of governors officers were elected for the new year as follows:

President, Clarence L. Collens II, Cleveland; vice-president, James Burke, Erie, Pa.; secretary, C. H. Roth, Chicago; treasurer, R. J. Russell, St. Louis.

JOBBER TO CO-OPERATE WITH THE CONTRACTORS

Resolution Passed by the Electrical Supply Jobbers' Association as a Result of Conference of Committees

At the request of the National Association of Electrical Contractors and Dealers the co-operation and harmony committee of the Electrical Supply Jobbers' Association met a committee of three contractors, appointed by the contractors' association at the Homestead, Hot Springs, Va., on May 19, 1918. The following were present, representing the contractors' association: W. K. Tuohey, Springfield, Mass., chairman; J. R. Strong, New York; G. M. Sanborn, Indianapolis. Representing the jobbers there were W. E. Robertson, chairman; F. S. Price, N. G. Harvey, F. M. Bernardin, E. W. Rockafellow, Fred Bissell, V. C. B. Wetmore (by invitation), F. Overbagh, F. E. Neagle and E. D. Tolles.

After a full discussion of the problems confronting the electrical contractors, a request was made by them summarized as follows:

That the jobbers aid the contractors' association to increase its membership by, personally and through salesmen, urging contractors not members to join the association.

That in the same way the jobbers urge retail electrical dealers, hardware and other stores operating retail electrical departments to become associate members, and that jobbers operating retail departments also join the association, to the end that a far-reaching, properly financed campaign of education as to cost accounting and proper merchandising methods may be carried on, resulting in making the contractors better business men and merchants and larger and better customers of the jobbers, with a corresponding improvement in the credit risk involved.

That the jobbers' association appoint a committee to attend the national meeting of the contractors' association at Cleveland in July and that this committee, preferably of three, meet a similar committee of contractors to confer from time to time with reference to matters of mutual interest.

As a result of the meeting of the committees, the following resolution was passed by the Electrical Supply Jobbers' Association:

Your committee, in accordance with the objects expressed in the constitution of this association, believes that we should forward, by co-operative action, improvement in all

lines that will benefit the electrical industry and therefore recommends:

First—That all members of the jobbers' association having retail departments become associate members of the contractors' association.

Second—That the members of the association personally and through their salesmen urge all electrical contractors and electrical contractor-dealers to become members of the contractors' association, and urge all electrical dealers and all other merchants operating retail electrical departments to become associate members.

As there seems to be some misunderstanding as to the meaning of the term "retail department" or "retail business," the following definition, to avoid misunderstanding on the part of jobbers not present, is given:

By retail departments operated by jobbers your committee understands the term to cover departments that sell at retail prices, in retail quantities, to the consumer, and expressly excludes sales to isolated plants, central stations and power companies, philanthropic, educational, health or corrective institutions or enterprises related thereto; industrial firms or corporations of every kind engaged in commerce or in undertakings relating thereto; the government or any political subdivision thereof or agency in connection therewith.

Third—That the invitation to attend the national convention in July be accepted, and that the chairman of the co-operation and harmony committee designate three members of the committee to attend.

THE KANSAS CITY CENTRAL STATION RATE SITUATION

Analysis of Conditions That Make an Increase in Charges Necessary and a Statement of What the Company Is Asking For

In May, 1917, the Missouri Public Service Commission reduced the rates of the Kansas City (Mo.) Light & Power Company. At that time the commission decided to allow the Kansas City company to earn 6½ per cent on a valuation of \$7,200,000. A rate schedule was made effective which it was expected would give the company the stipulated return.

Prevalence of high prices and constant increase in cost of labor and material during the year have prevented the company from getting the net return expected. The earnings have fallen \$300,000 short of the allowable amount. During the same time a reduction in steam-heating rates was made effective. This has added further burdens to the company, and if these heating rates are effective during the coming winter the company's heating revenue will be reduced \$100,000. But, in addition to all this, the rate which the Kansas City Light & Power Company pays the Kansas City Railways for electricity which it buys to distribute has been increased by the commission by an amount that means an added annual expenditure of \$400,000 to the electric light company. The rate was formerly 1 cent per kilowatt-hour. It was increased to \$15 per kilowatt of maximum demand and 1.14 cents per kilowatt-hour.

So in the aggregate the company stands to-day with \$300,000 less than the commission expressed willingness to allow it and also in a situation where it will see revenues reduced and expenses increased. The shortage for the coming year, unless some relief is granted, will be in round figures \$800,000, in addition to the existing shortage of \$300,000.

The company has asked the commission for this relief in the shape of an increase in electric service rates.

The approximate amount of the increase asked is \$500,000. The application to secure this increase in revenue contains two plans either of which the company considers satisfactory.

One plan contemplates an increase in all rate schedules in an amount equal to about 1 cent per kilowatt-hour. This applies to both power and light. At present the top step in the residential rate is 8 cents.

The other plan is a combination of the surcharge and straight increase ideas. Under the terms of this plan the company asks a surcharge of 7 cents per room per month against residential consumers; a surcharge of

The 1917 Light, Heat and Power Rates Failed to Meet the Fixed Expenses.

"It Is Essential Public Utilities Be Maintained"

Under an order made by the Missouri Public Service Commission the present schedule of rates—a reduction of the former rates—was placed in effect by us May 1, 1917.

These rates were based on pre-war prices and were to be given a trial for one year. They were made in good faith to meet the requirements of the Commission, and were calculated to bring the service given by this Company to the consumer at the actual cost of delivery plus a FAIR RETURN on the actual investment.

Since May 1, 1917, we have increased the wages of our employes \$155,000, over 46 per cent as compared with a year ago. Most of this increase has been made during the last six months.

In the same period materials used by this Company have advanced \$90,000; a 30 per cent increase; fuel advanced more than \$200,000 or 57 per cent above a year ago; our tax increase was \$56,750, an increase of 53½ per cent.

With the advances in fuel, labor, materials and taxes the rates fixed failed to produce sufficient revenue to meet the expenses by approximately \$300,000 (\$265,000 for eleven months).

During the same time our heating rates were reduced, which, if in effect during the coming winter, will decrease our revenue from that source more than \$100,000.

Most of the electric current used by us is purchased outside our own plants. Under the recent finding of the Public Service Commission the same amount of current purchased this year as purchased in 1917 will cost us \$400,000 more during 1918 than in 1917 under the present coal prices. This means the Company is now facing a deficit during the current year of approximately \$800,000.

The rate which has been fixed for light, heat and power service in Kansas City will not meet the cost of supplying that service. It will not pay the increases in labor, fuel and materials, to say nothing about a fair return on the money invested in the property.

The Kansas City Light & Power Company

HOW THE KANSAS CITY COMPANY TALKED TO THE PEOPLE

\$1 per kilowatt of connected load per month on commercial consumers, and an increase of 25 cents per month per kilowatt of demand on an increase of 1½ cent in the energy rate for power customers.

No change in the municipal lighting rate is asked.

In preparation for the pending hearing on its application for increased rates the company has conducted an advertising campaign in the daily papers. This advertising is written in a vein of frankness and sincerity. It sets forth that the company is supplying power to many essential war industries and that it is therefore essential and must be maintained. President Wilson's correspondence with Secretary McAdoo is quoted. Facts and figures from the company's books are also used to show that the company has not made the money which the commission said it is entitled to make.

IOWA ASSOCIATION DISCUSSES PROBLEMS OF VARIOUS SORTS

Methods of Holding Labor, Securing Higher Rates and Saving Coal Are Topics of Two-Day Round-Table Discussion

On May 31 and June 1 the Iowa Section of the National Electric Light Association held at Des Moines its first convention since the declaration of war. About fifty operating men, most of whom are responsible heads of properties, were in attendance. The convention was noticeably different from those in former years because of its entire lack of entertainment features and the absence of set papers. The program, as laid out, provided only for discussions of topics which are now uppermost in the minds of all utility men. The convention was also notable for the wealth of valuable discussion which its more or less informal sessions developed.

President John M. Drabelle, in addressing the first session, dwelt at length on the increasing cost of giving service and the difficulty of keeping sufficient labor. He expressed the belief that interconnection of plants and the shutting down of inefficient stations could be carried still further with beneficial results. As a suggestion to companies which are having trouble in getting local city councils to agree to proper rate increases, he advised that recourse be had to the federal courts. He also stated that, in figuring rates, companies should revise their ideas of interest and fixed charges.

A round-table experience meeting on the labor situation brought out that difficulties in getting and keeping plant men are extraordinary. It was the opinion that it is cheaper to pay more, to firemen especially, than to change frequently. In Iowa wages for firemen and engineers are now ranging between \$80 and \$100 a month for shifts from eight hours to twelve hours long. On the question of hiring women it was agreed that it is wise to begin immediately, if the plan has not already been adopted, to replace with women men who leave, so that it will be possible to get into the woman labor market while conditions are favorable. While only one man present had had experience with women as meter readers, many seemed to think they would soon be using women in this work.

F. A. Warfield of Peoria, Ill., leading the discussion on rates, told how the properties of the Illinois Traction System had recently secured an increase amounting to 18 per cent. He also emphasized the national aspect of the present tendency to ask for increased rates and pointed out that it is as much to the interest of communities as to utilities that relief be granted to afflicted companies. He declared the present rate situation to be a test of commission regulation. The discussion brought out that many rate increases have been effected in Iowa. These have amounted to an average of about 20 per cent, but some rates will have to be raised a second time. Even in communities paying 16 cents for energy the price has been raised to 20 cents per kilowatt-hour.

Next in point of interest to the question of getting more revenue was that of reducing operating expense. This program, it was conceded, should start in the boiler room. E. S. Hight of Peoria, in leading the discussion, stated that a boiler-room economy department of the Illinois Traction System had saved the company

\$239,000 in six years by simply seeing that the obvious sources of loss were stopped.

Frank Linebaugh of Boone, Iowa, speaking on the coal situation, urged early purchase and storage. "No all-wise authority," he said, "is going to take care of central stations this winter. They must help themselves by storing clean lump coal if the other grades they can secure do not permit successful storage." Mr. Linebaugh also advised that managers study the relative cost of operating on mine-run coal and steam coal. In many instances it will be learned that the higher-priced coals are least expensive in the long run. While coals which contain lumps require crushing, Mr. Linebaugh said plants should have crushers anyhow for emergency work.

Those who took prominent part in the various round-table discussions were: W. H. Abbott, Omaha, Neb.; R. H. Holbrook, Cedar Rapids; H. Simonds, Dubuque; M. G. Linn, Des Moines; R. C. Clifton, Idagrove; E. T. Hughes, Sheldon; John M. Drabelle, Cedar Rapids; Harold Boehner, Malvern; J. W. Walsh, Burlington; R. E. Brooks, Red Oak; C. E. Fahrney, Ottumwa; C. O. Ingersoll, Marion; L. C. Spake, Chicago, and Mr. Ham-lon, Mason City.

Officers elected for the ensuing year are: President, Herbert Bellamy, secretary Marion County Electric Company, Knoxville, Iowa; vice-president, O. H. Simonds, Dubuque; secretary-treasurer, M. G. Linn, Des Moines; assistant secretary-treasurer, Ira Steel, Des Moines, and director, John M. Drabelle, Cedar Rapids.

EXEMPTION PROVIDED FOR TECHNICALLY TRAINED MEN

Highly Skilled Enlisted Men Are to Be Returned
to Necessary Industries by the
War Department

In response to appeals from all over the country, the War Department has decided upon a policy which will permit the return to necessary industries of highly skilled men taken from such industries, under a system of furlough which will be automatic and which will not in the future as in the past leave to the discretion of company and other subordinate commanders the question of whether such furloughs shall be granted. Thousands of applications for such furloughs are now being sent out of Washington by various branches of the War Department, in response to the appeals of manufacturers and other producers of war material whose draftsmen, mechanics and other employees, engaged in the past and now upon government orders for war work, have been taken from them by operation of the draft.

The application blank is reproduced here.

The adoption of the new policy means that enlisted men are to be returned to industry only in cases where the drafted man's employer is willing to swear that the man is badly needed and that no one can take his place. The government department for which the manufacturer or other employer is working will, upon application, send one of the blank forms to the employer, which he must fill out, swear to before a notary and have a government inspector conversant with the facts also sign. The signed application then goes to the Adjutant General's office, with request from the in-

terested government department that the man wanted be granted an indefinite furlough, without pay, with the promise that after the need for the man's service has passed he will be returned to the army and the government notified.

While such men are on furlough they are not to be allowed to wear the uniform. The company employing such men must furnish to the government each month a report that such men are still in employment and of the class of work in which they are engaged. In case

APPLICATION FOR RETURN OF ENLISTED MAN IN HIGHLY SKILLED CLASS OF LABOR TO "NECESSARY" INDUSTRY

Dated at.....191

Application is hereby made for the return of following enlisted man:

Name....., Residence.....

Exact description of trade.....

Registered Local Board..... Order No..... Serial No.....

Last reported to Camp..... Unit.....

Taken into army.....191, because.....

.....

We ask that he be directed to report to.....

We have the following direct government contracts:

Date	Gov. Order No.	Quantity	Description	Dept. of Gov.
.....
.....

We are under contract with the following, who have direct government contracts from.....Dept.

.....

We have established our status as "necessary" industry with District Board No..... of State..... located at.....

.....

By.....(title)

Sworn to before me at.....

this..... day of.....191..

.....

Title of official administering oath

I have checked the foregoing statements and have found them to be correct.

.....

Local representative of.....dept.

such men leave their employment the employers must immediately notify the government.

Thousands of applications for furloughs for enlisted men in necessary industries have recently reached Washington, and Washington has been unable to grant permission for the necessary furloughs because company commanders and other subordinate officers could not be convinced that certain of their men might be more necessary in civil life than in the ranks. The Adjutant General's office has now sent a circular to heads of War Department divisions permitting the new system. The government is protected, from the army-in-the-ranks point of view, by the fact that wherever a fraud is perpetrated or an attempt is made to perpetrate fraud enough persons will be familiar with the facts to result in the War Department being notified.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Electrical League of Cleveland.—William T. Clark, a Civil War and Spanish War veteran, talked before the Electrical League of Cleveland on Wednesday, May 29.

N. E. L. A., Toledo Section.—At a meeting of the members of the joint section of the Toledo Railways & Light Company and Associates held May 24 G. E. Snider was elected chairman and G. E. Lafferty secretary.

A. I. E. E., Erie Section.—The Erie (Pa.) Section of the American Institute of Electrical Engineers held a meeting on May 23, at which the subject of discussion was "The Part Electricity Is Taking in the World War."

New York Electrical Society.—The annual meeting of the New York Electrical Society for the election of officers was held in the board room of the National Electric Light Association, in the Engineering Societies Building, New York, on June 6.

San Francisco Electrical Development League.—At the May 29 meeting of the San Francisco Electrical Development League D. C. Nutting, superintendent construction of the navy at the Union Iron Works, San Francisco, spoke on "How Shipbuilders Are Helping to Win the War."

A. I. E. E., Spokane Section.—The annual session of the Spokane (Wash.) Section of the American Institute of Electrical Engineers was held on May 17. Prof. M. K. Akers spoke on "The Fundamental Mathematics of Alternating-Current Circuits," and P. T. Acland of the Forty-eighth Highlanders of Canada gave his "Recollections of Ypres Salient."

Electrical Dealers and Contractors of Tennessee, Mississippi and Arkansas.—On May 27 and 28 the Electrical Dealers and Contractors of Tennessee, Mississippi and Arkansas held a meeting in Memphis. W. L. Goodwin gave a talk on "The Science of Electrical Merchandise." General trade topics were discussed at the meeting, and the aviation camp at Millington, which is near Memphis, was visited by the members attending the meeting.

A. I. E. E., Portland Section.—The last meeting of the Portland Section of the American Institute of Electrical Engineers was held on June 4 at Crown Point on the Columbia Highway. O. F. Stafford, head of the department of chemistry at the University of Oregon, addressed the meeting on "Utilization of Waste Wood in Two New Processes." The apparatus described was developed at the University of Oregon for producing distillation products and high B.t.u. gas.

Society of Automotive Engineers.—There will be a meeting of the Society of Automotive Engineers at Dayton, Ohio, on June 17 and 18. The papers will be on subjects such as refining of petroleum, aeronautic engineering, tractor engineering and the design of heavy fuel engines.

National District Heating Association.—Although there will be no regular convention of the National District Heating Association this year, it has been decided that the executive committee, together with the chairmen of the standing committees and as many members as possible, will hold a meeting at the Breakers Hotel, Cedar Point, Ohio, July 8 and 9, to discuss various matters now affecting the heating companies and to receive the reports of the standing committees for the year.

National Association of Manufacturers.—Among the important papers presented before the twenty-third annual meeting of the National Association of Manufacturers at New York were "Export Trade During War Time," by H. B. van Sinderen, director Bureau of Exports, Washington, D. C.; "France and Her Industrial Needs," by Charles F. Beach of Paris; "Combinations for Foreign Trade," by N. B. Williams, Washington, D. C., and "Trade Acceptances and the Manufacturer," by W. M. Nones, Norma Company, New York.

A. I. E. E., San Francisco Section.—At the May 24 meeting of the San Francisco Section of the American Institute of Electrical Engineers Lieut. William S. Leffler, reserve military aviator, described the training given to combat flyers. Before entering the air service Lieut. Leffler was assistant to W. W. Briggs of the Great Western Power Company. Lieutenant Flynn of the British Royal Flying Corps, an instructor at the Fort Worth (Tex.) flying school, also spoke on the work of the air service. J. W. Beckman of the Beckman-Linden Company, read a paper on "Electrochemistry and the Power Industry."

Providence Engineering Society.—The importance of thermal insulation as a factor in coal saving in steam plants under present conditions was emphasized at a recent meeting of the Providence (R. I.) Engineering Society in a paper by L. B. McMillan, consulting engineer, general power specialties department, H. W. Johns-Manville Company, New York. At present fuel costs, the author said, the losses of heat encountered in uninsulated pipe and fittings are very serious. The loss of heat per square foot of bare pipe at 100 lb. pressure may easily represent the equivalent of more than one-third of a ton of coal per year at the pipe surface alone, or more than one-half ton at 150 lb. The loss at the coal pile itself may be five or ten times as great. More attention should be given to insulating pipe flanges than in the past. A 10-in. bare flange at ordinary steam-plant pressures like the above may cost more than a ton of coal per year in fuel loss. From 80 to 90 per cent of these losses can be prevented.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Wires Accessible to Boys.—Electric companies stretching wires through trees which children can climb must anticipate their presence in such trees, and where a boy climbed from a building into a tree and a twig broke and he fell against electric company's uninsulated wires and was injured, the company was liable, the Supreme Court of Missouri held in *Williams versus Springfield Gas & Electric Company* (202 S. W. 1). Where a boy playing upon a building belonging to another party by owner's sufferance climbed upon a tree either on such party's premises or in an alley and while there was injured by defendant's uninsulated wires, such boy was not a trespasser as to defendant. Where plaintiff, a boy, climbed into a tree and slipped or fell, because of the breaking of a twig, against defendant's uninsulated wires passing through the tree, and there was no evidence that he knew of the defect of the insulation or that he purposely touched the wires, contributory negligence is not shown.

Validity of Municipal Contract with Competing Utility.—The act of the Georgia General Assembly empowering the board of lights and waterworks for the city of Marietta to "take the proceeds of any bonds sold for the purpose of creating a system of waterworks and build and erect such waterworks for the best advantage of the city," and to this end, if thought proper, to "purchase and acquire any property now owned and operated by any other company," and to "make all contracts for the lights and water supply for the city of Marietta," did not authorize such board, after it had built and equipped an electric light and waterworks plant, to pay \$15,000 to a competing plant to "quit operating its electric light plant in the city," where, under the contract, the board obtained nothing in the way of plant, poles, wire or other property of any kind from the selling company, and where the consideration was not money arising from authorized sale of bonds, but where part of the purchase price was to be met by unauthorized borrowed money and a new debt created for the remainder, payable in notes due beyond the year in which they were executed. In the opinion of the Supreme Court of Georgia (95 S. E. 7) such contract is illegal and the payment of such notes can be enjoined at the instance of a taxpayer of the municipality. This ruling above makes it unnecessary to decide whether the contract would have been legal had the consideration therefor been obtained from the sale of the bonds authorized by the act.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

San Diego Company Now Employing Water Power.—On May 21 connection was made with the Southern California Edison Company's transmission lines at San Juan Capistrano, and the San Diego Consolidated Gas & Electric Company is now purchasing a considerable part of its electric energy requirements from the Southern California Edison Company, whose electricity is largely developed by water power.

War-Time Strikes on War Utilities.—Commenting on the threatened strike of the Western Union telegraphers, the New York Times says in an editorial: "Public utility strikes differ from other strikes in that the rights of the public are superior to those of either party to the strike. Capital is not compelled to invest in public utility undertakings, but if it does invest it invests with knowledge that the investment is subject to continuous service of the public. There should be the same understanding on the part of labor. . . . There should be no reluctance to meet the issue. It will not grow less if dallied with. The right to unionize, the right to bargain collectively, the right to improve conditions of employment, are all subordinate to the right of the public to have uninterrupted public service. If there should be a strike so obviously in the interest of the enemy, there should be the strictest inquiry into any concealed motive for the strike, and punishment fit for any such disclosure of treachery."

Change of Rates Sanctioned in San Bernardino, Cal.—The California Railroad Commission has authorized the Southern Sierras Power Company and the Southern California Edison Company to change their electric lighting rates for domestic and commercial service to consumers in San Bernardino. This revision of the previous rates fixed by the commission will reduce the rates to residence and large commercial lighting consumers, while the rest of the rates will remain as formerly fixed. The company asked for the change. The new rates are as follows for both companies: First 100 kw.-hr. a month, 7 cents per kilowatt-hour; next 200 kw.-hr. a month, 6½ cents per kilowatt-hour; next 500 kw.-hr. a month, 5½ cents per kilowatt-hour; next 1000 kw.-hr. a month, 5 cents per kilowatt-hour; next 1000 kw.-hr. a month, 4 cents per kilowatt-hour; next 2000 kw.-hr. a month, 3 cents per kilowatt-hour. All energy used in excess of 5000 kw.-hr. a month is to be billed at 2½ cents per kilowatt-hour; minimum monthly bill, 75 cents.

The Doherty Fraternity Plan.—The initial plan for a Doherty fraternity, to be known as "The Doherty Men," has been prepared by a committee of which George Williams of New York is chairman. It is proposed that there be a central organization which shall grant charters to subsidiary bodies on their petition. The general purposes of the fraternity, it is stated, are to foster patriotism, to promote the interests of Doherty men and their families, and to perpetuate and develop the business ideals of Henry L. Doherty. Different classes of membership are contemplated.

Hartland Power Company.—The Hartland Power Company was organized several months ago as an independent public utility operation by W. S. Barstow & Company, New York, and Steel, Jones & Company, bankers, Philadelphia, to supply power to West Virginia coal mines. The plant of the company is at Hartland, on the Elk River, West Virginia, the center of the new coal-mining activities, and consists of 1000-kw. General Electric steam turbines, complete with condensers, boilers, etc. Construction work is now completed, the organizers state, and within the next ten days the company will start operation. Transmission lines have been built up Middle Creek to the coal mines in the section and are being extended to other nearby developments. The coal operators are rapidly installing modern electrical machinery and a number of them are ready for power. Within a radius of four miles of the power plant there are some ten or twelve large coal-mining developments. The Coal & Coke Railroad, running along the Elk River Valley, passes through the center of the field and is equipped with adequate facilities for handling a large output.

Officers for Submarine Duty Needed.—Lieut. Commander Conant Taylor, U. S. N., calls attention to the fact that the submarine force of the United States Navy requires the services as officers on board submarines of young men who have had technical training and experience in mechanical and electrical engineering. It is intended to enroll a number of such men as provisional ensigns in the Naval Reserve force, give them a course of instruction in deck duties at Annapolis and a course in submarine work at New London. Those who successfully pass these courses will then be sent on board submarines for regular duty. Candidates with the degree of M. E., E. E. or E. M., who have had two and a half years' practical experience in their profession and are not over thirty-five years old and physically strong and sound, should apply to the commander of the submarine force, U. S. S. Chicago, care of Postmaster, New York. The indorsement of one of the following organizations is desirable but not obligatory: Naval Consulting Board, National Research Council, American Society of Mechanical Engineers, American Institute of Electrical Engineers and American Institute of Mining Engineers.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rates of Return in Illinois.—The Illinois Public Utilities Commission, in a decision affecting the Citizens' Gas, Electric & Heating Company, Mount Vernon, allowed a return of 6½ per cent for gas property which appeared undeveloped, 8 per cent for electric property which seemed efficiently managed, 7 per cent for water property and 6 per cent for heating property which appeared ill-advisedly located. The commission believed, in considering the reproduction cost of utility property, that it would be just and proper that the value of utility land should reflect proportionate increases of value as shown to exist in adjacent and comparable property.

Rate-Making Practices in Illinois.—Authorizing an increase in electric rates by the Lena Electric Light & Power Company, the Illinois Public Utilities Commission comments on rate-making practices as follows: "It appears from the record that the company in the past has charged certain consumers at flat rates for power service. These consumers in some cases have been large users of power. In addition to these power consumers several lighting consumers have been charged at flat rates. This practice must be discontinued in the future and all rates must conform to the schedules on file. The commission has frequently expressed itself regarding flat rates when applied to consumers who have the opportunity to waste energy. In the case of very small light consumers whose monthly bills would scarcely justify the installation of a meter there appears to be a legitimate demand for flat-rate service. For a small plant, and particularly in case it does not operate twenty-four hours per day, it would appear that the advantages of such a rate more than offset its theoretical disadvantages. Such a rate will be provided in the schedule hereinafter ordered. The records of the company have not been well maintained. No records are available showing the energy supplied for municipal pumping or for some of the largest power consumers; neither are there means provided for obtaining the total energy generated. The order will provide for maintaining more complete records. The rates filed by the company contemplate a monthly minimum bill for lighting service of \$1.25 per month per consumer. This amount is unusual for a community of this size, and in the absence of proof as to any peculiarity of conditions which would make the cost of service to small consumers unusually expensive the commission will not authorize an increase in the present minimum bill, which is \$1 per month."

H. N. Slaughter, lieutenant-colonel in the Signal Corps, engaged in the development of radio apparatus for all branches of the army, was research engineer for the Western Electric Company on radio-telephone work for a year and a half prior to entering the Signal Corps. He was born March 17, 1888, at Danville, Va., and at the age of twenty was graduated from the Georgia School of Technology with the degree of B. S. in electrical engineer-



H. N. SLAUGHTER

ing. For three years he taught electrical engineering at Pennsylvania State College. The next three and a half years were spent with the Marconi Wireless Telegraph Company in England and in Hawaii. When in Hawaii he was in charge of construction and operation of one of the world's largest radio stations. He then entered the employ of the Western Electric Company. In April, 1917, he was commissioned as major in the Signal Reserve Corps to take charge of development of radio apparatus and in December was promoted to lieutenant-colonel.

James T. White, manager for the Oregon Gas & Electric Company at Roseburg, Ore., has been appointed to succeed O. R. C. Grow, resigned, as manager at Medford, Ore.

Henry G. Kobick, who has been with the Commonwealth Edison Company of Chicago for the last nine years, has resigned his position as superintendent of employment bureau to enter the aviation section of the Signal Corps, United States Army.

Arthur H. Savage, newly elected president of the South Dakota Electric Power Association, is a resident of St. Paul, Minn., and is treasurer of the Dakota Light & Power Company. He organized this company in 1912, and it commenced operations in August of that year, supplying the city of Flandreau, S. D. Mr. Savage was for thirteen years in charge of the Northwestern district as representative of the Fort Wayne Electric Works, severing his connection with that concern in 1914. He has since then been a manufacturer's agent for the sale of electrical machinery and central-station power plants.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Ralph E. Harris has been appointed successor to George W. Scott, resigned, as superintendent of the Warrenton (Ga.) municipal light and power plant.

J. A. Harnett, electrical engineer with the Western States Gas & Electric Company, has resigned to become connected with the Southern California Edison Company.

L. J. Porter has resigned as superintendent of the municipal water and light plant at Sandersville, Ga., to take charge of the municipal water and light plant at Waynesboro, Ga.

Charles H. Maxfield, superintendent of the Dexter district of the Central Maine Power Company, has taken charge of the Dover-Foxcroft office, of which W. G. Parker was formerly in charge.

A. D. Mackie, general manager of the Springfield (Ill.) Gas & Electric Company, has been appointed by Governor Lowden as a captain of infantry in the Fifth Regiment, Illinois Reserve Militia.

R. H. McKibbin, who has been with the Cerro de Pasco Mining Company at Pachachaca, Peru, for the past year on hydroelectric construction, is now electrical engineer for the Southwest Cotton Company at Phoenix, Ariz.

Fay Griffith, who has been superintendent of the lighting department of the Little Rock (Ark.) Railway & Electric Company, has been promoted to be superintendent of light and power and has taken over both the meter and line departments.

Clarence K. Beilharz, engineer in charge of operation of the steam and electrical plants of the Northwestern Ohio Light Company and for six years manager of the company at Delphos, Ohio, has been appointed manager of the Alva (Okla.) Light & Power Company.

A. A. Brown, formerly sales manager of the St. Paul division of the Northern States Power Company, who received a commission as first lieutenant on completion of the second Officers' Reserve training camp course, has been promoted to a captaincy and transferred to the Seventh Division engineers, Waco, Tex.

Ex-Senator John W. Slocum of Monmouth, N. J., has been elected president of the Board of Public Utility Commissioners, succeeding Lieut. Col. Ralph W. E. Donges, who recently resigned to devote his entire time to his duties as a member of the War Department Board of Appraisers. Mr. Slocum has been acting president of the commission.

D. C. Green, the president-elect of the Arkansas Public Utilities Association, is vice-president and general manager of the Fort Smith (Ark.) Light & Traction Company. Mr. Green was graduated from Purdue University with the class of 1908. After a brief experience with the Allis-Chalmers Company in its Cincinnati works he became associated with H. M. Byllesby & Company of Chicago. His experience with the Byllesby company has in-



D. C. GREEN

cluded such positions as manager of new business at San Diego, Cal., and manager at Albany, Ore., Marshfield, Ore., Everett, Wash., and Fort Smith, Ark. Mr. Green has been with the Byllesby organizations continuously since his first affiliation with them except for a period of about one year when he was connected with the Electric Bond & Share Company at Salt Lake City, Utah.

Malcolm G. Chace of Providence, R. I., has been appointed Fuel Administrator for Rhode Island, succeeding George H. Holmes, resigned. Mr. Chace is a partner in the firm of Chace & Harriman, Boston, which has developed from their inception the hydroelectric systems now combined in the New England Power Company.

Obituary

Charles Christopher Trowbridge, assistant professor of physics, Columbia University, died suddenly on Monday of blood poisoning. Professor Trowbridge, who was forty-eight years old, had been a member of the Columbia faculty since 1892. Owing to his efforts in physical research the Ernest Kempton Adams Precision Laboratory was founded at Columbia six years ago. The laboratory was given to the university by Edward Dean Adams in memory of his son, and Professor Trowbridge planned the laboratory and developed the institution until at the present time it is considered one of the best-planned and best-equipped laboratories of its kind in the country. In it are kept instruments equipped to determine with the highest accuracy facts affecting electricity and kindred subjects.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

ELECTRICAL EXPORTS FOR MONTH OF MARCH, \$5,147,921

Volume of Foreign Trade Is Falling Off, with Indications of Still Further Decrease in Future Months

Exports of electrical merchandise during the month of March last amounted to \$5,147,921, as compared with \$5,199,163 for March, 1917. During the month, however, there was a particularly large shipment of motors. This item reached a total of \$785,233. Telephone exports also were large, amounting in all to \$758,233.

During the nine months ended March last electrical exports reached a total of \$39,921,619, as compared with \$36,992,004 for the corresponding period of the previous year.

Electrical exports so far this year have been falling off in comparison with 1917, and with the most recent limitations on exports by the War Trade Board it seems very doubtful, unless the war comes to a close very quickly, that electrical exports will reach the total set last year. According to present indications, exports will be somewhere in the neighborhood of \$40,000,000 to \$50,000,000 for the year 1918.

The figures in the accompanying table were compiled by the Bureau of Foreign and Domestic Commerce.

	March		Nine Months Ended March	
	1917	1918	1917	1918
Articles				
Batteries	\$380,992	\$289,251	\$2,150,150	\$2,502,333
Carbons		181,617		1,160,653
Dynamos and generators	132,760	269,409	1,876,824	1,803,378
Fans	18,004	65,643	272,768	428,419
Heating and cooking apparatus		31,553		397,352
Insulated wire and cables	719,639	536,247	5,277,206	4,574,597
Interior wiring supplies, including fixtures	80,579	129,703	776,775	1,116,983
Arc lamps	4,015	2,001	11,808	9,703
Carbon-filament lamps	12,505	8,840	109,455	125,952
Metal-filament lamps	176,577	236,817	1,224,751	2,119,690
Magneto's, spark plugs, etc.		318,333		2,608,501
Meters and measuring instruments	99,509	125,207	781,486	1,064,740
Motors	572,733	785,233	4,174,965	4,942,714
Rheostats and controllers		29,429		144,568
Switches and accessories		222,338		1,729,180
Telegraph apparatus, including wireless	135,775	15,429	327,487	214,132
Telephones	151,739	368,338	1,306,847	1,867,423
Transformers	116,347	95,325	856,793	1,399,793
All others	2,597,989	1,437,208	17,844,889	11,711,508
Total	\$5,199,163	\$5,147,921	\$36,992,004	\$39,921,619

NEW OFFICIAL SPECIFICATIONS FOR RED-CEDAR POLES

Revised Standards Are Issued by the Producers' Association for 4-In., 20-Ft. and Larger Poles of This Description

The Western Red Cedar Association, Spokane, Wash., has issued the following official specifications, as revised April 30 last, for Western red-cedar poles 4-in., 20 ft. and larger:

1. Live Timber.—All poles must be manufactured from live growing cedar timber.
2. Manufacture.—All poles must be peeled, knots trimmed close and butts and tops sawed square.
3. Variation in Length.—Poles may be 6 in. longer or 3 in. shorter than length specified.

4. Knots.—Knots are not a defect if they are sound, trimmed smoothly and do not plainly impair the strength of the pole.

5. Discoloration.—Discoloration is not a defect.

TABLE NO. 1—MINIMUM TOP MEASUREMENT

Top Designation	Circumference, In.
4-in. top	12
5-in. top	15
6-in. top	18 1/2
7-in. top	22
8-in. top	25
9-in. top	28
10-in. top	31

6. Miscellaneous Defects.—No poles shall contain sap rot, woodpecker holes, plugged holes or evidence of having been eaten by ants.

7. Rot.—Tops of poles must be free from rot. Butt rot in center, including small ring rot, shall not exceed 10 per cent of the area of the butt. Butt rot of a character which impairs the strength of the pole above the ground line is a defect.

TABLE NO. 2—MINIMUM BUTT MEASUREMENT

Poles 35 ft. and longer shall have a minimum circumference measurement at extreme butt as follows:

Length, Ft.	7-In. Top, In.	8-In. Top, In.	9-In. Top, In.	10-In. Top, In.
25	33	36	39	42
40	34	37	40	44
45		39	42	45
50		41	44	47
55		42	45	48
60		44	47	50
65		45	48	51
70		47	50	53
75		48	51	54
80		50	53	56
85		51	54	57
90		52	55	58

8. Cat Faces.—Sound cat faces are not a defect if no part of the cat face shows on the upper one-fifth of the length of the pole or within 2 ft. above or 1 ft. below the ground line.

9. Dead or Dry Streaks.—A sound dead or dry streak is not a defect if it does not cover more than 25 per cent of the surface of the pole at any one point.

10. Minimum Measurements.—(a) The tops of all poles shall have a minimum circumference measurement as shown in Table No. 1. (b) The extreme butt of all poles shall have a minimum measurement as shown in Table No. 2. (c) Poles having a decided swell or flare at the butt shall

TABLE NO. 3—MAXIMUM ONE-WAY SWEEP

Length of Pole, Ft.	Maximum Sweep Between Top and Ground Line, In.
20	3
25	3
30	4
35	5
40	5 1/2
45	6
50	7
55	8
60	9
65	10
70	10 1/2
75	11
80	12
85	13
90	14

have a sufficiently larger measurement at butt to insure a reasonable measurement at the ground line.

11. Short Kinks.—Short kinks are not permitted.

12. Reverse Sweep.—Reverse sweep and two-way sweep, meaning a sweep in two planes, is permitted, provided a

straight line drawn from the center of pole at top to center of pole at ground line does not leave the pole at any point.

13. One-Way Sweep.—One-way sweep is permitted provided it does not exceed maximum shown in Table No. 3.

14. Method of Measuring Sweep.—That part of the pole below the ground line not to be taken into consideration. Tightly stretch a tape line from point at ground line (see paragraph 15) on the side of the pole where the sweep is greatest to the upper surface at the top of the pole, and having so done, measure widest point from tape to surface of pole and if, for illustration, upon a 30-ft. pole the widest point does not exceed 4 in., this pole shall be accepted.

15. Explanation of Term "Ground Line."—The term "ground line" as used in these specifications shall mean a point on the pole a distance of 4 ft. on 20-ft., 5 ft. on 25-ft. and 30-ft. and 6 ft. on 35-ft. and longer poles from the extreme butt.

HIGHER PRICES PUT ON ELECTRICAL APPARATUS

**Motors, Switchboards, Turbines, Transformers and
Generators Are Marked Up 10 per Cent—
Selling Terms Stricter**

Within the past ten days numerous announcements of advances in power-plant equipment have come out from the manufacturers. A general advance of 10 per cent on motors was made in the neighborhood of June 1. One of the leading manufacturing concerns sent the following notice to its agents:

"Effective Saturday noon, May 18, advance net selling price 10 per cent on all lines covered by apparatus, switchboard, turbine and motor price book sheets dated prior to May 16, pending receipt of revised price sheets or discounts."

Another company of prominence made the switchboard advance about the middle of May; but on motors of all sizes, alternating and direct current; transformers, generators and motor-generator sets its new prices went into effect June 3. Transformers, electric locomotives and some other specialties were made exceptions under the new ruling by the first-named concern. Special motor manufacturers in some cases also exempted fractional motors. Their lists became effective June 1.

It is held by the various manufacturers that a steady advance in the cost of material has rendered the increase in finished goods imperative. Further, it is also the opinion of several large producers who adjust their operations strictly on market and general conditions that a mark-up in a couple of months on all lines of electrical supplies should be no cause for special astonishment. The manufacturing situation, for obvious reasons, has been getting more acute within the last few months. It is safe to say, according to authorized statements, that with the still further anticipated scarcity and difficulty of obtaining material, shortage of skilled labor and other drastic contingencies, conditions are speculative and far from stable or certain. Therefore it is hard to tell what may occur.

With possibly one exception, the manufacturers have a standing rule of "price subject to change without notice," applicable to current buying and ordering. This concern stipulates that a leeway of fifteen days be allowed on all acceptance orders. For a while this clause was more or less loosely construed, but recently the trade was notified that it would be strictly enforced.

In the past it was the general practice in this branch of the industry to inform the trade in advance of a price increase. It was found, however, that some of the larger jobbers immediately proceeded to "load up" with goods to the disadvantage and detriment of the smaller buyers. In fact, it is said that several attempts were made to corner the market on motors. The factories were swamped with orders, and to protect the trade and check this tendency it was necessary to establish a system of allocation. This led up to the present method of wiring agents or house representatives of any change as being immediately effective, with no general notice to the trade. Buyers, under the circumstances, were uninformed until they actually came into the market.

THE WEEK IN TRADE

ADVANCING prices have been discussed and looked for in all parts of the country. Conditions due to the war are constantly changing, with almost kaleidoscopic effect. The actual happenings along this line justify expectations, for recently prices have actually been advanced on motors, turbines, transformers, generators and switchboards by the principal manufacturers. Some of the announcements became effective the middle of May, with the more recent dating from this week. It is even hinted that a further increase on general supplies may be looked for in a couple of months.

The shortage in conduit has not been overcome, New England points being in slightly better shape on some types. In the Far West substitution on color and size is in order. Fans are in active movement, distributors and jobbers who were forehanded in contracting for liberal stocks reaping the benefit of sound judgment, and supplies are being absorbed rapidly. Everywhere shipping delays are inconveniencing all branches of the trade, and no decided improvement is expected in the near future. The new increase in freight rates, effective June 25, is causing no little concern, particularly among jobbers distant from the factories.

Collections are reported as satisfactory in some sections and falling behind in others. An improvement is looked for. Credits are receiving close attention.

NEW YORK

Business in all departments of the electrical trade during the past week has been excellent. Occasional reports of a low supply or shortage of some staples are heard. As yet, however, no uneasiness is felt. Jobbers and distributors have in not a few instances anticipated their requirements for the fall and winter as much as possible. Manufacturers are not disposed to accept other than the usual orders from any one at the present time. They will do their utmost to take the best care of the old, steady customers, but new trade, unless gilt-edge and of the best repute, must take chances.

Some changes in prices were made, especially on motors, while mysterious suggestions of sharp increases on other lines are afloat. Collections represent a strong average, with credits held along an undeviating line of firmness.

WIRE.—Rubber-covered wire has hardened in price, an advance of from 2½ to 3 per cent being ordered by the manufacturers. The American Steel & Wire Company advanced the base price to 31 cents a pound.

DRY BATTERIES.—Stocks are in fair condition, and the demand is active. The high price of solder has not as yet influenced the dry-battery producers to change their prices. If this necessary material suffers a few more mark-ups—there have been drastic changes in the mill prices—an advance on the finished goods would be no surprise.

CONDUIT.—Jobbers report all sizes of conduit as being short in supply, with general stocks becoming weaker. The latest news from the mills is not reassuring by any means. Some producers are pushing their plants to the limit for output, and others have been required to curtail their operations to release steel for more pressing needs in war material.

PORCELAIN.—General report, which reflects current opinion, says that porcelain is hard to get. No advance in prices has materialized, though for a month reports of this tenor have been discussed by jobbers in the East. The government's requirements are still heavy, leaving little for commercial purposes.

COLLECTIONS AND CREDITS.—Credit men with leading jobbers and distributors state that collections are steadily

improving, the week's record being at least 5 per cent better than at the close of May. Credits are closely watched, with new accounts rigorously handled.

MOTORS.—Sizes from 25 hp. to 50 hp. are difficult to obtain. Within the past two weeks a number of the more prominent manufacturers have advanced their prices 10 per cent. One of them announces also that hereafter adherence to the fifteen-day price acceptance clause will be rigidly enforced.

HOUSEHOLD APPLIANCES.—Prominent New York department stores say that during the past few weeks their sales on household appliances, especially tableware, were not only very satisfactory but in some instances broke previous records. Sewing and washing machines led the list.

WIRING DEVICES.—Jobbers report a fair sale of wiring devices, particularly for suburban homes. The slump in building operations has worked havoc with the call for these staples, but there is still quite a movement. New England manufacturers are running their plants up to capacity on government orders.

SOCKETS.—Standard lamp sockets are said to be selling as well as could be expected at this time of year.

LAMPS.—The factories claim to have strong stocks on all the standard numbers, but have not yet quite caught up on miniatures. They are making good progress, and in a couple of weeks believe they will be on an even footing. Deliveries are shorter.

CHICAGO

The opinion of jobbers seems to be that while business is holding up fairly well, it is at this time rather unsettled and is in a state which makes it difficult to predict what the future will bring. The general plan followed by these distributors in the present market is to discover those points which are now most active and to make a special effort to keep sales representatives on the job at these points during as much of the time as possible. Prices still continue to increase.

The city of Chicago is still without a great deal of war work that it might handle if the government were convinced that the labor situation was bearable. Business men who are interested in getting war factories to come to Chicago feel very strongly that a strenuous effort should be made to get some sort of an understanding with labor which would permit the city to take care of its share of the country's war program.

Railroads are only buying from "hand to mouth." All have made up their budgets and, according to the newspapers, have been told how much they can spend in the coming year. None of the roads in this territory, however, has yet had official announcement on this point. While business with the roads is not so good now as it should be, it is momentarily expected that something will open up in this line.

In Chicago shipbuilding activities largely consist of making over passenger vessels into freight vessels and doing other repairs. The buying for some of this work is being done in Cleveland. Further north along Lake Michigan the activity is more intense, and Chicago and Milwaukee jobbers are securing some of this business.

LAMPS.—Distributors report that stocks are accumulating on all sizes except 75-watt. This does not apply to the miniature lamp business, where the shortage of stock still is acute.

WIRE.—Rubber-covered wire has advanced about 10 per cent.

CONDUIT.—The situation in the metal conduit field is still bad. It is most essential now to be able to tell where conduit is going before it can be secured, as there is a tendency to curtail the use of this class of goods in any except war work.

SCHEDULE MATERIAL.—There has been an increase in this class of goods which amounts in the aggregate to about 8 per cent.

FANS.—Even as far north as Chicago jobbers report that fans are moving in good fashion. Further south the activity in this class of goods is reported to be still better.

INDUSTRIAL LIGHTING FIXTURES.—Sales are bigger this spring than last, indicating that the operators of plants which have night shifts are breaking over the seasonable precedent and are buying fixtures right through the summer.

BOSTON

No let-up is to be seen in the volume of trade, speaking generally. This is a natural result of the accelerating war preparations of industrial New England, which are throwing a flood of orders upon jobbers and which are giving the contractor some important work in the way of plant remodeling, extensions and some new construction. The pressing claims of war funds are influencing collections a little unfavorably. Trade acceptances are being used with good results between jobbers and contractors, but credits are being very carefully watched. Transportation congestion is very serious in spite of open-weather conditions. Work is progressing rapidly at the army and naval bases, and the shortage of labor reported last week tends to grow more and more acute. There is a good deal of unrest in the textile industry at present, but in the main labor seems to be continually employed, although the turnover is abnormally high. A 10 per cent advance in prices took effect June 1 on Lincoln motors, otherwise prices are showing little change.

FANS.—The retail trade is picking up rapidly, and some dealers report an unusually heavy demand for fans, despite increased prices. Jobbers are well stocked, and one house reports fan sales of over \$2,000 so far this season. Another house has received nearly 8000 fans from the factories and notes a larger demand from the distributors in the retail trade than at this time a year ago. Some buying for summer homes is in evidence.

STORAGE BATTERIES.—The automobile trade is buying heavily, especially for renewal business. Stocks are still pretty well prepared for this call, but there is some question how long orders can be filled immediately upon receipt, owing to railroad congestion and enormous government demands. No price changes have been heard of since April.

LAMPS.—As the central-station demand sags off stocks are increasing somewhat. A shortage is reported in miniature sizes, factories being from three to six months behind on orders. Ordinary sizes are now well in hand, and if the anticipated coal-saving campaign develops as expected, conditions should be much easier this fall than during the past winter.

FIRE-ALARM APPARATUS.—A substantial demand is reported at present for protective equipment for industrial plant service. One maker reports that he has more orders on his books than he can fill.

MOTORS.—Prices remain steady, with the exception of a 10 per cent advance by the Lincoln Electric Company dating from June 1. Government commandeering of steel and labor scarcity are factors in the increase. Delays in shipments are proving troublesome. One dealer reports that he has received no motors for stock additions since the last of April, and that an important shipment has been three weeks en route between New York and Boston. The demand for alternating-current motors seems to predominate.

ELECTRIC WELDING APPARATUS.—Increasing interest in this equipment is noted in New England, and the outlook is exceptionally good for its use in shipyard, railroad and metal repair shop service.

CONDUIT.—Rigid pipe is plentiful in sizes up to and including ¾-in., but above this it is very difficult to obtain deliveries even on quasi-government work. The demand for larger-sized pipe continues heavy in connection with war-service plants, where first-class wiring now appears to be an essential on account of the severe working conditions present.

SMALL STEAM TURBINES.—Few commercial orders, so called, are being received at present in comparison with naval requirements. Quotations for commercial delivery give little hope of meeting the purchaser's requirements in less than five months.

APPLIANCES.—A Boston department store reports exceptionally active sales in percolators and curling irons. Small electric cooking devices in general are in good demand. Few central stations are doing much with ranges at the moment, but here and there sales are being recorded even of large units.

ATLANTA

Jacksonville, Fla., has been named as one of the locations for the establishment of yards for the construction of concrete ships. Official announcement covering details will be available very soon. For those that have been following the rapid expansion and influx of population at Southeastern coastal cities, it will be of interest to note the announcement of the War Department to the effect that the Butterworth-Judson Corporation of New York City has secured a contract to erect a plant for the manufacture of picric acid on Turtle Island, three miles from Brunswick, Ga., costing \$7,000,000. The plant itself will cost \$5,000,000 and the industrial city \$2,000,000.

These developments will have a tendency to stimulate sales in all electrical staples and to expand the market for marine supplies at Jacksonville and heavy apparatus at Brunswick. The Marion Coal & Lumber Company of Chattanooga, Tenn., has been incorporated for \$1,000,000. This company will open up timber and coal land, accelerating the market for electric locomotives, generating apparatus and miscellaneous equipment.

FANS.—The hot wave this week has started a heavy movement of fans to all outlying sections, the demand for all sizes being strong. A large number of the ceiling type are being used locally. A few jobbers' stocks are in excellent shape, but others are experiencing great difficulty with the transportation problem. Shipments received are absorbed before stocks have a chance to accumulate.

AUTOMOBILE SUPPLIES.—There is no cessation in the call for spotlights, and prompt deliveries are made in the face of this pressure. The demand continues for miniature lamps, with some improvement in shipments, which is accounted for by the jobbers by the fact that factories are getting ahead with stocks.

ENTRANCE CUT-OUTS.—Stocks are very good considering the heavy draft that is evidenced by an ever-swelling volume of business.

LABOR-SAVING DEVICES.—Sewing-machine motors are moving freely. A brisk trade has been done this week in washing machines, dish-washers and churns. While vacuum cleaners are not quite so active, a satisfactory volume of business is being transacted for this time of the year.

ELECTRIC RANGES.—Manufacturers and jobbers report a very good business in these, the states most active being Florida and South Carolina. The latter State handles the larger volume at this time.

SEATTLE

In spite of holiday sales the volume of business for the past week nearly equaled that of the week previous. The volume to shipyards and industrials was maintained but there was a slight decrease in commercial business. Government buying too, was noticeably less. Freight from Eastern factories is subject to serious delays, and local jobbers are considerably inconvenienced. Jobbers have practically given up hope of improvement. Mix-ups and delays in L. C. L. shipments are the rule. Outgoing freight, both rail and steamship, is terribly congested. A slight impetus in sales of power apparatus, particularly of the smaller-size motors, is noted. There has been no change in price of any consequence. Dealers are apprehensive about an announced increase of 25 per cent in freight rates and are anxiously awaiting specific information.

As usual, activities pertaining to the Puget Sound, Gray's Harbor and Columbia River shipyards command the center of the stage, aside from actual shipbuilding, which is going on night and day. During the first five months of the year

the Seattle yards have launched twenty-two steel ships, aggregating 180,400 deadweight tons, all for the Shipping Board. In addition, one wooden steamship for the government and seven wooden ships for foreign governments and private interests were launched during the week. The Shipping Board awarded contracts to the Seattle yards involving \$31,000,000. The contracts are for nineteen 8800-ton steel freighters. In less than a month the Shipping Board has added more than \$130,000,000 to Seattle's shipbuilding contracts. The yards obtaining the above contracts will make enormous extensions to the present establishments.

Portland reports that the supply of vacant dwellings is exhausted and the demand increasing daily. In spite of increased building activity in residence sections, towns in the Gray's Harbor district to date have been unable to meet urgent demands for housing. Record residence construction in Seattle and Tacoma continues unabated, notwithstanding the excessive costs of materials. New business accepted by the West Coast lumber manufacturers during the past week was the greatest for any single week in more than six months.

Seattle retailers report fixture and small domestic appliance sales for the past week very satisfactory. In spite of the holiday considerable out-of-town business was received, particularly from Bremerton, where unprecedented residence building is under way. Local retail sales were on an equal level with the past few weeks. Conduit shortage is extremely acute. Shipyards, the principal users, are forced in many cases to resort to substitution. For instance, if black cannot be obtained white will be used, and the same applies in sizes. Substitution is also practiced in the larger type of lamps. The scarcity of the smaller lamps is practically overcome. The lamp sales in all sizes to shipyards have increased considerably over the past month.

METAL MARKET SITUATION

Orders and Deliveries on Copper Closely Scrutinized
—Tin Coming in Stronger

Apparently there is no trouble in getting all the copper needed for commercial consumption, although deliveries are uncertain. No complaint is heard on the part of wire and cable producers that the metal is difficult to obtain in any reasonable quantity when its purpose is disclosed to the official distribution committee. It is said the producers continue to book domestic orders with reluctance and great circumspection and shipments are closely looked after. The jump in the price of zinc by government designation was a surprise to outsiders. Tin is reaching this market in better quantities.

The new maximum base price for aluminum, effective June 1 to Sept. 1, has been fixed by the President at 33 cents a pound, under an agreement between producers and the War Industries Board. This figure applies to the ingot of 98 to 99 per cent grade in lots of 50 tons or more. Differentials for sheet, rod and wire will be increased about 12½ per cent. Advances in freight rates on June 25 may affect future prices on steel following June 30.

NEW YORK METAL MARKET PRICES

	May 27			June 3		
	l	s	d	l	s	d
Copper:						
London, standard spot.....	110	0	0	110	0	0
	Cents per Pound			Cents per Pound		
Prime Lake	Govt. price 23.50			Govt. price 23.50		
Electrolytic	Govt. price 23.50			Govt. price 23.50		
Casting	Govt. price 23.50			Govt. price 23.50		
Wire base	26.25 to 26.75			26.25		
Lead, trust price.....	7.00			7.00		
Nickel, ingot	10.00			10.00		
Sheet zinc, f.o.b. smelter.....	Govt. price 15.00			Govt. price 15.00		
Spelter, spot	7.35 to 7.45			7.40 to 7.50		
Tin, Chinese*	\$1.02			\$0.86		
Aluminum, 98 to 99 per cent ..	Govt. price \$32.10			Govt. price \$33.00		

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire.....	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 13.75	13.50 to 13.75
Brass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	6.00 to 6.25	7.75 to 8.00
Zinc, old scrap	5.50 to 5.75	5.50 to 5.75

*No Straits offering. †In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid.....	\$61.00
No. 12 solid.....	71.00
No. 10 solid.....	90.00
No. 8 solid.....	106.00
No. 6 solid.....	145.00
No. 10 stranded.....	95.00
No. 8 stranded.....	115.00
No. 6 stranded.....	160.00
No. 4 stranded.....	205.00
No. 2 stranded.....	266.00
No. 1 stranded.....	315.00

Twin-Conductor

No. 14 solid.....	104.00
No. 12 solid.....	135.00
No. 10 solid.....	185.00
No. 8 stranded.....	235.00
No. 6 stranded.....	370.00
No. 4 stranded.....	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil.....	List to + 15%
Coil to 1000 ft.....	10%
	No. 12 Solid
Less than coil.....	List to 15%
Coil to 1000 ft.....	10%

Twin-Conductor

	No. 14 Solid
Less than coil.....	List to 120.00
Coil to 1000 ft.....	\$93.60 to \$100.00
	No. 12 Solid
Less than coil.....	List to + 15%
Coil to 1000 ft.....	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	15% to + 10%
	No. 12 Solid
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%

Twin-Conductor

	No. 14 Solid
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	15% to + 10%
	No. 12 Solid
Less than coil.....	15% to + 10%
Coil to 1000 ft.....	10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10% to 20%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	28% to 44%

BATTERIES, DRY

NEW YORK

	No. 6 Regular	No. 6 Ignitor
Each Net.....	\$0.40	\$0.40
Less than 12.....	.35	.35
12 to 50.....	.31	.32
50 to barrel.....	.285	.295
Barrel lots.....		

BATTERIES, DRY—Continued

CHICAGO

	No. 6 Regular	No. 6 Ignitor
Each Net.....	\$0.40	\$0.40
Less than 12.....	.35	.35
12 to 50.....	.3190-.32	.3290-.33
50 to barrel.....	.2890-.29	.2990-.30
Barrel lots.....		

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16.....	250	\$5.00
3/8.....	250	7.50
1/2.....	100	10.00
3/4.....	50	13.00
1.....	50	21.00
1 1/4.....	50	26.00
1 1/2.....	25-50	35.00
2.....	25-50	45.00
2 1/2.....	25-50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/4-in. s. stp.....	List to \$82.50	\$63.75 to \$67.50
3/4-in. d. stp.....	\$82.50 to 84.00	69.00 to 75.00
1/2-in. s. stp.....	List to 110.00	85.00 to 90.00
1/2-in. d. stp.....	110.00 to 112.00	92.00 to 100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/4-in. single strip.....	List	\$63.75
3/4-in. double strip.....	78.25-78.75	71.25-71.75
1/2-in. single strip.....	List	85.00
1/2-in. double strip.....	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32.....	\$0.05 1/2	1.....	\$0.25
1/4.....	.06	1 1/4.....	.33
3/8.....	.09	1 1/2.....	.40
1/2.....	.12	1 3/4.....	.47
5/8.....	.15	2.....	.55
3/4.....	.18	2 1/4.....	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$55.00	\$20.50-\$26.00	\$20.00-\$24.00
1/4-in.—	\$28.00-\$60.00	\$22.50-\$28.20	\$22.00-\$26.00

NET PER 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.00-\$55.00	\$25.00	\$22.50
1/4-in.—	\$40.00-\$60.00	27.00	25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
1/4.....	\$0.08 1/2
3/8.....	.08 1/2
1/2.....	.08 1/2
3/4.....	.11 1/2
1.....	.17
1 1/4.....	.23
1 1/2.....	.27 1/2
2.....	.37 1/2
2 1/2.....	.58 1/2
3.....	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4.....	\$0.05	\$0.19
3/8.....	.06	.19
1/2.....	.07	.19
3/4.....	.10	.25
1.....	.13	.37
1 1/4.....	.17	.45
1 1/2.....	.21	.50
2.....	.28	1.10
2 1/2.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	.4% to 1%	.7% to 14%
2500 to 5000 lb.....	.6% to 1%	.9% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.....	.68% to 7.3%	9.8% to 10.7%
2500-5000 lb.....	.8.8% to 9.3%	11.8% to 12.7%

(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

FUSES, INCLOSED

	250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100		\$0.25
35-amp. to 60-amp.....	100		.35
65-amp. to 100-amp.....	50		.90
110-amp. to 200-amp.....	25		2.00
225-amp. to 400-amp.....	25		3.60
450-amp. to 600-amp.....	10		5.50
	600-Volt		
3-amp. to 30-amp.....	100		\$0.40
35-amp. to 60-amp.....	100		.60
65-amp. to 100-amp.....	50		1.50
110-amp. to 200-amp.....	25		2.50
225-amp. to 400-amp.....	25		5.50
450-amp. to 600-amp.....	10		8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	30%
1/5 to std. pkg.....	40% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	30%
1/5 to std. pkg.....	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.....	\$5.00 to \$6.30
1/5 to std. pkg.....	4.50 to 5.25

Standard packages, 500. List, each \$0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.....	\$7.00
1/5 to std. pkg.....	5.75

Standard packages, 500. List, each \$0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B.....	100	\$0.30
60-watt—B.....	100	.35
100-watt—B.....	24	.70
75-watt—C.....	50	.70
100-watt—C.....	24	1.10
200-watt—C.....	24	2.20
300-watt—C.....	24	3.25
Round bulbs, 3 1/4-in., frosted:		
15-watt—G 25.....	50	.53
25-watt—G 25.....	50	.55
40-watt—G 25.....	50	.55
Round bulbs, 3 3/4-in., frosted:		
60-watt—G 30.....	24	.77
Round bulbs, 4 3/4-in., frosted:		
100-watt—G 35.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.....	List
Std. pkg.....	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	List
Std. pkg.....	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$31.00 to \$34.90
Coil to 1000 ft.....	24.98 to 26.20

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$29.00 to \$30.00
Coil to 1000 ft.....	21.50 to 25.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100.....	\$20.00
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CHICAGO

Net per 100.....	\$21.75 to \$30.00
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OUTLET BOXES

Nos.	List, per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200, S.E., 300, A.X., 1 1/2 4 S.....	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list....	25%	20%
\$10.00 to \$50.00 list....	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list....	40%	35%
\$10.00 to \$50.00 list....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000.	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000.	\$20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	4000
	5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85	\$30.70 to \$30.75	
1/5 to std. pkg.....	11.10	24.20	

CHICAGO

Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	4000
	5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85	\$30.75	
1/5 to std. pkg.....	11.10	24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/2-in. cap key and push sockets. 500	\$0.33	
1/2-in. cap keyless socket.....	500	.30
1/2-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List to + 10%
1/5 to std. pkg.....	.8% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.....	10% to 29.70 cts.
1/5 std. pkg.....	20% to 26.40 cts.

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.90
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.....	List to + 5%
\$10 to \$25 list.....	11% to 12%
\$25 to \$50 net.....	14% to 15%
	Low Grade
Less than \$10 list.....	5% to 10%
\$10 to \$25 list.....	16% to 20%
\$25 to \$50 list.....	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.....	+ 5%
\$10 to \$25 list.....	10% to 11%
\$25 to \$50 list.....	14%
	Low Grade
Less than \$10 list.....	5%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single-pole, ind.....	100	.54
5-amp. three-point.....	50	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	List to + 10%
1/5 to std. pkg.....	.8% to 15%
Std. pkg.....	25% to 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	List to + 20%
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	25% to 28%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....	40%	30%
\$2.00 to \$10.00 list.....	50%	40%
\$10.00 to \$50.00 list.....	64%	52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25%	20%
\$2.00 to \$10.00 list.....	25% to 50%	20% to 40%
\$10.00 to \$50.00 list.....	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List price.....	\$5.50 to \$6.00
Discount.....	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.....	\$41.25-0.44 1/4
No. 18, full spools.....	36.25-0.43 1/4

CHICAGO

	Per Lb. Net
No. 18, less than full spools.....	\$0.60-0.65
No. 18, full spools.....	0.50-0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net
	Less than 500 Ft. 500 to 1000 Ft. 1000 to 5000 Ft.
No. 14.....	\$15.00-\$18.00 \$12.50-\$14.00 \$9.85-\$12.25
12.....	23.25-25.40 19.96-21.80 15.95-19.35
10.....	32.40-35.20 27.66-30.20 22.10-27.00
8.....	45.63-49.15 38.66-42.10 30.85-38.00
6.....	72.40-77.85 61.71-66.75 48.95-60.30

CHICAGO

	Price per 1000 Ft. Net
	Less than 500 Ft. 500 to 2500 Ft. 2500 to 5000 Ft.
No. 14.....	\$13.00 \$13.00 \$11.50
12.....	25.69-\$25.69 22.02-\$25.33 18.55-\$20.40
10.....	20.49-35.04 27.94-30.03 22.86-28.23
8.....	42.54-48.97 38.99-41.98 31.90-39.42
6.....	66.46-67.38 56.15-62.43 50.53-56.39

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$35.25 to \$36.85
25 to 50 lb.....	31.40 to 36.85
50 to 100 lb.....	30.10 to 36.10

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.....	\$37.13 to \$40.00
25 to 50 lb.....	36.43 to 39.00
50 to 100 lb.....	35.43 to 38.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Inclosed Overload Safety Relay

Protection against overload for alternating-current motors equipped with starters or switches having low-voltage protection is afforded by a relay manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

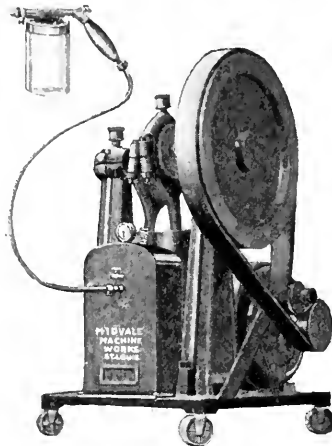
The relay is inclosed in a sheet-steel case which excludes dust and foreign particles of all kinds. The cover of this case is secured by two thumb screws and is provided with a safety device which automatically trips the relay when the cover is removed, thus rendering all parts of the relay "dead" as long as the cover remains off. This facilitates inspection and repairs. The relay operates by means of magnet coils which are inactive at loads less than that for which they are set. When the current value reaches or exceeds this setting the coils lift plungers which break the control circuit and operate the low-voltage relay to open the line circuit. With no current flowing in the line the coils are de-energized and the relay is automatically reset, the bridge being pressed against the contacts by means of a compression spring. The plungers operate in oil dash-pots, providing a time element which allows the relay to carry a momentary overload without tripping.

This time limit is adjustable by means of a small perforated disk in the dash-pot which is readily accessible by unscrewing the dash-pot from the casting which holds it. To prevent acci-

dent bridge away from the contacts. When the cover is fastened in place this spring is depressed by a pin on the cover, thus allowing the contact to be made between the contacts and the bridge. These relays are made in all commercial frequencies and voltages and in capacities of 5 amp. to 300 amp.

Motor-Driven Gasoline Sprayer for Automobiles

A small portable machine for spraying gasoline as a cleaning medium is being manufactured by the Midvale Machine Works, St. Louis, Mo. This machine can be used for applying waterproofing or finishing coats to automobile tops or for repainting wire or wood wheels. It also finds application for



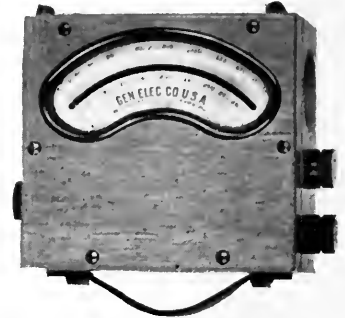
PORTABLE MACHINE WEIGHS 190 LB.
COMPLETE

quickly applying any liquid to automobile bodies or metal parts. The machine consists of a Midvale-type duplex-cylinder compressor mounted on a portable roller base, with an air-pressure tank, air cleanser and renovator, relief pressure valve, 6 ft. (1.8 m.) of rubber tubing, an air cock and a vapor gun with a glass cup container. The outfit complete weighs 190 lb. (86.1 kg.).

Small Testing Instrument

Light-weight and small testing am-meters, voltmeters and wattmeters for alternating and direct current of the dynamometer type have been placed upon the market by the General Electric Company of Schenectady, N. Y. The manufacturers claim that these are the smallest and lightest practical sets of instruments on the market that are applicable to all commercial frequencies and wave forms without appreciable error. These ammeters and wattmeters are furnished only for se-

ries current rating up to and including 20 amp. The wattmeter is single-phase, but can be furnished with double voltage potentials if desired. The ammeter is of the iron vane type. The windings are magnetically shielded and equipped with an air damper. The instrument

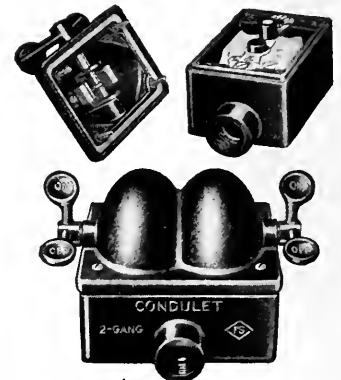


SMALL AND LIGHT-WEIGHT TESTING
WATTMETER MAY BE EASILY CARRIED

case with a window in the cover over the scale plate forms the carrying case. The dimensions of the instrument are approximately 4.75 in. by 4.37 in. by 2.6 in. (12 cm. by 11.1 cm. by 6.5 cm.). Voltmeters and wattmeters of this type for 600 volts have also been developed. The cases in these instruments, however, are slightly larger to care for the additional resistance.

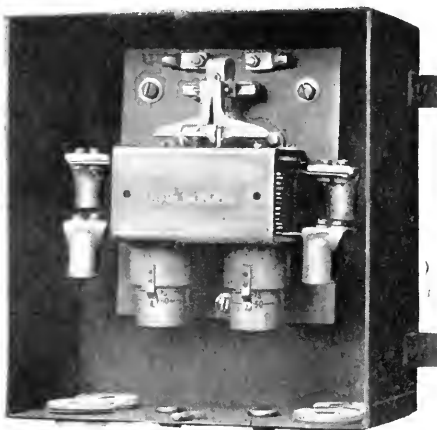
Serviceable Cover for Push- Button Switches

The liability of moisture, gas or dust getting into the operating parts of push-button switches is entirely eliminated, according to the Crouse-Hinds



BEARINGS ARE WELL SEALED WITH A
HARD GREASE

Company, Syracuse, N. Y., in a cover that it has recently placed upon the market. This device is designed to be installed in one-gang or two-gang condulets of either the FS or FD series, and it consists of a cover with a switch-operating mechanism. Like the con-



RELAY AUTOMATICALLY TRIPS WHEN
STEEL COVER IS REMOVED

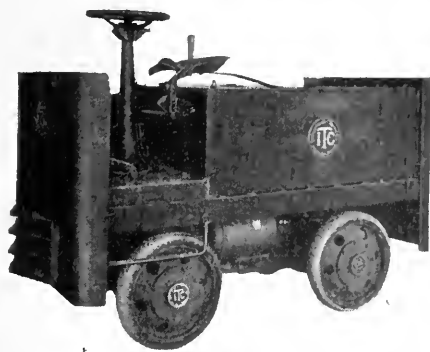
dental change of adjustment from vibration or jar a spring lock is provided which holds the dash-pot firmly in place. The safety device by which the relay is tripped on removal of the cover is a flat looped spring which when free to act holds the contact

dulet, the cover is a casting, either iron or brass as specified. The mechanism which operates the push-button is under the dome of the cover and is controlled by a shaft flattened at its inner end and extending through the side of the cover, where it terminates in the operating handle. That portion of the shaft which passes through the cover is provided with grooves containing hard grease which effectually seals the bearing, and a rubber gasket likewise seals the joint between the cover and the conduit. On-and-off indicators cast on the ends of the handle facilitate the operation of the switch.

With this cover and the necessary conduit it is now practicable to use push-button switches in places where excessive moisture, explosive or corrosive vapor or fine dust circulates in the atmosphere, as in ships, ammunition plants, refineries, textile and flour mills.

Industrial Tractors

A line of electric tractors for use in factories, shops, etc., has been placed upon the market by the Industrial Truck Company, Holyoke, Mass. The tractors are manufactured in two types with end or center control and with either two-wheel or four-wheel drives as desired. Removable side doors are provided for changing batteries, and the inner top plates on the tractor allow easy access for flushing or inspection. The battery equipment is of the Edison or lead-plate type as desired. The frame and battery box can be lifted from the cabinet, leaving the entire driving mechanism accessible for inspection or repair. Power is transmitted from the motors to a single reduction worm and gear differential and a universal joint to the wheels. The universal joint is inclosed in a dust-proof and oil-proof case, and it is capable of operating at an angle of 43 deg. Two brakes are provided, one operated by the left foot and the other operated by the right. To operate the tractor the driver must be sitting in the seat



TRACTOR WITH COMPLETE ARRANGEMENTS FOR SAFETY

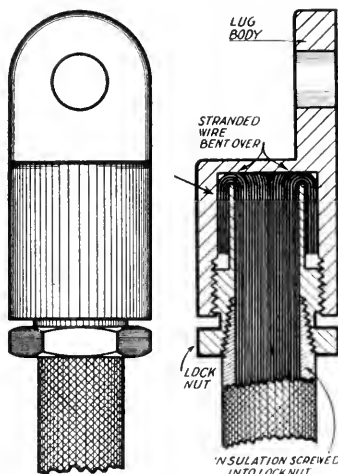
with his left foot pressing on the emergency brake pedal. On removing the foot from the left pedal the brake is applied, the controller handle is thrown off, and the controller is placed in neutral position. After this has happened it is impossible to start again without

first releasing the emergency brake and bringing the controller back to neutral.

An additional safety device is found in the tilting steering wheel, which is so placed that the operator must tilt the wheel to leave his seat. This arrangement is connected with the controller shaft clutch so that the battery current cannot be applied until the wheel is in running position.

Solderless Wire Terminal

Great conductive capacity is obtained by a solderless terminal that has been placed upon the market by the Cruban Machine & Steel Corporation, 2 Rector Street, New York City. Each strand of the cable comes in direct contact with the lug body. An absolutely firm contact is obtained, and it is impossible to pull out the wire without destroying either the lug or the wire. The wire can be taken out of the lug with-



WIRE CANNOT BE PULLED OUT WITHOUT INJURING LUG OR CONDUCTOR

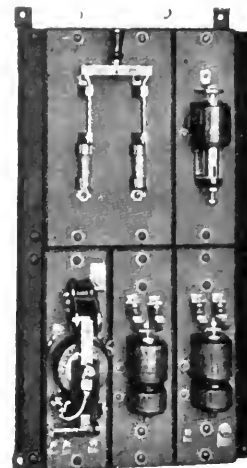
out injuring the wire or the lug. The grip of this lug is in no way affected by excessive heating. The cross-section in the illustrations shows the body, the lock nut and the cable. The wire strands of the cable are bent back on to the smooth part of the lock nut. To attach, the end of the cable must be cleaned of all insulation for about 9/16 in. (14.3 mm.). The insulated part is then slightly tapered on the edge, so that the lock nut can be screwed in over the insulation as shown in the figure. This connector is known as the "Cruban" solderless wire terminal, and may be used wherever stranded conductors are in service.

Current-Limit Automatic Controller for Motors

An automatic controller consisting of a number of lock-out accelerating switches having series-wound coils has been placed upon the market by the Industrial Controller Company of Milwaukee, Wis. The rate at which the motor accelerates up to full speed is

limited by the current in the armature—under light loads the motor will start rapidly, under heavy loads more slowly. The motor will accelerate to full speed in the quickest possible time consistent with safety.

This device is known as a "unit panel



COMPLETE UNIT-PANEL CONSTRUCTION CONTROLLER FOR ACCELERATING MOTORS

construction" controller—that is, each accelerating unit, contactor, overload relay and knife switch which may be used with the complete controller is mounted on a separate panel. The panels are in turn mounted on a frame completing the controller. Each of the accelerating unit panels also carries the necessary resistance units. This panel construction permits very easy replacement or additions.

Solid copper contact fingers are furnished with these controllers, laminated brushes being entirely eliminated. The controllers are arranged so that inclosing covers may be easily attached to the standard frames when desired. These controllers are particularly adapted for use with all types of machine tools, centrifugal pumps and fans, blowers, etc.

Platform Electric Washer

Lifting of water is eliminated in a platform electric washer that has been placed upon the market by Voss Brothers Manufacturing Company, Davenport, Iowa. The washer is placed on one end of the platform with the motor on a shelf immediately beneath it. Tubs for hot and cold water can also be placed upon the platform, and the wringer is placed at the opposite end with a basket for receiving the dry clothes. The wringer is operated by means of a rod drive parallel to the platform. To drain the wash tub and rinse tub when through washing it is only necessary to open the pipe in the wash tub and pull the plug at the bottom of the rinse tub. The double wringer control allows the operator to control the wringer either by hand or by the foot pedal at the bottom of the machine. While using the foot pedal the operator has both hands free to handle the clothing.

Trade Notes

JOHN F. GODFREY, manufacturer of coal handling conveyors, has removed his plant from Elkhart, Ind., to Chicago.

THE KILG ELECTRIC METER COMPANY has removed its plant from Indianapolis to Richmond, Ind. Its capitalization will be \$125,000.

THE MOLONEY ELECTRIC COMPANY, St. Louis, Mo., announces that J. Van Burskirk, formerly associated with the Mineralac Company of Chicago, has just been appointed manager of the Chicago office.

THE ELECTRICAL ENGINEERS' EQUIPMENT COMPANY of Chicago has appointed the Beidle Equipment Company, 1309 and 1310 Union Trust Building, Cincinnati, Ohio, district representative for that city and the surrounding territory.

THE DETROIT ELECTRIC SALES & SERVICE COMPANY of Detroit, Mich., is erecting a new building, an addition to its plant, two stories high and 200 ft. by 400 ft. in size. When completed the company will have 160,000 additional sq. ft. of floor space.

THE JEFFREY DEWITT INSULATOR COMPANY, the new corporate name of what was formerly the Dewitt-Jeffrey Company, manufacturer of the J-D high-tension suspension insulator, will be operating its new plant at Kenova, W. Va., on June 1. Its offices will be in the first National Bank Building, Huntington, W. Va.

THE HOLTZER-CABOT ELECTRIC COMPANY, Roxbury, Mass., announces that its business in motors, dynamos, motor-generators, etc., previously conducted by the James Goldmark Company, 83 Warren Street, will be hereafter handled from its New York office at 101 Park Avenue, corner of East Fortieth Street. Douglas Cairns is in charge of the New York office.

J. BECKEL, secretary of the Ministère de l'Industrie et du Travail, 15 Boulevard de Strasbourg, Havre, France, requests American manufacturers of electrical apparatus, machinery, supplies and specialties to send him their catalogs, together with such technical information as might be useful or interesting to future possible buyers. These catalogs will be filed and indexed, and placed at the disposal of Belgian manufacturers and buyers as soon as the war is over.

THE HOOVER SUCTION SWEEPER COMPANY of New Berlin, Ohio, still has its plant and general offices in that place, now known as North Canton. Owing to the prejudice against German names and at the request of its people, the name of the town, which is virtually a suburb of Canton, has been changed as just indicated. From July 8 to 13 a meeting of the twelve division sales managers will be held at the Hoover company's factory, and it is understood that one of the main topics to be discussed will be that of prices.

COMMERCIAL AGREEMENT WITH NORWAY.—The War Trade Board announces that in consequence of the conclusion of a general commercial agreement with Norway exports of commodities embraced in the schedules attached to the agreement are about to be resumed. Exports from the United States will be licensed subject to the general policy of conservation and to the general rules and regulations of the War Trade Board. Shipments will only be made on vessels flying the Norwegian flag and the total exports are limited in quantity.

THE AMERICAN TRADE ACCEPTANCE COUNCIL of New York City will hold a special all-day trade acceptance session at the LaSalle Hotel, Chicago, on June 17. The National Association of Credit Men will also hold its annual convention at the same hotel on the preceding day. Paul Warburg, deputy governor of the Federal Reserve Board, will address the trade acceptance meeting. A representative attendance is expected of the trade acceptance committee men of the forty-eight state banking associations and committeemen appointed in the various industries, also of officers and directors of the more prominent trade and commercial organizations, besides leading bankers, manufacturers, merchants and students of economics.

THE GENERAL VEHICLE COMPANY, INC., and the Walker Vehicle Company make the following announcement: "On account of the existing national emergency it has become imperative, in the interest of winning the war, that the General Vehicle Company, Inc., vacate the plant at Long Island City. In order to conserve the interests of the many users of G. V. trucks, the General Vehicle Company, Inc., has

made arrangements with the Walker Vehicle Company, Inc., of Chicago, Ill., to supply spare and repair parts and to furnish repair service to users of G. V. trucks. It is expected that this arrangement will result in the same satisfaction to G. V. users that they have enjoyed in the past. In general, stocks of spare parts will be carried as requirements determine, the principal stock being carried in Long Island City. After this date will you please communicate with the nearest Walker branch or dealer for parts or service."

Trade Publications

SWITCHES.—The Matthews "fuswitch" is described in a circular distributed by W. N. Matthews & Brother, Inc., 3727 Forest Park Boulevard, St. Louis, Mo.

WIRE TERMINALS.—The Cruban Machine & Steel Corporation, 2 Rector Street, New York City, has issued a circular describing its solderless wire terminal.

RHEOSTATS.—Universal battery-charging rheostats for garage duty are described in circular No. 501, issued by the Ward Leonard Electric Company of Mount Vernon, N. Y.

LAMP RENEWERS.—Lamp renewers for both series and multiple lamps are illustrated and described in a circular issued by the G. C. A. Manufacturing Company of Pittsfield, Mass.

PORTABLE INSTRUMENTS.—The General Electric Company of Schenectady, N. Y., has issued bulletin No. 46,018A, describing and illustrating its type P-8 voltmeter, wattmeter and ammeter.

WASHING MACHINES.—Voss Brothers Manufacturing Company, Davenport, Iowa, has issued an illustrated circular describing its latest model-platform, peg-type and vacuum-type washing machines.

RESISTANCE UNITS.—Enameled resistance units are illustrated and described in a booklet that has been issued by the Ward Leonard Electric Company, Mount Vernon, N. Y. Prices of the resistance units are also given.

SWITCHES.—A two-color folder, publication No. 252, has been issued by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., describing and illustrating its "seventy-fifty" switch for use with electric appliances.

FIELD RHEOSTATS.—The Ward Leonard Electric Company of Mount Vernon, N. Y., has issued some general information on field rheostats in a bulletin. Dimensions, price lists and illustrations of the rheostats are given in the booklet.

STOKERS.—The Combustion Engineering Company of New York has issued bulletin CI, describing its Cox stokers. This booklet is profusely illustrated with actual installations and shows diagrams of several different kinds of boiler settings.

CONDULETS.—Motor-switch condulets are described in bulletin No. 1000H, now being distributed by the Crouse-Hinds Company, Syracuse, N. Y. Its new steam-type cover with switch-operating mechanism for single and two-gang series conduit bodies is also illustrated in a photo of an actual installation.

MECHANICAL DRIVE.—The Poole Engineering & Machine Company of Baltimore, Md., has issued circulars describing the application of its turbo-gear for rubber-mill drive, pump drive, line-shaft drive, cement-mill drive, belt-conveyor drive, fan drive, air-compressor drive, centrifugal-pump drive and stoker drive.

STEAM TURBINES.—The Terry Steam Turbine Company, Hartford, Conn., is distributing a vacation schedule for 1918 that can be used to show graphically the vacation periods of any number from one to twenty-five employees. Some of the Terry products are shown on the schedule. Copies of this publication will be furnished on request by the company.

INSTRUMENTS.—Engineering instruments are described in a bulletin that is being distributed by James G. Biddle, 1211 Arch Street, Philadelphia. Some of the instruments are meggers for testing electrical resistance of conductors or insulations, hand tachometers, vibrating reed tachometers, reed frequency meters, portable switchboard electrical instruments and rheostats.

ELECTRIC DISTRIBUTION SPECIALTIES.—The G. & W. Electric Specialty Company of Chicago has issued a very complete catalog describing and illustrating its several distribution specialties. In this bulletin series cut-outs, filling compounds, ground-pipe caps and points, primary cut-

outs and fuses, line disconnectors, cable and conduit hangers, outlet hoods, potheads, sub-way cut-outs, distribution boxes, switching boxes, splice boxes and tap boxes are described.

LINE MATERIAL AND ELECTRIC RAILWAY SPECIALTIES.—A complete and comprehensive catalog has been issued by the Drew Electric & Manufacturing Company, Indianapolis, Ind., describing and illustrating its overhead line material and electric railway specialties. It is known as catalog No. 18 and contains specifications and photographs of splices, trolley frogs, trolley crossings, adjustable crossings, section insulators, approachers, triple-beam insulators, pole brackets, line suspensions, feed-in hangers, insulated hangers, cap-and-cone hangers, globe strain insulators, giant strain insulators, standard insulated bolts, porcelain strain insulators, etc. It also contains various accessories used on electric railways. High voltage porcelain insulators are extensively treated, and diagrams are given illustrating construction and sizes. Glass insulators are also described and illustrated.

New Incorporations

THE FREEMAN ELECTRIC COMPANY of Cleveland, Ohio, has been incorporated by Katherine Freeman and Louis Kronenberg.

THE BORDER POWER COMPANY of New York, N. Y., has been chartered with a capital stock of \$10,000 by S. B. C. J. and J. L. Sauer of New York City.

THE LOCO (OKLA.) LIGHT & FUEL COMPANY has been chartered with a capital stock of \$25,000 by Percy W. Newman and W. H. Rader of Loco and G. W. Newman of Dixie, Okla.

L. R. WOOD, INC. of New York, N. Y., has been incorporated with a capital stock of \$50,000 to manufacture electrical goods. The incorporators are M. H. and L. H. Wood and C. F. Hoffman, 49 Wall Street.

THE PINE BLUFF BATTERY COMPANY of Pine Bluff, Ark., has been chartered by R. G. Craig, Gordon M. Rudd and others. The company is capitalized at \$10,000 and proposes to manufacture electric batteries.

THE ROMMEL-GUSSET COMPANY of Louisville, Ky., has been incorporated by John D. Rommel, W. A. Gusset and W. A. Turner. The company is capitalized at \$10,000, and proposes to manufacture storage batteries.

THE ANGOLA (IND.) ELECTRIC MANUFACTURING COMPANY has been incorporated with a capital stock of \$150,000 by Samuel C. Wolf, Edward C. Kolb and Carl A. Redding. The company proposes to manufacture machinery.

THE INDUSTRIAL APPLIANCES CORPORATION of New York, N. Y., has been incorporated by J. J. Sullivan, N. V. Rothenberg and M. C. Kahl, 35 Nassau Street. The company is capitalized at \$10,000 and proposes to manufacture telephone and telegraph devices.

THE STANDARD ELECTRIC ENGINEERING COMPANY of Hammond, Ind., has been chartered by A. R. Stowell, George M. Chapin and Roy W. Weir. The company is capitalized at \$100,000 and proposes to manufacture electrical and mechanical apparatus.

THE ELECTRIC RIVETING CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$1,250,000 to manufacture machinery for electrical riveting. The incorporators are C. L. Rimlinger, M. McLancy and F. A. Armstrong.

THE INTERNATIONAL INSULATING CORPORATION of New York, N. Y., has been incorporated by O. and Heineman, 25 West Forty-fifth Street, and J. Schecter, 10 Wall Street, New York City. The company is capitalized at \$60,000 and proposes to manufacture insulating materials.

THE MASTER TELEPHONE SYSTEM OF THE BRONX, New York, N. Y., has been incorporated with a capital stock of \$75,000 by L. Poster, 2126 Vyse Avenue; R. Carlin, 945 East 181st Street; M. L. Heller, 2126 Vyse Street, the Bronx. The company proposes to deal in electric sound transmitting devices.

THE IROQUOIS UTILITIES, INC., of Syracuse, N. Y., has been organized by the consolidation of the Randolph Light & Power Company and the Gowanda (N. Y.) Light & Power Company. The company is capitalized at \$165,000, and the incorporators are A. M. Ellis, B. H. Shepard and L. S. Chapman of Syracuse.

New England States

CHARLESTOWN, N. H.—The local substation of the Fall Mountain Electric Company was recently destroyed by fire, causing a loss of about \$20,000. The main office of the company is located at Bellows Falls, VT.

RUTLAND, VT.—Plans are being considered by the Rutland Railway, Light & Power Company for extensions to its system. A large number of industries using steam power in this vicinity are contemplating changing the motive power in their plants to electricity.

STOUGHTON, MASS.—After being without street lamps for several weeks the citizens at a special town meeting voted to appropriate \$11,000 for lighting the town.

TURNERS FALLS, MASS.—The Franklin Electric Light Company has petitioned the State Board of Gas and Electric Light Commissioners for permission to issue \$25,000 in capital stock, the proceeds to be used for extensions to its local system.

WORCESTER, MASS.—Contract has been awarded by the W. H. Sawyer Lumber Company, 66 Lincoln Street, to L. Rocheford & Son, 44 Front Street, Worcester, for construction of the proposed addition to its boiler plant. The company is also contemplating other extensions to its works.

BRIDGEPORT, CONN.—Contract has been awarded by the United Illuminating Company to Casey & Hurley, 120 Pequonnock Street, Bridgeport, for the erection of an addition 50 ft. by 80 ft. to its plant.

HARTFORD, CONN.—Bids, it is reported, are being asked by the Terry Steam Turbine Company of Hartford for erecting an additional story to two sections of its plant, 40 ft. by 100 ft. and 20 ft. by 200 ft. respectively. The capital stock of the company has been increased from \$350,000 to \$700,000.

MONTVILLE, CONN.—Permission has been secured and all arrangements made with government officials and others interested by the Eastern Connecticut Power Company for the construction of an electric generating plant across the Thames River near Bartlett's. The proposed work will include the erection of high-tension aerial cables across the Thames River at Montville, which will swing from steel towers on either side of the river, and it has been decided that the minimum clearance shall be 175 ft. Power generated at the plant will be furnished principally to the submarine base near New London; also to the town of Groton and other towns and industries in that district. Fred T. Ley & Company of Springfield, Mass., have contract for construction of the plant.

NEW BRITAIN, CONN.—Contract has been awarded by the New Britain Machine Company to the Abertshaw Construction Company of Boston, Mass., for the construction of a factory, 114 ft. by 340 ft., to be erected on a site recently acquired on the Berlin branch of the New York, New Haven & Hartford Railroad Company.

Middle Atlantic States

ALBANY, N. Y.—Contract has been awarded by the State Board of Health to Gagen & Butler, 1402 Broadway, New York, for electrical work in connection with the construction of the new laboratory to be erected on New Scotland Avenue. The cost of the work is estimated at \$10,484.

BROOKLYN, N. Y.—Plans have been filed by the Edison Electric Illuminating Company of Brooklyn for extensions and improvements to its plant on Gold Street, including the erection of an addition to power house. Contract has been awarded to John H. Duncan, foot of Sixty-sixth Street Brooklyn.

BROOKLYN, N. Y.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the erection of a new structural shop at the Brooklyn Navy Yard, to cost about \$1,000,000. The bureau, it is reported, is considering the construction of a series of drydocks at Weehawken, N. J., to cost about \$8,000,000.

BUFFALO, N. Y.—Plans have been filed by the Buffalo General Electric Company for an addition to its generating plant on Staats Street, to cost about \$33,700.

BUFFALO, N. Y.—The Buffalo Cereal Company is planning to construct and equip an electric power plant in connection with its proposed new grain elevator and mill at Abbott Road and the Lake Shore Railroad.

BUFFALO, N. Y.—Plans have been filed by Cousins & Sons, 74 Wabash Street, and contract awarded to B. I. Crocker, 57 Builders' Exchange, Buffalo, for the construction

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

of a new boiler plant at its works at Hopkins and Tift Streets.

BUFFALO, N. Y.—A new switchboard building will be erected in connection with the proposed new plant under construction by the Linde Air Products Company at Broadway and Ideal Streets, to cost about \$60,000. J. W. Cowper, Fidelity Building, is contractor.

DEPEW, N. Y.—The Gould Storage Battery Company is contemplating the construction of an addition, about 75 ft. by 90 ft., to its plant.

FAIRPORT, N. Y.—Plans have been prepared by the Douglas Packing Company for an extension, 50 ft. by 75 ft., to its power house on John Street. A. S. Crocker, Mechanics Institute, Rochester, is engineer.

HUDSON, N. Y.—Bids will be received by Mrs. Annie Winsor Allen, president of the board of managers of the New York State Training School for Girls, Hudson, until June 14 for repairs to boiler settings at the New York State Training School for Girls at Hudson. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

NEW YORK, N. Y.—The Public Service Commission has granted the application of the New York Telephone Company for an increase in capital stock of \$25,000,000.

NEW YORK, N. Y.—Plans have been prepared by Warren & Wetmore for the erection of a new building for the Mexican Telegraph Company and the Central and South American Telegraph Company on Broad Street, between South William and Stone Streets. The general contract has been awarded to John I. Downey, 410 West Thirty-fourth Street.

OSSINING, N. Y.—Bids will be received by the Commission on New Prisons, Room 618, Hall of Records, New York City, until June 27 for electric work, including underground electric conduit and feeder system, for registration building No. 1; outside cell block No. 2; detention building No. 5; outside cell block No. 7; clinic building No. 8, and pump house at Sing Sing Prison, Ossining. Specifications may be consulted at the office of the warden of Sing Sing Prison, Ossining; at the office of the Commission on New Prisons, Room 618, Hall of Records, New York City; the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Albany, N. Y.

POUGHKEEPSIE, N. Y.—Improvements are contemplated to the waterworks system, including the installation of new electrically operated pumping machinery, a reserve boiler and a new pre-filter bed. The cost of the proposed work is estimated at \$65,000.

SCHENECTADY, N. Y.—The Schenectady Illuminating Company has petitioned the Public Service Commission for authority to acquire the property of the East Creek Electric Power Company of St. Johnsville, which operates an electric plant on East Canada Creek, supplying the bulk of the power to the Edison Electric Light & Power Company of Amsterdam; also to purchase the plant and system of the Edison Electric Light & Power Company, which has franchises in the city of Amsterdam, the town of Amsterdam, village of Fort Johnson and in Schenectady County.

SYRACUSE, N. Y.—Investigations are being made by Prof. A. R. Acheson, consulting engineer of the Bureau of Gas and Electricity, relative to making changes in the ornamental lighting system in Syracuse. It is understood that the lighting commission will ask that some special arrangement be made for lighting the downtown section during the remainder of the war, with a view toward saving fuel and in co-operation with the fuel administration. It is expected that the illumination will not be so elaborate as during the past few years. The new contract with the Syracuse Lighting Company for street-lighting must be made before July 1.

WARSAW, N. Y.—Plans have been prepared by the Warsaw Elevator Company for an addition to its power house. C. E. Ketchum is president.

WATERTOWN, N. Y.—Plans are being prepared by the Northern Utilities Company for a hydroelectric development at Black Carthage, to cost approximately \$500,000. E. A. Rogers is vice-president and general manager.

WATERVLIET, N. Y.—Bids will be received by the Board of Water Commissioners, City Hall, Watervliet, until June 25 for furnishing material and constructing extensions to the filter and pumping station of the municipal water-works system. The work will include the installation of four additional 500,000-gal. mechanical filter units with extensions to superstructure and piping of present filter plant on the Shaker Road west of the city of Watervliet, together with furnishing and installing a motor-driven centrifugal pump on foundations, with all necessary piping and appurtenances in the pumping station at French's Mills. Plans and specifications are on file at the office of the Board of Water Commissioners, Watervliet, and also at the office of Solomon, Norcross & Keis, Atlanta, Ga.

ATLANTIC CITY, N. J.—John Stafford has awarded contract to the Baird-Osterhout Company for furnishing and installing electric-light and power system, fire-alarm system and public telephone system in the building to be erected at Brighton Avenue and the Boardwalk, at \$62,000.

BORDENTOWN, N. J.—Bids will be received at the Department of Architecture, State House, Trenton, N. J., until June 18 for general plumbing, heating and electric work in connection with alterations to tenements, Manual Training and Industrial School at Bordentown. Bids will also be received at the same time and place for general, plumbing, heating and electric work in connection with an administration building and principal's house at the Manual Training and Industrial School, Bordentown. Plans and specifications may be obtained upon application to the Department of Architecture upon deposit of \$25 for each set of plans.

HOBOKEN, N. J.—The business of the Bijur Motor Lighting Company of Hoboken has been purchased by the General Electric Company. The company will vacate its new plant and will occupy its old building again. The new Bijur plant will be turned over to the Remington Arms U. M. C. Company, which will make extensions to same for the manufacture of small-arms ammunition. New equipment will probably be purchased soon.

LANDING, N. J.—The Atlas Powder Company of Landing has contracted with the New Jersey Power & Light Company of Dover for furnishing additional power needed to operate its works. The powder company will use about 150,000 kw.-hr. per month, and a connected load of about 300 kw. will be required. Plans are being considered by the New Jersey company for extending its transmission lines to the plant at Landing. The cost is estimated at \$5,800.

NEWARK, N. J.—Bids will be received by the Board of Education of Newark until June 10 for general supplies, including electric lamps, electrical supplies, hardware, etc. Specifications and proposal blanks may be obtained at the office of the Department of Supplies, third floor, City Hall, Newark. R. D. Argue is secretary.

NEWARK, N. J.—Contract has been awarded by the Maas & Waldstein Company, Avenue R and Passaic River, Newark, to Henry M. Borems & Company, 36 Orange Street, Newark, for the construction of a boiler and nitrating chemical works, to cost about \$65,000. The buildings will be 55 ft. by 215 ft., and 55 ft. by 128 ft., respectively, one story high. The Maas & Waldstein Company also contemplates the erection of a foundry, 30 ft. by 40 ft., at its chemical works.

PAIK RIDGE, N. J.—The Board of Utility Commissioners has handed down an order requiring the local electric lighting company to make various changes and improvements to its system.

PERTH AMBOY, N. J.—The Standard Underground Cable Company, 26 Washington Street, has purchased a site in Woodbridge Township on which it proposes to erect a large new plant. The company manufactures wires, cables, etc.

PASTON, PA.—Notice has been filed with the Public Service Commission by the Pennsylvania Power Company of an issue of \$10,000 in bonds, the proceeds to be used for extensions, improvements, etc.

HARRISBURG, PA.—A special meeting of the stockholders of the Harrisburg Light & Power Company has been called for July for the purpose of voting on the proposal to increase the capital stock from \$10,000,000 to \$10,500,000 to provide for extensions and improvements to its system.

HILLSVILLE, PA.—Preparations are being made by the Bessemer Limestone Company for the installation of an electric haulage system at its Hillsville plant. The present plans provide for an expenditure of about \$60,000 in the partial installation. The cost of the complete equipment of the works is estimated at about \$20,000.

MEADVILLE, PA.—The Northwestern Electric Service Company is planning to extend its electric lighting service to Kearsage in the near future. C. M. Hatch is manager.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia Range Boiler Company, 2021 North Tenth Street, for the construction of an addition to its works. Other improvements are also contemplated.

PHILADELPHIA, PA.—The Philadelphia & Reading Railway Company, Reading Terminal, is considering the construction of a two-story signal tower and battery building at Manville Junction, N. J., for which plans have been prepared.

PHILADELPHIA, PA.—Plans have been filed by the Bellevue Worsted Mills, Wister Street and Reading Railway, for the construction of a new power house to be erected at Sixteenth and Hunting Park Avenues, to cost about \$10,000. Contract for building has been awarded to W. E. S. Dyer, Land Title Building, Philadelphia.

SOUTH BETHLEHEM, PA.—Plans have been prepared by the Bethlehem Steel Company for the construction of an addition to its power plant at McAfee, N. J., and also for improvements to the present building.

BALTIMORE, MD.—Contract has been awarded by the Baltimore County Water Company, 100 West Fayette Street, to the Price Construction Company, Maryland Trust Building, Baltimore, for the construction of a new pumping plant to be erected at Falls Road and the Viaduct.

MARLINTON, W. VA.—The erection of a new building at the electric-light and water works plant, to cost about \$6,000, is under consideration.

FREDERICKSBURG, VA.—The contract for the construction of the proposed power plant and laundry building at the State Normal School, Fredericksburg, has been awarded to E. G. Hellin, Fredericksburg. The cost is estimated at about \$20,000.

MANNINGTON, VA.—Plans are being considered by the Rachel Coal Company for the reconstruction of its power house, compressor and ventilation system, recently destroyed by fire, causing a loss of about \$65,000.

NEWPORT NEWS, VA.—The Chesapeake & Potomac Telephone Company has purchased a site in Newport News on which it will erect a new telephone exchange, to cost about \$40,000.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 10 under specification 3041 for electric-light and power system for shipbuilding slip No. 1 at Norfolk, Va. The cost is estimated at about \$15,000.

RICHMOND, VA.—Plans and specifications are being prepared by the Newport News (Va.) Shipbuilding & Dry Dock Company for the Emergency Fleet Corporation for the construction of a plant to manufacture boilers for all government steamships being constructed along the Atlantic seaboard. The proposed plant, it is understood, will be located on the James River and will include a foundry, machine shop and boiler shop. Electricity will be used for lighting and power. The cost of the work is estimated at \$4,000,000. The Newport News company will have charge of construction of the plant and will operate it for the Emergency Fleet Corporation.

WASHINGTON, D. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to Skinner & Garrett, 1416 F Street, Washington, for construction of an addition to the Walter Reed Hospital, to cost about \$750,000.

WASHINGTON, D. C.—Estimates of appropriations required by the Engineer Department for the fiscal year ending June 30, 1918, have been submitted to Congress by the Secretary of War, asking for \$1,475,000 for searchlights for defensive purposes, and \$800,000 for sound-ranging equipment.

WASHINGTON, D. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, for substitution switchboards to the Carroll Electric Company of Washington, D. C., at \$48,250. Contract has also been awarded to the White City Electric Company of Washington, for an electric lighting system for shipbuilding slip, at \$25,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Eastern and western deliveries, Schedule 1831—dry cells; Schedule 1834—various deliveries of weatherproof sockets; Schedule 1835—various deliveries of rubber and cotton insulating tape; Schedule 1839—for various yards, 68,500 flashlights and 181,000 flashlight batteries. Bids will be re-

ceived until June 11 for furnishing at Washington, D. C., under Schedule 15631₂ & 25 instruction radio sets. Bids will also be received until June 17 for furnishing at the eastern navy yards under Schedule 4577₂—fifty searchlights. Bids will also be received until June 17 for furnishing at Washington under Schedule 4577₂—243 range and deflector transmitters, 1158 springs and 1270 range and deflector indicators. Further information may be obtained on application to the above bureau.

North Central States

CHEBOYGAN, MICH.—The Cheboygan Electric Light & Power Company has awarded contract for the construction of its new power house at the Black River dam to William Moody.

CHILLICOTHE, OHIO.—Application has been made by the Chillicothe & Camp Sherman Electric Railway Company to the Public Utilities Commission for permission to issue \$225,000 in capital stock and \$150,000 in bonds, the proceeds to be used for the construction of the proposed electric railway from Chillicothe to Camp Sherman. George A. Vaughters of Chillicothe is interested.

COLUMBUS, OHIO.—The Frankenburg Construction Company has been awarded the contract for construction of an addition to the power house at the Smith Agricultural Chemical Company.

FREMONT, OHIO.—The City Council is considering the installation of a municipal gas and electric-light plant to be operated in conjunction with the water-works system.

MIDDLETOWN, OHIO.—The Hamilton Electric Company submitted the lowest bid (\$2,800) for lighting the viaduct between Middletown and West Middletown.

LEXINGTON, KY.—The Elkhorn Coal Company, recently incorporated at Lexington, has acquired the property of the Detroit Elk Coal Company and has increased the capital stock from \$100,000 to \$600,000. The company holds many acres of valuable timber and coal lands in Kentucky. Development, it is reported, will begin at once with the establishment of electric plants, telephone and telegraphic service and the building of several towns. A. F. West, C. C. Winters, A. L. Mancourt and John Koenig of Detroit, Mich., are interested in the project.

SERGEANT, KY.—The Whitley-Elkhorn Coal Company is contemplating the installation of electric equipment.

WHITESBURG, KY.—The Elkhorn Superior Block Coal Company is contemplating the installation of new electrical machinery. The capital stock of the company has been increased from \$35,000 to \$100,000.

FRANKLIN, IND.—The Franklin Water, Light & Power Company has petitioned the Public Service Commission for permission to issue bonds to provide for extensions and improvements, etc.

PERU, IND.—The property of the Peru Electric Manufacturing Company has been purchased by Frank Moeck of Peru.

LENA, ILL.—The Public Utilities Commission has approved the contract of the Lena Electric Light & Power Company for the joint use of the transmission lines from Lena to Lanark and the lines of the Pearl City Independent Telephone Company, the Stephenson County Telephone Company and the Pearl City Mutual Telephone Company at Pearl City.

ROCKFORD, ILL.—A new special committee, consisting of Aldermen Clothier, Ogren, Murphy, Croon and Johnson, has been appointed by Mayor Rew to investigate the proposition of establishing a municipal electric-light and power plant in Rockford.

WOODSTOCK, ILL.—The Woodstock Typewriter Company, North Dearborn Street, Chicago, is planning to build a power plant at its works in Woodstock, to cost about \$10,000.

MILWAUKEE, WIS.—Contract has been awarded by the Lavine Gear Company of Racine to the Dahlman Construction Company of Milwaukee for the construction of a new machine shop and manufacturing plant, 175 ft. by 275 ft., at Keefe Avenue and North Pierce Street, Milwaukee. The cost of the building with equipment is estimated at \$350,000.

ROCKDALE, WIS.—The Village Council has granted the Cambridge (Wis.) Electric Light & Power Company a franchise to construct and operate an electric-light and power system in Rockdale.

MUSCATINE, IOWA.—The City Council is considering the question of establishing a municipal electric-lighting plant.

NEOLA, IOWA.—Bonds to the amount of \$10,000 have been voted for improvements

to the municipal electric-light plant and water-works system.

ADRIAN, MO.—A special election will be held on June 11 to submit to the voters the proposal to grant an electric-light franchise to Mr. Green.

CAMERON, MO.—The installation of a forced draft system in the municipal electric power plant is under consideration by the electric light committee.

JOPLIN, MO.—The Bankers' Mining Company of Joplin is contemplating the installation of new machinery in its concentrating plant, to cost about \$25,000.

KANSAS CITY, MO.—Plans are being considered by the A. Holtman Heating Company for rebuilding its plant, recently destroyed by fire. The cost of the proposed new plant is estimated at about \$90,000. Smith, Rea & Lovitt of Kansas City are architects.

ST. LOUIS, MO.—The capital stock of the Union Electric Light & Power Company has been increased from \$21,240,000 to \$22,240,000. The company, it is understood, contemplates improvements to its system.

MILLER, S. D.—Bids will be received by the city auditor, Miller, S. D., until June 17 for additions and improvements to the municipal electric-light plant as follows: (1) Concrete addition to building; (2) an 80,000-gal. steel tank on a 100-ft. steel tower; (3) a 50,000-gal. reinforced concrete reservoir; (4) furnishing and erecting two 72-in. by 16-ft. fire-tube boilers, a 100-ft. concrete chimney, one 75-kw. and one 100-kw., 2300-volt steam engine-driven generating unit, switchboard, two 200-gal. per minute motor-driven centrifugal pumps, steam piping connections and some miscellaneous water and sewer connections; (5) for furnishing and erecting materials for reconstruction of existing alternating-current pole line distribution system in Miller. Plans and specifications may be obtained upon application to Earle D. Jackson, Capital Bank Building, St. Paul, Minn., upon deposit of \$10. Plans are on file at the office of the city auditor, Miller.

CEDAR, KAN.—The Solomon Valley Power Company of Downs, it is reported, contemplates some changes in its local wiring system.

CHENEY, KAN.—At an election held recently bonds to the amount of \$15,000 were voted, the proceeds to be used to purchase the local electric-lighting plant and for improvements to same.

LARNED, KAN.—Arrangements have been made between the City Council and Nathan L. Jones whereby the latter will purchase the surplus energy from the municipal electric plant. Mr. Jones and associates are planning to erect an electric transmission line up the Pawnee Valley, and from the station of Frizell south to Garfield to connect with a line just completed by Mr. Jones from the line extending to Lewis and Belpre from the plant at Kinsley. Application has been made for a charter for the company.

WELLSVILLE, KAN.—C. A. Smith, owner of the local electric-light plant, has applied for permission to erect an electric transmission line to supply electricity in the towns of Garfield and Edgerton.

Southern States

ATLANTA, GA.—An election will be held on July 10 to submit to the voters the proposal to issue \$75,000 in bonds for the installation of an electric generating plant.

BRUNSWICK, GA.—The City Council is considering taking over the water plant of the Mutual Light & Water Company, to be owned and operated by the municipality.

DAVISBORO, GA.—Contract has been awarded by the City Council for the construction of an electric-light plant. The initial installation will provide sufficient electricity to light the streets and business houses. Later an addition will be made to furnish electrical service for domestic purposes. The plant will be driven by a gasoline engine.

BRISTOL, TENN.—The Waggoner, Phillips, Barnes Company, care of the Bristol Ice Company, would like to receive prices, catalogs, etc., on ice-manufacturing machinery, etc.

NASHVILLE, TENN.—Messrs. Morgan & Hamilton of Nashville are erecting an addition to its plant, which will be equipped with motor-driven machinery. The company manufactures bags.

MENA, ARK.—The local electric-light plant, owned by Tomlinson Brothers, has been purchased by the Commonwealth Public Service of Muskogee, Okla., at \$24,200. The company also purchased the property of the Mena Ice & Cold Storage Company.

A new electric franchise, it is understood, will be asked by the new company.

RISSON, ARK.—The Fordyce (Ark.) Light & Water Company has been granted a franchise to construct and operate a waterworks system in Risson.

POTEAU, OKLA.—The Citizens' Consolidated Power & Electric Company, recently organized, has petitioned the city of Poteau for a franchise to install and operate an electric plant.

BRYAN, TEX.—Material has been ordered for the erection of an electric transmission line from the city limits to the clubhouse and grounds of the Fin-Feather Club, south of the city.

Pacific and Mountain States

BELLINGHAM, WASH.—Plans are being considered by the Boundary Red Mountain Mining Company of Bellingham for replacing its power plant destroyed by fire last winter. It is proposed to install a much larger plant.

CHEHALIS, WASH.—G. O. Anderson has filed a petition with the City Commission for the resubmission of the Anderson franchise for furnishing electricity for lamps and motors in Chehalis to the voters. The franchise was rejected at the election held April 20. Resubmission is asked on account of technical irregularities in the election.

EVERETT, WASH.—Bids are being asked by the United Steel Company for the erection of buildings for its plant. The main building is to be 70 ft. by 200 ft. The company proposes to install two reheat furnaces and an electric furnace. The equipment will also include two large magnets operated by electricity for handling scrap.

NEWPORT, WASH.—A large transformer in the local substation of the Washington Water Power Company was recently destroyed by fire, causing a loss of about \$3,000.

OKANOGAN, WASH.—The Okanogan Valley Power Company is contemplating the erection of an electric transmission line between Riverside and Tonasket during the summer.

SEATTLE, WASH.—The Rothert Process Steel Company, 622 Harrison Street, is planning to install a 10-ton electric furnace at its plant in connection with other extensions.

SEATTLE, WASH.—The City Council has passed over the veto of the Mayor a bill granting the National District Telegraph Company a franchise to install a signal alarm system in Seattle.

SEATTLE, WASH.—The War Department has awarded contract to the Aero Alarm Company of Seattle for equipping 2000 hospital buildings in camps and cantonments with aero apparatus.

SEATTLE, WASH.—The City Council has passed an ordinance placing the sealing operations on the basin of the new Cedar River dam under joint supervision of J. D. Ross, superintendent of lighting, and L. B. Young, superintendent of the water department.

SEATTLE, WASH.—The City Council has passed the ordinance providing for the development of a hydroelectric power plant on the Skagit River and for the issuance of \$5,500,000 in bonds to cover the cost of the work. The additional \$500,000 was suggested by A. H. Dimmock, city engineer, and J. D. Ross, superintendent of lighting, as the original bids did not include the cost of the city substation.

SPOKANE, WASH.—The Spokane Heat, Light & Power Company will not extend its lines into the residential district this year as had been announced. In view of the government's request to curtail all unnecessary extensions in all lines of business, no new patrons will be sought by the company.

VANCOUVER, WASH.—Bids will be received by the Columbia River Interstate Bridge Commission, Vancouver, until June 28, for furnishing material and construction of a transformer house on Washington Street, Vancouver. Plans may be secured at the office of the clerk of Multnomah County at Portland, Ore., or the county auditor of Clarke County at Vancouver.

KLAMATH FALLS, ORE.—The Keno (Ore.) Power Company has submitted a tentative proposal to the city of Klamath Falls offering to sell its plant at Keno to the city to be owned and operated by the municipality. The company was granted a franchise to operate in the city over a year ago.

PORTLAND, ORE.—A permit has been granted to the Northwestern Electric Company for the erection of a power plant at the foot of Lincoln Street, to cost about

\$250,000. Charles C. Moore & Company are engineers.

ANGELES CAMP, CAL.—Work has begun on unwatering the Pioneer Mine at Angeles Camp. Electricity will be used to operate the machinery in the mine. The company has already taken over the transmission line of the Brown-Smyth-Ryland Company adjoining, together with transformers, etc.

CHOWCHILLA, CAL.—Contract has been awarded by George R. Perry for the construction of a machine shop, 350 ft. by 100 ft., to James Daly, of Fresno. It will be equipped for automobile and tractor engine construction and repairs, with overhead cranes, etc.

FRESNO, CAL.—Rosenburg Brothers & Company, 706 G Street, Fresno, have awarded contract for the construction of a new packing plant to the Clinton Construction Company, Townsend Street, San Francisco. The plans provide for the erection of a power plant, 15 ft. by 85 ft. The cost of the entire plant is estimated at about \$200,000.

JACKSON, CAL.—Plans are being considered by the Gage Mining Company, located near Shawmut, for equipping the machinery in its mines for electrical operation. Electricity will be supplied by the Sierra & San Francisco Power Company of San Francisco.

LOMPOC, CAL.—The Lompoc Light & Power Company is contemplating improvements to its plant and distributing system, involving an expenditure of between \$5,000 and \$10,000.

LOS ANGELES, CAL.—Preparations are being made by the Pacific Electric Railway Company for the construction of an electric substation, 32 ft. by 50 ft., to be located at Slauson Junction, Slauson and Long Beach Avenues.

LOS ANGELES, CAL.—Plans have been prepared by the General Petroleum Company, Higgins Building, for the erection of a new machine shop, 40 ft. by 100 ft., one story high.

LOS ANGELES, CAL.—The Water Department is considering equipping four of the waterworks pumping plants for electrical operation. The plants to be operated by electricity are located at Wilmington, Edendale and Garvanza. William Mulholland is chief engineer in the water department.

REDDING, CAL.—The California-Oregon Power Company is planning to erect a high-tension transmission line from its southern terminus at Castella to Kennett, at a cost of about \$330,000, and to furnish electricity to the Mammoth mine and smelter for a minimum of \$105,000 per year. The Northern California Power Company of San Francisco, it is said, will reinforce its transmission line from the Coleman power house to Hamilton, at a cost of \$110,000, and deliver energy at Colusa to the Pacific Gas & Electric Company. Improvements, involving an expenditure of about \$3,000,000, are contemplated by the three companies.

SAN PEDRO, CAL.—Extensive additions are being made to the plant of the Southwestern Shipbuilding Company, located south of Fish Harbor Wharf, which will include the erection of a transformer station, 20 ft. by 27 ft.

SANTA BARBARA, CAL.—The City Council has adopted a resolution authorizing the installation of an ornamental lighting system on Chapel Street from Ocean Boulevard to Gutierrez Street.

SANTA BARBARA, CAL.—The City Council has granted the Santa Barbara Telephone Company a franchise to erect and maintain pole lines, etc., and to lay underground conductors for wires on and under the streets, alleys and avenues in Santa Barbara.

TORRANCE, CAL.—The Pacific Electric Railway of Los Angeles has awarded contract to the Wurster Construction Company, Central Avenue, Los Angeles, for the construction of its new shops at Torrance as follows: Car works, 180 ft. by 150 ft.; force shop, 150 ft. by 200 ft.; erecting shops, 180 ft. by 450 ft.; paint shop, 180 ft. by 450 ft.; power plant, 60 ft. by 120 ft., and other structures. The cost of the entire works is estimated at \$1,000,000.

WINTERHAVEN, CAL.—The Board of Supervisors has granted the Winterhaven Improvement Company a franchise to construct and operate an electric-light and power plant, waterworks and gas plant in Winterhaven.

BOISE, IDAHO.—The Public Utilities Commission has granted the Idaho Power Company permission to cancel its air-heating contracts in Twin County, contracts to be abrogated at once, except in hospitals and homes where there is sickness. The heavy load on the Shoshone plant since the

opening of the irrigation season has made the cancellation of the contracts necessary.

BEAVER, UTAH.—The Beaver River Power Company is contemplating extending its electric transmission line to the sulphur mine near Cove Front, northeast of Milford.

SALT LAKE CITY, UTAH.—The lighting and heating plant, laundry, engine room and part of the nurses' quarters at the St. Mark Hospital were recently damaged by fire.

SALT LAKE CITY, UTAH.—The County Commissioners have authorized the county attorney to draw up a contract with the Utah Power & Light Company for the installation of 98 lamp posts on the Redwood Road and 177 on State Street.

SOLIGMAN, ARIZ.—Surveys have been made for a large hydroelectric development on the Colorado River north of Soligman. E. L. Boyard of Soligman may be able to give further information.

SACO, MONT.—Arrangements are being made by D. T. Gilbert, owner of the local electric-light plant, for extensions and improvements to his plant.

MINA, NEV.—The installation of new electric machinery in the new 100-ton concentrating plant to be erected at the Gunmetal tungsten mine, about 2 miles from Mina, is under consideration.

PALISADE, NEV.—The installation of considerable new electric machinery in connection with the construction of a new large concentrating plant is under consideration by the Union Mines Company.

TONOPAH, NEV.—Work has begun on the erection of the new Tonopah-Gold Mountain transmission line of the Nevada-California Power Company. The proposed line will be extended from the Jim Butler mine to the property of the Tonopah Divide Company and other Gold Mountain companies.

DEMING, N. M.—The Deming Ice & Electric Company is contemplating the installation of new machinery at its plant.

Canada

VANCOUVER, B. C.—Mundy, Rowland & Company of Vancouver have been awarded the contract for the electrical work on the Manitoba Parliament Buildings at Winnipeg, amounting to more than \$100,000. The company has also secured the contract for the electrical installation in the Saskatchewan Co-operative Hospital at Port Arthur, Ont., at \$25,000.

HAMILTON, ONT.—Tenders will be received by Charles G. Booker, Mayor, addressed to S. H. Kent, city clerk, Hamilton, until June 17 for furnishing and installing two 200-hp. water-tube boilers or one 400-hp. water-tube boiler. Specifications and form of tender may be obtained at the office of the engineer.

DRUMMONDVILLE, QUE.—The Southern Canada Power Company has awarded contract for the construction of a dam and concrete power house on the St. Francis River, near Drummondville, to Morrow & Beatty of Peterboro, Ont. The company is planning for a development of 10,000 hp. at present, but will make provision in the power house for an ultimate development of 18,000 hp.

HULL, QUE.—The Hull Electric Company is considering making extensions to its system.

MONTREAL, QUE.—The contract for rebuilding the hydroelectric plant for the College de Montfort, including a concrete dam, a wooden-stave pipe line and a brick and concrete power house, has been awarded to Arsenault & Plamondon, Ltd., of Montreal.

SHAWINIGAN FALLS, QUE.—Work, it is reported, will soon begin on the construction of a new plant for the Canadian Ferro-Alloys Company, to cost about \$100,000.

LLOYDMINSTER, SASK.—The installation of an electric-lighting plant, to cost about \$60,000, is under consideration by William and E. Johnson of Lloydminster.

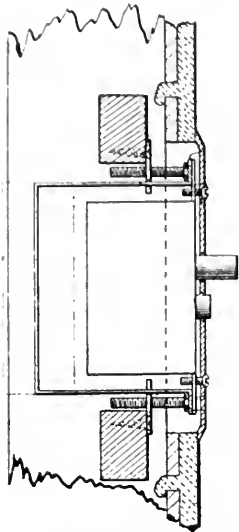
Miscellaneous

MANILA, P. I.—Arrangements are being made by the Manila Electric Railway Light Company for extensions to its plant. New equipment, including a 1000-kw. turbine and a 10,000-sq. ft. building, one 1000-kw. rotary, one 1000-kw. exciter, switchboard, etc., has been purchased from the Westinghouse Electric & Manufacturing Company. The cost of the plant, including the cost of the land, is estimated at \$1,000,000. The company is also planning to install a new steam boiler and induced-draft fans.

(Issued May 7, 1918.)

Record of Electrical Patents

Notes on United States Patents



1,265,744—Wall Box for Electrical Apparatus

- 1,265,716. MEASURED-SERVICE TELEPHONE SYSTEM; George A. Yanochowski, Chicago, Ill. App. filed Feb. 4, 1914. A simplified cord circuit for use in semi-automatic systems.

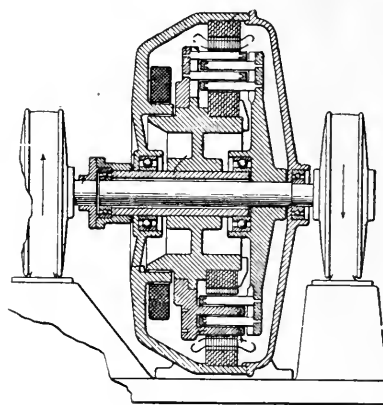
(Issued May 14, 1918.)

- 1,265,728. TELEGRAPH SYSTEM; John H. Bell, East Orange, N. J. App. filed July 12, 1917. Reproduces signals in the form of a printed record.
- 1,265,744. WALL BOX FOR ELECTRICAL APPARATUS; Clair C. Canfield, Crafton, Pa. App. filed April 6, 1915. Improvements.
- 1,265,749. SIGNAL BOX WITH LOCAL ALARM MECHANISM; Frederick W. Cole, Newton, Mass. App. filed May 10, 1915. Box having a normally unwound signaling mechanism.
- 1,265,751. SIGNALING SYSTEM; Roy D. Conway, Chatham, N. J. App. filed July 9, 1917. Signaling on composite telegraph and telephone circuits.
- 1,265,765. ELECTROTHERMOSTATIC DEVICE; Harry A. Ferris, Cheyenne, Wyo. App. filed March 2, 1917. Devices for shifting valves or the like, etc.
- 1,265,820. FLASHLIGHT; Edward W. Seymour, New York, N. Y. App. filed April 10, 1917. Pocket lamp.
- 1,265,829. ELECTRIC RAILWAY SYSTEM; Kenneth E. Stuart, Philadelphia, Pa. App. filed Aug. 29, 1914. For electric railway system where the motor cars are automatically controlled.
- 1,265,830. POLARIZED REPEATING SOUNDER; Adolph Swoboda, Montclair, N. J. App. filed Sept. 13, 1915. Telegraph sounders.
- 1,265,849. ELECTRIC WATER HEATER; Jesse F. Wheelock, Dobbins, Cal. App. filed May 19, 1914. Improvements.
- 1,265,851. MECHANISM FOR INSTALLING TRANSMISSION-LINE WIRES; Harry C. Williams, Irvington, N. J. App. filed Nov. 2, 1917. Improvements.
- 1,265,873. BRUSH MOUNT FOR ELECTRIC MOTORS; Joseph Berg, Chicago, Ill. App. filed Jan. 27, 1917. Improvements.
- 1,265,875. PIPE CONNECTION; Carl H. Bissel, Syracuse, N. Y. App. filed June 2, 1913. Pipe connection for electrical conduits and service boxes.
- 1,265,879. COMBINATION TERMINAL AND FIXTURE BOX; David Byrne, Toledo, Ohio. App. filed July 30, 1917. Provides a means whereby a terminal box or plate can be formed into a fixture box or plate.
- 1,265,884. ELECTRIC REGULATION; John L. Creveling, New York, N. Y. App. filed Sept. 29, 1911. Automatically regulating

dynamo when used to charge a storage battery.

- 1,265,885. LIGHTING FIXTURE; David Crownfield, Cambridge, Mass. App. filed Dec. 4, 1916. Lighting fixture for use on the walls of a hospital ward.
- 1,265,887. TELEGRAPH KEY; Benjamin de Alcala, New Orleans, La. App. filed March 6, 1917. A telegraph key which automatically completes the circuit.
- 1,265,911. MULTIPLE-FRICTION-DISK DEVICE; Clark T. Henderson, Milwaukee, Wis. App. filed Feb. 1, 1913. Improvements that provide for the ventilation of the disks, etc.
- 1,265,918. CIRCUIT BREAKER AND DISTRIBUTER UNIT; William O. Kennington, Detroit, Mich. App. filed April 14, 1916. For ignition apparatus.
- 1,265,927. HEAT-REGULATING SYSTEM; Harry Lewis, William R. Scott and Charles Dell, Pittsburgh, Pa. App. filed June 1, 1916. Involves use of a thermostat and a valve with an electromagnet.
- 1,265,945. ELECTRIC FURNACE; Hans Nathusius, Friedenshutte, Kreis Beuthen, Germany. App. filed Jan. 15, 1914. Heated by means of electric resistances.
- 1,265,959. ROTARY SPARK GAP; Robert C. Richter, New York, N. Y. App. filed April 13, 1917. Spark gaps used in radio communication.
- 1,265,973. ELECTRIC ZINC-DISTILLING FURNACE AND CONDENSER; John Thomson, New York, N. Y. App. filed Jan. 19, 1916. Furnaces and condensers for the metallurgy of zinc.
- 1,265,998. METERING PANEL; Henry H. Curtis, Springfield, Mass. App. filed April 6, 1917. Assembles blocks or sections of insulating material.
- 1,266,006. CABLE CONSTRUCTION; Henry W. Fisher, Huguenot Park, N. Y. App. filed July 10, 1916. Method used in construction of a multiple-conductor cable.
- 1,266,057. ELECTRIC BRAKE DEVICE; Alson C. Sargent Des Moines, Iowa. App. filed Oct. 12, 1915. For automobiles.
- 1,266,062. ELECTRIC MOTOR FOR TALKING MACHINES; Howard A. Selah, Newark, N. J. App. filed Dec. 7, 1915. Direct-current induction motor for operating the turntable of talking machines.
- 1,266,063. MAGNETO; Luther J. Severson, Constantine, Mich. App. filed Aug. 10, 1908. For high-tension ignition system.
- 1,266,094. ELECTRIC WELDING MACHINE; Edmund J. von Henke, Lynn Mass. App. filed May 14, 1917. Embodies a transformer.
- 1,266,095. MULTIPLE FUSE; Louis B. Bennett, Detroit, Mich. App. filed March 26, 1917. Fuses mounted in a screw-plug engage with a socket fitting in the electric circuit.
- 1,266,101. SIGNAL DEVICE FOR AUTOMOBILES; William J. Bunyan, Cleveland, Ohio. App. filed Oct. 12, 1917. Red and blue lights are controlled by a switch.
- 1,266,114. CORD TERMINAL; Arthur E. Francis, Cleveland, Ohio. App. filed Aug. 17, 1917. Connectors adapted for connecting wires with spark plugs of internal-combustion engines.
- 1,266,143. SPRINKLER ELECTRIC SIGNAL SYSTEM; James D. Nelson, Cincinnati, Ohio. App. filed April 19, 1917. For supervising sprinkler system.
- 1,266,114. ELECTRIC SIGNAL SYSTEM; James D. Nelson, Cincinnati, Ohio. App. filed May 5, 1917. For indicating a flow of water through automatic fire extinguisher systems.
- 1,266,150. ELECTRIC SIGNALING SYSTEM FOR RAILWAY TRAINS; Nicholas Pignataro, Hilton, N. J. App. filed Jan. 16, 1914. Safety appliances for railroads.
- 1,266,158. RAILWAY-TRAIN DISPATCHING CIRCUIT; William Reid, Chicago, Ill. App. filed Sept. 8, 1914. Provides a balanced receiving circuit.
- 1,266,166. BATTERY CELL; John C. Sangers, Cleveland, Ohio. App. filed Oct. 15, 1917. Dry-cell type.

- 1,266,175. LIGHTNING PROTECTOR; Nikola Tesla, New York, N. Y. App. filed May 6, 1916. Lightning protectors in which the terminal has a large surface.
- 1,266,180. ELECTRIC CONTROLLER; Herbert S. Valentine, Philadelphia, Pa. App. filed June 30, 1915. Controller finger automatically adjusts itself.
- 1,266,190. CIRCUIT-CHANGING SWITCH; Arthur H. Adams, Sparkill, N. Y. App. filed Dec. 9, 1916. Register controller in automatic telephone systems.
- 1,266,206. ELECTRIC SWITCH; Charles W. Brockett, Brooklyn, N. Y. App. filed June 26, 1916. Key-socket type.
- 1,266,209. ELECTRICAL GROUND; Thomas W. Byrne, Boston, Mass. App. filed March 16, 1917. Ground of carbon, which is non-corrosive.
- 1,266,259. GEARING; Otto Helms, New York, N. Y. App. filed July 27, 1916. Improvements.
- 1,266,287. HIGH-FREQUENCY APPARATUS; Antonio Longoria, Cleveland, Ohio. App. filed Aug. 10, 1914. For therapeutical purposes.
- 1,266,302. DYNAMO-ELECTRIC MACHINE; Alfons H. Neuland, New York, N. Y. App. filed Feb. 10, 1915. Alternators have relatively low angular and peripheral speed; suitable for wireless signaling.
- 1,266,303. ELECTROMAGNETIC POWER-TRANSMITTING APPARATUS; Alfons H. Neuland, San Francisco, Cal. App. filed Aug. 8, 1914. Adapted to transmit power from one rotatable element to another.
- 1,266,329. ELECTRO-OSMOTIC EXTRACTION OF WATER FROM ANIMAL, VEGETABLE AND MINERAL SUBSTANCES; Botho Scherwin, Frankfurt-on-the-Main, Germany. App. filed Nov. 20, 1912. Electro-osmotic process in conjunction with mechanical pressure.
- 1,266,330. PROCESS FOR REMOVING LIQUID FROM STEATITE; Botho Scherwin, Frankfurt-on-the-Main, Germany. App. filed Nov. 11, 1914. Removing of water from steatite by electro-osmosis.
- 1,266,347. ELECTRIC METER; Elihu Thomson, Swampscott, Mass. App. filed April 6, 1916. Direct-current meter of the motor type.
- 1,266,377. CONDENSER; E. F. W. Alexander, Schenectady, N. Y. App. filed Nov. 26, 1915. For the protection of distribution systems.
- 1,266,388. DYNAMO-ELECTRIC MACHINE; Sven R. Bergman, Nahant, Mass. App. filed May 13, 1916. Embodies a distributed compensating winding.
- 1,266,389. AUTOMATIC WIRELESS APPARATUS FOR PREVENTING COLLISIONS; Harry D. Betz, Kansas City, Mo. App. filed Dec. 20, 1913. Wireless apparatus for automatically stopping a railway locomotive.
- 1,266,405. RAILWAY SIGNAL AND TRAIN-STOP SYSTEM; John B. Casselman, Oakland, Cal. App. filed June 29, 1914. Automatic signal system.



1,266,302—Dynamo-Electric Machine

- 1,266,420. SWITCH; William W. Dean, Chicago, Ill. App. filed Nov. 7, 1913. For electric alarms for motorcycles, etc.
- 1,266,421. SIGNALING DEVICE; William W. Dean, Chicago, Ill. App. filed May 18, 1914. For use in connection with automobiles, motorcycles, etc.
- 1,266,424. ELECTRIC SWITCH; Frank C. De Reamer, Schenectady, N. Y. App. filed Dec. 11, 1916. For vacuum cleaners.
- 1,266,434. PROTECTION AGAINST EXCESSIVE VOLTAGES; Hans Engel, Charlottenburg, Germany. App. filed July 14, 1915. For preventing current rushes and excessive voltages when transformers are connected to high-voltage supply circuits.

Electrical World

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Number 24

Atlantic City Convention of the N. E. L. A.

SERVICE in its highest, deepest, broadest sense was the nucleus about which the convention activities of the National Electric Light Association at Atlantic City this week concentrated. There was no escape from its spell. Conscious of its ability and power as a creative and directive force in the community and in the nation, this association of public utility interests solemnly pledged its all to the government in the holy cause in which we and our allies are now engaged. Is there, can there be any doubt of the whole-hearted patriotism of the central-station companies of America? Have they not endured suffering and privation in a material and monetary sense at the hands of the government? Have they not been chastened and sorely tried in spirit by the uncertainties and the realities of legislation? And have they not borne all gladly and willingly because it was for the public good? One motive dominates, and one only—service. Selfishness has no place in it. The spirit of sacrifice which animates the American people also animates the electric lighting interests, and while the reward of victory will eventually and surely come to us as a nation, recognition has already in large measure been attained by the electrical industry.

The war has done more for the electrical industry during the past year than all other agencies combined. It would appear as though the nation had discovered electricity anew, so confidently and enthusiastically do the government and the war industries turn to it for the power to fashion and weld the thunderbolts which our brave soldiers hurl at the enemy. We need production of food, ships, munitions and other things to win this war. Time was when the prowess of one human being was matched against that of another, hilt to hilt; but that time has passed. Nation now faces nation, production is matched against production and engineering skill against engineering skill. The final victory will be won "over there," but only because of the production "over here," and the greatest aid to that production is electricity. Therefore, the obligation to supply that electricity is very real, and it is comforting to feel that the central-station interests realize it and that the Fuel Administration stands ready to aid.

We commend to the prayerful consideration of every public utility executive and operator the address of Samuel Insull, delivered at the Thursday night session of the association. From the wealth of his experience with the largest central-station system in the world he spoke authoritatively and reassuringly of the outlook. Naturally he is gratified at the trend of developments and the belated recognition of the economy of concen-

trated power production from superstations. It needs no second taste to detect the seasoning which makes the dish so palatable to American operators. Mr. Insull has been the leading exponent of the central-station industry in that cause and in the welding together of great distribution networks. The striking passages of Mr. Lieb's admirable presidential address also will bear much re-reading, indorsed as they are by the committee to which they were referred and by the association. It would be difficult indeed to find any vital phase of central-station operation that was overlooked in the convention program or on which advice and guidance were not freely given. Certainly the coal situation and the financial situation, the two most pressing problems, were adequately presented and discussed from all angles.

Certain outstanding features of the convention were so apparent that they could not but impress themselves on the consciousness of all in attendance. The necessity for storing coal before the winter and of using it economically was manifest both from the warnings of the Fuel Administration representatives and from the testimony of utility operators themselves. Nor could sight be lost of the fact that electricity must be conserved for war industries and withheld from industries under the ban of the administration. Wider interconnection of generating systems with a view to the saving of money, equipment, coal and transportation, not to mention the increase in the reliability of service, must obtain and may be insisted on if the war is of long duration. The utilities must also, if they are to be kept in condition to render good service, be granted an increase in rates. On their part they must husband all their financial resources, curtail extensions and endeavor to arrange their financial affairs without much assistance from the government. Certain economies are possible in power-house operation and in distribution circuits, and these should be effected as speedily as possible for patriotic as well as for selfish reasons. Maximum output and use must be found for all apparatus, labor must be spared, and attention given to the substitution of female for male help in various departments. Opportunities in the electric vehicle field for relieving transportation congestion and for hastening distribution in industrial plants should not be overlooked by central-station companies in their endeavor to measure up to their enlarged standards of service in helping to win the war.

With due consideration and study of these important points in a broad and patriotic spirit there can be no doubt as to the ultimate outcome. The central-station industry is destined to go forward; the war has pushed it on, and under that impetus it can outrun all calculations if those in charge will it so.

Interconnection Does Not Mean Monopoly

AS THE interconnection of central-station and transmission systems develops into a general network of energy supply, it is important for the local publics concerned to realize that such a program is primarily an efficiency measure. War accelerates negotiations between interests which in peace times might work for years with little or no physical co-ordination. The necessity for accomplishing results at lower unit cost is enormously increased as a nation of highly complex industrial organization goes deeper and deeper into the conflict. Hence many steps are taken to meet acute national needs which in normal times could not be carried out except at the price of protracted public discussion, prolonged negotiations and often needless delays. The emergency nature of many things done under the stress of war conditions, however, should not prevent utility managements from clearly setting forth their economic benefits, their patriotic value and their freedom from ulterior motives.

We say this because there is a feeling in some quarters that interconnection of electric systems is being furthered chiefly that a monopolistic control of distribution may be established. Even in the minds of some public utility commissioners there exists an opinion that interconnection is a camouflage for absorption. As a practical matter, interconnection is fundamentally a give-and-take affair, worked out in relation to such technical variables as local loads, available generating capacity, size of conductors on lines, installed transformer ratings, stages of water in streams and reservoirs, duration and extent of demands, location of demands, and cost of fuel, labor and unit power, whether primary or secondary. In a well-worked-out plan energy may be fed in one direction to-day and in the opposite direction to-morrow, or such a reversal may occur during a single twenty-four-hour period. By and large, the idea is simply to generate, transmit and distribute energy at specified points at the lowest attainable cost, conserving fuel, labor, water, supplies and capital outlay as well to the utmost consistent with first-quality service.

Given a workable agreement among the parties to an interconnection scheme, the question of ownership is really no test of its value. There may be, of course, a monopolistic intent behind any co-operative plan, but the fact that co-ordination of agencies is sought is no indication of it. Team play in energy interchange between adjacent utilities is primarily an economic affair; it should be judged according to the engineering and commercial benefits which it insures, and not by the possibility of abuse arising from community of interest.

There are plenty of ways in which the public welfare can be safeguarded against exploitation; in fact, the publicity necessary to-day before utilities may formally unite and issue securities therefor with the approval of a public regulating board leaves little to fear from the advance of the usual interconnection scheme. Early setting forth in each case of the benefits to all interests from such a program will go a long way to disarm ill-advised criticism and to convince the public and the service commissions which protect its interests that the plan is a praiseworthy one.

Interconnecting New England Power Stations

THE shortage of coal in New England during the past season has been a very serious matter, affecting generating stations all over the territory, and the situation threatens to be little if any better during the coming season. The warning has already gone out that trouble in transportation is to be looked for. Particularly pertinent therefore at the present time is the study of interconnecting plans for New England stations developed by L. L. Elden, the accomplished engineer of the Boston Edison company, embodied in an address before the New England Central Station Power Engineers' Association and noticed in an article in our issue for June 8. In brief, he estimates that within the New England territory interconnections can be made at a cost of about \$2,750,000 which would be sufficient to release 50,000 kw. in equipment for additional service. New England is, on the whole, covered by power distribution systems, but they have not been as yet skillfully interconnected as a whole. The Boston Edison company gathers between 400 and 500 square miles (from 100,000 to 130,000 hectares) into its distribution territory. South of Boston, running all the way down to Fall River, are other systems, each covering its own district but not working in co-operation. To the northward lie plants along and near the coast as far as Portsmouth, N. H., and inland to Lowell, Mass., and Manchester and Concord, N. H., all with more or less scattered service and yet not gaining the advantages of unity.

Westward there is another great territory, in part reached by the hydroelectric system of the New England Power Company, with stations on the Connecticut and Deerfield Rivers. Plans are now under way for bringing this power into Boston; it already reaches Fitchburg, Worcester and Providence, as well as some nearer points. Mr. Elden's proposition looks to a thorough linkage of all these distribution networks so that the aggregate capacity of all will be available throughout the whole territory taken in. To the south there is no difficulty in linking the lines so as not only to interconnect them with the Boston Edison company but, without much difficulty, with the New England Power Company as well, providing what amounts to a ring system of distribution. To the northward interconnections with the Edison company are already in force and may be easily extended, while it is no long reach from the northern lines of the New England Power Company to those in the Merrimac Valley and again those in eastern New Hampshire. The practical result would be to gather into one physical entity electric lines serving a territory reaching from Providence and Fall River on the south to Manchester, Concord and Portsmouth on the north, covering, with its connections already existing, the major part of the great manufacturing territory of New England.

Could this be accomplished before winter sets in, as is perfectly possible, the fuel situation would be very much relieved, for most of the deliveries could be then made at various tidewater plants. A considerable number of small stations, relatively inefficient, could be shut down altogether, and Mr. Elden estimates the annual reduction in coal consumption at at least 70,000 tons, no insignificant amount at present prices and with the increasing stress on transportation facilities. It is a

large but particularly sensible project which he has set forth, and if carried out it would be of great benefit to New England territory. The distances to be covered are altogether conservative. There is no need for extreme voltages and no call for any construction of extraordinary difficulty or cost. As to feasible methods of accomplishing such interconnection, the necessary pooling of interests for direct action might not prove to be easy, but the formation of a subsidiary company to attend to the distribution on a fair basis of cost to all the contributing companies ought to be easily within the bounds of possibility and could carry out the work quickly and effectively.

The project outlined as a whole strikes us as being a particularly desirable one, to which very careful attention should be given.

Secrecy in Research for War Purposes

MUCH of research and development work done under the direction of the Council of National Defense is shrouded in deep mystery. Not only are the subjects and the methods of investigation treated as confidential but even the places and the persons doing the work are not supposed to be generally known. It is only natural that the general public should be curious to know what is being done and what results have been achieved, and there is a still more natural desire on the part of various specialists to learn of the difficulties and methods of attack. Thus, electrical engineers at large like to know what special electrical problems are confronting the army and the navy, what is being done to solve them, and who are the trusted ones chosen to do the responsible work.

While the ELECTRICAL WORLD realizes the duty of keeping its readers fully informed up to the minute upon the electrical features of the great war, it also is aware of its higher duty to the country of not giving out information that may help or give comfort to the enemy. In most cases important information is impossible to obtain anyway, but even where an interesting item of confidential war news of an electrical nature has been learned inadvertently through some local worker in the field the editors without hesitation place their duty to the country above that to their readers and withhold such items from publication.

Apparently the great majority of our readers fully appreciate this delicate situation and are satisfied with the general items of news, such as those giving the personnel of the various central administrative committees of the Council of National Defense and of its affiliated bodies. The number of "registered kicks" has been remarkably small and probably does not represent the actual amount of dissatisfaction in the electrical ranks. Chief Engineer A does not understand why Chief En-

gineer B of another company has been appointed chairman of the committee on "electric sparks for the navy," while he, who knows infinitely more about sparks than B, has not even been asked to serve on the committee. He wants to know how little the committee has accomplished so as to have a tangible reason for telling his friends at the club that things are pretty rotten over in the little district between Maryland and Virginia. Also Professor X can hardly believe his ears when he finds out that his colleague, Professor Y, whom he never considered his equal, has had allotted to him some mysterious problem on micro-amperes the nature of which even the president of the institution is not allowed to learn. Now Professor Y walks on the campus with the air of a superior being, while Professor X feels mortified and slighted, almost to the point of doing something which will redound to the benefit of the country on his own hook.

Opinion has been expressed that an extreme secrecy in war research is unnecessary in most cases, because the Germans are ahead of us in the defensive and offensive weapons of modern warfare and in finding substitutes for scarce supplies. But these critics forget that considerable interference with the progress of the work would undoubtedly result were not the problems kept secret. With fires and explosions occurring frequently even in well-guarded munition factories, what chance would an individual scientific investigator have against the destruction of his apparatus and data by malicious persons? Moreover, the enemy must not know when we have solved a problem, nor should he get comfort from the knowledge of our failure or delay in obtaining a solution.

There is another reason for which much of war research must remain secret, and that is to avoid public discussion and controversies that would delay the work. Doing government work secretly and without the benefit of professional criticism is rather unusual and contrary to the spirit of this country, so that we are all the time tempted to "butt in," forgetting the unusual conditions under which the country is laboring and that this is literally the case of "à la guerre comme à la guerre." The war has forced us to be secretive, almost undemocratic, and this change should be one more powerful reason for making a supreme effort that this war shall be the last.

Some of the highest and best representatives of the electrical and other professions have been called into the principal committees that guide the research activities of the numerous workers throughout the country, and this fact alone would be a sufficient safeguard to insure that on the whole the work is being done efficiently and honestly. For the rest, our first duty as specialists is to register our qualifications with the proper governmental agency and to keep ourselves in readiness to do our share if and when called upon.

FROM all appearances a serious fuel situation will exist next winter; therefore every effort should be made to eliminate unnecessary and wasteful uses of electric energy, to improve the efficiency of steam production and utilization, and to procure fuel before the winter rush sets in. What New England industrial plants are doing along these lines will be discussed in a coming issue.

The Coming Issues

Another subject of interest to central-station engineers will treat of the use of iron wire for series lighting circuits, and particular attention will be directed to economic considerations. Other articles scheduled for early appearance will deal with features of construction employed on long-span mountain lines and with the development of search-lamps.



The N. E. L. A. "Win the War" Convention

President Lieb Sounds the Keynote in Stirring Patriotic Address, and Strong War Resolutions Are Passed While Current Problems Are Considered—
W. F. Wells Elected President

WAR conditions touched the attendance at the convention of the National Electric Light Association at the Hotel Traymore, Atlantic City, on Thursday and Friday of this week, but they did not dampen the enthusiasm of the delegates for the country which they serve or lessen the readiness to make every atom of sacrifice to win the war. Under the call of national necessity there was a remarkable concentration of thought, purpose and pledge covering all the resources and wide activities of a great industry. The business done was vital to the utilities. It was an earnest promise of co-operation in every government measure. It was a vigorous assurance of help in every possible way leading to victory.

The Opening Session

When President John W. Lieb let his gavel fall at 9.40 o'clock on Thursday morning for the forty-first convention, the thirty-fourth annual meeting, he looked upon an audience which included many men notable in the industry. Devotion to war-service needs was the keynote from the beginning of the first session.

Following the brief introductory remarks of Mr. Lieb a hearty "welcome to the city" was extended by Mayor Bacharach.

A letter to Mr. Lieb from Thomas A. Edison was read by Secretary T. C. Martin. Mr. Edison, expressing regret that war-service duties made it impossible to be present, wrote:

"I am much pleased to note the active part which the industry is taking in making available to the government the vast resources in men and materials which the central stations have available, and the hearty response which their employees have given to the call for service at the front and in all kinds of co-operation in the war activities of the government."

During the reading of the presidential address W. F. Wells occupied the chair.

Mr. Lieb's address was not only a discussion of the work of the year and a presentation of the large problems of the industry under war conditions; it was also a fine, strongly patriotic outline of our national ideals and unswerving purpose in the war.

"If we take a broad-minded survey of the whole field, and consider all the circumstances and conditions surrounding our national life," said Mr. Lieb, "we must come to the conclusion that what has been accomplished is nothing short of miraculous."

Defining the electrical industry as including electric railway, telephone and telegraph, electric light and power systems, and manufacturers on whose output these enterprises depend, Mr. Lieb said that this important industry employs 920,000 men, represents \$10,750,000,000 invested capital, and annual output of \$2,675,000,000. Of these totals the electric light and power industry represents 125,000 men, \$3,000,000,000 invested capital and annual business of \$575,000,000. This branch of public utility service "has become a prime necessity of our civilization, assuming an importance in our economic structure second only to our great railroad systems."

In regard to linking up the regional systems, Mr. Lieb said: "At the present time there is imperative need that our member companies take an advanced position in this matter, in order that every possible advantage may accrue to the nation and its war necessities from the saving in fuel, in plant capacity, in service reliability, and in economy of operation, that is possible through interconnection, exchange of current, and joint operation between adjoining systems."

In going into general economic conditions, President Lieb said that the higher operating costs and the difficulties of getting corresponding advances in rates present a most serious situation that requires the earnest and urgent consideration of the national government.

Mr. Lieb, however, appealed to "every central-station company in the country to go to the very limit of its

power in meeting the urgent requirements of the government, and to respond in a spirit of patriotism and sacrifice to the needs of the nation."

The coal outlook was discussed exhaustively, Mr. Lieb indicating the concern of managers over the coming winter.

Describing the compliance with fuel conservation movements, Mr. Lieb also spoke of the fact that the advancement of the clock to be operative all the year instead of during a limited spring and summer season would have important economic advantages, and would render available a large additional capacity in power plants to be applied to satisfy the present unsatisfied demand of war industries.

A hope for development of the stupendous national asset in water powers was expressed by Mr. Lieb. After taking up labor conditions the president went more into detail on rate-making problems. He showed them the work of the N. E. L. A. and member companies in the war, giving in addition the data on war contributions printed on this page.

The address of Mr. Lieb was received with great applause, and was referred to a committee consisting of Samuel Insull, Joseph B. McCall and Charles L. Edgar.

In the absence of W. H. Atkins, treasurer, his report was read by Frederick Schmitt.

T. C. Martin presented his annual report as secretary.

After Walter Neumuller had read the report of the membership committee President Lieb called upon the sections.

R. J. McClelland, for the Technical and Hydroelectric Section, appointed a nominating committee.

William Schmidt, Jr., reporting for the Accounting Section, announced the following officers for 1918-19: Chairman, Paul R. Jones; vice-chairman, R. W. Symes; treasurer, C. E. Calder; secretary, Frederick Schmitt.

E. S. Mansfield reported as chairman of the Electric Vehicle Section and appointed a nominating committee.

A brief report was also made by E. A. Edkins, chairman of the Commercial Section, and a nominating committee was similarly appointed.

President Lieb then brought up the work of the geographic sections. A. H. Halloran, who had met with the executive committee, had presented three suggestions which will be referred to a committee to be appointed by the incoming president.

An address by Arthur Wright of London, England, who was in this country recently, on "War by Civilians," was then read by Secretary Martin. Apart from its vigorous remarks on the war, Mr. Wright's address touched on the position of the electrical industry as

MEMBER COMPANIES' WAR CONTRIBUTIONS

Liberty loans:	Amount
First loan—Company purchases of bonds	\$6,567,950
Second loan—Company purchases of bonds	9,552,800
Third loan—Company purchases of bonds	13,134,500
Total	\$29,555,250
	Number
First loan—Employees' purchases of bonds	35,108
Second loan—Employees' purchases of bonds	35,212
Third loan—Employees' purchases of bonds	53,278
Total	123,598
War Saving Stamps, amount sold	\$680,728.91
	Number
Employees engaged in campaign	6,778
Officers utilized in campaign	618
Red Cross subscriptions—company	\$1,095,159.67
Red Cross subscriptions—employees	44,129 372,786.02
Total	\$1,467,945.69



PRESIDENT-ELECT W. F. WELLS

forming a useful illustration of the stimulating effect of war on trade. He said in part:

Electrical power is now recognized as one of the most useful agents in producing the various kinds of war munitions. In most European countries an ever-increasing demand for power has been experienced at much higher costs and rates than in pre-war days. During the last three years in England the tremendous demand for all kinds of manufactured accessories has caused the government to distribute broadcast huge orders for materials and articles among an endless variety of small engineering, woodworking and textile shops with the result that a wholly unexpected demand from them for electrical power, motors, cables, switches, lamps, etc., has occurred.

Unfortunately, the electrical utilities in the early years of the war, owing perhaps to the belief in its probably short duration and to the higher price of money, materials and labor, allowed their active power plant, stocks of materials and standby plant to get into a state of disrepair and low in quantity,

so that when the demand for additional power came in 1916 and 1917 they were unprepared, in many cases, to meet it or began overloading the plant with the usual consequences of frequent breakdowns. Some other electrical industries have not benefited by the war, such as those dealing in expensive lighting fixtures and luxury appliances, yet the manufacturers who have understood the altered conditions have not only benefited greatly by the war demands, but have indirectly materially helped their country.

If public service commissioners can be convinced of the very essential nature of electrical power in war times and made to realize how seriously the present high price of money, plant and labor must affect the cost of producing electrical energy, it surely should not be difficult to obtain their consent to raise the rates to meet these present higher costs. Thus utilities would be assured of a fair return on any existing or new investment required to meet the increased demand for supply during the period of the war and the subsequent years of reconstruction with their multiple problems.

E. W. Lloyd opened discussion on "Line Extensions in War Time." He contrasted the old conditions, under which central stations had optimistically thought it good policy to make line extensions, with present conditions, where inability to raise capital and scarcity of materials and labor have forced a reversal of practice. He urged the appointment of a committee to consider the subject and make recommendations.

Many interesting points were brought out in the dis-



PAST-PRESIDENT J. W. LIEB

cussion, in which W. H. Johnson, T. I. Jones, C. D. Marsh, D. H. McDougall, James T. Hutchings, M. R. Bump, V. E. Bird, L. H. Scherck, H. C. Abell, W. P. Schwabe and J. W. Lieb took part.

Thursday Afternoon Session

Thursday afternoon's session was devoted to reports from three committees—the National Committee on Gas and Electric Service, of which J. W. Lieb is chairman; the National Committee on Public Utility Conditions, P. H. Gadsden chairman, and the public policy committee, W. W. Freeman chairman—and a symposium on labor problems of the hour.

FINANCIAL RELIEF ONLY THROUGH GOVERNMENT

Mr. Gadsden very impressively pointed out the inadequacy of rates to meet present conditions and declared that relief from the existing critical financial condition is only available through the help of the government. Not only are operating expenses higher than ever before, but \$250,000,000 in public utility securities will mature during 1919, and enormous investments are required to provide the increased service demanded by war industries. To provide the additional station and substation equipment alone, nearly \$200,000,000 will be required in 1918. The serious part of the situation is that ordinary channels of financing are not open owing to the war conditions.

Even if the government's help can be secured in meeting maturity of securities and in obtaining money for extensions, however, the fundamental problem still remains—that of securing rates which will permit the companies to exist.

While a few scattered commissions had granted increases of rates to meet war conditions, the committee on public utility conditions thought it could obtain

more prompt relief by securing government action on the matter. By showing that the central station business is the very foundation of war industries and an absolute essential to the prosecution of the war, the committee was successful, through Secretary of the Treasury McAdoo, in securing an expression of opinion from the President of the United States, who said: "It is essential that these utilities should be maintained at their maximum efficiency and that everything reasonably possible should be done with that in view."

With this expression of opinion in hand, the committee has endeavored to open the eyes of the state commissions and local regulatory bodies to the national importance of adjusting rates. To do this, it has appointed committees in every state whose duty it is to call attention of these bodies to the desperate condition of public utilities and to show how intimately their success is connected with the national welfare. It is the hope that this committee can work out the salvation of the industry. Between 600 and 700 rate increases have been allowed since Jan. 1, 1918.

The Investment Bankers' Association thoroughly sympathizes with the committee regarding the situation and has established committees in several Middle West states to assist in bringing about rate adjustments. The American Bankers' Association has also offered its co-operation.

Expressing the opinion of the National Committee on Public Utility Conditions, Mr. Gadsden said that he is firmly convinced that the federal government has the right to fix rates of public utilities that will enable them to exist in time of war. Whether it can be induced to do so remains to be seen.

In trying to obtain relief from the War Finance Corporation for financing new extensions, the committee was greatly discouraged by the corporation's decision that it could not give relief and that help would have



SECRETARY T. C. MARTIN



VICE-PRESIDENT BALLARD

to be secured through banking channels, despite the fact that the committee had already tried this and every other obvious course. Ever since this decision the committee has been making further efforts.

Mr. Gadsden referred to the remarks of Mr. Warburg, Federal Reserve Bank, who emphasized the nation's need of investors' savings, saying that these cannot be obtained unless corporations be placed on a financially successful basis. In closing the speaker invited the hearty co-operation of all in the industry in finding relief from the problems named.

In presenting the report of the National Committee

on Gas and Electric Service, J. W. Lieb called attention to various problems which this committee has helped the government in solving. Among them were the following: Service to cantonments, fuel supply, curtailment of lighting, coal zoning system, oil conservation, power supply, enabling coastwise ships and navy to travel through danger zones without being detected by the smoke from their stacks, night lighting, and shortage of equipment.

INDORSEMENT OF PRESIDENT LIEB'S ADDRESS

Samuel Insull, chairman of the committee to which President Lieb's address was referred, made a report



TREASURER F. W. SMITH



P. H. GADSDEN

expressing high appreciation of the views which it contained.

"The address," said Mr. Insull on behalf of the committee, "with singular clearness and in the broadest spirit reflects the attitude of the association and its members toward the great problems which are confronting our country at this crisis in the world's history.

"It is clearly our duty, as he so admirably indicates, to use every possible human effort, to make every sacrifice and to devote our time to the supreme business of the moment—the winning of the war, to the successful conclusion of which every true American should be pledged."

The committee on the president's address presented the resolution published on page 1252 of this issue, which was adopted with great enthusiasm.

PUBLIC POLICY COMMITTEE

W. W. Freeman, chairman public policy committee, presented a report showing that the first year of war produced many results of radical character affecting company operations. Cost of every element entering into service increased in startling degree, and there was correspondingly increased difficulty in securing satisfactory quality in materials and workmanship. The labor problem has been unavoidably complicated by enlistment and conscription and further government requirements.

"With all of these war operations, we are in the heartiest accord and willingly accept the difficulties which they necessarily involve."

It must be evident, however, says the report, that when operating costs increase enormously, there must be a corresponding increase in income if service is to be maintained and financial stability insured.

Consideration of increased rates for service has become a matter of necessity to member companies. The

rate of return allowed to the companies has been far below the profits realized and approved for other commercial enterprises and generally no margin of safety has been allowed for fluctuation in expenses or unusual contingencies.

"The utilities companies do not ask or desire war profits," the report says. "They are, however, amenable to the same axiomatic laws as other lines of business and cannot alter the rules of arithmetic in their favor or make their dollars go any further in paying bills than can others. This merely means that rates absolutely must be increased, as necessary, to meet new conditions."

Conservation of capital was also considered. Hearty and vigorous co-operation of member companies in every effort and campaign with relation to the war was recognized as a noteworthy activity of the year.

In the concluding section the committee said:

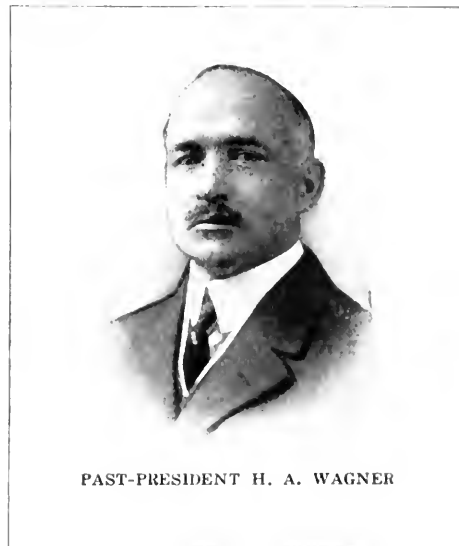
"We are absolutely united in the idea that all other interests and considerations must be secondary to the quickest possible winning of the war, and the victory of the Allies must be complete and final, no matter how long it takes or how much it costs."

Friday Morning Session

Flag Day exercises, with bugle, the reading of "The American's Creed" by Secretary Martin and the unfurling of the flag opened the Friday morning session.

President Lieb announced the appointment of a committee on line extensions as recommended by E. W. Lloyd on Thursday. The committee is: E. W. Lloyd, chairman; R. S. Hale, Alex Dow, H. C. Abell and M. R. Bump.

Herbert A. Wagner then made a general presentation



PAST-PRESIDENT H. A. WAGNER

of "The Coal Situation as Affecting Public Utilities." This opened a broad discussion covering many phases of the coal problem.

Mr. Wagner emphasized the seriousness of the coal situation and reviewed the figures of estimated production and demand for consumption this year. He called attention to the need of coal for shipping and the navy, comprising the first demand to which everything else must give way, and to the requirements for war industries. The points brought out by Mr. Noyes and Mr. Insull in the addresses of Thursday evening were also summarized by Mr. Wagner.

As the primary question is not one of coal production but one of coal transportation and it is not expected that transportation conditions will be improved it is necessary to look to methods of conservation and greater economy. Much emphasis was placed by Mr. Wagner upon the importance of storing coal during the summer months.

The need of conserving energy and the waste of carbon lamps were urged by Mr. Wagner.

In concluding, the speaker called attention to the laws against discrimination between consumers and to the necessity that the federal or state officials give authority to the companies to withhold energy supply from some customers when it is decided by the government that this step is required as a war measure.

At this point a nominating committee was appointed, with J. B. McCall as chairman.

REPORT ON RESUSCITATION FROM SHOCK

Before proceeding with the discussion on the coal situation President Lieb introduced W. C. L. Eglin, who presented the report of the committee on safety rules and accident prevention and of the new Commission on Resuscitation from Shock.

The committee on safety rules and accident prevention included what was formerly known as the accident prevention committee. It was organized with a separate sub-committee on accident prevention with Charles B. Scott as chairman. The activities of the main committee have been somewhat restricted during the year, but the sub-committee on accident prevention has held meetings periodically as it was felt that work of this character should proceed in so far as possible undisturbed and that active and diligent work on the part of safety departments and others was necessary when the man power of the industry and the nation must be conserved to the fullest extent.

In reference to circular No. 54 of the Bureau of Standards Mr. Eglin said that in view of the situation confronting all utilities it was deemed advisable to present the status of affairs to the Bureau of Standards. A conference was held and the general understanding arrived at was to the effect that the Bureau of Standards would, where regulatory bodies raised the question as to the promulgation of rules, continue to emphasize the desirability of any such rules conforming to those in Circular 54 and that they were to be clearly indicated as tentative and subject to a trial period.

In view of the great importance of the report of the Commission on Resuscitation from Shock and of keeping members informed at once as to the best methods, President Lieb recommended that when an interim report reaches headquarters it be sent to members. This was ordered.

COAL CONSERVATION

Philip Torchio discussed the subject of utilization of water powers as a means of coal conservation. Mr. Torchio spoke separately of the potential water powers of Eastern and Western States and emphasized that the amount of water power east of the Rocky Mountains is insignificant in proportion to the energy required by the nation. Even now in the East the water powers are an insignificant factor for supplying the B.t.u. units needed by the Eastern States. Therefore the future must depend on science to provide B.t.u.

units by economizing in the use of coal. In the meantime water powers answer a useful purpose in retarding the days of coal exhaustion. The steam plant must be the backbone of the development in the Eastern States. The use of the water powers should be concurrent with steam utilization.

George A. Orrok referred to the conditions in the anthracite districts, the available fuel in the culm banks and the possibilities of pumping coal by construction of pipe lines.

W. F. Wells discussed the question of whether it was desirable for central station companies to purchase coal mines at this time. He spoke of the experiences of several companies and gave some details of the

CARRY THE WAR TO VICTORY

Resolved, that the National Electric Light Association, in annual convention assembled, desires to extend to the President of the United States and all others in authority the assurance that in its organization and its membership it is in thorough accord with the fixed determination of the American people and their chosen representatives to prosecute the war with the utmost vigor and to a victorious conclusion, however long it may take and however much it may cost in men, money and other forms of sacrifice.

The goal we seek through the prosecution of the war is the winning of a great peace—a peace so well established that it cannot lightly be disturbed by autocratic force wedded to the doctrine that might makes right. For such an end of the war we are ready cheerfully to submit to such further restrictions of personal and corporate activities and to such further burdens upon private and corporate property and business as may be found necessary to impose upon the people and industries of the country.

We recognize as the one great menace of the future the possibility of an inconclusive peace—an armed truce which would inevitably end in a renewal of the unspeakable horrors of the present war. That must not be, and the only way to prevent it is to carry this war to victory—a victory so complete and overwhelming that the forces of evil will be glad to accept such terms as an outraged world may be willing in justice to accord. No compromise, no half-way measures, no patched-up "scraps of paper," can accomplish this great end; but only the devotion, the patience, the self-sacrifice and the undying patriotism of our people and their great allies.

With a realizing sense of the stupendous sacrifices involved, but with an abiding faith in the ultimate result, we pledge all that we have and all that we are to the holy cause.

views of the Commonwealth Edison Company on this question.

Charles E. Stuart, chief of the power and light division of the Bureau of Conservation of the Federal Fuel Administration, outlined the large plans for the conservation of light and power in the coal economy program.

R. J. McClelland, chief engineer Electric Bond & Share Company, emphasized the importance to both the commonwealth and the operating company of obtaining clean coal. Even on the very conservative assumption that the use of dirty coal has increased the total consumption 6 per cent (10 per cent in some cases), it means that 1,000,000 carloads of useless dirt

is carried every year when we have such vital need of transportation facilities. Besides congesting transportation and tying up men in this business, burning of dirty coal increases the unit cost of power production and seriously impairs the operating efficiency obtainable, thereby making fuel still scarcer.

This situation, if allowed to continue, will undoubtedly result this winter in a greater fuel famine and more serious curtailment of our industries than obtained last winter. Worse still, it may cost us thousands and even hundreds of thousands of lives of our soldiers unless this winter we speed up our program and produce the supplies and instruments for their needs. Another important link in this chain is the efficient burning of coal in our furnaces. Unless a day by day check is kept of the efficiency obtained an insidious decrease will take place, which will add another large amount of unnecessary hauling and transportation congestion. Electrification of coal mines may increase their output about 8 per cent.

Reginald Pelham Bolton emphasized that it is not the central station that is burning coal uneconomically, but domestic users and some hotel, industrial plant and heating system organizations. Employment of unqualified firemen and use of unsuitable equipment are the chief causes of waste.

Alex Dow, president of the Detroit Edison Company, said that companies are anxious to abide by the rulings of the Fuel Administration and other federal bodies, but that it is difficult, if not impossible, to do so in many localities because public utility restrictions imposed by local regulatory bodies have not been lifted. Referring to the problem of securing sufficient fuel to meet demands, he pointed out that slow movement of cars and not shortage of cars is one of the principal hindrances.

P. G. Gossler, of A. B. Leach & Company, New York, referred to a specific case where a substantial coal saving was made by avoiding unnecessary lighting, and L. S. Streng, chief engineer Louisville Gas & Electric Company, suggested prompt unloading of cars to relieve congestion of transportation facilities.

Owing to the time taken up in discussing the coal situation as it affects public utilities, the Technical Section, which assembled the latter part of Friday forenoon for presentation of reports, had little time for discussion. R. J. McClelland occupied the chair. After drawing attention to the fact that the committees had confined their attention to war-time problems he called on various committeemen, whose reports are given on pages 1260 to 1263 inclusive.

DOHERTY AND BILLINGS PRIZES

The committee on Doherty and Billings prize competition reported as follows:

Doherty Medal—H. C. Pollak, Milwaukee Electric Railway & Light Company; subject, "The Electric Range as a Distribution Engineer's Problem."

Billings Prize—G. B. Springer, Commonwealth Edison Company; subject, "Underground Construction."

Honorable Mention—B. H. Blaisdell, Manila Electric Railway & Light Company; subject, "A Kilowatt-hour and the Coal Required to Produce It." Carl Horine, Commonwealth Edison Company; subject, "Electrolytic Chlorine."

A lecture illustrated with motion pictures was pre-

sented on Friday evening by Major O. O. Ellis, Infantry, U. S. A., to show how officers and enlisted men of the army are trained by means of motion pictures.

ELECTION OF OFFICERS

J. B. McCall presented the report of the nominating committee, for which the secretary was directed to cast one ballot. The following nominees were thereupon declared elected for the ensuing association year:

President, W. F. Wells, Brooklyn; first vice-president, R. H. Ballard, Los Angeles; second vice-president, Marton J. Insull, Chicago; third vice-president, D. H. McDougall, Toronto; fourth vice-president, M. R. Bump, New York; treasurer, Frank W. Smith, New York; executive committee, to serve three years, H. C. Abell, New York; H. G. Bradless, Boston; J. E. Davidson, Omaha; to serve one year, W. H. Atkins, Boston, and P. G. Gossler, New York.

Mr. Wells was then asked to take the chair with President Lieb.

In expressing his sense of the responsibility carried by the election, Mr. Wells said:

"We will do everything we can to forward the winning of the war. All that I have and all that I am will be devoted to the great cause."

The new executive of the National Electric Light Association has been vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn for the last five years and has been a prominent figure in the electrical development of Greater New York almost since its beginning. He was born in Rahway, N. J., in 1870, was educated at Rutgers College, and joined the Brooklyn Edison company first as a draftsman in 1892. From 1894 to 1897 he was electrical superintendent of the company, which position he resigned to become assistant general manager of the Manhattan Electric Light Company, one of the pioneer electricity supply companies of Manhattan. When the New York Edison Company was formed Mr. Wells was made one of the district superintendents of the operating department. He superintended the installation of the electric plant at the immense Waterside station at Thirty-eighth Street and East River and upon its completion became superintendent in general charge of its operation. He returned to Brooklyn in 1905 as general superintendent of the Brooklyn Edison company, in charge of a great many of its activities. On Jan. 3, 1913, he was elected vice-president and general manager and director. He is also vice-president and general manager and director of the Kings County Electric Light & Power Company, vice-president and director of the Amsterdam Electric Light, Heat & Power Company and a director of the National City Bank of Brooklyn.

Mr. Wells has been active for many years in the National Electric Light Association, having held the offices of treasurer, second vice-president and vice-president. He was also president during 1915 and 1916 of the Association of Edison Illuminating Companies. In June, 1915, Rutgers College conferred upon him the honorary degree of electrical engineer. He is a fellow of the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers, Franklin Institute, the Illuminating Engineering Society, the Merchants' Association of New York, the Brooklyn Chamber of Commerce, the New York Electrical Society and the Brooklyn Engineers' Club.

Symposium on Labor Conditions

The Rehabilitation of the Returned Soldier Receives Special Attention—Description of the Methods Now Being Followed in Canada—Training of the Blind and Mutilated



LEFT TO RIGHT—D. H. McDOUGALL, S. S. WHEELER, J. T. HUTCHINGS
Contributors to the Symposium on Labor Problems

THE procurement of a sufficient and satisfactory supply of labor was voiced often in the many addresses as one of the vital problems of the hour. Enlistments and drafts have eaten into the ranks of utility operators and employers to a considerable degree. The many aspects of labor supply received a general recognition and brought forth considerable discussion. In fact, this situation was of such importance that a considerable portion of the Thursday afternoon session was devoted to a symposium on labor problems of the hour.

In this symposium, which was carried over into the Thursday evening session, the broader aspects of the situation were discussed with due reference to the rehabilitation of the returned soldier as well as to the present supply of labor.

D. H. McDougall, assistant general manager Toronto (Canada) Power Company and president of the Canadian Electrical Association, gave a very full description of the work being done in Canada in training returned Canadian soldiers. James T. Hutchings, Rochester Railway & Light Company, Rochester, N. Y., told of the "Rochester plan" for helping co-operatively to man the local munition plants without disturbing labor in other manufacturing plants unduly.

Dr. Schuyler S. Wheeler, president Crocker-Wheeler Company, Ampere, N. J., who has but recently returned from France, where he has been making an investigation of the rehabilitation of the blinded soldier, spoke in the evening on that phase of the problem.

TRAINING OF RETURNED SOLDIERS IN CANADA

Mr. McDougall said, in his address, that in Canada there was established a hospital commission known as the Military Hospital Commission, which procured hospital accommodations all over the Dominion. This was taken over by the military, and there was established a

department to effect soldiers' civil re-establishment.

In considering the demobilization and employment of returned soldiers the men were divided into three classes—men for immediate discharge without pension; men who might be benefited by treatment; men permanently disabled and who could not be helped by treatment.

A system of interviews with returned men was devised. On the first interview the men are divided into two classes: (1) Those not in need of special training because they could go back to former occupations; (2) those in need of special training. Very many men who return are not capable of taking up again their former occupation.

There is in Canada a compulsory vocational training under discipline for all returned soldiers not able to take up former work. There are convalescent courses in the hospitals. In these cases the goods made are sold, the profits from the sale going to the man who made the goods.

A second interview is had with all men ready for occupation. The interviewers are largely returned men. The man is given the choice of an occupation. On the third interview he is enrolled in the proper course in one of the twenty-five schools maintained for this purpose.

There is one important feature in this connection. All men are urged to go in for productive work.

Of the 400,000 men who went from Canada to the battlefield, 35,000 had returned by April. Of these men 1230 had had amputations—520 of the leg above the knee, 320 of the leg below the knee, 259 of the arm above the elbow, 115 of the arm below the elbow. About fifty were blind. Fewer than 10 per cent of those who have returned, or 3356, required special courses.

The address was concluded with a set of lantern slides showing the extent to which Canada is rehabili-

tating the returned soldier. A number of interesting pictures of men actually in training for an occupation were given.

THE ROCHESTER PLAN

Mr. Hutchings, in describing the Rochester plan, spoke in part as follows:

"Owing to the successful and prompt manner in which shrapnel had been supplied under contracts with the English and Russian governments, Rochester was selected as a place to build a complete plant for the manufacture of a famous French gun, two shell plants and a forge shop. Early in August Major Jameson of the Ordnance Department placed himself in touch with the Rochester manufacturers. At a meeting of some fifty of the executive heads of our largest manufacturing plants he outlined to us what has since developed into the 'Rochester plan.' The problem which he outlined and which the Rochester manufacturers agreed to accept as their responsibility was to see that as fast as tools and machinery could be assembled and housed, the necessary men should be forthcoming to man these tools and at no time should there be more than forty-eight hours' delay in putting tools into production after they were ready for the operators. Up to the present time Rochester manufacturers have performed their part.

"A committee was appointed to outline the scope of the work and the method of financing the project. This committee reported on a plan to raise \$30,000 to cover the necessary expenses of carrying on the work, and, as it was felt that the principal difficulty would be in securing skilled machinists and tool makers, the first assessment was based upon the payment by each manufacturer of \$3 for each skilled metal worker in his employ and 25 cents for every other employee. This plan was immediately adopted and the \$30,000 required was underwritten. An executive committee of nine of the principal manufacturers to carry on and supervise the work was appointed. This committee immediately secured the services of a man who had had considerable experience along similar lines to take charge of and establish a central employment bureau which should act as a clearing house between all of the members of the underwriting companies and should be responsible for the supply of the necessary labor for the munition plants, and this bureau operates under the supervision of the executive committee of the underwriters.

"The munition manufacturers were asked to furnish, so far as possible, an exact schedule of the number of men required and the date on which they should be furnished. Through these methods up until about the middle of March, this year, we have been able to supply all of the labor required without interfering in any way with other Rochester manufacturers. But we have now approached the time when the real problem of supplying labor confronts us. We must begin immediately to train the semi-skilled to become skilled, the handy man to become semi-skilled and the common laborer to become handy man, and consider the possibilities of the use of women in industry.

"The total labor requirement for our war industries will amount to 12,000 men. A majority of these have been supplied. We find at the present time there are no skilled tool makers and machinists who are not employed. The problem which confronts us is to obtain the necessary skilled men to man the tools which will

very shortly be ready for operation, and to do this the committee was authorized to make an inventory of the men available in all of our Rochester factories and to authorize the employment manager of our central employment office to make a draft equally upon all of the Rochester industries, the method to be pursued being to determine from week to week the requirements and the percentage which these requirements bear to the total men available in the city and to then draw from the various manufacturers in proportion, through the application cards which we have on file, from the help in these various factories. Through this method we will not cripple any individual factory and will still be able to supply the necessary help to the munition manufacturers, and, further, we will place an equal burden on all manufacturers in the matter of training new help through their training schools."

REHABILITATING THE BLIND

Dr. Wheeler, in his address, said that there are some kinds of work that can be done as well by the blind as by those with their sight, and one of these is electric winding. There are now at the Crocker-Wheeler works forty blind men winding coils for armatures and taping at the regular factory piece rates. These men are able to earn a good living, and they rapidly acquire a feeling of independence. No contributions are allowed, for the fundamental idea is that this is not charity work.

Several things must be worked out:

1. The relation of the labor unions to the blind. The unions must know how this activity is going to work out in relation to their interests. They want to know how many blind will be employed.

2. Accident insurance. At one time employers were prevented from taking out accident insurance on the blind operatives. Now, however, insurance companies are writing policies on the blind.

3. Arriving at processes enabling the blind to do factory work. By a little ingenuity in developing devices a great deal can be done for the blind.

In France the Thomson-Houston Company came forward, stating that it appreciated the work now being done at the Crocker-Wheeler plant, and offered to help by opening a room in one of its factories for this work, by telling the societies engaged in training the blind of this work of armature winding, and by telling all of the electrical companies in France that it is going to do this. This company opened a large workroom about ten miles outside of Paris for this work and in a short time became very much satisfied with the work accomplished.

From France Dr. Wheeler went to London to help Sir Arthur Pearson. Conditions there are different from those found in France owing to the close co-operation among English electrical manufacturers through the British Electrical and Allied Manufacturers' Association. This association had a meeting to hear the facts regarding the training of the blind in this work. All of these manufacturers, about thirty of them, then decided to give work to the blind in every job that was of a suitable nature.

Two electrical manufacturing companies in Birmingham, the General Electric and the Siemens, and two more in Manchester, the Westinghouse and one other, sent coils to the shops prior to Dr. Wheeler's arrival and as soon as he got there at once started work.

Patriotic Optimism at the Dinner

P. B. Noyes Shows the Present Status of the National Coal Problem—Samuel Insull Sounds Note of Assurance and Confidence in the Rate Situation

MESSAGES of patriotism and public service, with a word of optimism from Samuel Insull for the outlook in the industry, deeply interested those who attended the dinner at the Hotel Traymore on Thursday evening. It represented the high mark of attendance at the Atlantic City N. E. L. A. war convention and was thoroughly characteristic of the spirit in the industry, in that it was a new consecration of resources to win the war and an expression of faith in the future.

The speakers were P. B. Noyes, director of the conservation division, Federal Fuel Administration; Samuel Insull, director of the Illinois Council of National Defense, president of the Commonwealth Edison Company, Chicago; Dr. S. S. Wheeler, president Crocker-Wheeler Company; Arthur Williams, Federal Food Administrator for New York City, general commercial manager New York Edison Company, and W. W. Freeman, president Union Gas & Electric Company, Cincinnati.

Reports of the addresses, except that of Dr. Wheeler, are published in this article. The remarks of Dr. Wheeler, who told of his work in bringing the blind into industry, are reported in the article on the symposium on labor problems which appears elsewhere in this issue.

President J. W. Lieb, who presided as toastmaster, said that the acceptance of an invitation to a function of this character must be conditioned on the possible call for service elsewhere; and he added that Oscar T. Crosby, Assistant Secretary of the Treasury, had telegraphed expressing very keen regret at inability to be present. An invitation had also been given to Dr. H. A. Garfield. He could not be present. The convention was fortunate, however, in having present one of Dr. Garfield's right-hand men, Mr. Noyes.

MR. NOYES ON THE COAL SHORTAGE

Mr. Noyes then spoke in part as follows:

"I would not need the testimony I have seen since coming here with you as to the spirit of this association to say what I have long ago learned, that we have no monopoly of patriotism in Washington. We recognize that there is just as much patriotism in a group like this one assembled here as in any group that could be got together in Washington, no matter who they were, so I shall waste none of your time in a patriotic address, trying to persuade you to do something for the Fuel Administration.

"When I tell people at this time of the year I believe there will be a greater shortage of coal this year than last year, I find that many men are surprised, with eight months before us to prepare for next winter, and they say, why don't you prevent it? As I have studied the problem, there is no other problem that comes to us that could not be solved by American pluck and ingenuity in eight months.

"In the coal business, as most of you realize, we are dealing in a business which has enormous physical proportions. It is beyond anything else that we undertake to do in this country. I made a calculation to illustrate it the other day. The coal movement in the United States is so much larger than the food movement that, for instance, all the wheat that is raised in the country would be moved in twenty-six days of the coal movement. Speaking of the cotton crop, a big crop, with millions of bales, that could be moved in one and one-third days of the time it takes to move the coal supply, at 9 o'clock on the second morning you would have it shipped to its destination. All the grain and the entire crops moved in this country last year, every pound of it, would be moved in fifty-four days, or something less than two months of the coal movement.

TREMENDOUS INCREASE IN COAL OUTPUT NECESSARY

"Now, when you start with that idea that you are dealing with such an enormous physical problem that time must be an element, you realize that our railroads, before this war began, were burdened; you know we were having our embargoes, and there has been very little done since that time to increase railroad facilities until very recently. Last year, 1917, we mined and delivered more than 50,000,000 tons in excess of any previous year. This year our increase indicates that we must mine and distribute 100,000,000 tons more than last year if we are to satisfy all the demands for coal.

"Our figures, as compiled during the last three months, carefully, industry by industry, show requirements of over 80,000,000 tons, and I know, and many of you realize, that we must recognize an increasing demand from week to week. There never is a week goes by that something does not come up that shows us we have not got the whole demand. So we must mine 100,000,000 tons more than we did last year; that is, more than 220,000,000 tons in excess of anything mined before this war.

"That is what the mines must mine, railroads must carry, switch and deliver to destination, more than was mined before on a railroad system that has been very little enlarged; but it must also take care of all of these enormous new supplies, shipbuilding and other supplies.

"Up to the present time the coal shortage has certainly been a railroad problem. We have lost considerable help from lack of work. Many of you know the situation. It is going to be a mixed problem before we get through. It is going to be a labor problem as well as a railroad problem. As I say, we have lost help, and the draft is taking help. If you say we must mine all this coal, yes, you can do it, and you can even get the railroads to carry it if you don't do anything else in the country, but there are all these other things to do. It all goes back to man power, and you have got to spread that man power around, to use it in shipbuilding, furnish so many to the army, and you must devote

its share to improving the railroad facilities, and getting into the mines and getting the coal out. The problem we have is to meet an increase of 100,000,000 tons, and we can't make it. If we make half of it, we will do well.

"Now, what is the answer? There are two. The first, of course, and the obvious one, is to save all we can. Fortunately this country has been a very extravagant and wasteful country. Coal has been so



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P. B. NOYES

cheap for manufacturing interests—I won't say the utilities, because that is their raw material—only 2½ per cent, or in some cases only 1 per cent, of the cost in coal so they haven't given any attention to it.

"The second is the great question of economy of power, of getting the benefit of the power we do make by fuel, and by other means, such as water, oil and so on, and getting all we can out of it. Then there are the other avenues of waste, as the householder, and the waste of light, all of those, in six divisions, we are attacking. But to save anything like 100,000,000 tons, as you all know, or even 50,000,000 tons, is something that we get up our enthusiasm and say we are going to do, but if your life depended on it, you would say, 'Well, that is on paper,' and we had better look around to some other life preserver, rather than to depend on it.

"There also comes in it the other safety valve, which is curtailment. Now, curtailment of industry, which is the place where curtailment has to come, is almost as serious as not having shell steel. The only standard you can make is war and non-war. Now, it is easy to understand, if we are going to have a shortage, it is certainly coming out of the non-war.

"We have probably 10,000,000 men, probably \$20,000,000,000 worth of capital that is almost as important as the shell steel to the success of the war, to say nothing of the economic life of our country, to say nothing of after the war, so that I tell people to not always be saying a ton of coal means so many ships and means so many shells. Get your eye on the other end; a ton of coal in many places means a hundred people kept at work, every ton of coal you can save anywhere will keep at least fifty people at work.

"We have no right to put the utility people on the

Table A list, and be sure that they get 100 per cent coal, if 60 per cent of their power is non-war, unless they are a part of the Fuel Administration, and the other 40 per cent is handled as we would handle it. In other words, as I said to the steel people, there is no way to try to give you 80 per cent or 60 per cent of your coal. The first thing to do is to make the steel business a war industry, a 100 per cent, and then be sure it has 100 per cent coal. Now we want to make the utility business a 100 per cent war business in the double sense. Now that means that you have got to act for us on the remaining 10, 20, 30 or 40 per cent, which does not belong to any of the war needs.

"We have got to police the distribution of all the coal that can be saved from war industries. I have told the people down in Washington when we get to the district where there is only enough coal for war industries, and not a ton for anything else, we have got to be brave enough to face it, and say we are going to furnish the other industries some. If we have districts in which there is not enough coal for the war industries or any to spare, we have got to take a certain portion of that away from war and spread it around just enough to prevent disaster. Now, somebody has got to divide that, got to put it where it will do the most economic good, and you have got that same delicate problem of dividing your power, because it is not going to be fair for us to say to an umbrella man, you are only allowed your share of 70 per cent, whatever it is, and the other umbrella man alongside of him gets his power from the public utilities, which get 100 per cent.

"In other words, we have got to get close enough to you and you have got to get close enough to our problems so that we are just as safe in your hands, not only in the economical making of the power, but in the



ARTHUR WILLIAMS

distribution of it first to war industries, and second what is left along similar lines to those on which we are distributing coal, so that it will preserve this country from economic disaster."

INSULL SPEAKS WITH OPTIMISM

In introducing Samuel Insull, President Lieb said that there are many lines of activity and many directions in which people permanently identified with the

industries can and do co-operate with the government to solve the stupendous problems which are before us.

Mr. Insull said in part:

"I have been sitting listening to some of the speeches delivered to-day at our convention meetings, and I must say that a note of despair has run through some of the speeches delivered, a note which I question to be justified by the conditions existing so far as the effect of the war on our business is concerned.

"While every article making up the cost of our product is either directly or indirectly governed as to price by federal action, our selling price of our product has remained more or less stationary, but I do not agree with some of the statements made to-day to the effect that we are getting little or no relief so far as selling price is concerned. In some states the wording of the laws creating commissions is somewhat ambiguous so far as increasing prices is concerned, but as a rule the laws creating commissions in the various states leave with the commissioners the authority to increase or decrease price as necessity may arise.

"In some states we are unfortunate enough to be still operating under conditions where our maximum price is governed absolutely by municipal ordinance, but in a few cases it has been found possible to create local sentiment of a sufficient and enlightened character to result in relief from your maximum prices and an increase in the selling price of our product proportionate with the increase in our cost. We certainly have no reason, and I am speaking alone of the electric light and power portion of the public service industry because I am addressing an audience that is particularly engaged in the electric light and power business, to complain of the course taken by most of the commissions governing our business in most of the states.

"It has been authoritatively stated that of the 460 applications made for increased rates in the year 1917, upward of 400 decisions were given favorable to an increase in the selling price of the applicant appearing before those commissions, and there are but few cases that have been presented to the commissions during the first half of 1918 where some relief has not been granted.

"Our fundamental trouble is a financial trouble. It deals largely with the refunding of maturing securities and the placing of new securities for necessary capital expenditures made during the last year. We cannot expect investment bankers and investors to have confidence in our securities unless we display a confidence and belief in the earning capacity of our own business.

"The note that I wish to sound here is not one of lament that our balance sheets are not showing up satisfactorily, but it is a note of assurance. With labor increasing in cost largely as a result of federal action in addition to the ordinary laws of supply and demand, with the cost of fuel increasing partly as the result of governmental action and partly as the result of the operation of the laws of supply and demand, with freight rates increasing entirely as the result of governmental action, and with the prices of all commodities used in our business increasing as the result of the increase of cost of labor and the increase in the cost of transportation, it does not seem possible in this day and generation that we can contemplate the possibility of our selling price remaining stationary. And the experience with those of us who have appealed to the

properly constituted authorities to deal with the question of our rates gives me every confidence that if we are diligent in the presentation of our situation to those properly constituted authorities, we are bound to get relief. And as a result of that we ourselves will regain confidence in the remunerative character of our business, and if we can pass that confidence on to the investment banker and to the investment public, if we are willing to pay the price we must necessarily put up in war times for money, we should not have more than the ordinary difficulty of all classes of business in time of war in providing for new capital and a refunding of outstanding securities.

"We will get some benefit from the action of the Fuel Administration in connection with our business. True,



W. W. FREEMAN

we have had to take the benefits with the disadvantages—the disadvantages consequent upon war conditions. Every order, with few exceptions, issued by Dr. Garfield's department has had a tendency to reduce our load factor, and consequently to reduce the earning capacity of our business on the dollar invested. The first orders as to signs, while in my judgment of great advantage nationally because that order performed a great educational service in teaching our people that sacrifices were ahead of them as the result of war, affected our own earning capacity out of all proportion to the saving obtained. But if it had been my privilege to occupy Dr. Garfield's position, I think I would have issued that order just the same, as I believe that it was part of the educational campaign, the patriotic propaganda for bringing home to the people of the United States the duties that they had to perform and the sacrifices they had to make in connection with this war.

"An advantage that we obtained from some of Dr. Garfield's orders was that in connection with the advice for production of energy massed, and that isolated plants should be dispensed with as much as possible, and that large distribution systems should be connected up so as to get whatever advantage there is from the differences in diversity of load between one system and the other.

"It was rather refreshing to some of us that Dr. Garfield in his first order should have quoted the course being taken in England, and that was taken as a result of the investigation of a committee presided over by

our friend Charles Merz, who is consulting engineer for some of our companies on this side, and who to a very large extent got his ideas as to the course which should be pursued in connection with such matters from the experience he had gained from the massing of production and the centralization of distributing systems in the United States.

"To some of us who have been engaged for years in pointing out the true economics of our companies, and who have had to reply to the claims of the politicians that we were engaged in building up great power trusts, it was rather a pleasure to have the assistance of the federal Fuel Administrator in urging that the very things that we have been doing on quite a large scale in different parts of the United States should be adopted as a universal rule so far as it is possible, when such a course could be adopted. (Applause.)

"Now, there are other advantages we have gained as the result of the increased cost of our product. We have learned to do away with a lot of unnecessary expenditures, both of a capital character and of an operating character. Our business has grown with such tremendous rapidity during the last quarter of a century that those who thought we were operating the most economically have fallen into practices not at all required under the orders of various regulating bodies, but adopted largely by us to foster the getting of additional business, and we have indulged in those extravagances which, at a time like the present, when operating expenses must be watched to the limit, we have been able to dispense with. And we have been able to compensate to some extent for the losses that have been brought upon us as the result of the increased cost of labor and material.

"But we are not here to-day to look into our balance sheets so much as we are to look into matters in which we can be of real help to the government in the operation of the war.

"Now, it does seem to me that such a body of men owe a particular responsibility to the government in a time like the present. It should not need any persuasion, judging from the experience we had last winter, to prevail on an electric light and power man to store fuel. It should not need any persuasion to get him to see that his employees store fuel. It should not need any persuasion for him to see to it that the community in which he lives, either as a community or as individual manufacturers or householders, store fuel.

"But there are a great many things in addition that we can do that will be of great assistance to the government and will greatly assist in the movement of fuel and the correcting of the trouble that the union as a whole suffers from in the shortage of production.

"I do not know that I absolutely agree with the previous speaker as to the causes of the present shortage of fuel. I make that statement with some trepidation, because my experience is confined to the State of Illinois, but I do know at the present time that the miners of the State of Illinois are not working more than 60 per cent of the time. I do know that that is not owing to the action of the miners themselves or of the operators of the mines. I do know that it is owing to the shortage of open top equipment for the purpose of carrying fuel. I know that such portion of the open top equipment as is applied to the carrying of coal can carry during the summer months an infinitely greater tonnage

than is possible to carry with the same equipment in the winter months, owing to the difference in the capacity of the motive power to haul a given tonnage of coal as between the winter and summer conditions.

"There is no time and there is no capacity to manufacture new equipment. It is a case of bringing that equipment from unnecessary uses, if Mr. Noyes will excuse my using that word, and employing it in the most essential uses, namely, to provide the fuel for the purpose of moving the wheels of industry and of commerce.

"If you will, all of you, turn around and adopt the resolutions which the association adopted this afternoon, as your individual resolve, if you will see that the war activities in the communities in which you live are influenced by you in the right direction, if, in short, you will use your influence to so steer things that unnecessary local improvements will be abandoned, that the erection of unnecessary public buildings will be abandoned, that the building of club houses and places of amusement that can be held over until this war is over are abandoned, you will be going a long way to help yourselves to get fuel. And unless we get fuel in this country the government is going to be tremendously handicapped in all of its war operations." (Applause.)

MR. WILLIAMS ON FOOD CONSERVATION

Arthur Williams discussed the Food Administration law and the general lines of effort followed by Mr. Hoover. He said that the large results obtained have been secured through patriotic co-operation by the people of all sections.

MR. FREEMAN ON "SERVICE FIRST"

W. W. Freeman spoke briefly, saying:

"One thought only occurs to me and that has been suggested by one of the early speakers, Mr. Noyes, in his perfectly proper criticism of the slogan 'Safety first,' in which we all concur. It does seem to me, however, that we have had, some of us at least, in our industry another slogan that we have been trying to use, to which that same criticism might not apply, and that is the slogan 'Service first.' It has perhaps had a narrow application in its inception and in the use to which it has been applied.

"The initial thought, doubtless, was to get the public to think that, after all, service was of greater importance than cost.

"It seems to me, Mr. President, that this is both the most serious and the most inspiring convention this association has ever held, serious because we have never met under conditions that are as crucial as the conditions under which we are now met, and inspiring because we have been brought to a true realization of these conditions. We are not going to fool ourselves as to the fact, but we realize what these conditions involve in their obligations upon us, and if we respond, as I believe we are prepared to respond, to this call for service, for sacrificial service, as may be required, for service not confined to the narrow limitations of our own communities, but service which reaches out beyond these limitations, beyond even the limitations of our own nation, out to the call of humanity for sacrifice, service necessary on the part of each one, that we may be inspired in the belief, in the conviction that this service will lead to assured victory."

War-Time Engineering Problems

N. E. L. A. Considers Problems Imposed on Public Utilities by War and Outlines Some Methods Which Have Been Adopted to Solve Them

ENGINEERING problems with which the central-station industry has been confronted since the war and methods of solving them were discussed by the Technical Section of the N. E. L. A. at Atlantic City yesterday morning. Among the specific subjects considered were the following: (1) Increasing cable-carrying capacity; (2) reinstallation of old cables; (3) use of aerial cable where overhead wires are prohibited and underground construction too expensive; (4) coping with the scarcity of labor in meter departments, and (5) increasing the output of existing apparatus.

The development of water power as a war measure was also discussed.

SOLVING DISTRIBUTION PROBLEMS

Increasing Dissipation of Heat from Cables—Utilizing Old Cable—Use of Aerial Cables

The heating and carrying capacity of cables is of exceptional interest at this time, when maximum use must be made of equipment and interruptions of service to war industries must be avoided. Experience has demonstrated that underground cables ordinarily have lower current-carrying capacity during the summer than in the winter, said E. B. Meyer, chairman of the underground committee of the N. E. L. A. Failure to recognize this fact has resulted in many cable breakdowns with consequent service interruptions. To prevent undue operating expense and service interruptions

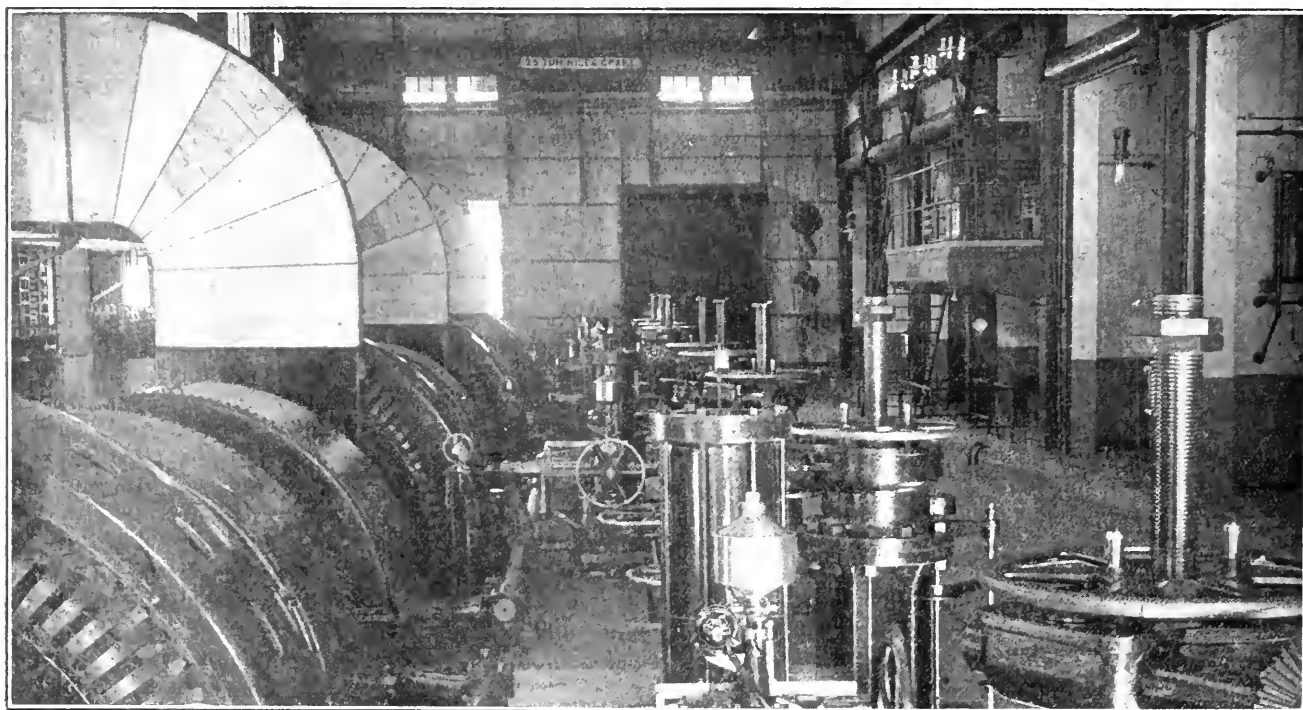
on the one hand and yet permit full utilization of the underground conductors on the other it is important that the rating of cables be known as closely as possible.

Various methods have been tried in a somewhat restricted way to increase the capacity of such cables, particularly during hot, dry seasons. Among them are cooling by the circulation of air through the cable ducts, circulation of water around the cable, hydration of the surrounding soil and immersion of the cables in materials which conduct away the heat readily.

The difficulty of obtaining material on short-time delivery, the speed with which installations have to be made at the present time and the need of conserving funds makes it imperative that all central-station equipment be utilized to the maximum. With this idea in mind some companies have adopted the practice of removing cable from certain sections of the system where load conditions have changed and reinstalling the same cable in other sections of the system where reinforcements are necessary.

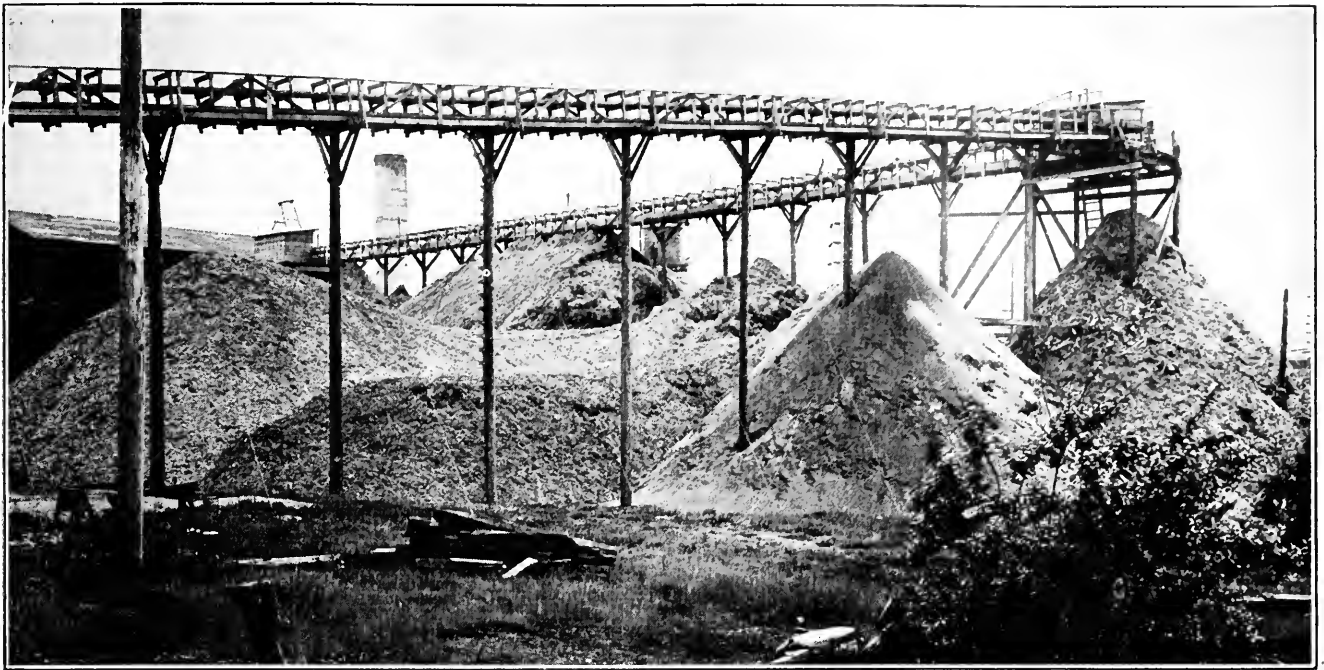
AERIAL CABLES FOR WAR INDUSTRIES

On account of the large power demands imposed upon central-station companies for furnishing service to war industries, a number of operating problems have developed which have made it necessary to devise special methods of construction to serve the industries upon which the government is depending to help win the war. The matter of giving primary service to the customer has been taken care of by one company with a



INCREASING THE OUTPUT OF EXISTING APPARATUS

By forcing air from the tailrace through the generator windings the 8500-kv. units in the Stanislaus hydroelectric station can be made to carry 10,000 kw.



USING SHAVINGS AND SAWDUST FOR FUEL

Oil is scarce on the Pacific Coast, so during low-water periods one of the hydroelectric companies will use wood refuse for fuel in its auxiliary steam station.

special form of aerial cable supported by messenger wire similar to that used in telephone work.

In early installations ordinary lead-covered cable was used, but the excessive weight of this type of cable made it necessary to provide short pole spacing. Recently, however, the use of lead-covered cable has been abandoned in favor of a cable having a reinforced rubber jacket which is considerably lighter and allows installations to be made on standard pole line construction. The cable is designed for operation at 13,200 volts and is made up of paper insulation over the individual conductors with a paper jacket and a final covering of reinforced rubber, over which is applied a galvanized-steel tape for mechanical protection.

One of the advantages of aerial cable construction is that the cable may be installed on pole lines without any changes whatever in the existing construction. Two or more cables may be installed and changes or repairs made on the circuits without taking out of service any line except the one on which the actual work is being done.

The aerial cable construction is, of course, used only in special cases where it is desirable to cross underneath highway or railroad bridges and where open wire would be undesirable and underground construction costs prohibitive. The construction is somewhat more expensive than an open-wire line, but costs considerably less than an underground conduit system.

MAKING CABLE CONNECTORS FROM FLAT-BAR COPPER

At present, when the manufacturing plants of the country are working to full capacity turning out munitions and delivery of other material is uncertain, utility companies have found it desirable to make their own copper sleeves as required and at the same time effect a saving.

Bar copper, usually end pieces ordinarily junked by station construction forces, is selected equal in thickness to the wall of the sleeve to be made and cut into rectangular pieces as long as the sleeve and with a width

equal to its circumference. Each piece is heated and bent around a mandrel just large enough to allow the ends to meet at the inner edge of the copper. Then the sleeve is run through a copper saw to clear away the surplus metal, after which it is hammered to size around a mandrel equal in diameter to the required bore. The solder slot is made on a milling machine or copper saw, depending on the size and type of sleeve.

LABOR SCARCITY IN METER SHOP

Two Methods of Relief—Employment of Women and Extension of Test Periods

Since the war commenced many meter departments have been handicapped by losing the young men who had been engaged for testing meters, said E. S. Mansfield, Edison Electric Illuminating Company of Boston, in presenting the report of the meter committee. As many as 50 per cent have left either to enter the country's service or engage in more lucrative employment. Older men cannot be employed, as they demand too high wages, so only two courses lay open to the solution—employment of women and extension of test periods.

Out of thirteen companies questioned three employ women in their laboratories. In one company they range between twenty and twenty-eight years in age and are required to have a grammar-school education. Electrical knowledge is not necessary, but some evidences of thoroughness in anything undertaken are essential. The women are trained by stationing them at the test benches as assistants to the regular testers and allowing them to absorb methods by watching. Educational courses are also given as to the requirements and best methods of doing the work. One difficulty experienced in central-station meter departments which does not exist in manufacturing plants is that each tester has to handle several different types of meters. Nevertheless, the women that have been employed in meter laboratories have in most cases been

found as satisfactory as men, and they are more contented to continue at this kind of work. No women are employed on routine system testing, but they may be employed later on small meters.

Extension of meter testing periods, as mentioned before, has also been adopted by some companies, the period between tests being six to twelve months except for high-tension or very large meters. This method of coping with the labor situation is being allowed in New York until conditions become normal again.

INCREASING EQUIPMENT RATING

Use of Forced Ventilation Where Not Already Used
—Change from Delta-Delta to Y-Delta

Various methods which have been employed by operating companies to increase the output of existing equipment were cited by H. C. Albrecht of the Philadelphia Electric Company in presenting the report of the N. E. L. A. electrical apparatus committee. In the Northwest, for example, one company was able to increase the rating of two 10,000-kw. water turbine-driven generators to 14,000 kw. (continuous rating) at a cost of only \$1,000 by merely providing forced ventilation. No difficulty was experienced on the turbine end because the prime movers were rated at 21,000 hp. each. To provide the forced ventilation the generators were inclosed above the floor line, a duct connected with the space over the tailrace and blowers installed to force air along the periphery of the stator laminations. Ordinary water sprinklers were installed in the duct from which air was drawn to cool and humidify the air further. Later it was made possible to develop 16,300 kw. continuously with each machine by re-insulating the windings with material that would withstand higher temperatures. If other companies having generators driven by overrated prime movers and not employing

forced ventilation do likewise, they too may benefit, suggests the committee.

Some companies have changed from delta-delta connections to Y-delta to permit carrying larger loads with existing equipment, while others have relied on load dispatching to secure the maximum use from equipment. Transferring apparatus to a place where it can be used more efficiently has also benefited some companies. On a Southern system where a rotary serving a three-wire system was damaged so it could not be used, the company avoided a prolonged interruption of service by transferring a railway rotary to the station and re-connecting it and the transformers to give the desired voltage.

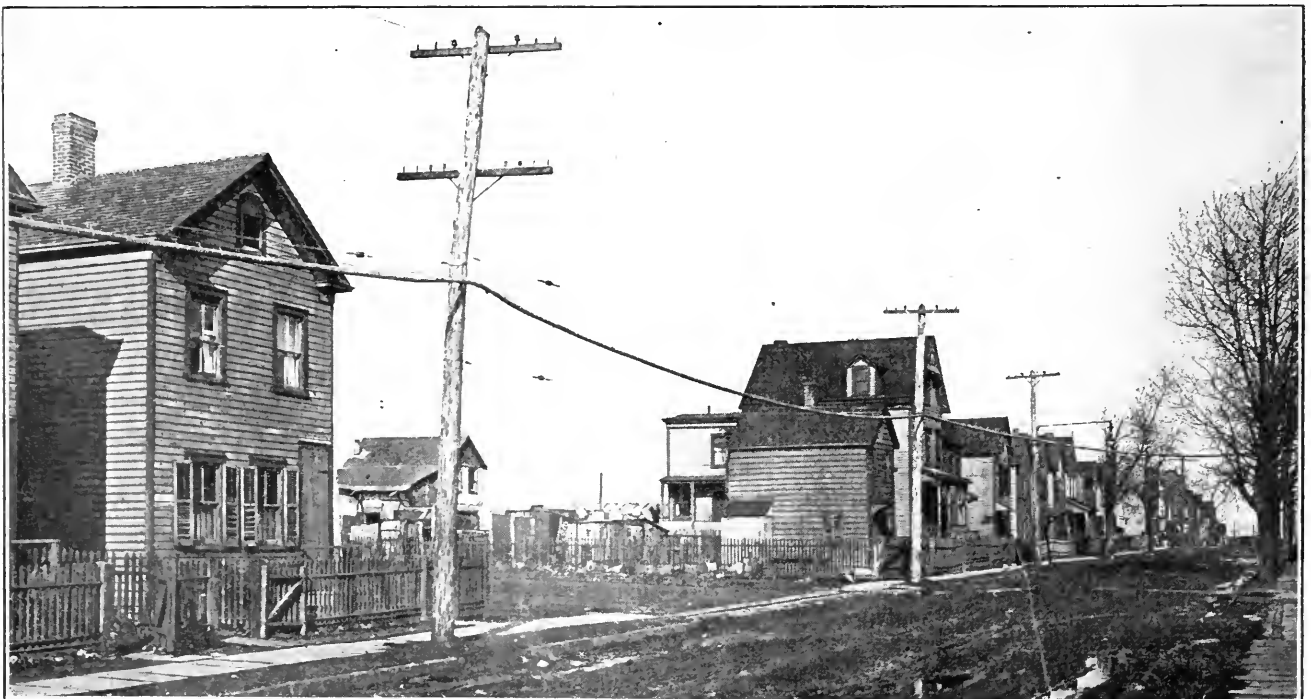
WOMEN AS SUBSTATION OPERATORS

Steps that Boston Company Has Taken to Train Women for Work in Substations

Realizing when this country was drawn into the war that men would be scarce, the Boston Edison company started in a small way to train women for certain occupations hitherto filled by men, E. S. Mansfield pointed out. Since then it has equipped them to perform the work necessary in substations, about fifteen now being thus employed.

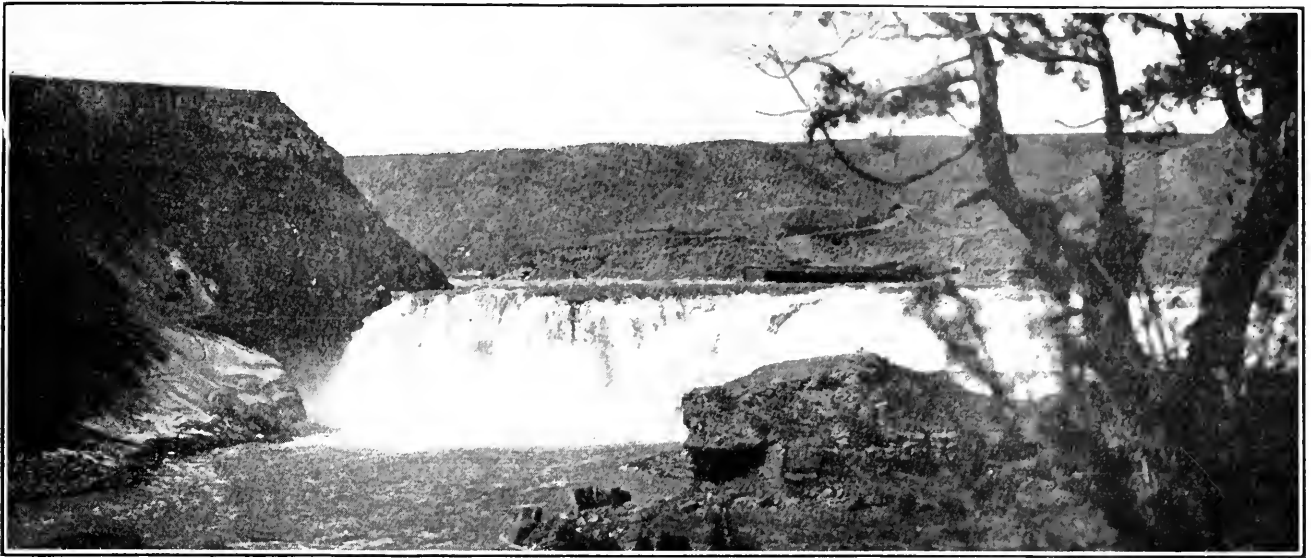
The women were not obtained through labor bureaus or in the usual ways in which help is employed. Instead, the company asked post office representatives, druggists, etc., in different towns which it served, for the names of young women who would be likely to undertake patriotic service. At first the women were instructed in the fundamentals of electricity, but later they were put directly in the substations after having received general instructions. This was done because it was found that the women who ranked the highest in laboratory work were poorest in actual substation operation.

The general instruction course lasts about four weeks.



RUNNING CABLES ON EXISTING POLE LINES

In emergencies one cannot wait to install underground ducts for cables, especially when there is a pole line available. Besides, an overhead cable can carry more current.

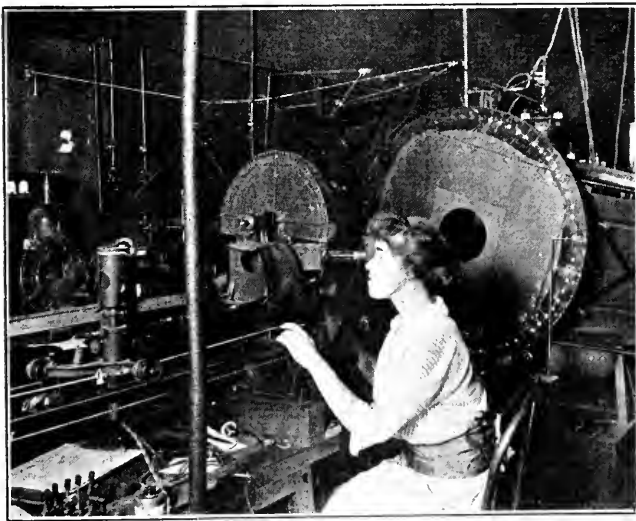


WATER UTILIZATION MEANS COAL CONSERVATION

A proper development of water power with suitable interconnections with steam stations where necessary would result in great savings of coal, labor and transportation.

Then, in the substations, under supervision of the regular male operators, the women are trained in their ultimate duties. Eighteen women were trained in this way. The shifts are eight hours long and are rotated at regular periods so that no woman will have to work the same hours all the time. After receiving their training the women are examined and a rank is given them. Two work on a shift without any man in supervision.

During the instruction period they are paid the same amount as later when in actual service; that is, \$15.40



WOMEN HAVE A PLACE IN THE ELECTRICAL INDUSTRY

a week at the start. The women can earn as much as the men, the amount depending on their ability. Quickness to act in an emergency, lack of nervousness, ability to act without instruction and similar qualifications are the requirements on which they are judged to a great extent. Of the eighteen women trained, fifteen qualified and have been found quite satisfactory.

On account of the importance of this subject, Mr. Vanderpool of the Public Service Electric Company of New Jersey recommended that a committee be appointed to consider the problem.

WATER-POWER DEVELOPMENT AN EVER-INCREASING NEED

How 6,000,000 Tons of Coal May Be Saved in Twelve Months, in Addition to Labor and Transportation

For a year or more, said W. W. Nichols, Allis-Chalmers Company, Milwaukee, Wis., he had been impressed that the use of water power was possible as a war measure. Certain steps, however, have been necessary.

The common conception of water-power development would induce the thought that the application now is under high pressure and that, time being now the desideratum, this development is impossible. On the contrary, there are many different kinds of water-power development.

Moreover, there is the fact that the Fuel Administrator has just reported an estimated shortage of 80,000,000 tons of coal for the year. It would therefore appear that some practical relief outside of the coal field is imperative. Here water power lends itself to a limited extent. The year 1917 was one of inferior demand in water-power machinery, yet 1,058,000 hp. of hydroelectric machinery was built and installed. This alone represents a saving of 8,500,000 tons of coal, besides a saving in production labor and transportation. Ten per cent of the estimated coal shortage of this year therefore would be met if the industry could do as well this year.

Without building new plants there are two ways of hydroelectric development: (1) By increasing the capacity of plants already built. In this connection it has been estimated that 300,000 hp. can be developed in the next twelve months by central stations.

(2) Replacement of machinery installed prior to 1911. This would take care of an increased horsepower of 450,000.

By these means 6,000,000 tons of coal would be saved in the twelve months in addition to labor and transportation.

Power is now more than ever fundamental to our existence. The power shortage is a national calamity, calling for a broad national treatment.

The Electric Vehicle as a War Measure

Abundant Evidence That the Storage Battery Commercial and Industrial Trucks Are Taking a Prominent Part in Present-Day Transportation as the Result of Situation Demanding Development in Haulage Methods

WHILE but one paper was presented at the Electric Vehicle Section meeting—that by James H. McGraw, president of the McGraw-Hill Company, Inc., New York—the situation that now exists in the field for storage-battery-propelled vehicles was fully outlined. The paper and discussion were decidedly progressive, and gave every indication that those interested in the development of this field felt that the electric vehicle had come into its own and that the field for this means of transportation offered immense possibilities. The war has changed normal conditions, and now the electric vehicle in its commercial and industrial uses is a necessity.

ELECTRIC VEHICLE SECTION ELECTION

The following officers were elected by the Electric Vehicle Section of the N. E. L. A. for the ensuing year:

Chairman—E. S. Mansfield.

Vice-chairman—G. E. Foster.

Treasurer—H. M. Edwards.

Secretary—A. J. Marshall.

Executive Committee—J. H. McGraw, P. D. Wagoner, H. G. Thompson, E. B. Chalfont, Charles Blizzard, W. W. Freeman, L. Ward and T. I. Jones.

ELECTRICITY AN AID TO WAR TRANSPORTATION

What might almost be termed a symposium on the present status of the storage-battery truck was contained in Mr. McGraw's paper, "The Electric Vehicle as a War Measure,"

After outlining briefly the general situation and the facts that give a sharper picture of transportation conditions, the question of how electricity can help was considered carefully. In this connection there are three means of auxiliary aid to the railroad freight problem: (1) By hoists and transfer cranes and platforms; (2) by the industrial electric truck, which is being used in large numbers, and (3) by the commercial electric truck for local short-haul, many-stop deliveries. All of these are now performing a distinct war service.

The extensive application of electric industrial trucks in government war work, together with the saving resulting, were given special attention. Of these trucks it is estimated that there are 5000 in use to-day.

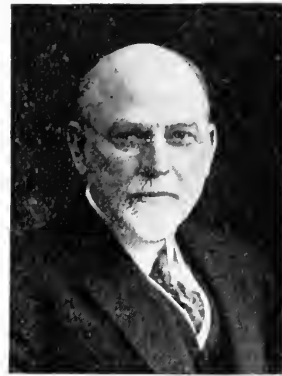
One of the biggest parts of the present transportation problem is the inefficiency of handling goods at terminals and from there to warehouses. In the solution of this problem by the electric vehicle lies a large opportunity for the central station and the manufacturer.

Electric industrial trucks, by conserving man power, speeding up production, and in other ways, have revolutionized the methods of handling goods in many munition factories and arsenals.

The local delivery problem, which has been the subject of national investigation, offers many opportunities to the electric vehicle. The high costs of local delivery service that now obtain are sufficient evidence of the

wastage incurred by other than truck delivery. The short-haul, many-stop deliveries provide the field for the electric truck. Another example of the present opportunity is in fuel handling.

The general advantage of the "electric" in this industrial and commercial work lies in the simplicity of manufacture and of operation, in the small amount of



JAMES H. MCGRAW

maintenance required, and in its very low operating cost.

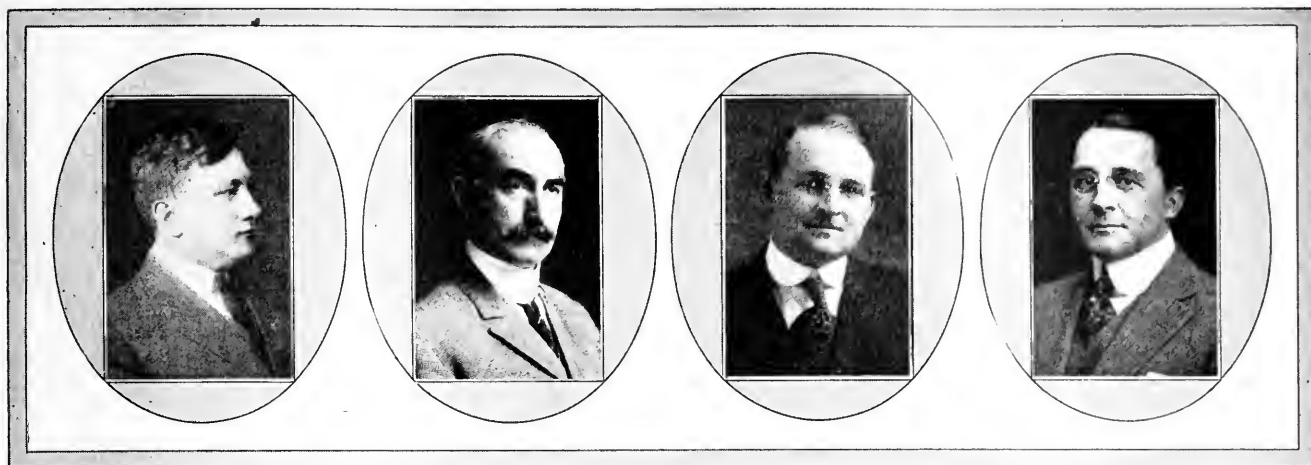
The experience abroad with the electric vehicle was briefly touched upon, and in closing attention was once more called to the opportunity of the central station to promote this activity as an economical solution for an important part of our big transportation problem.

"The supply of electricity," Mr. McGraw said, "for the big developments to come in cheapening the cost of handling goods in terminals and warehouses, and in cutting the cost of deliveries on our city streets, is worth the attention of every central station."

Discussion

In opening the discussion John W. Lieb pointed out that the electric truck is coming into its own, a situation which has been brought about by our national economies. The key to the solution of the release and clearing up of terminal congestion lies in the electric vehicle.

A number of others spoke, all adding a note of optimism and indicating unreservedly their belief that here lies a real opportunity for the central station. The point, however, of the necessity for adequate garage and repair facilities was most strongly emphasized. Those who participated in the discussion were C. K. Chapin, Memphis; F. W. Smith, New York; P. D. Wagoner, Long Island City, and F. D. Pembleton, Newark, N. J.



LEFT TO RIGHT—P. S. MILLAR, R. R. YOUNG, J. G. LEARNED, T. I. JONES
Leaders in the Discussion on Commercial Section Subjects

Commercial Economics Due to the War

Factors Involved in Lighting Curtailment, Equalization of Peak Loads, Appliance Sales Stimulation and Utility Co-operation in the Sale of War Securities Occupy Attention of Commercial Session

HOW to utilize existing equipment to the best advantage and give good service was the common theme running through the papers and discussion of the Commercial Section's session on Friday afternoon. From the discussion of those participating, though somewhat limited for time, it was apparent that the electric lighting commercial men are alive to the situation.

The report of the nominating committee was presented by Thomas F. Kelly and provided for the following officers, who were elected:

Chairman, C. J. Russell, Philadelphia; vice-chairmen, John G. Learned, Chicago, and M. A. Seelman, Brooklyn; secretary, Henry Harris, Pittsburgh; executive committee, terms expiring in 1919, F. H. Gale, James R. Strong, Thomas F. Kelly, H. R. King, R. H. Tillman and E. A. Edkins; terms expiring in 1920, M. O. Dell Plain, C. E. Michel, F. D. Pembleton and A. A. Pope; terms expiring in 1921, Oliver R. Hogue, S. M. Kennedy, J. C. McQuiston and W. H. Hodge.

ECONOMICS OF LIGHTING CURTAILMENT

Owing to the changes in quality of coal and other complications the effect that lighting curtailment has had on consumption of coal cannot be easily estimated. Even if it were definitely known, it would be found negligible, said Preston S. Millar, in his paper on this subject. Nevertheless, the psychological effect may be good.

Measures adopted for the national interest ought to encourage elimination of waste, since a great saving can be realized by inducing the public to turn off lamps when not in use. The speaker said that he does not believe the stoppage of carbon and gem lamp manufacture is advisable at this time, because rugged lamps are needed for certain service. In some places, however, more tungsten lamps can be substituted for the less economical kinds.

More lighting is needed in many places to increase

production and protect the public. Several curves were shown indicating the effect of daylight saving on residential loads.

PEAK EQUALIZATION

A plan to reduce and equalize the peak load in winter months was outlined in a paper prepared by R. R. Young, Public Service Electric Company, Newark, N. J.

The territory is divided into two zones, a northern and a southern zone. During November last the co-operation of all manufacturers using 50 hp. or more was asked in the redistribution of the load.

The power representatives went out to their assignments and daily made reports. All came together once a week for a meeting to discuss progress and developments.

No provision is made in the company's rate for off-peak power. All that the manufacturer received was a reduction of his demand on the peak and the consequent assurance of greater reliability of service.

The total load was 184,200 kw., of which the relief promised amounted to 16,416 kw., or 8.9 per cent. In the northern zone the actual results showed a saving on the peak load of 10,000 kw., while the peak occurred in November. Besides there was no curtailment of energy consumption.

In the discussion D. H. McDougall, Toronto, said that the daily load factor of his company had advanced from 60 per cent in 1915 to 97 per cent at the present time. A total of 40,000 hp. of off-peak load has been taken on, nearly all of which was the result of an educational process by the company's engineers in manufacturing plants. Now the off-peak development has reached its maximum and the company can take on no more of it. A much larger revenue per plant horsepower is now being derived as a direct result.

Messrs. Dell Plain and Harris entered the discussion, the former pointing out that he had experienced little difficulty in getting large consumers to shift the peak.

The course planned by the Public Service Company of Northern Illinois to meet the exigencies of the times was briefly outlined by John G. Learned, assistant to the vice-presidents of the company, under the title "Stimulating Appliance Sales." In this connection the company is making a special effort to obtain more business from the domestic consumer. Additional outlets are urged, more appliances are being sold to customers, and those owning appliances are encouraged to use them more. Because of the depletion by the army of the sales force the company has enlisted the services of all other employees by offering a 5 per cent commission on appliance sales outside of business hours.

The author suggested that now is opportune time to encourage wiring contractors, department stores, hardware dealers and other merchants either directly or through the manufacturers of appliances to engage in the sales of appliances, since the greater the number sold the greater the income to the utility.

In concluding the paper the author spoke of the importance of increasing as far as possible the wattage of customers' lighting installations. He said: "Lamp prices should be adjusted so as to encourage the customer to use either 50 or 60-watt lamps, preferably the latter, by establishing a lower price for that particular lamp. The increased wattage will be reflected in the increased gross income."

Chairman Edkins, in discussion, mentioned that manufacturers of appliances expect to do 40 to 50 per cent more business this year than ever before. Every central station, he stated, can improve its load by developing appliance business.

H. W. Peck, Schenectady, told of selling at list 150 washing machines in twenty-two days in November and more than 100 vacuum cleaners during the Christmas holidays last year in a city of 100,000 population. The net profit in appliance merchandising has helped to reduce materially the expense of the selling department.

J. E. Davidson, Omaha, Neb., told of how he took advantage of the shortage of domestic labor in his advertising and sales solicitation, thereby boosting sales considerably. In the past year and a half sales have been at the rate of \$225,000 a year by his property, which prior to this time did no merchandising.

Messrs. Dell Plain, Pembleton, Peck and Chapin contributed largely to the discussion.

SELLING GOVERNMENT SECURITIES

The activities of the Brooklyn Edison company in assisting the government's sale of its war-time securities—i.e., thrift stamps, war savings stamps and Liberty bonds—were described by T. I. Jones. The paper showed how a public utility may utilize its commercial force in time of war to arouse public interest and obtain public help in raising the necessary money to defray the expenses of the war.

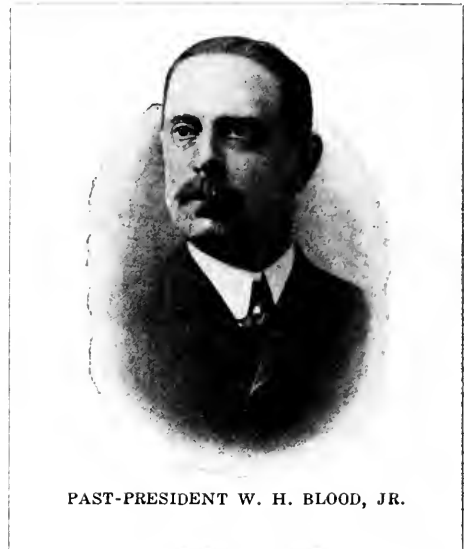
There are two methods which a public utility has of selling government securities—one to its employees and the other through them.

The campaigns described in this paper for war savings stamps and Liberty bonds were carefully worked out, and the entire sales force of the company was used for patriotic service. Company business was subordinate. Advertising and follow-up methods were devised and given as much attention as if they were business

campaigns vital to the success of the company. Every salesman was assigned to work the major part of each day, and during some periods the entire time of salesmen was devoted to the work. A written report was required of each call. Frequent meetings of the men were held for inspiration, co-operation and assistance. A daily report was written giving the name of each individual in the sales department and the result of his efforts. Copies of this report were sent to each district manager and bureau head, and an active rivalry was fostered in which each used his utmost energy to make the best showing.

Chairman Edkins directed special attention to the great service which the companies can render in selling government securities.

In discussion of this subject Henry Harris, Frank W. Smith and Frank H. Gale showed what companies and employees can do.



PAST-PRESIDENT W. H. BLOOD, JR.

Accounting Section

Toward the close of the Friday afternoon session the Accounting Section convened for the consideration of two papers, one on accounting practices and the other on accounting education. The limitations of time prevented discussion other than the reading of the papers.

ACCOUNTING PRACTICES

The paper by William Schmidt, Jr., Baltimore, on "Radical Accounting Practices," emphasized a number of advantages and economies obtained with various accounting practices and referred to the increasing use of women for this work.

ACCOUNTING EDUCATION

Owing to conditions of labor turnover the subject of specialized training has assumed a new importance, it was pointed out by Fred R. Jenkins, Chicago. This education, as applied to public utility accounting, has been taken up by the N. E. L. A. Accounting Section and a number of courses have been developed and are now in active use. These courses were described briefly, and in closing the author urged member companies to take full advantage of them for training purposes.

EMERGENCY CONSTRUCTION FOR THE WAR DEPARTMENT

Colonel Junkersfeld Reviews the Part of the Cantonment Division and the Rapidity with Which Work Was Completed

At the Friday night session of the N. E. L. A. an interesting account with lantern slides was given by Col. Peter Junkersfeld of the work of cantonment construction. How these great army centers grew up as it were over night is now a matter of history, and



COL. PETER JUNKERSFELD

the part played by public utilities in serving them was outlined by Col. Junkersfeld to the edification of the convention.

Through its investigations, the Council of National Defense determined that the matter of housing the armies to be called into service, if left to the then overloaded existing military organization, would unnecessarily hinder the development of the military resources as distinguished from problems which might be solved by the civilian body. The Secretary of War, recognizing the cogency of this fact, called to his aid a body of civilians, known to be successful and experienced in the character of construction work needed in emergency as distinguished from the construction ordinarily used for permanent or fortification work to which the army was accustomed, and developed it into an organization functioning along commercial

lines, coupling it with the military only to such an extent as was necessary to comply with law and to develop requirements. Confronted with a construction program involving work of a volume and at a rate of speed never before attempted, the Secretary of War saw the necessity of affording this organization direct access to the source of ultimate authority; free, but with resultant responsibilities to perform without the delays of military channels the gigantic task of housing the new army. The Secretary of War established the Cantonment Division, vesting it with the right to report direct to him and to communicate by order of the Secretary of War with department and other commanders.

In advance of construction the material market had been surveyed, and for each cantonment great quantities of materials had to be secured for the houses, streets, drainage and water systems required.

HOG ISLAND'S GREAT SHIPBUILDING PLANT

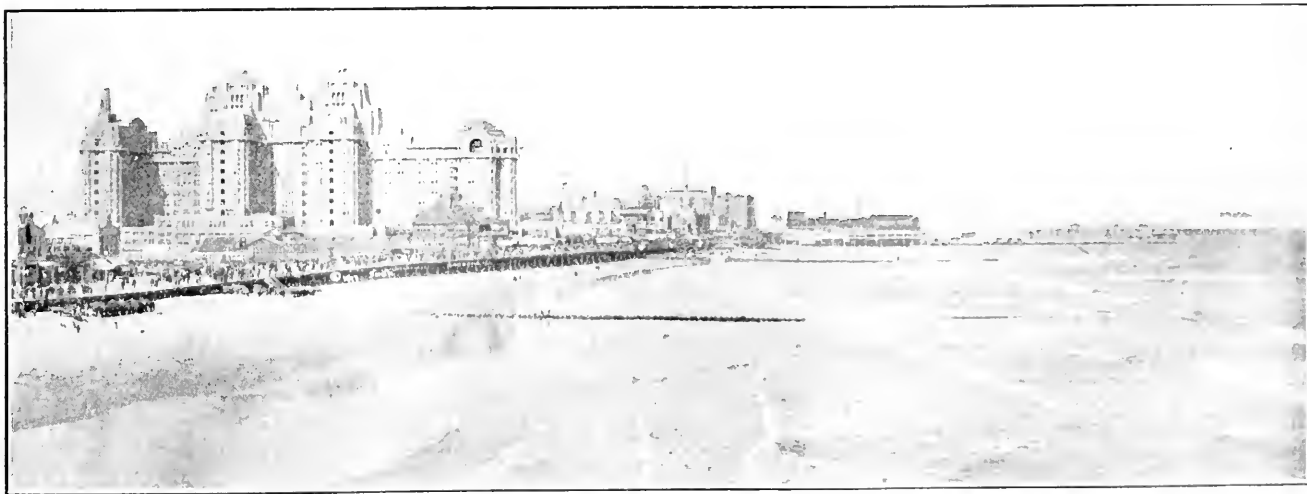
Fifty Shipways and Seven Outfitting Piers in This Tremendous Yard—The Part Played by Electricity

An important and highly interesting address was delivered by W. H. Blood, Jr., assistant to the president of the American International Shipbuilding Corporation at Hog Island, Philadelphia, before the N. E. L. A., covering the work done at Hog Island and giving figures on construction and making other important public announcements.

The shipyard itself will contain fifty shipways and seven outfitting piers capable of handling twenty-eight ships at one time. It is as large as six of the largest shipyards in the country at the outbreak of the war, and has a capacity equal to one-quarter of the present total capacity of all the shipyards in Great Britain.

The wires supplying electric service for motors and lights throughout the yard total 3,000,000 ft., or long enough if stretched in a straight line to run from Portland, Me., to Richmond, Va. Forty thousand electric lamps will be used to illuminate the yard and the ships and 650 electric motors will provide power.

To-day a number of delegates to the convention are to be conducted to the Hog Island yard of the American International Shipbuilding Corporation by W. H. Blood, Jr., where they will be shown some of the work.



The Effective Application of Protective Lighting

Improper Distribution of Light a Common Fault—Searchlight and Floodlamp Requirements—Floodlighting Versus Distributed Lighting—Examples of Protective Lighting

BY H. H. MAGDSICK*

EDMUND LEIGH, chief of plant protection, Military Intelligence Bureau, has stated that of the important means of protection against fires, explosions and sabotage in our industrial establishments, utilities, storage and forwarding systems, the value of lighting and its effective application are least appreciated and understood. An inspection of numerous plants and a consideration of current recommendations

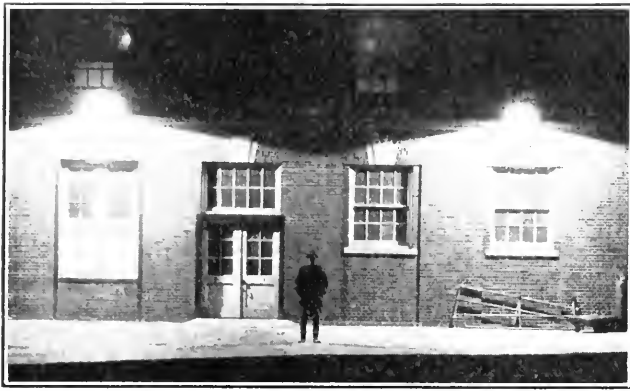


FIG. 1—SILHOUETTED FORM AGAINST AN ILLUMINATED BACKGROUND

in this field of illumination confirm Mr. Leigh's statement and suggest the desirability of emphasizing the points covered in the following notes.

A protective lighting system to be effective must be comprehensive. The danger of attack from within a plant is no less than that from without. Therefore, in the majority of installations provision should be made to light not only the boundaries and approaches, but every part of the yards and all interior spaces, so that no one can approach the plant from the outside or attempt to work destruction anywhere within its limits without being easily observed by armed guards or loyal employees. Occasionally the guards may be so stationed that, while themselves concealed in a shadow or dark area, sufficient surfaces about them will be lighted so that any one passing where no light falls directly upon him will nevertheless always be between a guard and a well-lighted surface and will therefore be distinctly outlined in shadow, as is the man in Fig. 1. More often the safe and practical way is to light every part of the plant.

The intensity of illumination which is provided must be adequate to meet conditions of visibility which are short of the ideal. The amount of light required in a clear atmosphere must be considerably increased to be effective when haze or smoke is present. A higher intensity is necessary when street lamps, brightly lighted windows or other sources are in the field of vision than when the background is always black. If the

buildings are dark, more light is required than when their surfaces have a high reflection factor. An intensity entirely too low to reveal a menace quickly is one of the most common deficiencies in yard and boundary lighting. By providing illumination generously the drain on man power for guarding purposes is greatly reduced.

INEFFECTIVE DISTRIBUTION OF LIGHT A FAULT OF MANY INSTALLATIONS

Much of the expenditure for protective lighting is wasted because the light is ineffectively distributed and directed. In general, illumination should be obtained at every point from more than one unit and from more than one direction. Bad shadows will thus be obviated and the failure of individual lamps will not leave large areas unprotected. Glare often nullifies the value of lighting. Particularly is this true where one encounters exposed sources or the direct beams from projectors at a low mounting height. To facilitate vision, glare should be minimized so far as possible by using accessories which shield the eye from the light source or by mounting units high above the usual line of vision. Diffusing globes reduce the contrast in brightness between the source and its background and thereby lessen the glare somewhat in interiors or when placed near light walls of buildings. Their glare-reducing value is slight, however, when they are viewed against a black background such as usually obtains out of doors, for the ratio of brightness is not greatly reduced.

Several types of equipment employed extensively for

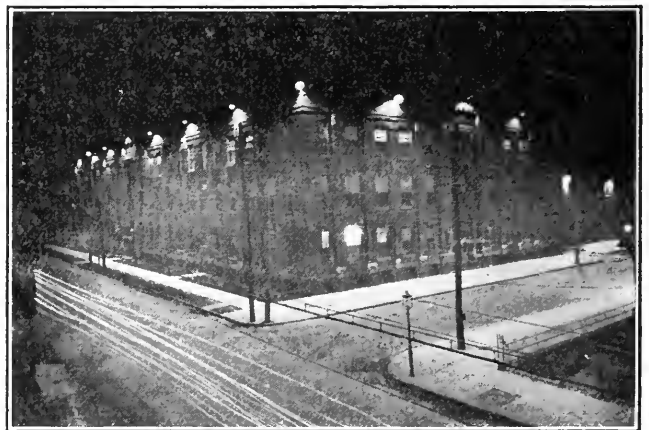
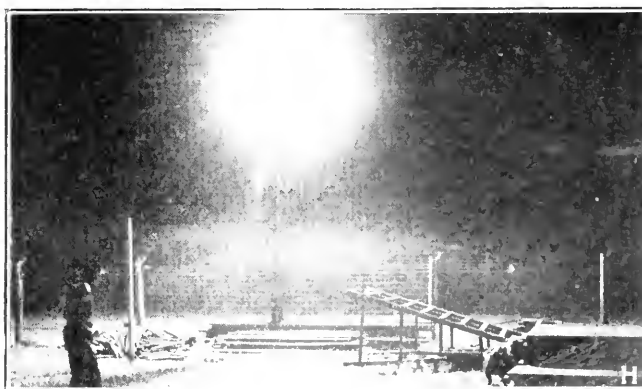
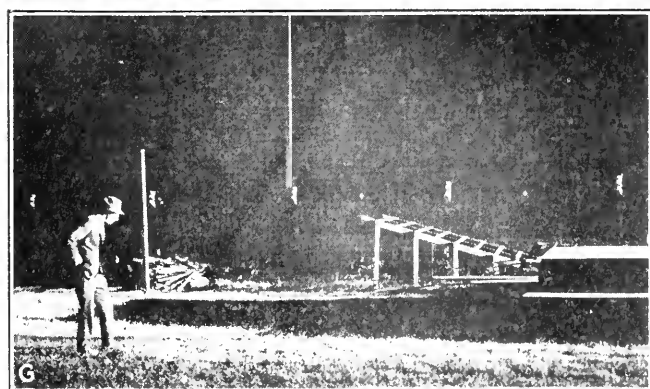
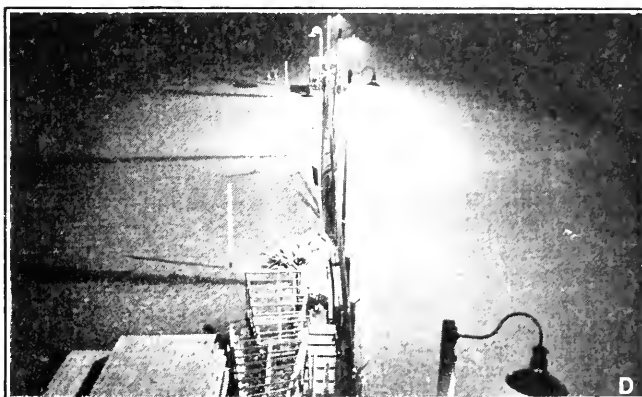
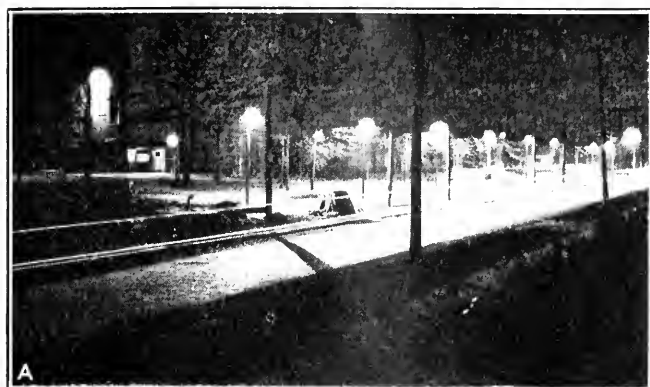


FIG. 2—ANGLE-TYPE ENAMELED-STEEL REFLECTORS WITH 300-WATT LAMPS

protective lighting are listed in Fig. 13. In selecting any of the equipments for out-door service one should be careful to secure well constructed, weatherproof fixtures. In a few cases the deep-bowl type of enameled steel reflector is of value in giving the maximum protection against interference with vision. Usually the

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FIGS. 3 TO 10 INCLUSIVE—COMPARISONS OF PROTECTIVE LIGHTING

A—Dome-reflector fixtures with 200-watt units reinforce street lighting. B—Dome reflectors around fence line. Units should be added along building face to avoid darkness cast by cars. C and D—Dome reflectors around boundary of large plot. E and F—

Same inclosure shown in C and D, but boundary is illuminated with floodlamps having spreads of 15 deg. and 25 deg. respectively. G and H—Man hiding at end of lumber pile is concealed by shadow when floodlighting is used but is clearly seen in local lighting.

dome type gives ample protection and is to be preferred because of the wider spread of light and greater output. In order that glare may be reduced with prismatic refractor fixtures, they should be ordered with the socket so placed that the maximum candlepower is

delivered at angles from 15 deg. to 20 deg. below the horizontal. The intensity at angles near the horizontal will then be greatly reduced.

It may be noted that floodlighting units are available for a wide range of beam spread, permitting

to meet varied requirements. With the specially concentrated filaments of the floodlighting lamps, accurate control of the light is possible, so that beams of small as well as large angular divergence can be obtained. The projectors shown at *c* and *d* in Fig. 13 are designed for use with such lamps. Equipments illustrated in *a* and *b*, which employ the regular multiple lamps pendent in the reflector, do not permit confining the beam to so narrow an angle because of the greater area of the light source.

The percentage of light directed into the beam varies greatly. Two characteristics determine the efficiency of projectors—the reflection factor of the surface and the depth of the reflector, *i.e.*, the percentage of the light from the lamp intercepted. Mirrored glass is becoming the standard reflecting surface, for it has a high efficiency which can be permanently maintained. The reflection factor is from one-fourth to one-third greater than that of the polished aluminum and nickel surfaces commonly employed in metal-reflector units.

SEARCHLAMP AND FLOODLAMP REQUIREMENTS ARE DIFFERENT

A large number of floodlighting projectors are still sold with shallow parabolic reflectors, directing only 18 to 25 per cent of the light into the beam. This condition exists because many designers have followed

ally required and the scattered light does not become detrimental, but on the contrary is frequently useful.

For most floodlighting it is possible to employ the deeper reflectors with contours formed and combined in such a manner as to redirect a large proportion of the light from the lamp. Such deeper projectors are illustrated, for the ordinary multiple and floodlighting lamps respectively, in *b* and *d* of Fig. 13. The common practice of employing the shallow paraboloid with the ordinary multiple lamps of large light source, as in *a*, is obviously very wasteful, when with an intelligent design it is possible to increase the output in the beam by from 50 to 100 per cent.

With the possible exception of the opal-globe equipments, all types of units listed in Fig. 13 can be used advantageously under many conditions, although each is better adapted than the others for certain applications. Many people have come to regard floodlighting units as the one type of equipment suited to protective service. The fact that they are relatively new and that they opened up new possibilities in lighting seems to have led to an exaggerated estimate of their performance and value. From Fig. 13 it is apparent that a projector mounted at a remote point actually delivers less light to a given area than would be secured from ordinary types of equipment in this area. However, it does not follow that the latter are always to be pre-



FIGS. 11 AND 12—BEAM FROM SEARCHLAMP FOCUSED ON ONE SPOT; BROADER BAND OF LIGHT PRODUCED WITH SAME SEARCHLAMP FITTED WITH FACTORY-RIBBED GLASS COVER

searchlighting practice without differentiating between floodlight and searchlight requirements. In designing or using searchlamps one is concerned only with securing the highest possible intensity at the center of the beam. It is desirable to suppress the light radiating at wide angles from the center of the beam so that the observer watching the distant illuminated area from his station near the searchlight may suffer the least interference with vision. The spread of the beam is determined by the angle which the light source subtends at the reflector; hence best results are obtained by using a paraboloid of relatively long focus, and therefore shallow, for a given diameter. In floodlighting one is concerned with delivering as large a percentage of the light from a lamp as possible to an area at a relatively shorter distance and viewing this area at closer range. Therefore a greater divergence of beam is usu-

ferred; due weight must be given to other factors as well. The relative advantages of lighting with floodlamps and with distributed systems of the other types of lighting units may, in a general way, be summarized as follows:

FLOODLIGHTING VERSUS DISTRIBUTED SYSTEMS

Dome and angle enameled-steel reflectors and prismatic refractor fixtures must be distributed at moderate spacings on supports relatively near the area to be illuminated. This distribution of units results in the marked advantage that at a given point light is usually received from several lamps and from different angles, thus obviating dangerous shadows and minimizing the effect of the outage of an individual lamp. Such equipments are efficient and their cost is relatively low. To mount the fixtures, however, it is sometimes necessary

to erect additional poles or other supports and extend the lighting circuits.

With projectors a different practice may be adopted, for the control of light in narrow beams gives the advantage of mounting equipment at a few favorable points, often on existing circuits, and delivering the light to areas at a distance. Thus the cost of additional poles and wiring is frequently saved, but this advantage is usually more than offset by the relatively high cost of the projectors themselves and the somewhat lower utilization of light flux. This is particularly likely to be the case if a sufficient number of lamps are installed at different points to eliminate long, sharp shadows. Furthermore, it is difficult to arrange flood-lamps so that objectionable glare will not at times be experienced, nullifying much of the value of the light.





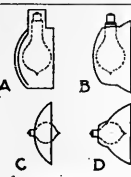
EQUIPMENT FOR PROTECTIVE LIGHTING			
ACCESSORY		LAMP	PER CENT OF LIGHT FROM LAMP DELIVERED BELOW HORIZONTAL
 DOME TYPE ENAMELED STEEL REFLECTOR		Mazda B and Mazda C; Multiple of all sizes to 1000 watts	75 - 80
 ANGLE TYPE ENAMELED STEEL REFLECTOR		Mazda B and Mazda C; Multiple of all sizes to 1000 watts	60 - 65
 PRISMATIC REFRACTOR FIXTURE		Mazda C; Multiple of 75 to 1000 watts Mazda C series of 60 to 1000 candlepower	60 - 70
 OPAL GLOBE UNIT		Mazda B and Mazda C; Multiple of all sizes to 1000 watts Mazda C series of 60 to 1000 candlepower	35 - 50
FLOOD-LIGHTING PROJECTOR			PER CENT OF LIGHT FROM LAMP DELIVERED IN BEAM *
	BEAM-SPREAD 6°-15°	Mazda C flood-lighting 200 and 400 watts	20 - 40
	BEAM-SPREAD 12°-24°	Mazda C flood-lighting 200 and 400 watts	30 - 50
	BEAM-SPREAD 40°-60°	Mazda C flood-lighting 400 watts	40 - 45
	BEAM-SPREAD 15°-30°	Mazda C; Multiple 300 to 1000 watts	20 - 40
Incandescent Searchlight		Highly concentrated filament Mazda C	1,000,000 to 5,000,000 Beam candlepower

FIG. 13—TYPES OF EQUIPMENT EXTENSIVELY USED FOR PROTECTIVE LIGHTING

Nevertheless, when they can be carefully located and mounted high on pole brackets, platforms or roofs of buildings excellent lighting may be secured. The outage of individual projectors is likely to be far more serious than that of a unit of the other types in a more distributed system; also, where a number of projectors are mounted on a platform there is danger that all of the lighting for a large area may be put out by one quick attack. Floodlamps are particularly valuable for providing light quickly in an emergency, for supplementing the ordinary systems and temporarily reinforcing the intensity at certain points. They fill a great need in illuminating locations in or near which no wiring can be carried or no supports placed for the older types of lighting fixtures.

A number of applications of the lighting equipment listed in Fig. 13 are illustrated in Figs. 2 to 12. The plant shown in Fig. 2 is located directly on a city street and the units employed are angle enameled-steel reflectors with 300-watt lamps attached to the build-

ing. For mounting heights of 25 ft. (7.6 m.) or more, and spacings not more than twice the height, this system is a desirable one, although sometimes it may be improved by tilting the units in slightly to minimize the glare. Where the building surface is light and for lower mounting heights, dome reflectors are preferable, spaced not more than three times their height.

Dome reflector fixtures with 200-watt units mounted 20 ft. (6 m.) above the pavement reinforce the street lighting in Fig. 3. On the building face are two angle units which help to illuminate the space in front of the building and assist the watchman in identifying persons approaching the plant. A similar installation of dome reflectors is carried on the pole line along the fence bounding another side of this property (Fig. 4). In either case the spacing should not be more than four times the height of the units. Higher mounting is advantageous; a height lower than 20 ft. (6 m.) is likely to be objectionable except for lamps as small as 100 watts. It may be noted that the cars which have been left standing in the yard throw the strip adjacent to the building in darkness. Units should have been added along the face of the building to prevent this condition.

Dome reflectors like those just referred to but equipped with 100-watt to 500-watt-lamps are also particularly suitable for protecting the boundaries of large inclosures, as shown in Figs. 5 and 6. The views are respectively those of a patrolman on the ground and a watchman at an elevated post. Prismatic refractor fixtures are also desirable for this service. They illuminate a wider zone, and the spacing may be increased to eight times the mounting height. The largest sizes of lamps are therefore often employed with such equipment.

The same inclosure protected by a zone of light from projectors with a beam spread of 15 deg. and 25 deg. respectively is shown in Figs. 7 and 8. One edge of the beam is directed along the fence, allowing the patrolman to walk inside in comparative darkness. The projectors are placed 12 ft. (3.6 m.) above the ground, one every 200 ft. (60.9 m.), and the beams pointed in one direction around the inclosure. So long as the patrolman is able to walk in the direction in which the projectors are pointing, conditions for vision are excellent. If, however, it becomes necessary for him to turn around and face the units, the glare he experiences will make the lighting ineffective. Therefore it is better to mount the projectors high on pole brackets or elevated platforms. When they can be placed 30 ft. to 60 ft. (9.1 m. to 18.2 m.) above the ground the interference from glare is very greatly minimized.

An error which is commonly made is to space projectors at too great a distance. The range is rapidly reduced as the atmosphere becomes hazy; also the outage of a unit becomes more serious as the spacing is increased. Where mounted low, as in the illustrations, the maximum spacing recommended is about 250 ft. (76.2 m.), and this value should be reduced for the widest-angle units. Under favorable conditions, where the projectors are mounted high and the largest lamps are employed, the spacing may be increased.

For lighting the yard proper, various types of accessories may be utilized. Angle reflectors attached to the buildings may be employed to light adjacent spaces, if mounted 25 ft. (7.6 m.) or more above the ground.

Dome reflectors and prismatic refractors on brackets attached to buildings, poles distributed throughout the yard, etc., meet the requirements best in the majority of properties. When floodlighting projectors can be placed sufficiently high and at various points so as to deliver light from several angles, good results may be obtained by their use. However, there is always danger that glare will not be sufficiently minimized and that piles of material or other obstructions in the yard will cast long, dark shadows, creating an accident hazard and affording a place of concealment. Such a condition is illustrated in Fig. 9, where the light is coming from one projector. With a greater number of smaller wattage lamps in dome reflectors distributed about the yard, these dark shadows are eliminated and the guard is able to detect the intruder (Fig. 10). The conditions could also have been improved if projectors had been directed at this point from both sides.

Narrow-angle floodlamps on building roofs or elevated platforms are valuable in lighting long approaches to a plant or sweeping open fields or waterfronts about a property. Incandescent-lamp searchlights greatly increase the range. With one of these the attendant will be able to "pick up" a man at distances as great as one-half mile (8 km.). In Fig. 11 the beam from a searchlamp of this type is directed at a point about 1000 ft. (304 m.) from the building on which it is mounted. Occasionally it is of value to have a beam which is wider horizontally, while any greater spread vertically would be wasted. Under these conditions a piece of factory-ribbed glass may be substituted for the clear-glass cover, resulting in a band of light of wide horizontal divergence but little vertical scattering, as shown in Fig. 12. The intensity at the middle of the beam and the range of the unit are of course considerably reduced.

Readjustment and Reconstruction Commission—II

The President's Commission, Composed of Experienced Men in the Industrial, Commercial, Financial, Transportation, Labor and Educational Worlds, Would Help Make Us Ready

BY WINGROVE BATHON

Washington Representative ELECTRICAL WORLD

AN OUTLINE of a proposed Presidential readjustment and reconstruction commission, to deal in this country, now, with problems that will present themselves after the war, was suggested in these columns on June 1. It was suggested that such a commission, appointed by executive order of the President of the United States, with personnel selected from leaders in private industrial effort in the United States, should have the assistance of an advisory council, also appointed by executive order, whose personnel should be selected from executive officials and legislators of the government.

SUGGESTED PERSONNEL OF COUNCIL

Such an advisory council should be selected from those who are especially charged with the conduct of affairs vital to the industrial, commercial, financial, transportation, labor and educational worlds. Realizing the demands made by the war on the chief Cabinet officers, it should not be expected that they should serve actively on such a council, although in one or two cases, such as that of William P. G. Harding, the governor of the Federal Reserve Board, principal officials, rather than those second in command, ought to be selected. In the case of legislators, many chairmen of Senate and House committees are also too much occupied with war legislation to deal now with after-the-war problems. Officials of executive departments on such an advisory council should be charged not only with the duty of giving advice and outlining governmental policies of the present and possible policies of the future, but should detail to the service of the commission experts in their own departments. In the following list strict order of precedence and rank in the government is not followed, but such an advisory commission or council should include:

Frank Lyon Polk, counselor for the Department of State, for all international contact.

F. M. Simmons, chairman of the Senate committee on finance, for contact on future government revenues and taxes.

Claude M. Kitchen, chairman of the House ways and means committee, for contact on future government revenues and taxes.

Duncan U. Fletcher, chairman of the Senate committee on commerce, for contact on legislation affecting commerce.

Thetus W. Sims, chairman of the House committee on interstate and foreign commerce, for contact on legislation affecting commerce.

Gilbert M. Hitchcock, chairman of the Senate committee on foreign relations, for contact on future international legislation.

Henry D. Flood, chairman of the House committee on foreign affairs, for contact on future international legislation.

John Bassett Moore, vice-chairman United States Section, International High Commission, for contact with international law, patents, trademarks, etc., in Latin America.

John Barrett, director general Pan-American Union, for Latin-American contact in detail.

William P. G. Harding, governor Federal Reserve Board; Charles S. Hamlin, president Capital Issues Committee, and Sherman Allen, treasurer War Finance Corporation, for contact on finance.

E. R. Stettinius, Assistant Secretary of War, for contact in industrial war production, and Rear Admiral Samuel McGowan, paymaster general of the navy, for contact on industrial naval production.

Maj.-Gen. E. H. Crowder, provost marshal general, for contact on reintroducing returned soldiers to industry.

William H. Taft and Frank Walsh, chairmen War Labor Board, for contact with war labor problems and activities.

John A. McIlhenny, president Civil Service Commission, for contact on government employment.

Carl Vrooman, Assistant Secretary of Agriculture, for contact with the soil and its agricultural products.

Edwin F. Sweet, Assistant Secretary of Commerce, for contact with the census and other bureaus dealing with commerce.

William B. Colver, chairman Federal Trade Commission,

for contact with the coming administration of the Webb act, which permits combinations for foreign trade, and for contact on unfair practices under the Newlands act.

F. W. Taussig, chairman United States Tariff Commission, for contact on material now being gathered by commission on after-the-war problems.

Raymond B. Stevens, vice-chairman United States Shipping Board, for contact on tonnage available after the war.

Herbert Hoover, United States Food Administrator, for contact on food licenses during reconstruction period and possible repeal of laws.

H. A. Garfield, United States Fuel Administrator, for distribution of coal and oil and possible repeal of laws during and after reconstruction period.

Walker D. Hines, assistant to the Director General of Railroads, for contact with transportation and terminals after the war.

A. Mitchell Palmer, alien property custodian of the United States, for final disposition of enemy-owned plants and other property.

Bernard M. Baruch, chairman of the War Industries Board, for contact on sources of supply of raw materials and finished products.

Walter S. Gifford, director of the Council of National Defense, for contact on reviving less essential industries.

Vance C. McCormick, chairman War Trade Board, for contact on licenses for imports and exports after the war.

Executive secretary (when named) of the water-power commission of Cabinet officers which is about to be created.

Daniel C. Roper, Commissioner of Internal Revenue, for contact on collection of excess profits taxes, etc.

Charles D. Walcott, president National Academy of Sciences, for government contact with the sciences.

Charles F. Nesbit, Division of Military and Naval Insurance, for contact on personal insurance problems and defectives on his rolls who are returned soldiers.

Philander P. Claxton, Commissioner of Education and secretary of the Federal Board for Vocational Education, for contact on educational statistics and statistics on defectives.

George Creel, chairman committee on public information, for assistance and contact in educational work.

It is respectfully submitted that this is no mere list of names. Broadly speaking, it is an analysis of the industrial war organization of the United States, and a reading of the suggested contacts will show that the work of these officials and that of their departments, bureaus and associates will be just as vital to the solving of after-the-war problems as it is vital to winning the war now. The two problems cannot be separated. All national contacts to-day are international. We think and move in terms of world-wide importance.

TASKS THAT WOULD CONFRONT COUNCIL

After four years of war England has found it necessary to tear up and move to France between 15 and 20 per cent of her main-line tracks. If the war goes on a long while, if there is not iron enough, if there is not steel enough, if there is not labor enough, if there is not constant maintenance, something like that might happen in this country. Then there will be need for actual physical reconstruction in this country, as there is abroad, instead of need merely for readjustment. Plans for such possibilities must be made now. Again, it is estimated that we shall have within a year from 45,000 tons to 50,000 tons of steel-ingot producing capacity and probably 100 per cent greater finishing-machine producing capacity than we had in 1913, in which year we were obliged in many lines to go abroad for a market for our surplus production. What plans are in the making for our surplus production after the war? Again, it is estimated that we shall have, with what we now have, 15,000,000 tons in merchant ships available

after the war. What definite trade routes from American ports to the other ports of the world are being thought out?

The biggest American businesses which have been built up abroad have been in machine-finished steel products, such as talking machines and music machines, cash registers, agricultural machinery, adding machines, sewing machines, etc. Plans must be made to introduce these special products. One company now represented in Washington desires to open an office at Rio de Janeiro; another desires to send 600,000 tons of shipping to Australia next year. Is there any governmental agency or semi-governmental agency in Washington to offer encouragement or authoritative advice? No.

What is being done to divert to American ports the rehandling business previously done in Europe, such as the bringing of rice from India, to reclean it, regrade it and reship it? What is being done to hold for the United States the rubber which formerly went to England, now coming here to avoid two trips through the submarine zone? What is being done to hold for the United States the business in tin which formerly went to England and Holland from Bolivia? What is being done to hold for the United States the business in coffee which originally went almost entirely to Europe, at which time we paid for the longer freight haul and commissions in London, Hamburg and Bremen, and much of which now comes to this country?

An advisory council such as has been outlined in this article, working with the proposed Presidential readjustment and reconstruction committee or commission, could answer these questions, if answers are in existence; and if not could place industry through the commission in a position to meet such problems as have been suggested and a thousand more. The United States Tariff Commission is one of the few governmental agencies which are avowedly gathering data for after-the-war problems. The Federal Trade Commission, the Department of Commerce and the War Trade Board are also collating information. But there is no apparent co-ordination of these efforts, such as there is in England and other countries. The next article in this series will deal with what is being done in that respect in England.

Book Review

THE EMPLOYMENT DEPARTMENT AND EMPLOYEE RELATIONS. By F. C. Henderschott, New York Edison Company, and F. E. Weakly, employment manager Montgomery, Ward & Company. 60 pages, illustrated. Chicago: LaSalle Extension University.

With the present high rate of turnover this volume, published as part of the material for the course in business administration at LaSalle Extension University, becomes of unusual interest. It describes the organization and duties of an employment department, the function of its manager, relations to other departments, sources of labor supply and the scientific method of selecting those to fill situations. Practical questions of transfers, promotions and general welfare work are discussed. The analysis sheets of physical examinations of "turnovers" ought to prove particularly suggestive.

STATION & OPERATING PRACTICE

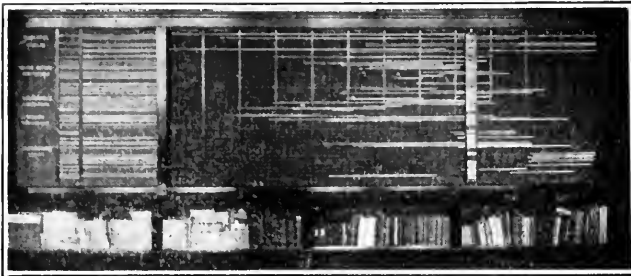
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

A SCHEDULE BOARD FOR ENGINEERING DEPARTMENT

Plan Which Allows the Schedule of Any Job to Be Changed Without Disturbing the Remainder of the Board

BY H. E. WULFING

For the purpose of keeping the members of the engineering department and others interested informed as to the work on hand—its progress and the scheduled date for completion—the Commonwealth Edison Company of Chicago has installed in the en-



BOARD INDICATES PROGRESS OF JOB AND ESTIMATED DATE OF COMPLETION

gineering department the novel schedule board shown in the illustration. The board proper is about 5 ft. (1.5 m.) high by 16 ft. (4.9 m.) long and is divided into two sections, the first section showing the class of the station, the name of the substation and a description of the work to be done. The second section is the schedule proper.

The first section is backed by cork linoleum, on which are pinned strips of paper showing the name of the substation and a brief description of work to be done. The second section is divided vertically into twelve parts headed by the months of the year, and at intervals of about 1 in. (2.54 cm.) steel wires are strung horizontally across the board. Strips of colored bristol board are attached to these wires by means of a paper clip. The color of the bristol board represents the kind of work being done—that is, whether building work or electrical construction—and the length of the strip indicates the estimated time to complete it. The location of the strip of paper on the wire indicates the time at which it is proposed to do the work. In order to facilitate reference the work involved is printed on the strip.

By means of colored stars pasted on each strip the date at which apparatus is to go into service is indicated. Other colored tags indicate apparatus to be moved or removed. A movable index is hung on a rod from the top of the board, indicating the current date.

The board is maintained as follows: As soon as the installation of apparatus is authorized the head of the department issues a preliminary order covering the engineering work and giving the scheduled date of com-

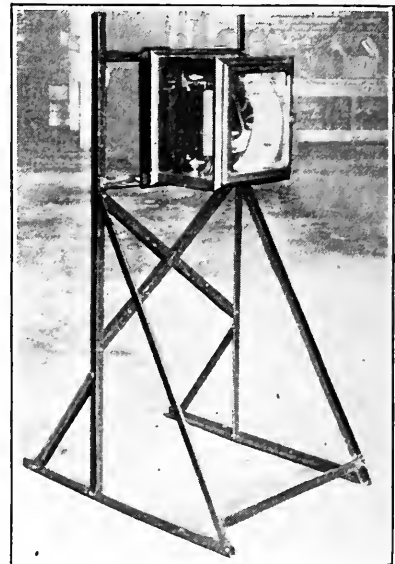
pletion. This order is issued in multiple and copies are sent to the engineer of design, the engineer in charge and the clerical division. The engineer of design makes an estimate as to the probable time it will take to complete the work. This information is given to the clerical division, which incorporates it on the schedule board. Any changes in the scheduled date or the probable duration of the job are made by supplementary orders to the original order by the head of the department, so that any additions or changes in this schedule board are made by his authority only.

This board has the advantage over a printed schedule in that it is possible to easily change the schedule for any one job without disturbing the rest of the board. As a result of this the schedule leads the work instead of lagging, as is the usual case.

LIGHT STRUCTURAL CARRIER SAVES TIME IN MACHINE TESTS

Meter Placed in Upright Position Near Apparatus
Eliminates Temporary Construction and
Obviates Use of Nails

To facilitate the use of a heavy curve-drawing ammeter in substation tests, H. J. Howarth, superintendent of the meter department of the Cumberland County Power & Light Company, Portland, Me., has designed



STRUCTURAL STEEL FRAME FOR TEST METER

the structural steel carrier illustrated herewith. The 2000-amp. meter is provided with four bolts so that it can be hung in four slots in the carrier. The frame is 30 in. (76 cm.) long, 23 in. (58.3 cm.) wide and 4 ft. (1.2 m.) high. The meter can be securely installed on the carrier by one man.

ASBESTOS INSULATION REDUCES LEAKAGE AND CONSERVES HEAT

Investigations of United States Bureau of Mines Show that Brick Conducts Heat Faster than Asbestos and Increases Loss in Boiler Settings

The use of asbestos insulation between the courses of the brick settings of boilers reduces air leakage and conserves heat that is usually wasted with the ordinary air space, according to recent investigations of the United States Bureau of Mines. Firebrick should withstand temperatures up to 3000 deg. Fahr., but it is a good conductor of heat and conducts it six to ten times as fast as the asbestos felt. Red brick conducts heat about five times as fast as the felt. Insulating material with smaller air spaces reduces convection losses far better than material with the larger air spaces. This practice is especially timely with the present fuel prices, and the result shows that it is not economical to use cheaper insulations for high steam pressures. When subjected to temperatures of 1200 deg. to 1500 deg. Fahr., the disintegration of the better grade of asbestos fibers starts and the material gradually becomes more brittle, not going to pieces, however, much below 1800 deg. Fahr.

SUBMARINE CABLE LAID UNDER MISSISSIPPI RIVER

Eliminates Necessity of New Machinery and Provides Permanent Connecting Link Between St. Louis and East St. Louis Companies

Two 5000-kw., 13,200-volt, three-conductor submarine cables about 2500 ft. (762 m.) long have recently been laid across the Mississippi River, connecting the systems of the East St. Louis (Ill.) Light & Power Company and the Union Electric Light & Power Company of St. Louis, Mo. These cables form a connecting link between the two systems and eliminate the necessity of the immediate installation of new machinery on the Illinois side of the river.

The cables consist of three No. 4/0 B. & S. gage conductors insulated with 7/32-in. (0.551-cm.) 30 per cent rubber compound and 1/16 in. (0.16 cm.) varnished cambric. The conductors are held together with a band of 1/8-in. (0.3-cm.) varnished cambric and a 9/64-in. (0.36-cm.) lead sheath. This sheath is covered successively with two layers of tar jute braid, an armor of No. 4 B.W.G. steel wire and two layers of asphalted jute braid.

The cables were laid simultaneously from a barge towed by tugs. The actual work of laying the cables required only about one and a quarter hours, and the entire job was completed by working continuously for sixteen hours. Four reels of cable in 1250-ft. (381-m.) lengths were placed upon the barge and two reels were paid out at the same time. The cables were then spliced to the remaining two reels by means of standard splice boxes and the remainder of the cable was laid. Considerable difficulty was encountered during the splicing owing to the tendency of the cables to go downstream. This was prevented by heading the tugs upstream and running the propellers while the splicing was in progress.

The cables are connected to the Ashley Street power

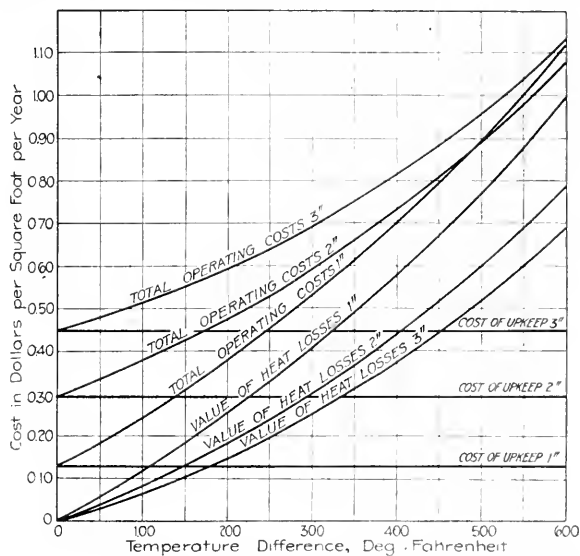
house on the Missouri side by two 1500-ft. (457-m.) standard underground cables. The Illinois end of the cables terminate in a switch house on the river levee. This cable is laid at a depth of about 3 ft. (0.9 m.) underneath the levee and is protected at its terminals by aluminum-cell lightning arresters. The two cables can be paralleled in the switch house by disconnecting switches. The remainder of the connecting link between the two systems consists of an overhead transmission line running from this switch house to the Lake Street substation of the East St. Louis company.

CHART FOR DETERMINING ECONOMY OF INSULATION

Permits Comparison of Expense Chargeable to Pipes Insulated with 85 per Cent Magnesia with That of Uninsulated Pipes

BY AUSTEN BOLAM

By calculating the volume of heat loss from insulated pipes and adding the fixed expense and cost of maintaining the insulating material a decision can be reached



TOTAL EXPENSES CHARGEABLE TO PIPE INSULATED WITH 85 PER CENT MAGNESIA

as to the expenditure which can be economically made to insulate pipes. Curves which take these considerations into account are given in the accompanying illustration, the actual cost per year per square foot of surface covered being shown direct.

The horizontal lines represent the cost of upkeep, and the curves radiating from zero give the value of the heat losses at various temperature differences. The temperature difference to be used is found by subtracting the temperature of the surrounding air from the temperature of the steam in the pipes. By adding the constant and variable costs the total expense chargeable to insulated pipes is obtained. This is shown by the remaining curves.

Referring to a handbook or similar source of information, the loss from bare pipes can be obtained and a comparison made. The experiments on which this chart was based were made at the Mellon Institute of Industrial Research at Pittsburgh, Pa. Insulating material known as 85 per cent magnesia was used in the tests, which covered a year's time.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

SALESMAN'S ASSISTANCE IN SELECTING TRANSFORMER SIZES

From a Careful Study of Load to Be Connected a
Considerable Saving in Transformer
Capacity May Result

BY A. G. DRURY

The salesman for the central station is finding the rising cost of construction quite a formidable consideration. The central stations are more conservative than formerly in making extensions, owing to their exorbitant cost, and many are asking the prospective consumer to pay a part of the expense. It is well known that the more money a "prospect" is asked to advance the harder it is to close the contract. It follows therefore that any information which the salesman can gather that will tend to decrease the expenditures will make it easier to do business.

The primary function of the construction department is to build and maintain the lines as economically as possible, and any assistance which the commercial man can lend in this work by his knowledge of the character of the power load to be added is likely to be appreciated by the superintendent.

One way in which to assist is in the selection of the size of transformers. It is evident that if at the end of the year the reports show that 2000 kw. connected load has been added to the system with 1000-kw. transformer capacity, it is better than adding 2000 kw. and 1500 kw. in transformers most of which are under-loaded. The advantage exists not only in the amount of capital saved, but also in the amount of energizing current required by the smaller transformers as compared to the larger one.

As a concrete example there is related an incident which came up in connection with a contract for supplying electric energy to a company which made small brass and bronze casting cages such as are used in receivers' booths in banks, etc. The equipment which was to be driven by motors consisted of an elevator, a blower for gas furnaces, emery grinders, polishing machines, lathes, a milling machine, drill presses, etc., in all twenty-four such pieces of apparatus. The total number of motors to be installed amounted to 42 hp. The salesman had become familiar with the character of the work and reported that he had secured a 15-kw. maximum-demand contract. The manager accordingly ordered three 4-kw. transformers. One of the men in the office, knowing the motor equipment to total 42 hp., out of friendliness to the salesman told him that three 4-kw. transformers had been ordered, when there should have been three 10-kw. machines. Upon inquiry it developed that the rule was for the salesman to report 40 hp. or 30 kw., upon which three 10-kw. transformers would be purchased, whereas with co-operation established between the two departments considerable saving in equipment would be accomplished.

The difference in first cost is as follows:

Cost to purchase and erect three 10-kw. transformers.....	\$271.50
Cost to purchase and erect three 4-kw. transformers.....	144.00
Saving in first cost.....	\$127.50

A test made on the installation mentioned after completion showed the maximum demand to be 12 kw.

The salesman by studying the characteristics of any new business can save as well as make money for his company. From considerable experience similar to the above the writer has found that the capacity of the transformers serving an installation can often be limited to less than a third of the connected load; but the salesman must make each individual investigation himself and not rely on the published tables of average load or maximum demands for different manufacturing businesses. The time and energy invested will be justified by the returns.

ELECTRICAL ENERGY FOR HOUSING REQUIREMENTS

Considerations Which Will Govern the Supply as
They Have Been Outlined by Government
Committee in Charge of Work

It has been definitely decided by the Bureau of Industrial Housing and Transportation to light the industrial homes with electricity where this is available.

The considerations governing the installation of electricity and lighting are outlined by the bureau as follows:

1. It is to be expected that usually the housing development will only introduce electric light and energy when adjacent utilities are available and can extend their service into the district.
2. It is possible in exceptional cases that plants for this purpose may have to be created. If so, experienced electrical and mechanical engineers should be engaged to design and construct them.
3. When existing utilities are available, some form of contractual relation must be entered into by which rates and service standards will be defined.
4. Under ordinary conditions overhead distribution is contemplated, preferably by pole lines installed as far as possible in alleyways.
5. Under conditions where frequent street lighting is afforded by electric energy, modification of this method may be necessary and desirable in some cases.
6. Standards of materials and construction will, as a rule, be similar to those adopted and defined in the existing ordinances in the community where they are installed.

The bureau suggests that the investigation of local utility service should include a full description of the local electric light and gas plants, with a statement of capacity, connections, cost, street-lighting methods, rates and reliability of service.

DISTRICTING CITY AS AID IN SUMMONING PHYSICIANS

St. Louis Company Informs Employees Concerning Methods of Handling Emergency Medical Calls

When the services of physicians are required in emergencies by workers for electric light and power companies the saving of a few minutes sometimes means saving or failing to save the life of the victim. In order to reduce as much as possible the time required in calling the proper physician and getting him quickly to the injured person, the Union Electric Light & Power Company of St. Louis has divided the city into five districts and has published a map showing the divisions between these districts and giving the name and telephone number of the doctor who should be called in case of an emergency within any district. Employees of the company are urged to keep the chart where it will be instantly available.

THE KIND OF PUBLICITY FOR INCREASED RATES

Public Must Be Shown the Same Things That Are Put Before the Commission, but in a Simple and Direct Manner

To go about the matter of obtaining higher rates is a new idea. Formerly the utilities had to contend with the possibility of having their rates lowered. There was no thought of raising rates. Now that the necessity for higher rates has become evident new practices must be developed. It is pretty generally held that to be entirely successful in this connection the confidence of the public as well as that of the commission must be obtained.

This idea was developed to some extent by L. W. W. Morrow, director of the School of Electrical Engineering of the University of Oklahoma, at the recent annual convention of the Oklahoma Gas, Electric and Street Railway Association. He said:

Extension of service and more than necessary service are the watchwords of successful utility operation. The task of the utilities is to show the public that present conditions mean decreased service or advance in rates, and to get the public to accept voluntarily the increase in rates upon decision of its representatives, the corporation commission.

The gist of every publicity argument should be that unless rates are advanced service will be decreased. The latter condition will not be permitted by the public, whose demand is more and better service. The utilities must show:

1. That they are not getting a fair return on the actual capital invested.
2. That their financial condition is not a temporary condition with relief in sight, but is in fact increasing in seriousness with the lapse of time.
3. That the increase is necessary in order to furnish adequate service of the kind the public requires.
4. That the increase desired is only reasonable and just and that their motive in asking it is only the application of fair dealing to present conditions.

The public must be shown the same things a commission is shown, but it must be shown these things in a simple and direct manner. No lengthy treatise on "going concern," "depreciation," "reproduction," "new value," etc., appeals to the public. Simply show that operating expenses are so much, operating revenues another sum, and the difference inadequate to furnish the service desired by the public.

The utility publicity man must have several essential characteristics. He must be able to marshal his facts and

present them in a telling and effective manner. He must believe in his own case enthusiastically and must be perfectly frank with his audience. He must be the personality of his company—no one cares about the hardships of the Blank Electric Company, but John Jones is a definite personality and his views and opinions are quoted and considered. The personality of the manager of a utility solves many vexatious problems in public relationship. The publicity man must establish the fact that a partnership exists between the utility and the public. Every one gets his share in the business either in wages, taxes, service or other returns. No one can take more than his share without affecting the others. The publicity man must reduce his statistics to the value of a dollar in order for the public to comprehend them. A balance sheet is a cipher to the average citizen he tries to reach. Publicity must be simple and concise—one fact at a time must be treated, and that fact must be handled in a manner to fix it in the mind of the citizen.

There are many methods for obtaining publicity—the newspapers, newspaper advertising, circulation, posters and street cars, addresses before civic bodies, personal relationship between the employees and the public are all legitimate means for obtaining publicity. The newspaper is the chief agent, as it reaches the maximum number of people. The publicity of the individual plant must be handled locally—no amount of generalization will be read by the local citizenship. The manager of the local utility is the one person to handle the public. A central bureau can compile his facts and arrange his material, but the manager's personal touch is essential in getting these facts across to his public. A lecture bureau is a great help in presenting matters to civic bodies of a general nature, but every question that is in dispute should be personally presented by the manager, even though in many cases he is far from being a fluent speaker or a logical floor talker.

The importation of a high-grade man by the utility to handle local disputes is poor policy, as it strikes the local people as a plan to talk them out of their side of the case by means of hiring an able lawyer. Instinctively the local people fall into an antagonistic mood. The manager, however, lives in the community and is one of the citizens and on a common basis with the local people from their point of view. Outside help can marshal the facts for the manager and obtain his material, but should not attempt to intervene directly in local disputes.

General publicity where there is no local dispute can be better handled by an able lecturer before civic bodies than in any other manner. A judicious use of newspaper advertising is also desirable.

NUMBER OF CUSTOMERS FOR REPORT PURPOSES

Pacific Power & Light Company Groups New and Lost Business Under Three Heads, According to Rate Schedule

Every installation that is billed under a separate rate schedule is counted by the Pacific Power & Light Company, Portland, Ore., as a customer in its monthly statistical report. Thus, a consumer having a lighting, power and range installation, although all on the same premises, is counted as three customers because each installation is billed under a separate rate schedule.

The company groups its new and lost business under the following heads: Class A business is secured when an additional load is added to an existing installation, and by installation is meant that load which is billed under any one rate schedule. Class B customers are secured when a load is connected where a similar service under the same rate schedule was rendered before. Class C customers are secured when a load is connected where similar service under the same rate schedule never was rendered before.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

The Commutator Machine as the Standard Single-Phase Type.—F. CREEDY.—The author cites advantages which could be realized through the universal employment of the commutator motor on single-phase circuits to the exclusion of the single-phase induction motor. He discusses the advantages of single-phase power over polyphase systems in certain districts and gives the relative costs, performance, weights and power factor of different machines. For variable speed it is desirable to vary both the auxiliary motor winding and the voltage from the transformer. In practice only three taps are provided on the motor winding and six on the transformer. By this means a sufficient number of combinations to give ten distinct speeds is provided, the field of the motor varying somewhat from the purely rotating character (which should theoretically be maintained) in the majority of these speeds.—*London Electrician*, April 19 and 26, 1918.

Elementary Principles of Continuous-Current Armature Winding.—F. M. DENTON.—The theory of equalizing connections is explained and rules are derived for the application of such connections. Chord winding is explained, and the use of interpolated commutator segments is discussed. Special consideration is given to the question of the number of slots that should be used for a given winding, taking into account the inductance of the parallel paths. The article concludes with a schedule of winding rules.—*London Electrician*, April 19 and 26, 1918.

Generation, Transmission and Distribution

National Electricity Supply in Great Britain.—The opinion is expressed that too great stress has been placed upon the saving of waste heat. Assuming that waste heat could be available generally as it exists around Tyneside, some 750,000 tons of coal per annum could be saved, which is only a small fraction of the 55,000,000 tons of saving promised. Furthermore, conceding that the £550,000 per annum might be saved by extensively utilizing waste heat, its importance is minimized when compared with the many millions to be expended. An important financial factor is the £210,000,000 initial cost to save 55,000,000 tons of coal per annum, and assessing the total capital charges at 8 per cent, there is an annual standing charge of £16,800,000 per annum, against a saving of £27,500,000 in coal.—*London Electrical Times*, April 25, 1918.

Utilizing the Escaping Steam at Coal Mines in Energy Production.—A. BARJOU.—First part of an article on this subject—an important one, the author holds, in view of the ever-growing use of electricity at coal mines. The problem consists of (1) the regulation of the steam escaping from the primary machines by its accumulation in a thermal or volumetric apparatus; (2) the utilization of this steam at low pressure by means of a turbine coupled to an electric generator;

(3) the attainment of as high a vacuum as possible to insure the performance and improve the output of this turbine.—*L'Industrie Electrique*, May 10, 1918.

Feed Water for Steam Boilers.—J. A. MONTELLIER.—The author estimates that when the incrustation caused to form on the sides of boilers by calcareous water reaches a thickness of 1 mm. (0.039 in.) it is necessary to increase combustion 10 per cent to get the same results as before any deposit was formed; if the thickness is 5 mm. or 6 mm., 40 or 50 per cent increase in combustion will be necessary. Eventually there is danger of an explosion. Cleaning the boilers is a long task which not only interrupts operations but also is likely to cause damage from the blows of the hammers. Feed water, the author says, ought not to contain too much of the salts of calcium and magnesium or too many organic substances. If it has more than 15 deg. of total hardness, it is essential to purify it. Practical directions for doing this are given.—*L'Industrie Electrique*, May 10, 1918.

Installations, Systems and Appliances

Switchgear Standardization.—CHARLES C. GARRARD.—Among the subjects discussed are the general principles underlying standardization, standard test pressure for switch and controlling gear, conductivity of current-carrying alloys, specifications for cast brass and gunmetal, millivolt drop at knife-switch contacts, and suggested standards for back-connection studs and nuts. The author calls attention to the urgent necessity of standard oil-switch rules in view of the conditions that exist in foreign countries and discusses breaking capacity, the connection between this and the quantity of oil required, the length of break and speed of operation. The millivolt drop at air-break circuit-breaker brush contacts is also considered; short-circuit tests, time element and determination of normal fusing current are subjects discussed in connection with cut-outs. Discussions regarding copper strip connections on switchboards, temperature rise, millivolt drop at bolted contacts, and lightning protective gears, including horn gaps, choke coils and lightning arresters, conclude the article.—*Journal of the Institution of Electrical Engineers*, London, April, 1918.

Rectification of Alternating Currents by the Corona.—The rectification of high voltage is an interesting problem on which some experiments described by J. W. Davis in a recent paper before the American Physical Society shed some light. Pressures as high as 42,000 volts have been rectified by the corona discharge in hydrogen. For a given gas pressure the maximum voltage which may be rectified is approximately proportional to the radius of the outer cylinder, provided that the inner cylinder is small compared with the outer. The rectification is practically perfect, but the efficiency is low, much energy being wasted in the discharge. The voltage at which discharge takes place may be con-

siderably reduced by arranging for the discharge to be started by an incandescent wire.—*London Electrician*, April 26, 1918.

Wires, Wiring and Conduits

Joining Triple-Concentric to Three-Core Cable.—P. WARDLE.—Description of a fitting which is not so bulky as those available heretofore. A 4-in. (10.2-cm.) sleeve will fit over the fitting.—*London Electrical Review*, April 26, 1918.

Heating of Conductors.—G. PERRIN.—A new method of calculating the maximum temperature that copper conductor can reach—an important consideration in the maintenance of insulation. The author, working out a numerical example, claims simplicity and rapidity for his method.—*Revue Générale de l'Electricité*, May 4, 1918.

Electrophysics and Magnetism

Resonance and Ionization Potentials for Electrons in Cadmium Vapor.—JOHN T. TATE and PAUL D. FOOTE.—The two types of electronic impact that take place with mercury also occur in cadmium vapor. The sudden decrease in current through the retarding field at an effective potential of 3.88 volts indicates a loss in energy of electrons having this critical velocity on impact with a cadmium atom. When the velocity of the electron corresponds to 8.92 volts, the collisions again become inelastic, and the sudden increase in the total current indicates that the loss in energy of the colliding electrons has disappeared in separating one or more of the electrons bound in the atom from the nucleus. That the entire spectrum of cadmium is probably radiated at potentials above 8.92 volts is indicated by the appearance of a visible glow around the hot wire at 9.2 volts. McLennan and Henderson were able to get the complete spectrum at about 15 volts. If, following McLennan, we calculate the ionizing potential on the basis of Bohr's theory, using the frequency $\nu = 1.5S$ of the cadmium spectrum ($\lambda = 1378.68A$) in the above relation, we obtain a theoretical value of 8.97 volts, as compared with 8.92 volts observed. The agreement is within the probable error of the experiment. The results obtained for the resonance and ionization potentials for electrons in mercury and cadmium vapors must be regarded as another very striking example of the fundamental accuracy of conclusions based upon Bohr's theory of atomic structure. Especially is this true of the results of mercury vapor, since for a long time the view that ionization took place at 4.9 volts, together with the known fact that the radiation emitted at that potential was monochromatic, formed a very serious obstacle to the complete acceptance of the theory of atomic structure.—*Paper No. 317, Bureau of Standards*.

Evolution of the Thermionic Value.—R. L. SMITH-ROSE.—The author refers to the investigations and findings of Elster, Geitel, Sir J. J. Thomson, Wehnelt, Edison, Fleming, Langnier and others. He concludes by saying that when a metal or carbon filament is rendered incandescent in a highly exhausted vessel there is a continual evaporation or emanation of negative electricity from it in the form of electrons, the rate of such emanation being dependent on the nature and temperature of the glowing filament and on the nature and pressure of the surrounding gas.—*London Wireless World*, April, 1918.

Miscellaneous

The Conservation of Platinum.—The Society of Expert Chemists of France is protesting against the employment of platinum in the manufacture of jewelry and silverware in view of its growing scarcity and its necessity in many manufactures of national importance, among which the electrical industry is prominent. The society desires either that such use be prohibited or that a heavy tax be levied on all articles of luxury containing platinum. In this connection the proposed substitutes for platinum—an alloy of gold and palladium, an alloy of nickel and chromium, an alloy of silicon and iron, quartz in its pure state and stellite—which were recently the subject of a paper read before the American Chemical Society by E. Haynes, are briefly dealt with.—*L'Industrie Electrique*, May 10, 1918.

Corrosion of Condenser Tubes Caused by Salt Water.—G. COSTESEQUE.—Central stations which get their circulating water from the sea have to contend with the corrosion of the condenser tubes. The author, who is the director of a power house at Marseilles, tells of his experiences during ten years, which show diverse and even contradictory results with identical condensers under the same conditions. He attributes the corrosion to electrolysis and has found that zinc disks through which a light current is allowed to pass have afforded a fair degree of protection.—*Revue Générale de l'Electricité*, May 4, 1918.

Purification of Boiler Water.—W. T. READ.—The article not only deals with the chemical and technical aspects of water purification but also gives, in plain and untechnical language, practical information and instructions for the benefit of those who are not conversant with chemical nomenclature and formulas. It is therefore valuable to every one interested in the purification of water for commercial purposes. Under the headings "Effects of Minerals in Water Used in Steam Boilers," "Common Scales in Boiler Water Supplies" and "What an Analysis Means and What It Does Not Mean," scaling, corrosion and foaming are very clearly discussed. Common chemical ingredients are given and statements are made when to use compounds, objections to compounds, mechanically acting compounds and legitimate compounds. Preheaters, water softeners and filters are also considered, mud and sludge removal, danger of incorrect filtration and coagulants being discussed. Under "Cost, Construction and Operation of Water Softeners" is listed the cost of standard patented water softeners. The variation of cost with size is pointed out. Under "Cost of Chemicals" the calculation of amount of chemicals needed for analysis of water, factors for use with hypothetical combinations and variations in cost of chemicals are given. The necessity for chemical control in an intermittent lime-soda softener is emphasized, and information is given on how to fix feed of chemicals to meet variations in water, use of one constituent to fix amount of chemicals, preparation of a table for amount of chemicals, how to determine bicarbonates, and apparatus and supplies for testing water. The reasons for testing, details of testing treated water and what the results mean are also discussed. The savings effected by water-softening plants, some general facts and some actual saving experiences with the Austin Street Railway Company softener are presented.—*University of Texas Bulletin* No. 1752.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Investigations Under Way or Completed (RESEARCH WORK REPORTED SINCE MAY 18)

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

FUEL CONSERVATION.

One of our larger problems is the conservation of petroleum and its products, as well as natural gas at the same time stimulating production and securing improved transportation to meet increased needs while avoiding waste. In the past eighteen months savings of from 20 per cent to 30 per cent have been effected by study of oil and gas problems and of gas made possible by special apparatus that heretofore was regarded as valueless. The processes now nearing completion in our refineries promise equal increases in fuel saving. We estimate that the work of our technical staff will show a saving of at least half a million dollars of crude-oil fuel in 1918 and nearly an equal amount in refiners.—H. B. Shaw, with Henry L. Doherty & Company, Toledo, Ohio.

LIGHTNING ARRESTER, ELECTRO-THERMAL.

The arrester, which is still in an experimental stage, consists of a bakelite tube containing two electrodes, one connected with the horn gap and the other with the ground. Normally the electrodes are connected by water, but when there is a discharge the vapor pressure generated forces the water out through a needle valve, breaking the circuit.—E. O. Schweitzer, Chicago.

PORCELAIN FOR SPARK PLUGS.

At the request of the Signal Corps and the National Advisory Committee for Aeronautics, the Bureau of Standards has undertaken a study of ignition problems with special reference to aeronautic engines. The investigation of spark plugs has involved the development of methods of testing the electrical conductivity of porcelain at high temperatures, the resistance to fracture of porcelain insulators by sudden changes of temperature and by mechanical impact, and the gas tightness of plugs at operating temperatures. Investigations of the characteristics of magnetos and other ignition systems are also being made to determine the relative characteristics of the spark discharges produced by the various systems. Much of the work is of a confidential nature and has, therefore, not been made public. A series of porcelains has been produced in the Pittsburgh Laboratory of the Bureau which show high electrical resistance at temperatures above red heat and at the same time good mechanical strength. Thus, at a temperature of 750 deg. C. one body showed a resistance of 1 megohm per centimeter cube.—Bureau of Standards, Washington, D. C.

RELAY, PROTECTIVE, ON THERMAL PRINCIPLE.

The relay is provided with a heating element the temperature of which increases in the same proportion as that of the piece of electrical apparatus to be protected. When the limiting temperature has been reached the relay causes the main circuit to be opened. In one form of relay a brass rod wound with asbestos-insulated magnet wire and an insulated casing are used. The expansion of the rod can be made to follow the dissipation of heat in any piece of electrical apparatus. To compensate for eddy currents a threaded iron screw is inserted inside the brass rod, upon which the asbestos insulated wire is wound. The expansive movement of the brass rod is multiplied by suitable levers in order to make and break a contact quickly. The disconnecting apparatus is a new form of polyphase magnet which has one axis for all the three phases and is active either on one, two or three of the phases.—S. N. Baruch, San Francisco, Cal.

STEEL, THE INFLUENCE OF HEAT TREATMENT ON ITS SPECIFIC RESISTANCE AND THERMO-ELECTRIC PROPERTIES.

The purpose of the investigation has been to add to the knowledge we have of the specific resistance and thermo-electric properties of steels of varying carbon content when these steels have been subjected to different heat treatments, and to point out the relation existing between specific resistance and chemical constitution, with a view to throwing more light on the underlying causes of hardness in steel. Experimental evidence shows that electrical resistivity in metallic solutions is an analogue of electrical conductivity in aqueous solutions, and consequently really a manifestation of the chemical constitution rather than of the purely physical structure.—E. D. Campbell, University of Michigan, Ann Arbor.

TRANSFORMER, SHORT-CIRCUIT, STRESSES.

A transformer under short-circuit was photographed by means of a moving-picture camera, to obtain information as to the process of the actual displacement and destruction of the coils. In preparing the positive of the film each element of the negative was printed ten times in succession, so that on the screen the motion of the coils appears slow enough for direct observation.—J. J. Frank, Pittsfield, Mass.

Suggestions for Research

DISTRIBUTION, MINIMUM-COST.

In view of the present high cost and scarcity of copper it would be advisable to make a study of the initial cost and operating expenses of some typical direct-current distributing systems with different distances between converter substations, for example, with substations 2 miles (3.2 km.) apart and again at a distance of 1 mile (1.6 km.) apart. In the first installation fewer generating units though of larger capacity would be required and fewer stations and switchboards. Against this saving there would be a greater amount of copper required in the distributing lines to obtain the same voltage regulation as would be obtained were smaller and more numerous units used. There are many existing installations in which a considerable amount of low-tension cable could be saved by adding more substations. The copper so salvaged could be used to advantage on other parts of the system.—E. C. Kincy, Columbus, Ohio.

FUSES.

The design of fuses is peculiar in that it is very largely an empirical proposition, there being a number of factors which probably have never been thoroughly and finally analyzed by either the manufacturers or engineers. This is due largely to the fact that the phenomena which take place, especially under severe short-circuit conditions, have so short a duration that they are unusually difficult to analyze. This is a fruitful field for an earnest student and a physicist to obtain definite laws, and to devise testing apparatus both accurate and reliable for practical use.—Editorial Suggestion.

FUSES.

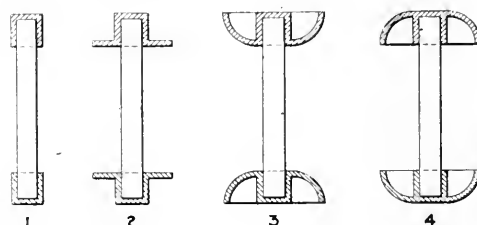
The present holders for refillable fuses being made of fiber cannot be used in mines on account of moisture and atmospheric changes. Therefore research could be profitably carried on with the idea of producing either a material with which the fiber could be treated or a substitute for it.—P. L. Raymond, Chicago, Ill.

HEATING OF CONDUCTORS IN SLOTS.

With the increase in the rating of synchronous and induction machines it becomes of more and more importance to strand and otherwise to subdivide the conductors in slots so as to reduce the skin effect and eddy currents. But with a parallel connection of conductors less current flows through the conductors on the bottom of a slot on account of their greater inductance. Various methods have been proposed for the equalization of currents in order to reduce the copper loss and to increase the rating of the machine. It is desired that a systematic study be made of the various arrangements proposed and used from both the electrical and the mechanical point of view. See, for example, R. Richter in the *Archiv für Elek.*, 1917, p. 335, where he proposes to surround with a magnetic circuit the end connections of the conductors on top of the slots so as to increase their inductance and thus to force a proper share of the current through the bottom conductors.—Editorial Suggestion.

INSULATORS, ROD TYPE.

Some investigations regarding the effect of different-shaped terminals on the arcing voltage of a rod insulator (see the sketches) would be beneficial. The insulator would in practice have a rod made of wood impregnated with paraffine. For



experimental work, if such a rod was not available, one made of glass, porcelain, solid paraffine or hard rubber would probably do. Fig. 1 shows an insulating rod with close-fitting metal caps on the end, Fig. 2 the same rod with flat disks added to the caps, Fig. 3 a rod with curved disks on the caps, with convex surfaces opposite each other, and Fig. 4 the same thing with the disks reversed. If the minimum arcing distance is the same in all cases, what voltage would it take to arc over the different types of construction? I would suggest that the flat disks shown in Fig. 2 be made of different diameters, so as to determine at what point it would cease to be worth while to increase further the diameter of the disk in order to increase the voltage. The terminals shown on Figs. 3 and 4 could be made both of different diameters and different radii of curvature, and further variation could be made by making cone-shaped terminals. The points on the disks from which the arc starts are also important, as it is desirable to have the arc jump from the outer edges of the disk rather than to follow the surface of the rod.—H. H. Cochrane, Montana Power Company, Butte.

LIGHTNING PROTECTION.

Some experiments indicate that the amount of atmospheric electricity which a lightning rod can conduct to the ground may be increased many times by artificially ionizing the air around the point. This artificial ionization may be produced by several known means such as radio-active substances, ultra-violet light, an electric spark, etc. Further laboratory experiments are desired with a view to developing practical arrangements for the protection of oil tanks, powder magazines and similar structures against lightning. The use of some inexpensive radio-active substance seems especially promising.

STARTERS FOR DIRECT-CURRENT MOTORS.

Valuable work could be done in determining the proper number of accelerating points and the relative value of the resistance steps to be used in connection with automatic starters for direct-current motors. Any information that could be tabulated or any empirical formulas that could be devised for this purpose for different makes and speeds of motors would be of considerable benefit.—H. L. Van Valkenburg, Milwaukee, Wis.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

ADDITION TO PROGRAM FOR A. I. E. E. ANNUAL CONVENTION

Several Papers Not Previously Announced to Be
Presented at the Atlantic City Meeting on June
26-28—Luncheon-Conferences

Besides the list of papers announced in the March 16 issue of the ELECTRICAL WORLD for the thirty-fourth annual convention of the American Institute of Electrical Engineers, R. E. Dougherty and O. E. Shirley will present a paper on "Reactance of Synchronous Machines and Its Application," and J. M. Drabelle and L. M. Bonnett will present one on "The Automatic Hydroelectric Plant."

Crosby Field, Ordnance Department, U. S. A., will read a paper on the same subject as that by Dr. C. P. Steinmetz, "The Oxide Film-Fighting Arrester."

At luncheon on the three days of the meeting there will be conferences of Institute officers and delegates of sections and branches. The board of directors will hold a meeting at 5 p. m. on June 26, and in the evening there will be an informal reception and dance. Technical committee reports will be read at the first session, opening 10.30 a. m. on Wednesday.

PLAN OF CONTRACTOR-DEALER CONVENTION AT CLEVELAND

First Annual Meeting of the Association Under Its
New Name and Object—All Executive and
General Meetings Open to All

The eighteenth annual convention of the National Association of Electrical Contractors and Dealers will be held at Cleveland July 15 to 20 with headquarters at the Hollenden Hotel. Monday, July 15, will be given over to the meetings of the national executive committee, and on Tuesday afternoon there will be meetings of the Atlantic, Central and Pacific divisions.

The convention will be opened at 10 o'clock on Wednesday, July 17, by A. L. Oppenheimer, president of the Electrical Contractors of Cleveland. An address of welcome by Mayor Davis of Cleveland will be responded to by President W. C. Peet. There will also be an address by W. C. Rose, president of the Cleveland Advertising Club. On Wednesday afternoon L. K. Comstock, New York, will present a paper on "Scientific System of Wage Adjustment," to be followed by a round-table conference on the labor cost data, J. N. Pierce being chairman.

On Thursday morning J. R. Strong, past-president of the association, will speak on organization and William L. Goodwin will describe the Goodwin plan. On Friday morning, following reports of the association committees, G. M. Sanborn of Indianapolis will read a paper on "How to Open a Retail Store," to be followed by another paper on "How an Electrical Contractor Can Become a Successful Retailer." The question box will be

opened and questions will be answered by Mr. Goodwin.

All sessions of the convention, as well as the meetings of the national executive committee and division meetings, will be open to any one wishing to attend. On all papers read before the convention a free and open discussion is invited.

STEP TAKEN FOR RELIEF OF POWER SHORTAGE IN CALIFORNIA

Utilities Meet with Commission and Agree on Plan
Involving Pooling of Power, Priorities and
Postponed Financial Adjustment

The California Railroad Commission called together on Tuesday representatives of all power companies now interconnected in the central California group to consider means of relief from the present power shortage.

Mortimer Fleishhacker, Great Western Power Company, after reviewing the causes of power shortage, suggested that the commission prepare a priority list of classes of consumers which would be used alike by all power companies. Paul M. Downing, Pacific Gas & Electric Company, also assured the commission that serious power shortage actually exists and that immediate action is necessary. Either certain consumers must be shut off entirely or the amount of power supplied consumers of certain classes must be reduced. The State Food Administrator and Emergency Fleet Corporation representatives predicted a large increase of power demand for irrigation pumping and ship construction respectively.

The commission then examined power company representatives successively, with the result that each agreed to three general features of a plan for relief; namely, first, pooling all available power; second, apportioning load in accordance with a priority rating to be prepared later, and third, postponing the incidental financial adjustment between companies until the physical results shall have been accomplished.

Representatives of the several power companies, at the commission's suggestion, then and there elected a committee of seven to act with the commission in taking steps to relieve the present crisis in such way as may be deemed best. A. E. Schwabacher, State Fuel Administrator; D. M. Folsom, Pacific Coast Petroleum Administrator, and a representative of the Federal Reserve Bank heartily indorsed the plan and agreed to cooperate. The commission then immediately went into session with the committee of seven, of which the members are: A. Casper, Vallejo Light & Power Company; Samuel Kahn, Western States Gas & Electric Company; John A. Britton, Pacific Gas & Electric Company; Mortimer Fleishhacker, Great Western Power Company; Edward Whaley, Northern California Power Company; H. F. Jackson, Sierra & San Francisco Power Company, and S. W. Coleman, Coast Valleys Gas & Electric Company.

INDUSTRIAL EFFICIENCY

AT A. S. M. E. CONVENTION

War Topics Predominate in Important Meeting at Worcester, Mass., Attended by Nearly 1000 Delegates and Guests

American industry is humming with a determination to force the Hun back through efficient co-operation with the men on the fighting fronts. The importance of the engineer's work behind the lines in productive service was emphasized over and over again at the spring meeting of the American Society of Mechanical Engineers held at Worcester, Mass., June 4 to 7, and the influence of the war upon the papers and discussions of nearly 1000 members and guests who attended the convention was apparent at every session. In munitions production, in the efficient use of fuel and in numerous other ways the engineers of America are accomplishing a superb task, whose magnitude could only be hinted at in the crowded hours of the meetings.

The opening session took place on the evening of June 4 at the Hotel Bancroft, greetings being extended by R. Sanford Riley, president of the Worcester Chamber of Commerce, and by Mayor P. G. Holmes of Worcester. A council meeting of the society was held in the afternoon, with President Charles T. Main in the chair. At this session resolutions were discussed relative to the elimination of the alien enemy members of the society, of which there are about 100 out of a total membership of 9000. It was decided to draft suitable resolutions and present them for consideration at the winter meeting of the society in New York.

Regular activities opened Wednesday with a business session at the Worcester Polytechnic Institute. A forty-eight page report was presented by the committee on limits and tolerance in screw-thread fits. This was followed by a report by the committee on weights and measures, a forty-eight page compilation of replies to a questionnaire regarding the use of the metric system by several thousand manufacturing concerns in the United States. The replies indicated that the metric system is not making great progress in this country.

Following the reports, Prof. George H. Haynes, head of the department of economics, Worcester Polytechnic Institute, read a suggestive paper on "The Small Industry in a Democracy." Dr. Haynes emphasized the value of team play to industry, pointing out how it is obtained in small establishments through direct relationship between employer and employee.

President Ira N. Hollis of the Worcester Polytechnic Institute, past-president of the A. S. M. E. and chairman of the New England Fuel Administration's engineering advisory committee on plant economy, made an address on the importance of fuel conservation through co-operative effort.

H. W. Ballou, consulting engineer, Providence, R. I., presented a paper on the "Use of Fuel Oil in New England Power Plants," which gave a statistical tabulation of installations of this type. Within four years sixty plants have adopted fuel for 344 boilers of ten different kinds, totaling 83,000 hp. One-half of these are in Rhode Island. The rapid adoption of fuel oil, the author stated, is due to its superiority to coal in all attributes except possibly that of first cost. Despite the great advantages of fuel oil, the increasing shortage threatens its future use, and the author predicted that

in time oil fuel will command a premium for marine use which will commercially debar it from the power plants of New England. In many cases, however, the whole cost of the oil-burning installations will be saved well within a period of five years.

A report of other proceedings of the convention will be published in a later issue.

COAL DEFICIT THREATENS

TO CAUSE FAMINE IN FUEL

"We Know the Worst of a Bad Situation," Says the Fuel Administration—Conservation the Only Safe Way

A statement on the critical coal outlook issued by the Federal Fuel Administration on June 10 says in part:

The fuel budget for the season 1918-1919 has been completed by the United States Fuel Administration. We know the worst of a bad situation. A detailed survey of the coal required during the present coal year for war purposes to keep our industries running and for domestic consumers foots up about 80,000,000 tons more than was produced last year. This is the figure on June 1. . . .

It is estimated that the industries not employed on war work will require something less than 100,000,000 tons of coal. All consumers of fuel, war industries and otherwise, must participate in the saving campaign, but non-war industries are especially interested, because whatever the deficiency turns out to be, it will come out of their quota. Hence, the general prosperity of our industries and the full employment of labor will depend upon saving, by economies and prevention of waste, between 50,000,000 and 60,000,000 tons.

In spite of intense efforts to increase the production of coal, the first five months of 1918 have produced only 10,000,000 tons in excess of the same period of 1917. If this is considered in relation to the immense physical task involved in producing 12,000,000 tons of coal per week, it is easy to draw the conclusion that this increased demand of 100,000,000 tons cannot to any large extent be met by increased production. And yet an actual deficit of 500,000 tons would mean a personal privation and an industrial disaster which no one can contemplate with equanimity.

What is the answer? There is only one; it is saving coal. It is the answer Europe has made in a similar situation—saving coal in every possible way and by all of the people.

The Fuel Administration has foreseen the situation represented by these figures and through its conservation division has organized fuel-saving campaigns reaching out into every department of our national life where fuel is consumed.

Fuel economy is receiving intensive study in connection with steam plants and industrial uses. An organization is already in existence provided with engineers and inspectors who will visit every one of the 250,000 steam-producing plants in the country with a view to the improvement both of equipment and firing practice. This is expected to save 20,000,000 tons of coal. The economical use of power in factories will be in the hands of organized shop committees. The power loads of the public utilities throughout the country are being studied with a view to readjustments which will result in large saving.

In many cities the isolated power plants which use an extravagant amount of coal in proportion to the power produced will be urged to obtain more economical power from large producing stations.

The introduction of "skip-stop" schedules on all the street railways is expected to save 1,000,000 tons of coal. The consolidation of ice plants will yield a still larger tonnage. Unnecessary outdoor lighting, including advertising signs and display illumination, will be reduced. Hotels, office buildings, apartment houses and public buildings are being asked to join in rigid economy of light and heat.

Every American citizen will be asked to clean his furnace, keep it in repair and study economical firing. Instructions prepared by the highest authority will be furnished by the Fuel Administration.

If every one joins in this movement from the owner of an industrial plant to the householder with his furnace and cookstove, if indoor and outdoor lighting is reduced to the amount absolutely needed, if houses are not overheated, the furnace dampers properly adjusted and the ashes sifted, it will be possible to save from 50,000,000 to 75,000,000 tons of coal without serious inconvenience to the American people.

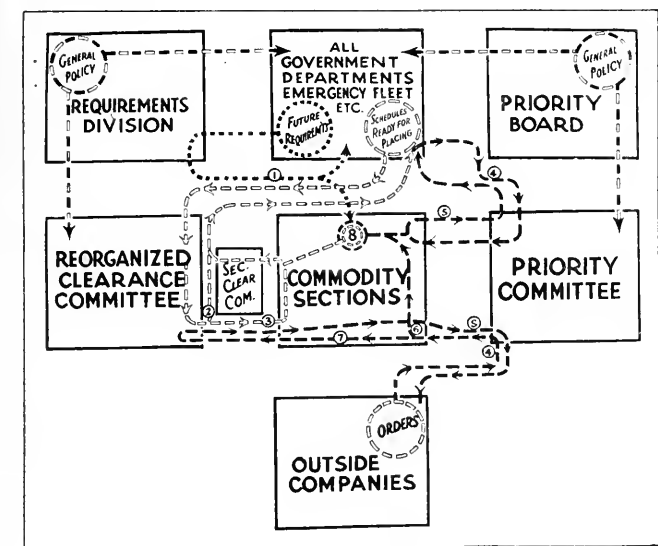
A saving of 60,000,000 tons of coal is the one possible avenue of escape from national disaster. Necessities of war must be supplied. The coal deficit must inevitably come out of the necessary fuel for non-war industries. These industries employ millions of our population and furnish the backbone of our national wealth. Factories will shut down and men be out of work in proportion to the coal deficit. Every ton of coal saved will keep fifty workmen from idleness and permit an additional creation of several hundred dollars' worth of national wealth.

The Fuel Administration has frankly given to the public statistics of an alarming fuel situation. It desires to state just as frankly and with all the emphasis possible that it is in the power of the American people through fuel economy to save the country from the effects of the fuel famine.

ECONOMIZING TIME IN WAR INDUSTRIES BOARD

Diagrams Presented by Walter Robbins Before the
Electric Power Club Show the Methods
Followed in Washington

Walter Robbins, chief of the power equipment section of the finished products division of the War Industries Board, presented the accompanying diagrams in connection with his remarks on war service work at the annual meeting of the Electric Power Club, Hot Springs, Va., on May 30 to June 1.



INTERRELATION OF WAR INDUSTRIES BOARD DIVISIONS

Here is a key to the numbers on the first diagram:

1. Requirements are presented in person by a representative of the department or organization in interest, who of course learns at the meeting whether they are approved or not. If approved, copies are sent to all commodity sections that may be directly or indirectly interested.
2. If the commodity representative is able to clear at the meeting, the proposal goes back with the representative.
3. When the commodity section having jurisdiction over the article in question is unable to offer immediate clearance, but must arrange clearance by negotiation with outside companies and all other departments whose work might be interfered with, then the requirement is taken back to his office for such study, and when ready for clearance is not

again presented at committee meeting, except in special cases, but is passed to the secretary for proper record.

4. Upon reaching priority division the application is numbered and recorded. All correspondence thereafter indicates the application number, the name of the specializing member is indicated upon the application, and it then passes to the proper commodity section for recommendation.

5. Upon return with recommendation the case is reviewed by the specializing member, with the sub-committee on rat-

GENERAL CLASSIFICATION OF PURPOSES DEMANDING PREFERENCE TREATMENT

SHIPS	Including destroyers and submarine chasers
AIR CRAFT	
MUNITIONS, MILITARY AND NAVAL SUPPLIES AND OPERATIONS	Building construction for Government needs Equipment for same
FUEL	Domestic consumption Manufacturing necessities named herein
FOOD AND COLLATERAL INDUSTRIES	Foodstuffs for human consumption and plants handling same. Feeding stuffs for domestic fowls and animals, and plants handling same All tools, utensils, implements, machinery and equipment required for production, harvesting and distribution, milling, preparing, canning and refining Foods and Feeds, such as seeds of Foods and Feeds, Binder Twine, etc. Products of collateral industries, such as Fertilizer, Fertilizer ingredients, insecticides and fungicides, Containers for foods and feeds, collateral products Materials and equipment for preservation of Foods and Feeds, such as Ammonia and other refrigeration supplies including ice
CLOTHING	For civilian population
RAILROAD	For other necessary transportation equipment, including water transportation
PUBLIC UTILITIES	Serving war industries, Army, Navy and civilian population

Including all necessary raw materials, partially manufactured parts and supplies for completion of products

ing, or taken to the meeting of the entire committee as circumstances may warrant.

6. Application may return immediately to priority committee if the commodity section is in position to make immediate recommendation without further investigation or consultation.

7. Original contact with secondary requirements frequently comes through priority application. It is the duty of commodity sections to watch for interferences, and when they cannot be removed by discussion with departments they are taken by the commodity representative on clearance committee to the meeting and then referred with recommendation as shown under No. 5.

8. Very often, upon the original appearance of the requirement clearance, priority recommendation and clearance of the secondary requirements can all be arranged in a single conference between the department or departments interested and affected, the specializing member of the priority committee and the commodity chiefs who may be interested, and procedure is arranged for clearance and for priority action when the priority application or applications actually appear through route No. 4.

MIDDLE WEST SUBSIDIARIES ANTICIPATE RATE INCREASES

Already \$400,000 of Increases Have Been Granted, and Applications for \$600,000 Additional Are Pending—Scrip Dividend

In mailing its first scrip dividend the Middle West Utilities Company, Chicago, by order of the directors and over the signature of Samuel Insull, president, made a statement of the financial position and future prospects of the company, in part as follows:

The very unfavorable condition of the securities market brought about by government needs makes the raising of funds for the natural necessities of a constantly increasing gross business difficult, even at excessive rates of interest. Directors therefore decided to pay the preferred stock dividend in ten-year 6 per cent interest-bearing certificates. Interest on these is payable quarterly or at such other periods as may be determined from time to time by the directors. The company at its option at any time before maturity may pay the principal with accrued interest then unpaid upon giving at least ninety days' notice. The holder at his option may convert certificates aggregating \$100 or any multiple at any time prior to payment into preferred or common stock at par.

In the twelve months ended March 31, 1918, the aggregate gross income of the company's subsidiaries was \$1,500,000 greater than for the preceding twelve months. Operating expenses for the same period increased \$1,670,000. The increase in gross income for the three months ended March 31, 1918, as compared with the corresponding period of 1917 was \$328,000. Operating expenses increased \$400,000 for the same period, owing largely to the fact that January was a most unfavorable month for all utilities because of unusually severe weather conditions and the governmental regulation with relation to heatless days. By reason of increased operating expenses the balance over preferred stock dividend will be somewhat less in the annual report for the fiscal year ended April 30 than in the previous fiscal year.

Some of the subsidiaries of the Middle West Utilities Company have already obtained by increased rates for service and by increasing the selling prices of other products increases aggregating over \$500,000 per year. The larger part of these increases has not yet been reflected in their earnings. As of January 1, 1918, only \$160,000 per annum had become effective, while as of May 1, 1918, this amount was increased to \$400,000 per annum.

In addition other subsidiaries now have before the various commissions applications for increases approximating a further amount of \$600,000, making increases of rates secured and anticipated amounting in the aggregate to upward of \$1,000,000. The management feels that with operating conditions no worse than in the year previous and with the increases now effective and those to be obtained by the subsidiaries within the next few months from applications pending the net earnings of the Middle West Utilities Company for the fiscal year starting May 1 will be satisfactory.

CHICAGO TECHNICAL MEN ARE UNITED FOR WAR WORK

Engineering and Technical Societies in That City Organize a Joint War Committee to Combine Strength and Resources

Representing an effort to co-operate effectively and vigorously for war work, an important joint war committee has been formed by representatives of technical societies centered in Chicago. The movement was started by the military committee of the Western Society of Engineers. As the result the "War Committee, Technical Societies of Chicago," has been organized.

The purpose of this organization is "to enable the technical societies of the Chicago zone to call into play the efforts of the members of the various societies herein represented as occasion may arise, and to co-ordinate their activities in the most effectual manner to help win the war." It is proposed to place at the disposal of the United States government and other authorized agencies the combined strength and resources of the Chicago technical societies for war work as need may arise. The following member societies are co-operating: Western Society of Engineers, Structural Engineers' Association of Illinois, Society of Industrial Engineers, Illinois Society of Engineers, Illinois Society of Architects, American Railway Engineering Association, Swedish Engineers' Society of Chicago, Illinois Chapter American Institute of Architects, Chicago Section American Society of Mechanical Engineers, Chicago Section American Institute of Electrical Engineers, Chicago Section American Chemical Society, Chicago Section American Institute of Mining Engineers, Mid-West Section Society of Automotive Engineers, Illinois Association of American Society of Civil Engineers, Chicago Section American Society of Heating and Ventilating Engineers, Chicago Section American Society of Refrigerating Engineers, Chicago Section Steel Treating Research Society, Chicago Section Illuminating Engineering Society and Chicago Chapter American Association of Engineers.

Officers of the war committee have been elected as follows: Chairman, F. K. Copeland; vice-chairman, W. L. Abbott; secretary, Edgar S. Nethercut; treasurer, William A. Fox.

The executive committee consists of F. K. Copeland, W. L. Abbott, William Hoskins, C. A. Keller, Charles E. Lord, C. F. Loweth, Isham Randolph and Richard E. Schmidt. The address of the secretary of the war committee is 1735 Monadnock Block, Chicago.

HOW TO WIN THE WAR

What we need to do is to speed up. It is not a question of what we must not do but a question of what we must do. We must win the war. We must provide all the arms, ammunition, ordnance, aeroplanes and other equipment that can be transported to Europe, and we must build ships as rapidly as possible.

We must make all the other goods that we can possibly make. We must keep on creating new wealth. We must keep our manufacturing organization in good running order. We must continue to go after foreign trade. And we must prepare ourselves for the intense competition for foreign markets that will occur after the war.

THOMAS A. EDISON.

(Letter read at Edison phonograph convention.)

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

N. E. L. A., Connecticut Section.—The fifth annual outing of the Connecticut Get-Together Club of the National Electric Light Association is scheduled for to-day (June 15) at the Momauguin Hotel, Cosey Beach, East Haven, Conn.

A. S. M. E., Indianapolis Section.—L. W. Wallace was elected chairman at the May 10 meeting of the Indianapolis Section of the American Society of Mechanical Engineers. "Heat Losses in Uncovered Steam Pipes" was the subject of discussion.

Engineering Society of Milwaukee.—H. M. St. John of the Testing Laboratory of the Commonwealth Edison Company, Chicago, gave an illustrated talk on "Products of Electric Furnaces and the Cost of Their Production" before the Engineering Society of Milwaukee on June 12.

A. I. E. E., Pittsburgh Section.—At the final meeting of the season of the Pittsburgh Section of the American Institute of Electrical Engineers, on June 11, Major Lyle spoke on "The Department Organization of a Modern Army" and S. Q. Hayes spoke on "Some Recent European Experiences."

Chicago Vehicle Association.—The Chicago Electric Vehicle Section, National Electric Light Association, has elected the following officers for the ensuing year: President, George D. Foster, Commonwealth Edison Company, and secretary-treasurer, E. W. Swift, Commonwealth Edison Company.

Electrical Club of Detroit.—Dr. A. C. Studar talked before the Electrical Club of Detroit at its regular weekly luncheon on June 1 on "The Y. M. C. A. and the War." The June 1 number of *Current Events*, issued weekly by the club, is dedicated to the Detroit Edison Company and called the "central-station edition."

N. E. L. A., Public Service Section.—The June meeting of the Public Service Section of the National Electric Light Association will be held in the assembly room of the Terminal Building, Newark, on Monday evening, June 17, at 8 p. m. There will be an election of officers and a discussion about the different departments.

A. I. E. E., Cleveland Section.—C. S. Ripley was elected chairman and R. K. Knowles was elected secretary at the May 20 meeting of the Cleveland Section of the American Institute of Electrical Engineers. This was the last meeting of the season and was held under the auspices of the committee on co-operation of engineering societies. It was addressed by C. E. Drayer, secretary of the national committee on co-operation.

Synchronous Club of Los Angeles.—"Electric Railways" was the subject of a lecture delivered by L. J. Turley of the Los Angeles Railway Corporation before the June 6 meeting of the Synchronous Club of Los Angeles.

A. I. E. E., Madison Section.—James W. Watson and L. E. A. Kelso of the University of Wisconsin were elected chairman and secretary respectively at the May 27 meeting of the Madison Section of the American Institute of Electrical Engineers. E. R. Shepard of the Bureau of Standards gave an address on "Electrolysis and Mitigation Methods." He first gave a short illustrated talk on the work of the Bureau of Standards.

A. I. E. E., Chicago Section.—The Chicago Section of the American Institute of Electrical Engineers, at its meeting on May 27, elected the following officers for the ensuing year: Chairman, C. A. Keller, and secretary, A. F. Riggs. On June 17 the section will hold a joint meeting with the Western Society of Engineers, at which time there will be a discussion of the economies which can be derived from the use of higher steam pressures.

Empire State Gas and Electric Association, Electric Section.—A meeting of the Electric Section of the Empire State Gas and Electric Association will be held in the Onondaga Hotel, Syracuse, N. Y., on Friday, June 21, at 9.30 a. m. This will be a combined meeting of the electric production and the electric distribution departments, and war-time topics will be discussed. Among these topics will be the labor situation and the substitution of women for men, fuel conservation, 11,000-volt distribution with special attention to connecting transformers and to protection from lightning in connection with rural service, the rear-lot distribution in residence districts, outdoor-substation design and construction, electric furnace operation and its effect on system regulation, and the installation and maintenance of synchronous motors on consumers' premises to improve the power factor on the distribution system.

Ohio Electric Light Association.—As previously announced in the *ELECTRIC WORLD*, the twenty-fourth annual convention of the Ohio Electric Light Association will be opened on Wednesday, July 10, at 10 a. m. at the Breakers Hotel, Cedar Point, Ohio. On that day, besides the president's address, there will be a report of the executive committee, secretary-treasurer's report, report of the illumination committee, appointment of committees, report of the station and operating committee, and report of the meter committee. Thursday morning there will be reports from the new-business co-operations committee, the commercial lighting and merchandising section and the industrial power and heating section. In the afternoon James M. Cox, Governor of Ohio, will deliver an address. On Friday there will be a report of the transmission and distribution committee and election of officers. Beecher W. Waltermire, Public Utility Commissioner of Ohio, will speak.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Discretion of Commission Regarding Rehearings.—Under the Public Service Commission law providing that, on application for rehearing of a proceeding, the commission shall grant and hold such a rehearing if in its judgment sufficient reason is made to appear, the granting or refusing of application for rehearing rests in the discretion of the commission, the New York Supreme Court held (169 N. Y. S. 953).

Rights to Use of Streets.—Where an illuminating and heating company had laid its conduits in a public alley, a contractor, excavating a basement on the land of an abutting owner, had no right to excavate part of the alley so as to cause a cave-in, resulting in injury to such conduits, and was liable for the resulting damage, the Supreme Court of Michigan held in *Edison Illuminating Company versus Mich* (166 N. W. 944). The requirement in a franchise to a lighting and heating company that it get an express permit to lay its conduits in a public alley, being for the protection of the city, might be waived by it, and failure to obtain such permit constitutes no defense in an action by the company for injuries to its conduits.

Secondary Municipal Franchises.—The right of a public service corporation to hold and enjoy a secondary franchise granted by a municipal corporation and conferring privileges and rights within the limits of the city, town or village that can be exercised only by its permission depends upon the continuous performance of the public duties assumed by the acceptance of the franchise, constituting a condition precedent to such right, it was held by the Supreme Court of Appeals of West Virginia (95 S. E. 6531). On the failure of such performance the right or privilege granted by the franchise terminates, and a court of equity has jurisdiction to cancel the franchise, by way of rescission of the contract between the granting and accepting corporations. A telephone company holding a franchise for the installation, maintenance, and operation of one telephone system in a city, town or village cannot without the consent of such municipal corporation take over by purchase another system constructed by another company under another franchise and operate both systems separately and contemporaneously, nor use the locations of such other system in the streets for wires and other appliances of its own system, nor take the benefit of other privileges granted to such other company, without having acquired its franchise as well as its tangible property.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Using Electric Light in Gas Works.

According to an item in a Richmond (Va.) newspaper, the superintendent of the city electric plant in that place is about to wire the gas works in order to permit electricity to be used for lighting them.

Spokane Extension Plans Abandoned.

It is announced that, owing to war conditions, the Spokane (Wash.) Heat, Light & Power Company will not extend its lines into the residential district this year, as had been intended. Minor adjustments and small extensions to hold the present field are to be made, but no new patrons sought.

State Franchise Tax Paid Under Protest.—At the recent convention of the Missouri Public Utilities Association the fact was brought out that a number of companies in Missouri are paying a state franchise tax under protest. It was also stated that this course was followed after a careful investigation had been made and legal counsel secured.

Kansas Rate Increase.—The United Water, Gas & Electric Company, Hutchinson, Kan., has been given authority by the Kansas Public Utilities Commission to add a surcharge of 3 mills per kilowatt-hour to all existing electric power rates and for energy supplied for electric ranges and battery-charging services. This will add 13 per cent to the gross earnings.

Rate Increase Granted in St. Joseph, Mo.—The Missouri Public Service Commission has granted authority to the St. Joseph Railway, Light, Heat & Power Company to increase all lighting rates to 9 mills per kilowatt-hour, which will mean an increase in lighting revenue of \$8,000 a month. The appeal for this increase was made two months ago. The company had previously received an increase in power rates.

Air Attack on Power House in the Trentino.—According to the London Times a squadron of Italian and British airmen flew on May 4 to Cavedine, which lies to the northeast of Riva (in the Trentino) and dropped such a weight of explosives on the celebrated hydroelectric power house that it will be some time before the supply can be resumed. The central station was actually seen to be destroyed. The raiders flew in four rotating groups, and it is stated that the attack lasted from 8 a. m. till midday. An important effect of the raid, it is said, will be a complete shut-down of the electric railway from Trent up the Val di Sole to Fucine, which is a valuable link in the Austrian army's communications.

Technical Men Needed for War Work.

Those who cannot take part in the actual fighting in France may find an opportunity to help in numerous technical positions under the War and Navy Departments, which are seeking trained men. The army and navy would be powerless without the backing of an efficient corps of highly trained men working in connection with the production of war material. The United States Civil Service Commission, whose duty it is to recruit the civilian army, announces that the government is in urgent need of large numbers of specialists to promote the war program.

Engineering Foundation Board Members.—At a regular meeting of trustees of the United Engineering Society this election was made to the Engineering Foundation Board: Calvert Townley, Westinghouse Electric & Manufacturing Company, New York, succeeding Gano Dunn. The following are additional members: Silas H. Woodard, consulting engineer, American Society of Civil Engineers; Dr. Joseph W. Richards, professor of metallurgy, Lehigh University, South Bethlehem, Pa.; Dr. David S. Jacobus, advisory engineer, Babcock & Wilcox Company, New York; H. Hobart Porter, Sanderson & Porter, consulting engineers, New York.

Course in Radio Communication.

On account of the urgent need of the government for men qualified to render special technical service in the Signal Corps, the University of Illinois will offer a course in radio communication during the summer session of 1918. This course is for men who wish to prepare themselves for research and development work or for field service in the Signal Corps of the army. Instruction will begin Monday, June 17, and will continue until Aug. 9. The assigned work will require the full time of the student registering. University credit of eight semester hours will be granted those who successfully complete the work. This course is planned for those who have completed two years of work in the College of Engineering of the University of Illinois or the equivalent. It is especially important that those who register should be well grounded in physics and in mathematics, including differential and integral calculus. The physical and mathematical theories underlying the phenomena of radio-telegraphy and radio-telephony will be presented in the class room through lectures and recitations on assigned work and through experiments performed in the radio laboratory. Use will be made of information furnished by the government concerning radio apparatus used in the army at the present time. In addition to the radio apparatus belonging to the university, there is available apparatus which has been loaned by the government for instructional purposes. For this reason the course is open only to citizens of the United States, and each one registering will be expected to take oath before a notary public binding himself not to misuse in any way information which may be received.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate Increase in Illinois.—In allowing the Alton Gas & Electric Company to increase rates the Illinois Public Utilities Commission holds that where a utility has abandoned its steam generating plant and purchases electrical energy from an affiliated company under a contract entered into prior to the increase in operating expenses, the purchase price will not be accepted as the rate base to the exclusion of the increased costs. In view of the facts of the particular case, the commission adjusted rates to meet increased operating expenses without requiring a valuation of the property where the utility had abandoned its generating plant and purchased its energy from an affiliated company.

Deposit for Service.—According to an opinion of Commissioner Corey of the Oregon Public Service Commission, the Portland Railway, Light & Power Company can no longer compel patrons of its electric lighting service in Portland to sign a three-year contract for service or a one-year contract with a deposit of \$3 attached. The commission holds that no more than a sum sufficient to furnish adequate security for the credit extended may be legally exacted. The commission believes that a deposit equal to the estimated maximum sixty-day bill is justified, or that a satisfactory guarantee should be asked. After a cash deposit guaranteeing payment for metered service has stood unimpaired for twelve months, thus reasonably establishing credit, the deposit should be returned with interest, according to the decision of Commissioner Corey.

Crossing Railroad Property.—A decision of the Pennsylvania Public Service Commission affecting the Butler Light, Heat & Motor Company says that the public service law is regulatory and not designed to enlarge powers of public service companies. The applicant proposes to furnish its product to a coal-mining operation, which necessitates crossing the tracks and property of the protesting railroad company. The crossing proposed consisted of eight high-voltage wires carried on wooden supports over the property of the railroad company, on which are four tracks and admittedly heavy traffic. The railroad company protested, alleging that the electric company was not authorized by law to cross its tracks, and that the crossing in the manner proposed was dangerous for its operations. The commission held that the crossing at the point and in the manner proposed was dangerous to the traveling public and beyond the power vested in the electric company by its charter.

Herbert Bellamy, president-elect of the Iowa Section, National Electric Light Association, is secretary and manager of the electric light department of the Marion County Electric Company, Knoxville, Iowa. This company and its predecessors were organized by Mr. Bellamy's father in 1887 as one of the first electric utilities in Iowa. Mr. Bellamy was graduated from Cornell College, Mount Vernon, Iowa, in 1906 and since that time has



HERBERT BELLAMY

been almost continuously engaged in public utility work at Knoxville, where his company has not only the electric light and power utility but also the telephone company.

William A. Magee, Pittsburgh, Pa., has been appointed a member of the Pennsylvania Public Service Commission. Mr. Magee was formerly Mayor of Pittsburgh.

Dr. A. E. Kennelly of Cambridge, Mass., acting head of the department of electrical engineering at the Massachusetts Institute of Technology, has been commandeered by the authorities in Washington for special work during the summer months. His position is that of civilian liaison officer to the Signal Corps, and his duties will be in line with his special attainments. He will be away from the institute during the summer months, but expects to report back in the fall. In his absence Dr. F. A. Laws will care for the direction of the special school for radio-engineers.

M. K. Arenberg, formerly a specialist in the supply department of the General Electric Company, who completed a course at the United States Naval Training Station, Great Lakes, Ill., after passing an examination was made chief petty officer in the United States Navy. Two months ago he was sent to the officers' material school, where he was commissioned as an ensign. He is at present under orders to report to Annapolis for a four months' course of training. Mr. Arenberg was also formerly in the employ of the Ilg Electric Ventilating Company, Chicago, as a ventilating engineer.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Oscar S. Straus has resigned as chairman of the Public Service Commission for the First District of New York to become associated with the National Food Administration at Washington, where he will investigate sugar costs and profits.

Charles H. Smith, an engineer of the executive department of the Westinghouse Electric & Manufacturing Company, has received a commission as major in the Reserve Engineers and has gone to Camp Lee to enter the engineering school, where he will receive further instruction. Major Smith is a veteran of the Spanish-American war, in which he served as a captain.

F. F. Espenschied has resigned as assistant engineer for the Hydro-Electric Power Commission of Ontario to become connected with the Combustion Engineering Corporation, New York City. Prior to going to Canada he was general manager of the Interstate Light & Power Company, Galena, Ill., having formerly been engineer with the West Penn Power Company at Connellsville and Pittsburgh, Pa. Mr. Espenschied was graduated from Cornell University in 1905 in mechanical engineering.

Hugh H. Harrison, who has been president of the Merchants' Heat & Light Company of Indianapolis for the last four and a half years, has resigned, effective at once. For fourteen years prior to his association with the Indianapolis company he was engaged in organizing and financing utilities. He was interested in street-railway companies in New Jersey, and it was largely through his efforts that the Imperial Electric Light Company of St. Louis, the Scranton Electric Light Company of New Jersey, and the Lackawanna Electric Light Company and the Baltimore Electric Light Company were organized and financed.

George Wilbur Hubley, who for the last two years has been general manager and chief engineer of the Merchants' Heat & Light Company of Indianapolis, has resigned to become general manager of the elevator department of the Badenhause Company of Philadelphia and New York City. His early years in the electrical field were spent with the Westinghouse Electric & Manufacturing Company and also with the Citizens' Traction Company of Pittsburgh, Pa. For twenty years he was chief engineer and superintendent of the old Louisville Lighting Company and its successor, the Louisville Gas & Electric Company, from which he resigned to join the electrical engineering staff of the Jones & Laughlin Steel Company of Pittsburgh.

Major J. O. Mauborgne, who has been in charge of the electrical engineering section of the Signal Corps since March 1918, was born in 1881 in New York City. He was graduated in 1901 from the College of St. Francis Xavier and recommended to the War Department as standing highest in the military department upon graduation. Two years later he was commissioned second lieutenant in the regular army, and he was promoted to first lieutenant in April,



J. O. MAUBORGNE

1909. He was graduated in 1910 from the Army Signal School at Fort Leavenworth, Kan., and for the next three years was instructor there in radio-telegraphy and other branches of engineering and in charge of the electrical laboratory. During 1914 and 1915 he was in charge of the army radio construction work in the Philippine Islands, and from October, 1916, to October, 1917, he was on duty at the Fort Leavenworth Army Signal School, acting as its director from October, 1916, to May, 1917. He was promoted to captain of the Signal Corps in September, 1916, and to major in August, 1917. Since October, 1917, he has been on duty in the office of the chief signal officer of the army. Major Mauborgne has had ten years of experimental work in radio-telegraphy and is the author of "Practical Uses of the Wave Meter in Wireless Telegraphy, 1914," and articles on radio research in the *ELECTRICAL WORLD*, the *London Electrician*, etc. He is also a member of the advisory board of the invention section, War Plans Division, General Staff, U. S. A.

Obituary

Zachary Taylor Underwood, aged seventy-one, an associate of Thomas A. Edison, when the latter was a telegraph operator in Louisville, is dead.

Oran O. Rider, assistant to the general superintendent of the Public Service Company of Northern Illinois, died at his home in Oak Park, Ill., on June 9, following an illness of more than a year. Mr. Rider was forty-seven years old.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

FEDERAL CHILD LABOR STATUTE DECLARED UNCONSTITUTIONAL

Supreme Court of the United States Holds that the
Law Invades the Right of States to
Control Internal Affairs

On June 3 the Supreme Court of the United States handed down a decision holding the so-called child labor law, which went into effect the first of last September, unconstitutional. The court declared that the law unwarrantably invaded the rights of the states to control their own commerce. Friends of the statute, which prohibited the shipment in interstate commerce of the products of child labor, had worked fifteen years for its passage by Congress. Justice Day, who wrote the prevailing opinion, said in part:

"Is it within the authority of Congress in regulating commerce among the states to prohibit the transportation in interstate commerce of manufactured goods the product of a factory in which, within thirty days prior to their removal therefrom, children under the age of fourteen have been employed or permitted to work, or children between the ages of fourteen and sixteen have been employed or permitted to work more than eight hours in any day or more than six days in any week, or after the hour of 7 o'clock p. m. or before the hour of 6 o'clock a. m.?"

"To sustain this statute would not be, in our judgment, a recognition of the lawful exertion of Congressional authority over interstate commerce, but would sanction an invasion by the federal power for the control of a matter purely local in its character and over which no authority has been delegated to Congress in conferring the power to regulate commerce among the states.

"We have neither authority nor disposition to question the motives of Congress in enacting this legislation. The purposes intended must be attained consistently with constitutional limitations and not by an invasion of the powers of the states.

"The far-reaching result of upholding the act cannot be more plainly indicated than by pointing out that if Congress can thus regulate matters intrusted to local authority by prohibition of the movement of commodities in interstate commerce all freedom of commerce will be at an end, and the power of the states over local matters may be eliminated, and thus our system of government be practically destroyed."

Regret over the decision was expressed by the large number of people interested in this class of legislation. A new campaign for a child labor law to meet the Supreme Court's objections, it is understood, will soon be inaugurated in Washington. The law affected jobbers as well as manufacturers.

CONFERENCE TO STANDARDIZE CATALOG SIZES AND PAPER

Meeting in Chicago Adopts Regulatory Resolutions
—Convenience and Economies Are the
Objectives Aimed At

At a catalog conference of the standardization committee of the National Association of Purchasing Agents on May 22, at the Hotel La Salle, Chicago, it was recommended that all catalogs meant for the use of purchasing agents be 7½ in. by 10½ in. in size.

Resolutions were also unanimously adopted to the effect that (1) catalogs be standardized to 6 in. by 9 in., or 7½ in. by 10½ in., or 8 in. by 11 in.; (2) sizes of paper, 25 in. by

38 in., or 32 in. by 44 in., or 33 in. by 46 in., with their double sizes; (3) weights of paper, 40, 45, 50, 60, 70 and 80 lb. on the basis of 25 in. by 38 in. It was recommended that printing colors be limited to white and natural. It is stated that the standardization adopted will release 30,000 people from the printing industry and save much paper.

W. L. Chandler of the Dodge Sales & Engineering Company, Mishawaka, Ind., chairman of the committee, explained the necessity for and advantages of standard catalog sizes. The size previously selected by the association, 8½ in. by 11 in., did not meet with favor.

GOVERNMENT DISCOUNTING LARGE PART OF ITS BILLS

General Engineer Depot Reports All Bills Not Subject to Cash Discount Paid Within Thirty Days
from Date of Service

Since so much of the business of electrical manufacturers and jobbers is with the government at the present time, it is interesting to note the promptness with which payments are made. A report from the finance division of the General Engineer Depot of the army, which purchases vast quantities of electrical goods, states that for the six months ended April 30, 1918, the saving made by the division through cash discounts amounted to \$166,256.03. From May 1 to 15 inclusive cash discounts earned were \$34,144. Many of these discounts were on material the price of which had been fixed by the government. All bills other than those subject to cash discount were paid within thirty days from date of invoice.

DISTRIBUTION OF STEEL PRODUCTS BY WAR BOARD

Agreement Entered Into with the Manufacturers—
Government Virtually Commandeers
the Industry

By an agreement entered into on June 6 between the War Industries Board and the American Iron and Steel Institute the government takes over absolute control of the distribution of all manufactured steel products and pig iron. Under the agreement the War Industries Board must pass upon all applications for the release of steel products and pig iron, thus giving it absolute control of the industry. It amounts to a commandeering of the output of all mills by the government and approaches closely government operation of the industry. A preference list is contained in the announcement and the requirements of the industries named on it must be met before other applications are satisfied.

The committee on steel and steel products of the American Iron and Steel Institute and the War Industries Board have agreed that no pig-iron or steel manufactured products shall be shipped or delivered, except as follows:

"(1) By priority certificates issued by the priorities division of the War Industries Board; or

"(2) After priority certificates shall have been issued or filed, then producers of pig iron and of steel manufactured products may utilize such raw materials and manufacturing capacity, if any, as they may have available to fill orders of their customers not covered by priority certificates, provided that such orders are embraced within the schedule of purposes entitled to preference treatment as determined by the Priorities Board."

No branch of the electrical trade is mentioned in the list promulgated by the board, which is confined strictly to war or collateral and essential activities. However, it is well known that a very large portion of the industry is now engaged in some fashion in war work. In very many instances the war work takes up the major portion of the concern's facilities. Inasmuch as apparently authentic reports state that war work will utilize 100 per cent of the steel output for many months, all steel shipments for some time will have to be made on priority orders. In order to secure these priorities the manufacturer, it seems natural, must have work of a priority nature.

THE WEEK IN TRADE

THE outstanding fact of the week was the recent increase of prices on practically all electrical material. The cause for this action on the part of the producers is variously ascribed, but the main reason is said to be the higher freight rates which become effective June 25. The 25 per cent advances add to the price of material and the costs of manufacturing, to which the shortage of labor and the greater wage scale also contribute. So far the Eastern territory is the first to experience the advances.

Electric fans are running low in supply in the East, where the warm weather has nearly cleaned out stocks, according to authenticated reports. Other parts of the country are not feeling this pressure as yet, and possibly a readjustment of stocks not needed may bring relief in districts not so fortunate. Shipbuilding and other industrial enterprises for the prosecution of the war are being carried on and extended along liberal lines in the Pacific Northwest, with an accompaniment of strong calls for equipment and other electrical material. Heavy motors are being purchased by the larger industrial corporations in the Southeast. In some sections the demand for rubber-covered wire of various grades has increased 100 per cent. The position of conduit is not improved and stocks are scant. The movement of sewing and washing machines is hampered by transportation delays, and on both an increase of price is announced by the manufacturers. As an authority phrases it, the electrical trades are tied up with federal orders and are turning business away. Perhaps this may also have a bearing on the anomalous price situation.

On the whole, collections are stated as constantly becoming better, regular settlements not being deferred. This promptness is due to the enforcement of short credit arrangements, with a tendency toward still further tightening.

NEW YORK

Following the price changes announced last week to a 10 per cent higher level on machinery came an increase, ranging from 10 to 15 per cent, on nearly the entire line of staple materials. Jobbers in this territory were somewhat surprised, but after a study of various trade tendencies regarding labor, material and transportation difficulties and the quick transformation of general mercantile affairs under war pressure it was realized that the market for electrical goods is in a natural state of ferment.

Other industries are going through the same experience. Foresighted distributors who operate on a large scale look for still further advances. They also admit that manufacturers are hampered in their activities, and consequently the obstacles against a free movement of merchandise are growing greater. In fact, reports say that some manufacturers refuse to quote prices and accept orders only on the basis of such prices as may prevail at the time of shipment. Sales have not diminished. On the contrary, the volume of commercial trade has swollen, with government orders continuing to dominate the market. Jobbers are con-

templating the employment of girls as a house sales force to fill the place of men taken for military service.

Collections are better than for some time with the majority of jobbers and distributors. Manufacturers who have heretofore stated that customers were not prompt are now of a different opinion.

FANS.—Predictions regarding the status of electric fans are being realized sooner than expected. The supply in the hands of jobbers is rapidly decreasing, and one of the largest distributors frankly admitted that with one more week of warm weather now it would be impossible to replenish stocks. This concern has been revising its prices for a month past, and on June 8 put out a new fan price list which on some numbers shows an increase of 20 per cent to dealers. It further stated that not a 16-in. fan was in stock and that none were to be had.

DOMESTIC APPLIANCES.—An advance of \$1 apiece on sewing machines was announced by a Western manufacturer, to become effective in the East at once. Distributors are in a quandary whether this should be passed along to the trade and the ultimate consumer or a reduction of profit at the primary source be accepted. At any rate, deliveries are so uncertain as to be hampering all around. This is also true of electric irons from Middle West plants. A Western manufacturer of washing machines has added 15 per cent to the selling price of his products. The demand for vacuum cleaners is brisk and the supply is apparently adequate.

SOCKETS AND RECEPTACLES.—The increase on all porcelain goods ranges from 10 to 15 per cent. It went into effect about two weeks ago. The new prices formulated by jobbers and distributors reflect these quotations. These figures also apply to fuse plugs and all schedule material.

SWITCHES.—An advance of 10 per cent was made within the last few weeks on all standard pendent switches. Stocks are none too strong.

COLLECTIONS AND CREDITS.—While in some quarters collections are reported as slowing down, elsewhere reports say that dealers and jobbers are paying bills promptly. Credit men are not relaxing their vigilance when accommodations or extensions are sought in the settlement of accounts.

CONDULETS.—One manufacturer in sending out a new discount sheet recently tightened the figures quite sharply on certain quantities. He also stated that quotations were f.o.b. factory with no freight allowance.

BATTERIES.—One of the largest manufacturers has made an advance of 10 per cent on his line. Others report all the business they can handle but no recent change in their prices.

HEATING APPLIANCES.—An authority states that it is likely the fall demand for electric heating appliances, radiators, etc., will be quite heavy. Gas companies are already sending out warnings of a probable shortage of gas next winter due to a possible curtailment of fuel. In that event electric fixtures will be called upon to meet the deficiency.

LAMP SHADES.—Flat plain and flat fluted porcelain shades were marked up 10 per cent, effective June 1. Steel-enameled shades were also increased in price at the same rate on that date.

LAMP GUARDS AND BELLS.—Exceptions to the long list of advances on staples recently formulated exist in the case of lamp guards, electric bells and flashlamps.

CONDUIT.—Flexible non-metallic conduit advanced 5 per cent about June 1. Some special brands of conduit were placed on a 10 per cent higher level. Stocks are very low and in certain lines are practically unobtainable.

RUBBER-COVERED WIRE.—As noted last week manufacturers increased rubber-covered-wire prices 2½ to 3 per cent. Some jobbers in their new price lists make it 10 per cent to dealers. This applies to both single-braid and double-braid solid in the standard numbers. On stranded double-braid the cost is higher, reaching 20 per cent in some instances. Discounts range from 60, 5 and 2 to 65, 10 and 5 per cent on bare wire, cable and weatherproof, according to the quantity involved and to the negotiation and credit rating of the buyer.

CHICAGO

The past week might well have been called "conduit week" in Chicago. The market was especially active. This can be attributed to the increase in freight rates and the increase in the price of conduit itself. Motors were also active. The news was given out at the Chamber of Commerce that Chicago is to have a shell plant costing \$6,500,000, and every one is now anxiously watching for an opportunity to supply goods for this project. Building activities in general are still lagging behind. It is encouraging, however, that electrical construction, while also behind last year's figures, is not lagging so markedly as building generally. This is due to the activity of the contractors in securing old-house-wiring business. A threatened strike of electrical workers against the city of Chicago did not materialize. Credit conditions remain especially favorable.

In the freight-rate situation the jobbers see considerable advantage accruing to the jobbing business in general. When the new rates become effective it will be the exception rather than the rule when it is economical for a customer to order direct from the factory.

WASHING MACHINES.—A survey of the washing-machine manufacturing field in the Central West shows that many of the factories are from 2000 to 3000 behind in production of the dolly type. This means that these factories are about one month behind on deliveries. There is said to be no sign of let-up in orders. Many of the orders originate with the government. These factories are increasing their output as rapidly as possible.

COPPER WIRE.—This has been an active week in copper wire. There was no change in price.

PUSH-BUTTONS.—The market on push-buttons is better than it has been in many months. To the equipping of new offices and the installation of time-saving buzzer systems credit is given for this increase.

DIRECT-CURRENT METERS.—Meters of this type are in strong demand, some factories having more than they can take care of.

CONDUIT.—Non-metallic conduit advanced about 10 per cent and metallic conduit between 5 per cent and 10 per cent. The conduit market was especially active, but the jobbers report they are still able to obtain about enough conduit to "get by." The advance in conduit is not at all unexpected, in view of the increased freight rate. In making conduit about five tons of raw material have to be shipped to get one ton of conduit ready to sell. On this basis alone an increase of 12½ per cent would be justified.

FANS.—While fans were active last week, cool weather has slowed up their movement in the immediate vicinity of Chicago this week.

CABLE COMPOUND.—Maintenance work of central stations, which must of necessity be done, is keeping up a steady and satisfactory market on this product.

BOSTON

The volume of trade holds up well, although business is somewhat irregular between different jobbers as to amount. Stocks are well filled in most lines, although slow deliveries are the rule on railroad shipments. Prices are holding firm, with an advance of about 10 per cent on BX conduit and about 20 per cent on non-metallic as of June 6. Retail sales are very good, one large house reporting a greater business over the counter in May than in any other month since last December. Green labor is causing some annoyance in office work as well as in industrial plants, but this condition is likely to improve soon. Edwin C. Lewis, Inc., Boston, has been awarded a contract for the electrical installation to be made at the quartermaster's terminal at Boston. This is said to be the largest electric wiring and supply contract ever placed in New England. It will total between \$1,500,000 and \$2,000,000, including lamps, wire, switchboard panels, hoists, motors and other equipment. Improved labor conditions are noted as regards relations between manufacturers and employees. A basic agreement for future negotiations is reported between the Pittsfield works of the General Elec-

tric Company and the various unions concerned in recent conferences with the federal labor authorities.

APPLIANCES.—Washing machines and vacuum cleaners are moving well. Deliveries are somewhat unsatisfactory, owing to railroad congestion, but the volume of sales is excellent, and so far demands are being met without widespread difficulty.

POLE-LINE MATERIAL.—This material is quiet at present, and one large jobber reports being heavily overstocked. Extensions of central-station service are few and far between, except here and there for war work off the limits of existing lines.

LAMPS.—New England storage supplies suffered a heavy loss by last week's fire in the South Boston warehouse of the General Electric Company, which contained about 1,000,000 lamps, mainly of 25-watt to 60-watt sizes. About 700,000 lamps were ruined, but vigorous efforts are under way to make good the loss. The East Boston and Lynn factories are being pushed to create a new supply, and extensions of the former, combined with available storage facilities, have made it possible already to minimize the disturbance to local distribution. Retailers still report a shortage of miniature and candelabra lamps.

FANS.—Cool weather holds back the expected rush sales. Dealers are well prepared for the summer drive, and jobbers have received large shipments from the factories.

MOTORS.—The demand continues substantial, especially for use on machine tools in army and navy work. Tool manufacturers are finding it difficult to make punctual deliveries, even to the government; but it is not thought that the motor manufacturers are responsible for this condition.

CONDUIT.—Stocks continue to be rather spotty. On the whole, there is not any too much conduit of the larger sizes in sight. Deliveries are running longer than is satisfactory, and the government is looking sharply into the matter of checking priority orders back to their source, with a closer control of actual pipe movement than has previously been noted.

ATLANTA

Activity in all lines is well sustained this week. Staples are moving briskly and the volume continues to grow. The jobbers in this section are taking more interest in activities now going on at coastal and shipbuilding centers.

On the whole, the jobbers were slow in perceiving the big business latent in connection with shipbuilding, but the outlook has changed considerably of late and they have awakened to the potentialities of this type of industry. Already some lucrative sales in marine and associated supplies have been made, and stocks are being replaced, anticipating a growing demand for this material. Deliveries have naturally been good as the greater portion has the benefit of priority shipment.

POLES.—There is a big demand for poles of all descriptions. Jobbers are finding it more difficult each day to handle orders which exceed the supply. In the face of these conditions it is singular that the price has remained the same for some time.

CROSS-ARMS.—The increasing fire requirements of the government have certainly affected the supply of cross-arms, and local jobbers are having a hard time trying to supply a part of the demand.

PINS.—Deliveries are long and only small quantities are available from time to time. Ordinarily prices are stable, but some wide variations have been noted lately in isolated cases where the need was urgent.

HARDWARE.—Call from the central stations has fallen off considerably, and although the government is absorbing large quantities, the volume of transactions at this time is somewhat below that recorded in the past few months.

INSULATORS.—All sources report that the demand appears to be increasing, with a corresponding scarcity. Deliveries are bad and jobbers are endeavoring to satisfy their customers by a distribution of less carload lot shipments.

CONDUIT.—There is no surface evidence of any material change in price, if any, in this line. The arrival of isolated

shipments has tended to balance the stock of all sizes, but the demand is well over replacement and stocks are gradually getting lower. If this condition exists for a protracted period, there is no doubt that Southeastern stocks will be eliminated, at least until such time as government takings are replaced through priority shipments. One jobber predicts a decrease in demand from normal commercial channels while the manufacturers are supplying government needs.

SEATTLE

Wholesale and retail business continues active, although the volume for the week showed no increase over the past week. The sales of large power apparatus have been light for the past ten days, but several orders of considerable size will be placed shortly. Conduit, wire, cable, lamps and small motors to shipyards and allied industries showed a decrease in movement. Retailers report a slight increase in the sales of wiring devices, wire, lamps, fixtures and the like.

Shipbuilding activities—work on the proposed plants, extensions to established institutions and the award of new contracts—still dominate business conditions in the Northwest. The immediate construction of a large wooden shipbuilding plant in South Bend, Wash., is announced. A plant for the construction of concrete barges, lighters, tenders and towboats up to 1500 tons capacity is started in Vancouver, Wash. Additions of considerable proportions have been begun on two Seattle steel plants and a steel and wooden shipyard in Vancouver, Wash. Two industrial plants closely allied to shipbuilding, engaged in boiler and ship machinery manufacture, one in Seattle and the other in Portland, are making large extensions. A Portland plant has secured contracts for six more ships from the Emergency Fleet Corporation.

Reports from various Northwest cities show that building is still on the increase. This is particularly true in Seattle, Tacoma and Puget Sound cities. Portland reports the issue of building permits to be the highest in five years. However, the large portion of the money expended is for new residence construction, although the building of business buildings, hotels and apartments is showing a decided increase. An authority states that the construction of new buildings in Portland at the rate of 4000 per year is necessary to care properly for the increasing population due to new war industries. Seattle builders anticipate a still more serious need of accommodation for war workers and are enlarging and rushing the building program. Astoria, Ore., under the leadership of the port of Astoria, is preparing to erect housing facilities for 5000 families. Contracts for between 400 and 600 residences, three or five large apartments and an enormous hotel for the Puget Sound Navy Yard, Bremerton, Wash., will be let in about ten days by the Seattle office of the Bureau of Housing.

Collections are reported satisfactory and in harmony with sales. New credits placed during May were larger in number than for the preceding month. However, the extension of credit rather than new credit predominates by far.

SAN FRANCISCO

The past week's business is recorded as being unusually good. Orders reported cover generous quantities of all electrical staples and industrial specialties and some stock orders for electrical appliances.

San Francisco building permits for May total \$805,000. An enormous amount of new building was reported during the week. The Santa Fé is greatly enlarging its car shops and terminal facilities at Bakersfield. New rice mills are reported for Woodland and West Sacramento. Important additions to the California Hawaiian plant at Crockett are announced, and educational institutions are represented by a three-million dollar addition to the University of Southern California and by purchases of one, two and three-room portable schoolhouses for various Arizona districts. War-work industrial plants which are adding to their equipment are the Southwestern Shipbuilding Company at San Pedro, ten new building berths for the Bethlehem Shipbuilding Corporation in Alameda and a Stockton tractor plant.

RUBBER-COVERED WIRE.—Sales are continually increasing, and new shipments are gobbled up almost as received. This is especially true of larger sizes, such as 0 and circular-mil sizes, which have increased nearly 100 per cent in their sales over those last year owing to long runs of big energy supplies in the shipyards.

LAMP CORD.—Sales have decreased about 50 per cent in comparison with those of last year, although there are big sales for deck cables, slicked reinforced cords and the like. Sales of lamp cords standardized in fixture use, such as single light 18 or parallel 18, have dropped to practically nothing.

FANS.—Export orders continue. Local shipments on contract orders have been about completed.

LAMPS.—Some big orders for industrial and power plants are reported during the past week.

FUSES.—There have been several large government orders for refillable fuses and extra refills. One cause for the number of standard fuses that are sent to the shipbuilding plants seems to be that work is such that certain fuses blow at very frequent intervals.

HEATING MATERIAL.—The officers' quarters at the Benicia barracks have been equipped with electric ranges and further government work is in sight. The owners and operatives of Camp Curry, in the Yosemite Valley, are enthusiastic over the hotel-type electric range installation, consisting of two 22-kw. ranges, one 25-kw., 180-loaf bake oven, one 9-kw., 18-in. by 54-in. griddle and one 3-kw., sixteen-slice toaster. The rate for electricity for cooking purposes will be 0.8 cent per kilowatt-hour. Energy is to be furnished from the government plant.

METAL MARKET SITUATION

Price of Copper Now Satisfactory and No Further Advance Advocated—Increases on Wire

At a meeting of the leading copper consumers held last week in New York, at which fully fifty firms were represented, the opinion prevailed that the present official price of the metal, 23.50 cents in car lots and over, was fair to all interests. Not only will a sufficient output be forthcoming, but the situation when the price term expires on Aug. 15 will be one to justify no increase in that figure then. One large distributor said deliveries of copper were behind from forty to sixty days, and that it may be longer when the order is finally obtained.

The War Industries Board on June 6 declared that wherever war requirements have created a scarcity of supplies its price-fixing committee would name a price for the commercial consumer that would be reasonable. On the list of these more essential commodities are finished cotton, copper and steel as employed by the electrical trade. Bare copper wire for electrical purposes—carloads, mill shipment—on June 3 was quoted 26½ cents base per pound. The advance is attributed to increased overhead, labor cost and additional costs for affiliated materials.

NEW YORK METAL MARKET PRICES

Copper:	June 3			June 10		
	£	s	d	£	s	d
London, standard spot	110	0	0	110	0	0
	Cents per Pound			Cents per Pound		
Prime Lake	Govt. price 23.50			Govt. price 23.50		
Electrolytic	Govt. price 23.50			Govt. price 23.50		
Casting	Govt. price 23.50			Govt. price 23.50		
Wire base	26.25			26.25		
Lead, trust price	7.00			7.25		
Nickel, ingot	40.00			40.00		
Sheet zinc, f.o.b. smelter	Govt. price 15.00			Govt. price 15.00		
Spelter, spot	7.40 to 7.50			7.60 to 7.65		
Tin, Chinese*	86			80		
Aluminum, 98 to 99 per cent	Govt. price \$23.00			Govt. price \$23.00		

OLD METALS

	Cents per Pound		Cents per Pound	
Heavy copper and wire	21.50	to 22.00	21.50	to 22.00
Brass, heavy	13.50	to 13.75	13.50	to 13.75
Brass, light	10.50	to 11.00	10.50	to 11.00
Lead, heavy	5.75	to 6.00	6.00	to 6.25
Zinc, old scrap	5.50	to 5.75	5.50	to 5.75

*No Straits offering. 4½ in 50-ton lots or more, 33 1/2 cents per lb.; 1-ton to 11-ton lots, 33 20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor	
B. & S. Size	List Per 1000 Ft.
No. 14 solid	\$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor	
No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
Less than coil	List to + 15%
Coil to 1000 ft.	List to + 10%
Twin-Conductor	
Less than coil	List to + 15%
Coil to 1000 ft.	List to + 10%

DISCOUNT—CHICAGO

Single-Conductor	
Less than coil	List to + 10%
Coil to 1000 ft.	List to + 10%
Twin-Conductor	
Less than coil	List to + 15%
Coil to 1000 ft.	List to + 10%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1 1/2 std. pkg.	+ 10% to 24.00c.
1 1/2 to std. pkg.	8% to 19.80c.
Std. pkg.	25% to 18.75c.

DISCOUNT—CHICAGO

Less than 1 1/2 std. pkg.	10% to 20%
1 1/2 to std. pkg.	List to 20%
Std. pkg.	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.285	.295

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3175-.32	.3275-.33
Barrel lots	.2875-.29	.2975-.30

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 100 FT.—NEW YORK

Less Than	Coil to 1000 Ft.
3/4-in. s. stp.	List to \$82.50 15% to \$67.50
3/4-in. d. stp.	+ 10% to \$4.00 List to 69.00
1-in. s. stp.	List to 110.00 15% to 90.00
1-in. d. stp.	+ 10% to 112.00 List to 92.00

NET PER 1000 FT.—CHICAGO

Less Than	Coil to 1000 Ft.
1/2-in. single strip	List \$63.75
3/4-in. double strip	78.25-78.75 71.25-71.75
3/4-in. single strip	List 85.00
1-in. double strip	105.00 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	\$0.05 1/2	1 1/4	\$0.25
1/4	.06	1 1/2	.33
3/8	.09	1 3/4	.40
1/2	.12	2	.47
5/8	.15	2 1/4	.55
3/4	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

Less Than	\$15 to \$60	\$60 to \$150
7/32-in.—	List	List
\$25.00-\$49.50	\$20.50-\$41.25	\$20.50-\$30.00
1/4-in.—	\$28.00-\$54.00	\$22.50-\$45.00
	\$22.00-\$36.00	

NET PER 1000 FT.—CHICAGO

Less Than	\$15 to \$60	\$60 to \$150
7/32-in.—	List	List
\$36.00-\$55.00	\$25.00	\$22.50
1/4-in.—	\$40.00-\$60.00	27.00
		25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit List per Foot
1/4	\$0.08 1/4
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/4
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb.	1/4 in. to 1/2 in.	3/4 in. to 3 in.
2500 to 5000 lb.	4% to 6.7%	7% to 20%
	6%	9% to 25%
(For galvanized deduct six points from above discounts.)		

DISCOUNT—CHICAGO

Less than 2500 lb.	6.8% to 8.8%	9.8% to 11.9%
2500-5000 lb.	8.8% to 10.9%	12.3% to 13.9%
(For galvanized deduct six points from above discounts.)		

FLATIRONS

NEW YORK

List price	\$5.00 to \$6.00
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to 30%
1/5 to std. pkg.	20% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28% to 30%
1/5 to std. pkg.	38% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Less than 1/5 std. pkg.	Per 100 Net List to \$5.50
1/5 to std. pkg.	15% to \$4.75
Standard packages, 500. List, each \$0.07	

CHICAGO

Less than 1/5 to std. pkg.	Per to 100/Net List to \$7.00
1/5 to std. pkg.	5.75
Standard packages, 500. List, each \$0.07	

LAMPS, MAZDA
105 to 125 Volts

	Std. Pkg.	List. Each
Regular, clear:		
10 to 40-watt—B.....	100	\$0.30
60-watt—B.....	100	.35
100-watt—B.....	24	.70
75-watt—C.....	50	.70
100-watt—C.....	24	1.10
200-watt—C.....	24	2.20
300-watt—C.....	24	3.25
Round bulbs, 3 1/4-in., frosted:		
15-watt—G 25.....	50	.53
25-watt—G 25.....	50	.55
40-watt—G 25.....	50	.55
Round bulbs, 3 3/4-in., frosted:		
60-watt—G 30.....	24	.77
Round bulbs, 4 3/4-in., frosted:		
100-watt—G 35.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.....	List
Std. pkg.....	10%

DISCOUNT—CHICAGO

Less than std. pkg.....	List
Std. pkg.....	10%

LAMP CORD

Cotton Covered, Type C, No. 18
NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)....	\$31.00 to \$33.80
Coil to 1000 ft.....	27.90 to 28.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)....	\$29.00 to \$30.00
Coil to 1000 ft.....	21.50 to 22.30

LAMP GUARDS, WIRE

Standard packages from 50 to 150
NEW YORK

Net per 100.....	\$20.00
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CHICAGO

Net per 100.....	\$21.75 to \$30.00
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OUTLET BOXES

Nos.	List per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200, S.E., 300, A.X., 1 1/2	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00 list....	30%	20%
\$10.00 to \$50.00 list....	35%	25%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list....	40%	35%
\$10.00 to \$50.00 list....	50%	45%

PIPE FITTINGS**DISCOUNT—NEW YORK**

Less than 1/5 std. pkg.....	5% to 10%
1/5 to std. pkg.....	15% to 20%
Std. pkg.....	25% to 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.....	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire
NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80 to \$20.00
1/5 to std. pkg.....	14.80 to 20.00
Standard package, 2200. List per 1000.	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	11.80
Standard package, 2200. List per 1000.	\$20.

PORCELAIN KNOBS**NEW YORK**

	Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	4000
		5 1/2 N.C.—Solid Nail-it—N.C.		
Less than				
1/5 std. pkg.....	\$11.85		\$30.70 to \$30.75	
1/5 to std. pkg.....	11.10		24.20	

CHICAGO

	Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	4000
		5 1/2 N.C.—Solid Nail-it—N.C.		
Less than				
1/5 std. pkg.....	\$11.85		\$30.75	
1/5 to std. pkg.....	11.10 to \$11.40		24.20	

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets.....	500	\$0.33
1/4-in. cap keyless socket.....	500	.30
1/4-in. cap pull socket.....	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	+ 10%
1/5 to std. pkg.....	5% to 8%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.....	10% to 29.70 cts.
1/5 std. pkg.....	20% to 26.40 cts.

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

High Grade	
Less than \$10 list.....	List to + 10%
\$10 to \$25 list.....	15% to list
\$25 to \$50 list.....	10%
Low Grade	
Less than \$10 list.....	10% to list
\$10 to \$25 list.....	10% to 25%
\$15 to \$50 list.....	15%

DISCOUNT—CHICAGO

High Grade	
Less than \$10 list.....	+ 5%
\$10 to \$25 list.....	10% to 11%
\$25 to \$50 list.....	14%
Low Grade	
Less than \$10 list.....	5%
\$10 to \$25 list.....	16%
\$25 to \$50 list.....	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.15
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd**DISCOUNT—NEW YORK**

Less than 1/5 std. pkg.....	+ 10%
1/5 to std. pkg.....	5% to 8%
Std. pkg.....	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10% to + 20%
1/5 to std. pkg.....	List to 20%
Std. pkg.....	List to 28%

SWITCH BOXES, SECTIONAL CONDUIT

	List. Each
Union and Similar—	
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00 list.....	List to 20%	List
\$2.00 to \$10.00 list.....	10% to 25%	5%
\$10.00 to \$50.00 list.....	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00 list.....	25%	20%
\$2.00 to \$10.00 list.....	25% to 50%	20% to 40%
\$10.00 to \$50.00 list.....	25% to 64%	20% to 52%

TOASTERS, UPRIGHT**NEW YORK**

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

CHICAGO

List price.....	\$5.00 to \$6.00
Discount.....	25% to 30%

WIRE ANNUNCIATOR**NET PRICE—NEW YORK**

	Per Lb. Net
No. 18, less than full spools.....	\$0.44 1/4—\$0.50
No. 18, full spools.....	0.13 1/4—0.45

CHICAGO

	Per Lb. Net
No. 18, less than full spools.....	\$0.57 1/2—\$0.65
No. 18, full spools.....	.50—0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No. 14.....	\$15.00	\$13.00—\$14.00	\$11.50—\$12.25
12.....	23.25—26.25	20.62—21.30	16.13—19.35
10.....	32.40—36.17	29.70—28.65	22.40—27.00
8.....	45.70—51.24	40.26—41.90	31.35—38.00
6.....	72.10—81.06	63.69—66.35	50.79—60.30

CHICAGO

	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
No. 14.....	\$18.00	\$13.00	\$11.50
12.....	25.33—26.28	22.02—26.28	18.55—20.93
10.....	30.19—36.51	27.94—31.26	22.86—29.23
8.....	42.51—51.57	38.99—44.13	31.90—41.23
6.....	66.16—88.38	62.13—71.61	50.53—70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 10 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$35.25 to \$37.85
25 to 50 lb.....	37.85
50 to 100 lb.....	31.25 to 37.10

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.....	\$37.13 to \$40.35
25 to 50 lb.....	36.33 to 39.35
50 to 100 lb.....	33.13 to 38.25

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Master Clock for Standardization of Frequencies

Independent generating stations can be tied together and held at a standard frequency by means of a clock that has been designed and placed upon the market by the Warren Clock Company, Ashland, Mass. This clock is placed on the switchboard in each station within view of the operator. It contains two complete movements, one accurately controlled by a pendulum having an in-bar rod and dead-beat escapement, and the other by a Warren self-starting synchronous motor. There are two second hands on the large upper dial of the clock, which is 5 in. (12.7 cm.) in diameter. One of these hands is black and connects with the pendulum so that it registers the correct time. The other second hand is mounted upon the same center and revolves over the same dial. It is gold color and receives its motion from the Warren motor. The motor, which requires only 2 watts power, is connected to some instrument transformer which is always in the circuit. Therefore the gold circuit hand on the master clock indicates or counts the alternation of the current because it moves at a rate depending entirely upon the frequency of the current.

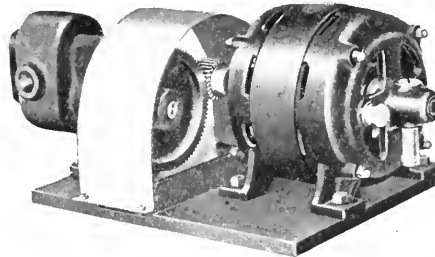
If the average value of the frequency of the current is exactly normal, the gold handle moves at the same speed as the black hand and they will constantly remain together. If the frequency is above normal, the gold hand will gain on the black hand, and it will lose if the frequency is low. The operator is instructed to adjust the speed of the turbine when these two hands do not agree. It is claimed that this device has an advantage over the ordinary

frequency meter is in use. It has been found in practice on large systems that when the frequencies are controlled by one of these clocks its average value, as measured over a twenty-four-hour period, can be held within one-five-hundredth of 1 per cent of its true values.

This device is especially desirable in the interconnection of power stations now being carried out in order to attain increased economy. It is said to greatly simplify the problem of parallel operation for power stations running at the same frequency.

Motor-Driven Pump for Handling Oil

For pumping oil from a barrel to an overhead reservoir and for oiling systems William W. Nugent & Company, Chicago, have developed and placed upon the market a motor-driven rotary oil pump. It may be used to store oil for use in a gravity oil system. The



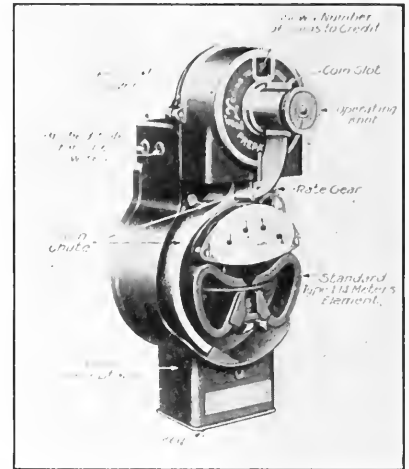
PUMP GEARED DIRECTLY TO ELECTRIC MOTOR BY NOISELESS GEAR

pump is driven by a General Electric 1/6-hp. motor by means of gear and a noiseless rawhide pinion. The machine can be fitted with the type of motor required for the prevailing energy supply. The motor is controlled by means of a rheostat and switch box mounted in a convenient location.

Prepayment Watt-Hour Meter

Elimination of uncollectible accounts and reduction in the cost of collecting from the small consumer are achieved by means of a prepayment watt-hour meter that has been developed and placed upon the market by the General Electric Company of Schenectady, N. Y. This meter is called the type I P-5 for use on alternating-current circuits and consists of a mechanically operated prepayment device which is an integral part of the regular I-14 G-E watt-hour meter. As shown in the accompanying

illustration, the prepayment mechanism is actuated by a large coiled spring, wound when depositing the coin. The only load imposed upon the driving element of the meter is that of actuating the tripping device, but this requires practically no energy and therefore



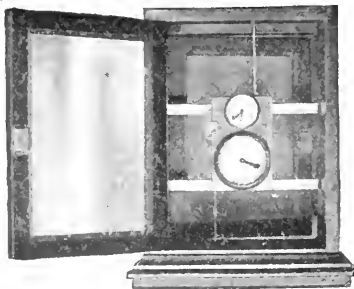
METER AUTOMATICALLY CUTS OUT OF SERVICE WHEN ENERGY PAID FOR IS USED

does not interfere with the accuracy of the meter. The insertion of the first coin and turning of the knob automatically closes the controlling switch. When energy to the value of the deposit has been recorded the switch is automatically opened until another coin has been deposited.

An additional feature claimed by the manufacturers is the fact that the apparatus can be left in service when consumers move in and out of houses. This eliminates the trouble and expense of cutting service, because the equipment is undisturbed.

Light-Weight, Easily Operated Lamp Renewer

Pole climbing or the handling of heavy ladders to make renewals is eliminated by a lamp renewer that has recently been placed upon the market by the G. C. A. Manufacturing Company of 92 Renne Avenue, Pittsfield, Mass. The device consists of a three-jawed clutch mounted upon the end of a pole. The pole is conveniently jointed in sections by means of metal ferrules and quick-change snaps which permit instant adaptation to the length desired. The clutch for the series lamps, which is made to grip the bead on the porcelain of the lamp socket, is opened by pulling a cord and closed by releasing the cord. The series of lamps are re-

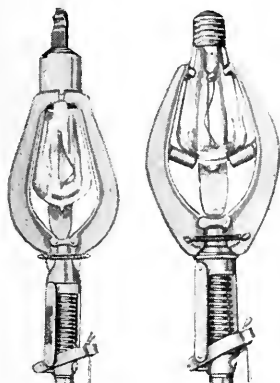


TOP PART OF MASTER CLOCK, SHOWING THE TWO SECOND-HANDS

frequency meter because it is not actuated by the temporary fluctuations of frequencies that usually occur in generating stations. The frequency will not be manually changed until it is absolutely necessary. This eliminates, the makers say, the corrections necessary

moved and replaced by pulling or pushing on the bead of the socket.

The lamp renewer for multiple lamps or others that unscrew from fixed sockets is fitted with rubber-tipped projecting fingers which automatically center the glass lamp bulb in the clutch jaws, holding the bulb in the same manner as when unscrewed by hand.



LAMP RENEWERS FOR BOTH SERIES AND MULTIPLE UNITS

These devices are made in four models—one for series street lamps 100 cp. and smaller, one for series street lamps 250 cp. and smaller, one for series street lamps 1000 cp. and smaller, and one for multiple lamps which accommodates all sizes. Each model includes 7 ft. (2.1 m.) of pole, besides the clutch mechanism. Additional 42-in. (104-cm.) interlocking pole sections may be obtained if desired.

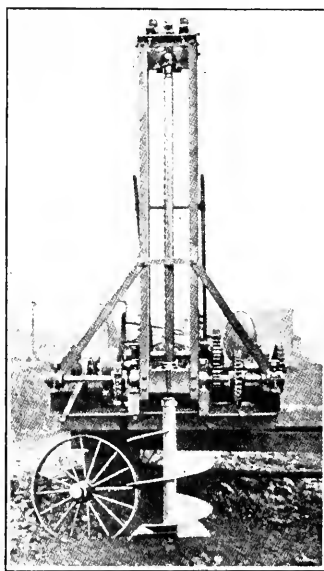
Power-Driven Machine for Boring Pole Holes

Pole holes for transmission and distribution lines can be quickly and efficiently bored by means of a machine that has been placed upon the market by the International Earth-Boring Machine Company, P. O. Box 408, Chicago. The machine shown in the accompanying illustration is mounted upon a steel roller-bearing hub truck and consists of a turntable 5 ft. by 12 ft. (1.5 m. by 3.7 m.) upon which is arranged the mechanism for transmitting the power from the driving engine to the boring auger. The turning power and pressure is applied by means of gears on the tower. The equipment is so balanced upon the turntable that it may be swung around to any point of boring and also may be adjusted for boring on hills or inclines at an angle of from 15 deg. to 20 deg. The motive power for the device shown in the illustration consists of a 40-hp. motor. Its connection with the gearing of the boring equipment is by means of a heavy socket chain. Two levers are provided for operating the auger, one controlling the speed and the other raising and lowering the auger. When boring in the ground the speed is about 10 ft. (3 m.) per minute, and when raising the pole from the hole, 25 ft. to 50 ft. (7.6 m. to 15.2 m.).

Two men can operate this machine, and it is claimed that the efficiency is,

on the average, 100 poles in a ten-hour day. This includes digging the hole, setting the pole and moving from one point to another. Provision is also made for equipping the earth-boring machine with a derrick for raising poles from the ground and lowering them into the holes. Augers of various sizes from 3 in. to 30 in. (7.6 cm. to 76 cm.) may be used with satisfactory results. The holes bored by this equipment are uniform and clean-cut, and the soil removed from the holes is well broken up for tamping purposes. In addition to the use of the machine for pole-line construction work, it may be advantageously utilized in digging trenches for underground conduit. For this purpose a series of holes, close together, may be bored and then the intervening walls removed, thus forming the trench.

A third model is being designed by the company that will be adaptable and attachable to any power truck with a



HOLES CAN BE QUICKLY AND EFFICIENTLY BORED WITH THIS MACHINE

shaft drive. It will then be able to be detached when earth-boring apparatus is not being used and the truck used for other purposes. This machine can well be used in city work such as putting pole holes in alleys and narrow streets.

Concrete Mixer for Manhole and Conduit Work

For mixing concrete for work on manholes and conduits the Oshkosh (Wis.) Manufacturing Company has placed upon the market a mixer that is said to be efficient and economical on construction of this kind. This type of work becomes very expensive when done by hand, and its heavy nature makes it hard to get men to do it. The mixer, as the manufacturers claim, is particularly fitted for manhole and conduit work and is highly portable, weighing only 1600 lb. (726 kg.). It is also said that it will withstand the hard

wear that it would be sure to get in this kind of service.

This mixer, known as the "Eveready," has a batch capacity of 4 cu. ft. (0.11 cu. m.) and turns out a perfect mix in forty-five seconds, which gives it a rating of 35 cu. yd. to 50 cu. yd. (26.7 cu. m. to 38.2 cu. m.) per day. The machine is of the worm-type drive, the worm gear running in oil and being completely housed, together with the bearings and shaft. The mixing drum is of the tub type and has the "four motion" mix. Material is shoveled in at an opening of ample size, and the drum is automatically discharged by opening a shutter and allowing the mixed batch to run out either into a wheelbarrow for conveyance or direct into the forms.

The whole drum can be discharged in twelve seconds, or only a portion of it may be discharged at a time, a feature which is very desirable in a mixer of this kind. The "Eveready" is driven by a 2-hp. two-cycle horizontal water-cooled gasoline engine directly connected.

Lighting Fixture That Fits Any Standard Socket

Objectionable glare is eliminated in a lighting fixture called the "Amco-Illuminet," according to the manufacturer, the Art Metal Manufacturing Company, Cleveland, Ohio. The fixture is a combination of metal and glass, the metal part being spun over the glass, forming one piece. The neck of the metal part of the fixture is so made that when it is pushed up over the head of the standard socket it snaps into place and forms one continuous line with the socket, as shown in the accompanying illustration. The glass is made with the bottom open, the bottom being made of various sizes to fit the large part of the standard 75, 100 and 150-watt type C lamps. The lamps used in the fixture have their bottom portion frosted, the bottom of the lamp



COMBINATION METAL AND GLASS FIXTURE

thus forming the lower part of the fixture. A flat, polished metal reflector is placed on the inside of the upper portion of the fixture and acts as a projector and diffuser to intensify the light downward and outward over a wide area.

Trade Notes

R. A. COVELL, who for some time has been connected with the New Haven office of the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has become office manager of the New York branch of the company.

THE GENERAL ELECTRICAL COMPANY of Chicago has lately opened a large branch with offices and a traveling force in Memphis, Tenn., in the Lotus Building, Jefferson Avenue, near Second Street, where the entire first floor is occupied.

ALBERT S. LINDSTROM has resigned as general manager of the Thordarson Electric Manufacturing Company of Chicago and has accepted a position at Washington, D. C., as representative for the Moloney Electric Company of St. Louis, Mo.

C. R. HUGHES, who was formerly sales manager of the Mineralac Electric Company of Chicago, has been made manager to succeed James Van Buskirk, who resigned to assume the management of the Chicago office of the Moloney Electric Company of St. Louis.

CHARLES A. McCUNE has resigned his position as chief engineer of the Commercial Acetylene Company to become sales engineer with the Page Steel & Wire Company, 30 Church Street, New York, where his efforts will be devoted to service in connection with Armo welding rods.

THE DOEHLER DIE CASTING COMPANY of Toledo, Ohio, which is housed in a model factory building completed a little more than a year ago, has in this short space outgrown its quarters. In order to provide for this expansion the company has found it necessary to take over the adjoining plant of the Ohio Electric Company, doubling the present capacity.

THE APPLIANCE MANUFACTURING & DISTRIBUTING COMPANY has leased the building formerly occupied by the Rutenber Electric Company and will establish a plant for manufacturing heating appliances and other specialties at Logansport, Ind. The company was formerly established in Chicago. It will also hold the State agency for the Brascolite lighting fixtures.

J. L. FUGATE of Salt Lake City, Utah, has associated himself with the William A. Mullins Electric Company of Tacoma, Wash., occupying the position of sales and factory manager. Mr. Fugate was manager of the factory and fixture department of the Capitol Electric Company of Utah. This concern has twenty-one stores in Idaho, Utah and Montana, which were under his supervision.

R. L. LUNT, electrical engineer of Minneapolis, Minn., has become connected with the sales department of the Packard Electric Company, in charge of the Minneapolis branch, 716-18 McKnight Building. For years Mr. Lunt was connected as sales engineer with the Western Electric Company's Philadelphia office. From there he went with the Electric Storage Battery Company of Philadelphia.

THE PARR TERMINAL COMPANY, Wilfred N. Ball engineer, 225 First National Bank, Oakland, Cal., wants catalogs and other data from manufacturers of electrical materials or equipments used in the construction of piers, warehouses, industrial buildings, belt line railway and street work and cargo-handling equipment, coal bunkering and handling equipment, floating drydock and marine railway equipment, and general shipyard machinery and equipment.

WIRELESS CASE POSTPONED.—The case of the Marconi Wireless Telegraph Company of America vs. the Kilbourne & Clark Manufacturing Company of Seattle, Wash., has been postponed for the duration of the war at the request of the United States Navy Department, formally made in letters addressed to both parties to the controversy. As the case stands now apparatus is being manufactured by Kilbourne & Clark under the protection of a decision of the United States District Court, which held that the company is not infringing. The case had been brought before the United States Circuit Court on the appeal of the Marconi Company.

THE FEDERAL TRADE COMMISSION of Washington, D. C., has ordered the establishment of three branch offices of the commission in New York City, Chicago and San Francisco. The following members of the staff of the commission are to be in charge of the newly established offices: A. P. Thom, Jr., Custom House, New York; Walter B. Wooden, 14 East Jackson Boulevard, Chicago; D. N. Dougherty, Appraiser's

Stores Building, San Francisco. The work of the commission has grown enormously as it touches war problems in the finding of costs of production and in the determination of stocks of war and contributing materials on hand and the production capacity for such materials. A great deal centers in New York and Chicago and a constantly increasing amount of work is coming to the commission from the Pacific Coast.

Trade Publications

FARM LIGHTING PLANTS.—The Winters Farm Light Company, Davenport, Iowa, has issued a booklet describing and illustrating its farm lighting plants.

ADDING MACHINES.—The Teetor Adding Machine Company, Des Moines, Iowa, has issued a circular describing and illustrating its electrically driven adding and subtracting machine.

FARM LIGHTING SYSTEM.—The Marron Manufacturing Company, Rock Island, Ill., is distributing a circular describing the Marron farm lighting system and telling why this type of unit should be used.

SWITCHES.—"Snap Switches That Are Different" is the title of folder No. 251, which is being distributed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. This folder illustrates and describes the features of the C-II snap switches.

LABOR-SAVING DEVICES.—The Hurley Machine Company of Chicago has just issued its 1918 catalog of Thor electric labor-saving devices for the home. The catalog illustrates washing machines, ironing machines and vacuum cleaners. It contains forty-eight pages.

RESISTANT UNITS.—An automobile storage-battery charging unit for use in connection with the Delco-Light 32-volt plant is described and illustrated in a circular that is being distributed by the Ward Leonard Electric Company of Mount Vernon, N. Y. The connections of the lighting outfit are shown.

POLYPHASE MOTORS.—Polyphase motors are illustrated and described in a bulletin, No. 25, that has been issued by the Century Electric Company of St. Louis, Mo. Motors of ½ hp. to 60 hp. of the automatic-start induction type are discussed. Several applications of this type of motor are illustrated.

AUTOMOBILE SUPPLIES.—Automobile supplies and garage equipment are described in catalog 122, issued by the Julius Andrae & Sons Company, Milwaukee, Wis. This book contains 515 pages and contains practically everything in accessories for the automobile. Net price list and discounts applying to this catalog are distributed with it.

ELECTRICAL DIRECTORY OF MILWAUKEE.—The Milwaukee Jovian League has compiled and published an electrical directory containing the names of the local members of this organization with their company connection and a complete directory of all electrical manufacturers, dealers, contractors, engineering firms and other concerns handling or making electrical goods and machinery.

BOILER-FEED PUMPS.—Centrifugal boiler-feed pumps are described in a pamphlet issued by the De Laval Steel Turbine Company of Trenton, N. J. The pumps are shown with casing removed, showing the turbine rotors and pump impellers. Cross-sectional views are also produced. Actual installations of De Laval motor-driven boiler-feed pumps in large central power stations are also illustrated.

LAMP SHADES.—Bowls and shades with "Rozelle" color decorations applied to Volvra and Ivre glass are illustrated in actual colors in catalog No. 260, issued by the Ivanhoe-Regent Works of the General Electric Company, Cleveland, Ohio. Decorative lighting for the home is discussed, and explanations of the different names of colored decorations are given. This company is also distributing a price list for catalog No. 257.

WIRE.—"Aristos Copper-Weld, Copper-Clad Wire" is the title of a 104-page book that has just been issued by the Page Steel & Wire Company, 30 Church Street, New York. This book contains notes on the manufacture of wire in general and on physical and electrical properties of composites (copper-weld wire); gives tests, specifications and suggestions for determining size of wire for high-tension, telephone, telegraph, signal, police and fire alarm lines; contains helpful information for cal-

culating line drops, meters and short transmission lines, sag and tension in spans, etc. Individual chapters also deal with different sizes of plain copper-weld wire, copper-weld weatherproof wire, tie wires, rods and other copper-weld products. A copy of this bulletin will be mailed on application to the company.

LIGHTING UNITS.—"Scientific Industrial Illumination" is the title of booklet No. 163 that is being distributed by the Holophane Glass Company, 340 Madison Avenue, New York City. This very complete booklet deals with the need of scientific illumination and gives photographs showing how Holophane scientific illumination decreases spoilage in machine shops and other plants. It also discusses fatal accidents due to insufficient illumination. Reflectors are discussed, and distribution curves of the various types are illustrated. Outdoor and indoor illumination of large areas and protective yard lighting are explained in full, with illustrations showing the typical curve for the refractors. Illumination data on such points as the intensity of illumination required in different working spaces are given, as are lamp data and metric and legal equivalents.

New Incorporations

THE CHATTANOOGA (TENN.) PLUMBING & ELECTRICAL COMPANY has been incorporated with a capital stock of \$24,000 by V. B. Whiteside, W. C. Teas, P. W. Curtis and others.

THE WINTER STORAGE BATTERY COMPANY of Middletown, N. Y., has been incorporated with a capital stock of \$54,000 by M. E. Slawson, E. E. Kidney and E. A. Wheeler of Middletown.

THE BEARMAN-HUGENOT ELECTRIC COMPANY of Mobile, Ala., has been incorporated by R. Baerman, H. Baerman and E. T. Huguenot. The company is capitalized at \$15,000 and proposes to do an electrical contracting business.

THE CITIZENS' CONSOLIDATED POWER & ELECTRIC COMPANY of Poteau, Okla., has been incorporated by Wiley W. Lowrey, H. J. Fowler and E. S. Hutton. The company proposes to construct and operate an electric plant in Poteau.

THE BOLTON-WECHTEL COMPANY of Brooklyn, N. Y., has been chartered with a capital stock of \$20,000 to deal in batteries and auto accessories. The incorporators are: H. J. Wechtel and W. C. Bolton, 261 Stuyvesant Avenue, Brooklyn.

THE EDISON PRIMARIES BATTERIES COMPANY of West Orange, N. J., has been incorporated with a capital stock of \$500,000 by Thomas A. Edison, Charles Edison and Stephen E. Mainbert. The company is a subsidiary of the Thomas A. Edison Company.

THE NATIONAL FIRE & BURGLARY PREVENTION COMPANY of Dover, Del., has been chartered with a capital stock of \$150,000 to manufacture fire and burglar alarm systems, etc. The incorporators are: M. M. Clancy and F. A. Armstrong of Wilmington, Del.

THE HOME ELECTRIC EQUIPMENT COMPANY of Clarksburg, Va., has been organized to deal in electrical products. The officers are A. Hattenbach, president; W. S. Waters, vice-president, both of Pittsburgh, Pa., and H. T. Gates, secretary and manager.

BOYLE & ESSENWANGER, INC., of Buffalo, N. Y., has been incorporated with a capital stock of \$10,000 by Harry J. Boyle, Louise M. Boyle and George P. Essenwanger of Buffalo. The company proposes to manufacture all kinds of electric storage batteries.

THE MARS MANUFACTURING COMPANY of New York, N. Y., has been incorporated by Max Ebetz, Solomon Luber and Edna I. Lines of New York City. The company is capitalized at \$10,000 and proposes to manufacture all kinds of electric and electro-technical novelties.

THE MARSHALL ELECTRIC COMPANY of Marshalltown, Iowa, has been chartered with a capital stock of \$50,000 to deal in electrical supplies of all kinds. The officers are: E. N. Peak, president; A. J. Clark, vice-president; R. W. Van Horn, treasurer, all of Marshalltown.

THE WATERLOO STORAGE BATTERY COMPANY has been incorporated with a capital stock of \$25,000 to deal in electric storage batteries, automobile accessories, supplies, etc. The officers are: E. G. Mann, president and general manager; Clifford DeFuy, treasurer, and Earl S. Linn, secretary.

New England States

HILL, N. H.—The local electric-light plant, owned by Frank R. Woodward, was wrecked by a flood caused by the breaking away of a dam. The plants of the New England Novelty Company and the George H. Adam Needle Company were also badly damaged. The total loss is estimated at about \$50,000. The town is at present without electrical service.

AMHERST, MASS.—Plans are being prepared for the construction of a new turbine house at Massachusetts Agricultural College in connection with the installation of a new coal-handling plant. The cost of the proposed work is estimated at about \$55,200. James H. Ritchie, 8 Beacon Street, Boston, is architect.

BOSTON, MASS.—James J. Storrow, New England Fuel Administrator, has appealed to the National Fuel Administration for authority to restrict the use of electricity for signs and other forms of display lighting in order to reduce the consumption of coal.

BOSTON, MASS.—The Eastern Massachusetts Electric Company has filed a petition with the Board of Gas and Electric Light Commissioners asking permission to issue \$300,000 in bonds and \$83,200 in capital stock. The company states that it requires additional funds to meet the indebtedness incurred in the construction of transmission lines and extensions to its property in Salem and Malden.

LEOMINSTER, MASS.—The Leominster Electric Light & Power Company has applied to the Council for permission to erect and maintain high-tension transmission lines through Nashua, Hamilton and Nile Streets for the purpose of supplying electricity to the new factories of the Standard Comb Company.

PEABODY, MASS.—Plans have been prepared by A. E. Bump, 60 North Market Street, Boston, architect, for a one-story addition to the power plant of the A. C. Lawrence Leather Company, Crownshield Street.

QUINCY, MASS.—Lieut. George Summersby, U. S. N., has petitioned the Board of Gas and Electric Light Commissioners to authorize the Murray & Tregurtha Company of Quincy to obtain electricity from the Edison Electric Illuminating Company of Boston to operate two aircraft plants. The law stipulates that whenever possible power must be purchased from the local company.

SPRINGFIELD, MASS.—The Little River power bill, which permits the city of Springfield to generate power from its Little River water system has been signed by the Governor. The Water Department will begin immediately preparing plans for power development to utilize water now going to waste for power development.

WORCESTER, MASS.—The Worcester Electric Light Company has purchased land (about 15,000 square feet) adjoining its present property. The site, it is understood, will be used as an extension of the Webster Street plant.

WORCESTER, MASS.—The New England Power Company has petitioned the Board of Gas and Electric Light Commissioners for permission to issue \$350,000 in capital stock and \$600,000 in bonds, the proceeds to be used to meet obligations incurred in the erection of power and transmission lines and improvements to its plants at Webster and Milford.

Middle Atlantic States

BROOKLYN, N. Y.—Contract has been awarded by Rubel Brothers, Inc., Glenmore Avenue, to the George Weideman Electric Company, 191 Flatbush Avenue, for all electrical work in connection with the construction of a large ice manufacturing plant at Blake and Van Sinderen Avenues.

BROOKLYN, N. Y.—The contract for the electrical work and equipment in connection with the reconstruction of the large public bath house at Sea Breeze Avenue, near Ocean Park, has been awarded to Louis Kalisher, 1225 Myrtle Avenue. The cost of the building is estimated at about \$275,000.

BROOKLYN, N. Y.—The Robert Gair Company, 50 Washington Street, has awarded contract for the construction of a four-story extension to its boiler plant, at Plymouth and Washington Streets, to the Turner Construction Company, 244 Madison Avenue, New York City. The cost of the proposed improvement is estimated at about \$20,000.

DUNKIRK, N. Y.—The Common Council has accepted the report of the special committee recommending the installation of a

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

single-lamp standard system for the new ornamental lighting system on the business streets. Bids will soon be asked by the street committee of the Council for the equipment and installation of the proposed system.

FAIRPORT, N. Y.—Arrangements are being made by the Rochester Railway & Light Company to extend its electric transmission line to Fairport to supply electricity to the Sanitary Car Company.

HUDSON, N. Y.—Plans are being considered by Benjamin Wenzel, who conducts the Lake Charlotte House, to establish an electric-light plant to supply electricity for lighting the hotel, cottages and farmhouses in that vicinity. It is proposed to utilize the fall of water from the lake to generate the power.

NEW YORK, N. Y.—The Detroit Cadillac Motor Car Company, 1881 Broadway, is planning to install a service and repair works in connection with its new 12-story building to be erected at Columbus Avenue and Sixty-second Street, New York, at a cost of about \$600,000. Frederick T. Ley & Company, 19 West Forty-fourth Street, have the contract for construction of building.

SYRACUSE, N. Y.—Plans are under consideration by the City Council for the construction of a new electrically-operated pumping plant at the municipal sewage disposal works, to cost about \$8,000.

UTICA, N. Y.—Improvements are under way at the local plant of the Adirondack Electric Power Corporation and will soon be completed. The work will include the installation of a new boiler, generators and transformers.

CAMDEN, N. J.—Bids are being asked by the New York Shipbuilding Company of Camden for the erection of a one-story plate and angle shop, 200 ft. by 594 ft. Plans are also being prepared for a new steel fabricating plant and for a one-story forge shop 45 ft. by 55 ft. The company has awarded contract to Doyle & Company, 1519 Sansom Street, Philadelphia, Pa., for the construction of an office building at the works, to cost about \$75,000.

JERSEY CITY, N. J.—The Terminal Transit Company, it is reported, is planning to construct a shipbuilding plant at Doyer's Point, Newark Bay, Jersey City.

KEARNEY, N. J.—Contract has been awarded by the Ford Motor Car Company, Highland Park, Detroit, Mich., for electrical work in connection with the new factory building, located at the site of its proposed new shipbuilding plant on Newark Bay, to the K. W. Electric Company, 49 Lawrence Street.

NEWARK, N. J.—Plans have been prepared by the Public Service Company for the erection of a new building, 50 ft. by 162 ft., at Bloomfield Avenue and Lake Street.

NEWARK, N. J.—Alfred Sommer, 466 Summer Avenue, submitted the lowest bid (\$9,379) to the Board of Education for electrical work in connection with the proposed improvements to the Hawkins Street school building.

NEWARK, N. J.—The plant of the Gleason Wire Company, John Street, East Newark, was damaged by fire recently, causing a loss of about \$65,000. It is understood that the works will be rebuilt at once. The company manufactures electric wires, etc.

PLAINFIELD, N. J.—Four additions are being erected to the plant of the Niles-Bement Company on South Second Street. Two of the large buildings will be 100 ft. by 180 ft., one story high. A large boiler plant is also being built in connection with the improvements. The cost of the work is estimated at about \$400,000.

EASTON, PA.—Preparations are being made for the installation of a 10,000-kw. turbine at the Dock Street station of the Pennsylvania Utilities Company. A condenser will also be installed at the same time. It is expected to have the new equipment in operation by August 1.

ERIE, PA.—Work is progressing rapidly on the installation of the ornamental street-lighting system along State Street and in Perry Square.

GLENWOOD, PA.—Contract has been awarded by the Baltimore & Ohio Railroad Company to the Westinghouse-Church-Kerr Company, 37 Wall Street, New York, N. Y.,

for the erection of locomotive repair shops at Glenwood, to cost about \$1,700,000.

HARRISBURG, PA.—Plans are under consideration by the Harrisburg Light & Power Company for placing its overhead wires in underground conduits.

HARRISBURG, PA.—The City Council is considering plans for extensions to the police and fire-alarm systems, for which plans have been prepared. Clark E. Diehl is city electrician.

PHILADELPHIA, PA.—Improvements are being considered for the power plant of the Miller Chemical Company at Delaware Avenue and Milfin Street.

PHILADELPHIA, PA.—The new foundry addition to be erected by the Aetna Foundry Company, Twenty-second Street and Allegheny Avenue, will be equipped with a 10-ton electric traveling crane.

SHARON, PA.—Plans are under consideration by the Savage Arms Company, 50 Church Street, New York, N. Y., for the construction of an addition, 40 ft. by 60 ft., to the power plant at its local works. Griggs & Myers, 110 West Fortieth Street, New York City, are engineers.

WAYNESBORO, PA.—The Chambersburg, Greencastle & Waynesboro Street Railway Company has begun work on the erection of a large steel tower to be located near its new building in East Main Street. The tower will receive high-tension current from the power house at Security, Md.

TIMONIUM, MD.—Plans are being considered by the Maryland State Fair and Agricultural Society for the installation of electric lamps on the grounds, erection of dancing pavilion and several new exhibition buildings. Louis McLane Merryman of Cockeysville is president.

HUNTINGTON, W. VA.—The Consolidated Light, Heat & Power Company, it is said, will petition the United States government for assistance in enlarging its plant to provide for the extraordinary demands upon it by war industries in this district, including Huntington and Ashland. Four new boilers are needed for the plant, which cannot be purchased as the government has commandeered all of that product. The assistance will be in nature of a loan. The government will furnish the needed equipment, to be used exclusively for war work. W. R. Power is general manager.

KINGWOOD, W. VA.—The Hoffman Coal Mining Company, recently incorporated with a capital stock of \$30,000, is planning to install an electric power plant to supply energy to operate machinery in the mines.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 17 under specification 3046 for two hydro-pneumatic gate elevators for dry docks at Philadelphia, Pa., and Norfolk, Va. The cost is estimated at \$15,000.

WASHINGTON, D. C.—Extensions are being made by the Potomac Electric Company to provide service for the many additional government buildings in Washington and to the camps and cantonments established around the city. A 15,000-kw. generating unit was installed in January, 1917, and orders have been placed for another unit of the same capacity, which is promised for delivery July 5, 1918. The company is now negotiating for a third generator of the same size. Boiler equipment for this additional power is also being installed. Additional substation equipment has been purchased, and the company is negotiating with the government to supply steam heat for certain new buildings of the government if erected near the station.

North Central States

GRAND RAPIDS, MICH.—Plans are being prepared by the Wernette-Bradfield Mead Company for remodeling the power plant of the Holland Furniture Company.

HOUGHTON, MICH.—The Peninsular Power Company of Houghton is building a power plant on the Brule River. The plans provide for a development of 5000 hp.

LIMA, OHIO.—An election will probably be called in August to submit a proposal to issue bonds for the installation of a municipal street-lighting system, instead of renewing the existing contract.

MIDDLETOWN, OHIO.—The County Commissioners have awarded the contract for lighting the viaduct between Middletown and West Middletown to the Beattie Electric Company of Cincinnati, at \$2,113.

DEERING, KY.—The Deering Telephone Company, recently incorporated, is contemplating the installation of a 25-mile telephone system. A. B. Johnson is president.

LOUISVILLE, KY.—A new garage, to cost about \$5,000, is being erected by the Columbia Truck Company, 119 South Seventh Street, Louisville. Equipment, including a drill press, overhead crane and general shop equipment, will be required.

ATTICA, IND.—Plans are being prepared for the construction of a new electric-light plant and water-works system for the Attica Electric & Power Company, to cost about \$100,000. Rubel & Wells, Chemical Bank Building, St. Louis, Mo., are engineers. R. H. Freeland is superintendent.

CONNERSVILLE, IND.—Plans are being considered by the Indiana Lamp Company for the construction of an addition to its plant, to cost about \$50,000. E. M. Ansted is manager.

GARY, IND.—The Gary Street Railway Company is contemplating an extension on East Fifth Avenue to the Aetna gunecotton plant, 2 miles east of Broadway.

MADISON, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 5 for conduit and wiring, gas piping and lighting fixtures in the United States post office at Madison. For details see Searchlight Section.

CHICAGO, ILL.—Contracts have been awarded by the Commonwealth Edison Company, 223 East Grand Avenue, for the erection of an addition to its power plant, to cost about \$8,000.

CHICAGO, ILL.—The former plant of the Allis-Chalmers Company at Washtenaw Avenue and Twelfth Street has been purchased by David A. Wright, 568 Washington Boulevard, Chicago, manufacturer of machine tools, which is being equipped with machinery for manufacturing Fifield lathes, special double-end gun boring and turning lathes, etc. The main building is 140 ft. by 500 ft., and is equipped with a traveling crane. Electricity will be used as motive power.

JACKSONVILLE, ILL.—Plans are being considered by the Board of Education for the construction of a new high school building, including boiler house, metal shop and smokestack, to replace building destroyed by fire several weeks ago. The cost is estimated at \$175,000.

BRODHEAD, WIS.—Preparations are being made for remodeling the municipal electric light plant, at a cost of about \$35,000. The Power Engineering Company, Corn Exchange Building, Minneapolis, Minn., has charge of the engineering work.

CHIPPewa FALLS, WIS.—The old lighting plant of the Wisconsin-Minnesota Light & Power Company was recently put out of commission when the flume leading from the canal to the wheels of the plant gave way. The lighting plant will now be permanently abandoned.

CLINTONVILLE, WIS.—A syndicate of local business men has acquired practically the entire water-power rights on the Little Wolf River at Little Wolf, Phillips, Osterander and Royalton, Wis. Tentative plans are being prepared to construct dams and hydroelectric power plants to develop about 2500 hp. The initial work may begin this year. W. A. Olen, president of the Four Wheel Drive Automobile Company of Clintonville, is interested in the project.

CUDAHY, WIS.—Contract has been awarded by the Ladish Drop Forge Company, Park Avenue, to Klug & Smith, consulting engineers, Mack Block, Milwaukee, to prepare plans and construct an addition 50 ft. by 60 ft. to its boiler house.

MONROE, WIS.—Contract has been awarded by the Marty-Gempeler Company to Wagner & Bauman of Monroe for construction of cheese factory, warehouse and power house, to cost about \$18,000. Claude & Starck of Madison are architects.

NEW LONDON, WIS.—A contract for addition to the municipal power house has been awarded to V. Thomas of New London.

NIAGARA, WIS.—The Trustees of the village of Niagara have granted the Niagara Light & Power Company a franchise to supply electricity in Niagara, subject to the approval of the Public Utility Commission.

WAUSAU, WIS.—Plans for the installation of a central heating and lighting plant in Wausau are reported to be under consideration by the merchants of Wausau.

WEST ALLIS, WIS.—Ground has been broken for the foundry unit of the new manufacturing group of the Universal Machinery Company, 784 Thirtieth Street, Milwaukee. Contracts will soon be awarded for the machine shop unit, which will be 150 ft. by 480 ft. Frank E. Gray and Val A. Siebert, associated architects, 86 Michigan Street, Milwaukee, are preparing plans. E. L. Devlin is president.

WEST BEND, WIS.—A two-story addition, 25 ft. by 40 ft., is being erected at

the plant of the West Bend Heating & Lighting Company. New equipment, including automatic stoking and coal and ash-handling equipment will be installed.

DULUTH, MINN.—Plans are being prepared by the Duluth Street Railway Company to extend its railway from South Superior to Oliver.

PINE CITY, MINN.—The Eastern Minnesota Power Company of Pine City has extended its electric transmission line through Rodum.

APPLETON CITY, MO.—Contract has been awarded by the Missouri, Kansas & Texas Railway Company to the Queen City Electric Company of Sedalia for electric wiring in connection with the erection of a number of buildings, etc., at Appleton.

INDEPENDENCE, MO.—Arrangements are being made by local business men for the location of an electric railway from Independence to Sugar Creek, a small industrial center, about 1½ miles from this city. The cost of the proposed railway is estimated at about \$50,000, of which about \$13,000 has been subscribed. The Kansas City (Mo.) Railways Company will construct and operate the line. Preliminary surveys have been made.

KANSAS CITY, MO.—Contract has been awarded by the Kansas City Railways Company for the erection of substation No. 2 to L. Breitag & Son Construction Company, 3701 West Prospect Place, Kansas City. The building will be 43 ft. by 82 ft., and will cost about \$25,000.

KIRKWOOD, MO.—The sale of the municipal electric generating plant to the Union Electric Light & Power Company of Webster Groves is reported to be under consideration by the Board of Aldermen. It is not proposed to sell the distributing system, but to purchase energy from the Union company, for local distribution.

ST. JOSEPH, MO.—The St. Joseph Warehouse Cold Storage Company is reported to be contemplating the installation of new ice-manufacturing machinery, etc., to cost about \$50,000. H. R. Worsley is architect and engineer.

BANCROFT, NEB.—Material for power house and equipment for the new municipal electric light plant have been received. The cost of the proposed system is estimated at about \$45,000.

BELVIDERE, NEB.—Lighting bonds to the amount of \$7,000 for the town of Belvidere have been approved by the State auditor.

FALLS CITY, NEB.—Bonds to the amount of \$60,000 for improvements to the municipal electric-light plant in Falls City have been approved by the State auditor.

SYRACUSE, NEB.—Preparations are being made for the installation of new equipment in the municipal electric light plant, for which bids have been received. The cost is estimated at \$7,500.

THURSTON, NEB.—The installation of an electric lighting system in Thurston is under consideration.

KANSAS CITY, KAN.—The Contractors' Machinery Company of Kansas City, Kan., is contemplating the purchase of two 500-hp. water-tube boilers and other equipment.

Southern States

HIWASSEE, N. C.—A decision handed down by the court permits the Carolina-Tennessee Power Company to construct a hydroelectric power plant on the Hiwassee River in Cherokee County near the Tennessee State boundary. The properties include land and water rights for a distance of 26 miles. The project includes the construction of two dams, each 150 ft. high, one near Tennessee and the other 13 miles up the river, to develop about 60,000 hp. W. V. M. Powelson, care of Bertram, Grison & Company, 421 Chestnut Street, Philadelphia, Pa., is engineer.

SPRAY, N. C.—Plans and specifications are being prepared for the erection of two large mill buildings, one a one-story weave shop, 1300 ft. by 250 ft., and the other a four-story spinning mill, 1300 ft. by 150 ft., by the Carolina Cotton & Woolen Mills Company at Fieldale. The initial unit will provide for 75,000 spindles and will cost about \$2,000,000. The ultimate plan is for a total of 300,000 spindles and accompanying looms. The general land developments for the village are progressing and many buildings for dwellings, offices, etc., are in course of construction. The Carolina Cotton & Woolen Mills Company is controlled by Marshall Field & Company of Chicago, Ill.

FLORENCE, S. C.—The Florence Ice & Fuel Company, recently organized, is reported to have purchased the ice plant of the Carolina Gas & Electric Company.

FLOVILLA, GA.—An election will probably be called soon to submit to the voters the proposal to issue \$25,000 or \$30,000 in bonds for the installation of an electric-light plant and water-works system.

WAUCHULA, FLA.—The Wauchula Light & Power Company is contemplating the installation of a fertilizing mixing plant of 5 tons capacity, and also a crate mill with a daily capacity of 2000 packages.

CHATTANOOGA, TENN.—The F. J. Lewis Manufacturing Company has purchased a site (five acres) adjoining the oven plant of the Chattanooga Coke Company, on which it proposes to erect a coal tar distilling plant, 200 ft. by 64 ft., to cost about \$40,000. The plans provide for a power plant, several stills, steel tanks, etc. Contract for buildings has been awarded to the Mark Wilson Company of Chattanooga. W. H. Lewis, 2500 South Robey Street, Chicago, Ill., is vice-president.

JONESBORO, TENN.—Plans have been prepared by the Pleasant Valley Telephone Company for the construction of a new metallic telephone system to Johnson City, a distance of about 10 miles.

ANNISTON, ALA.—A company has been organized to build an electric railway from Anniston to Camp McClellan. The company is capitalized at \$200,000 and as soon as permission is granted by the War Department to enter the reservation, work on the railway, it is expected, will begin. W. H. McKleroy is president and W. H. Weatherly is vice-president. James Mitchell, president of the Alabama Power Company, is interested in the company.

CHENEYVILLE, LA.—An election will soon be called to submit to the voters the proposal to issue \$16,000 in bonds for the installation of an electric-lighting plant and water-works system in Cheneyville.

NEW ORLEANS, LA.—Bids will be received by the lighthouse inspector, New Orleans, La., until June 21 for two 15-hp. kerosene engines, electric ignition; two air compressors, fuel, air and cooling tanks, etc. Further information may be obtained upon application to the above office.

RAYNE, LA.—Bonds to the amount of \$35,000 have been voted for improvements to the municipal electric-light plant and water-works system.

DENISON, TEX.—The construction of a new passenger station and repair shop in Denison, to cost about \$10,000, is under consideration by the Texas Electric Railway Company.

LUFKIN, TEX.—The Lufkin Electric Light & Power Company is contemplating the installation of additional machinery at its plant. The capital stock of the company has been increased from \$30,000 to \$45,000.

SWEETWATER, TEX.—Dr. A. W. Caulfield would like to receive information on an individual lighting system in connection with remodeled building for bathhouse and massage parlors and other buildings, comprising a sanitarium.

WACO, TEX.—The Waco Electrical Supply Company has increased its capital stock from \$20,000 to \$30,000.

WICHITA FALLS, TEX.—Bids will be received until June 25 by the State of Texas, W. P. Hobby, Governor, Austin, for the erection of buildings for the Northwest Texas Insane Asylum. Separate bids to be submitted on each building. Funds to the amount of \$385,000 are available for the work. Charles H. Page & Brother of Austin are architects.

Pacific and Mountain States

GROUND MOUND, WASH.—Bids will be received by the State Board of Control, Olympia, until June 21 for the construction of cottage and power house at the State School for Girls near Grand Mound. The power house with equipment will cost about \$15,000. Plans are on file at the above office and at the office of George W. Lawton, Alaska Building, Seattle.

LA CROSSE, WASH.—Local business men are considering asking the Washington Water Power Company of Spokane to take over the local electric plant and extend its electric transmission line from Endicott to La Crosse.

SEATTLE, WASH.—A permit has been granted to the Puget Sound Traction, Light & Power Company for the erection of a reinforced concrete smokestack, 225 ft. high, to cost about \$15,000.

SEATTLE, WASH.—The Heffernan Engine Works are rebuilding their plant and will install considerable new machinery. The company manufactures marine engines and deck equipment.

SEATTLE, WASH.—The Stone & Webster Engineering Corporation will begin

work at once on the construction of a power station for the Puget Sound Traction, Light & Power Company, to be located at 6500 Fourteenth Avenue, South Seattle, to cost about \$30,000.

SEATTLE, WASH.—Bids will be received by the Board of Public Works of Seattle until June 21 for furnishing one 1000-kw. motor-generator set for the City Light Department. This will be installed in the substation being erected to supply power to the Seattle municipal railway.

HOOD RIVER, ORE.—The Pacific Power & Light Company has recently completed a link in the high-voltage transmission line near White Salmon, Wash., connecting the Hood River and White River plants with the large plant of the Northwestern Electric Company on the White Salmon River. Energy is transmitted across the Columbia River over six cables.

PORTLAND, ORE.—Projects of the Portland Railway, Light & Power Company, involving an expenditure of \$1,550,000, have been approved by John R. Lewis, state engineer, to increase the power facilities in Portland by development of water rights on the Clackamas River. One of the projects approved is for the appropriation of 667 second ft. of water, together with the waters of the Clackamas River, for development of 10,000 hp. The proposed plans will involve the construction of a flume 4 miles long, with a power plant, to cost about \$1,250,000. Another application calls for the construction of the Timony Meadows reservoir on Oak Creek in Clackamas

County of 40,000 acre-ft. of water. This project includes the construction of a dam 80 ft. high and 440 ft. long, to cost about \$300,000. These projects were started by the company several years ago and later dropped.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is contemplating the construction of an extension to Yucaipa as soon as possible.

OAKLAND, CAL.—The San Francisco-Oakland Terminal Railways Company is planning to build an extension to the Moore shipbuilding yards in Oakland.

ONTARIO, CAL.—The Ontario Power Company, which supplies electricity in Ontario and Upland, has petitioned the State Railroad Commission for permission to develop an additional source of power, which will necessitate an expenditure of about \$60,000. The company contemplates a hydroelectric development just above Hog's Back in San Antonio Canyon.

SAN DIEGO, CAL.—On May 21 connection was made between the Southern California Edison Company's transmission lines at San Juan Capistrano and the San Diego Consolidated Gas & Electric Company. The latter company is now purchasing a considerable part of its electrical energy from the Southern California company, this energy being generated by water power.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded contract to the General Electric Company for furnishing and delivering electric locomotives at the Hetchy Hetchy site, at \$39,162.

MILFORD, UTAH.—Preparations are being made for the development of the sulphur mine northeast of Milford on the Beaver-Milford County line. The Beaver River Power Company of Beaver, it is understood, expects to erect an electric transmission line to the mine.

VERDI, NEV.—The power plant of the Verdi Lumber Company was damaged recently, causing a loss of between \$20,000 and \$30,000.

Canada

BURNABY, B. C.—The local stations of the British Columbia Electric Railway Company were recently destroyed by fire.

ELMIRA, ONT.—The Elmira Machinery & Transmission Company, Church Street, is planning to build an addition to its plant, to cost about \$50,000. E. Vice is manager.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agents, the Panama Canal, Washington, D. C., until June 26 for furnishing cable, wire rope, brass tubing, porcelain insulators, bridge and aerial cable rings, signal gongs, etc., under circular 1220. Further information may be obtained at the above office.

(Issued May 14, 1918.)

1,266,435. **TELEPHONE INSULATOR**; Roy W. English, Victoria, B. C., Canada. App. filed June 30, 1917. Glass or porcelain insulators whereby the line wires can be securely gripped.

1,266,440. **TAP CONNECTOR FOR ELECTRIC CONDUCTORS**; Morris F. Finkelstein, New York, N. Y. App. filed May 22, 1917. Binds the connector to the cable in a simple, reliable and effective manner.

1,266,441. **ELECTRIC CONNECTOR**; Morris F. Finkelstein, New York, N. Y. App. filed May 22, 1917. In form of a duplex clamp.

1,266,460. **TROLLEY POLE**; Peder Hammer, Chicago, Ill. App. filed Jan. 13, 1917. Has means for locking the pole.

1,266,473. **ELECTRICAL MEASURING APPARATUS AND METHOD OF OPERATING THE SAME**; Charles A. Hoxie, Schenectady, N. Y. App. filed May 19, 1916. Includes a thermo-cell.

1,266,478. **METHOD OF PRODUCING SILICON-CARBIDE ARTICLES**; Otis Hutchins, Niagara Falls, N. Y. App. filed March 3, 1917. Uses electric furnace of the type ordinarily employed in the production of carborundum.

1,266,479. **FUSE**; Victor G. Jensen, Chicago, Ill. App. filed Sept. 18, 1916. Improved type of cartridge fuse.

1,266,480. **TRANSFORMER**; Svend E. Johannessen, Pittsfield, Mass. App. filed Dec. 11, 1915. Transformer terminal boards.

1,266,487. **TACHOMETER**; Petrus van Santen Kolff, Philadelphia, Pa. App. filed May 2, 1916. Electrical speed-indicating mechanism.

1,266,516. **HIGH-POTENTIAL INSULATOR**; Sadaji Momota, Tokio, Japan. App. filed June 14, 1916. To prevent creeping or surface discharge.

1,266,517. **RECTIFIER**; George S. Meikle, Schenectady, N. Y. App. filed Oct. 9, 1914. Improvements.

1,266,530. **TELEPHONE TRANSMITTER**; John Z. Miller, Erie, Pa. App. filed April 18, 1917. Improvements in the diaphragm.

1,266,727. **CIRCUIT CONTROLLER**; Thomas E. Barnum, Milwaukee, Wis. App. filed April 8, 1916. Provides contact-supporting means.

(Issued May 21, 1918.)

1,266,548. **ELECTRIC SWITCH**; Harry J. Bradley, Milwaukee, Wis. App. filed May 22, 1916. Relates particularly to that type which is operated magnetically.

1,266,555. **APPARATUS AND METHOD FOR OPERATING SWITCHES**; Roy W. Collins, New York, N. Y. App. filed May 13, 1913. Provides a switch automatically controlled by the condition of the motor circuit of an approaching car.

1,266,557. **FILM-FORMING ELECTROLYTE**; John Coulson, Wilkesburg, Pa. App. filed May 3, 1916. Provides an electrolyte which shall be capable of acting upon film-forming metals to produce dielectric films.

1,266,558. **PROTECTIVE DEVICE**; Elmer E. F. Creighton, Schenectady, N. Y. App. filed

Record of Electrical Patents

Notes on United States Patents

Feb. 17, 1915. Relates to protective devices for maintaining continuity of service on transmission lines under short-circuit conditions.

1,266,566. **BAROMETRIC VALVE**; Earl E. Eby, Wilkesburg, Pa. App. filed July 6, 1915. Relates to valves of the barometric type.

1,266,570. **MEASURING DEVICE**; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed July 3, 1916. Means for accurately determining variations in temperature and pressure by the use of a resistor.

1,266,571. **COIL RETAINING AND VENTILATING MEANS**; Allan B. Field, Westcliffe-on-Sea, England. App. filed Feb. 5, 1914. Relates particularly to rings adapted for employment in the rotors of turbo-generators and similar machines.

1,266,573. **SHOTGUN**; George Fleming, Princeton, Tex. App. filed Jan. 18, 1917. Provides a trigger-operated gun which closes an electrical circuit.

1,266,575. **TERMINAL CONNECTION**; Richard H. Frank, Malta, Mont. App. filed May 24, 1917. Improvements in terminal connections, adapted for use with high-tension cable wires.

1,266,586. **SYSTEM OF CONTROL**; Arthur J. Hall, Wilkesburg, Pa. App. filed March 4, 1916. Provides a control system for the operation of the driving motors of an electric locomotive.

1,266,592. **SYSTEM OF CONTROL**; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 4, 1916. A means is employed for effecting a uniform rate of deceleration of momentum-driven dynamo-electric machines.

1,266,593. **CONTROL SYSTEM FOR ALTERNATING-CURRENT COMMUTATOR-MOTORS**; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 13, 1916. Provides a system whereby the motor may be started and accelerated in a smooth and uniform manner with ample torque.

1,266,599. **CARTRIDGE FUSE**; Alfred E. Johnson, Denver, Col. App. filed Dec. 20, 1915. Divides the interior of the cartridge into two compartments by means of a partition.

1,266,604. **ELECTRICAL MEASURING INSTRUMENT**; Paul MacGahan, Pittsburgh, Pa. App. filed April 29, 1915. Relates to power-factor meters for polyphase electric circuits.

1,266,607. **CONTROL SYSTEM**; Paul L. Marquis, Altoona, Pa. App. filed May 3, 1915. Relates to control systems for dynamo-electric machines and to four equipments of the series-parallel type.

1,266,614. **SEAL**; Harold A. Newcomb, Wilkesburg, Pa. App. filed Jan. 6, 1915. Relates to gas-tight seals between glass and metal.

1,266,615. **INSULATOR CLAMP**; David S. Nicol, Quebec, Canada. App. filed July 23, 1917. Insulator clamps securable to the large insulator of power-transmission line for supporting air-break switches, lightning arresters and the like.

1,266,623. **TELEPHONE SIGNALING SYSTEM**; Ralph K. Quess, New York, N. Y. App. filed July 1, 1916. Relates to a system of the type in which automatic switches are employed for controlling the connecting and signaling circuits.

1,266,630. **AUTOMATIC-DUMPING TRANSPORT SYSTEM**; William Ross and Walter F. J. Cosser, South Porcupine, Ontario, Canada. App. filed June 4, 1917. Relates to transport systems in which dump trucks provided with outlet doors run on suitable rails.

1,266,612. **AUTOMATIC MOTOR STARTER**; Herman L. Van Valenburgh, Milwaukee, Wis. App. filed Aug. 21, 1916. Device will automatically control the circuit relations of the different sections of starting resistance.

1,266,615. **TELEPHONE-EXCHANGE SYSTEM**; Harry G. Webster, Chicago, Ill. App. filed May 29, 1914. Consists in the provision of improved means for automatically extending a calling line to an idle operator.

1,266,652. **ELECTRICITY METER**; Jacob W. Bard, Springfield, Ill. App. filed June 7, 1915. Relates to direct-current watt-hour meters of the mercury motor-meter type comprising a rotating armature immersed in a mercury bath.

1,266,811. **TELEGRAPHIC RECEIVER**; Edwin W. Mayfield, Chicago, Ill. App. filed May 29, 1916. Improved means for receiving telegraphic signals with speed and secrecy and at a minimum of discomfort to the receiving operator.

1,266,879. **ELECTRICAL HEATING APPARATUS FOR PERMANENTLY WAVY HAIR**; Eugene F. Suter, London, England. App. filed Aug. 6, 1917. An improved electrical heater arranged so that the heat can be applied to and distributed over the different parts of the coiled hair.

1,266,887. **CONDUIT CAP FOR ELECTRIC INSTALLATION**; Wheeler H. Vibber, New London, Conn. App. filed Nov. 28, 1916. An improved conduit cap for use as an end terminal for electric installation.

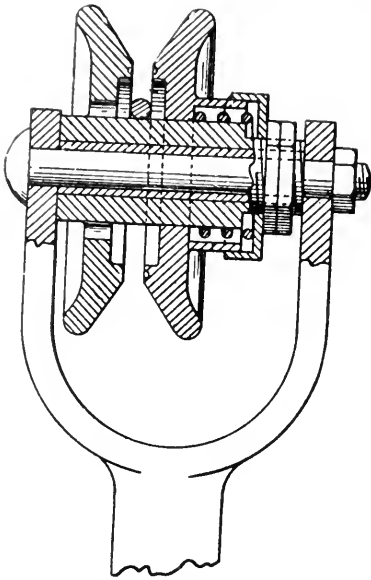
1,266,897. **CIRCUIT CONTROLLER**; Paul H. Zimmer, Milwaukee, Wis. App. filed April 8, 1916. Circuit controllers adapted for starting alternating-current motors.

1,266,898. **ELECTRICAL SYSTEM**; Carroll R. Alden, Detroit, Mich. App. filed Feb. 4, 1916. A simple and efficient means for controlling the resistance of ignition circuits.

- 1,266,911. VACUUM FOR ACCUMULATING BATTERIES OR THE LIKE; Georges Boulton, Paris, France. App. filed Dec. 10, 1917. Relates to an arrangement which simplifies the fitting and facilitates the cleaning of the various parts.
- 1,266,917. ALTERNATING CURRENT SOLENOID; George A. Burnham, Saugus, Mass. App. filed Sept. 28, 1916. A form of solenoid adapted to be associated with a circuit breaker or switch.
- 1,266,920. SIGNAL BOX HAVING LOCAL ALARM; Frederick W. Cole, Newton Highlands, Mass. App. filed April 19, 1915. Improved means whereby a local alarm or bell is sounded at the box concurrently with the actuation of the mechanism for transmitting the signal.
- 1,266,931. POLARITY-INDICATING MECHANISM FOR X-RAY APPARATUS; Charles Payser, New York, N. Y. App. filed May 18, 1916. Relates to X-ray apparatus in which a high-potential current discharge is sent through an X-ray vacuum tube.
- 1,266,941. ELECTRICAL HEATING APPLIANCE; Cedric E. Heller, Milwaukee, Wis. App. filed Oct. 26, 1917. Provides means whereby any gas range may be readily converted into an electrical range.
- 1,266,978. TELEPHONE EXCHANGE SYSTEM; Roy E. Noble, New York, N. Y. App. filed Nov. 6, 1916. Extension telephone lines terminating at a private branch exchange may make outgoing calls during the period when no operator is at the private branch exchange.
- 1,266,979. PLUG; George W. Norgate, Chicago, Ill. App. filed June 16, 1914. Relates to plugs or connecting devices adapted to establish circuit connections with the customary form of threaded socket.
- 1,266,988. AMPLIFYING RECEIVER; Edwin S. Priddham and Peter L. Jensen, Napa, Cal. App. filed July 3, 1916. Receivers of this type of conducting coil for telephone currents disposed in a magnetic field so as to cut transversely the lines of force of the field.
- 1,267,013. TRANSFORMER; Chester M. Thornderson, Chicago, Ill. App. filed Sept. 27, 1915. Means for adjusting transformer to potential drops along the transmission line.
- 1,267,018. TRANSMITTING APPARATUS FOR WIRELESS TELEGRAPHY AND TELEPHONY; Georg von Arco and Alexander Meissner, Berlin, Germany. App. filed March 6, 1914. A transmitting station for wireless telegraphy and telephony in which the high-frequency currents are produced in a generator switch.
- 1,267,031. TELEPHONE TRUNK CIRCUITS; Bernard D. Willis, Chicago, Ill. App. filed Aug. 23, 1916. Interoffice trunk circuits for use in automatic telephone systems.
- 1,267,044. ELECTRIC WATER PURIFIER; Edward M. Barnes, Hastings, Mich. App. filed June 30, 1917. Provides an electric water purifier of type in which spaced electrodes are immersed in the water to be purified.
- 1,267,060. ELECTRIC HORN; William W. Dean, Chicago, Ill. App. filed Oct. 15, 1913. Improvements in electric signal horns or alarms.
- 1,267,068. RECORDER FOR TELEGRAPH MESSAGES; Reid G. Ford, Brooklyn, N. Y. App. filed Jan. 21, 1916. Consists in mechanism connected with the sending instrument by which a complete record of all messages sent is automatically taken.
- 1,267,069. ELECTRICALLY CONTROLLED TEMPERATURE REGULATOR; Henry W. Grom and Frederick Terry, Pasadena, Cal. App. filed June 14, 1917. Relates to an electric contact switch and a thermostatic control therefor.
- 1,267,097. AUTOMATIC TELEPHONE SYSTEM AND APPARATUS; Talbot G. Martin, Chicago, Ill. App. filed March 26, 1907. Relates to automatic systems in which step-by-step actuated and electrically propelled switches are employed for extending connections to systems.
- 1,267,104. HEAT - CONTROLLING DEVICE; Henry A. Moore and Albert H. Brunner, Burbank, Los Angeles, Cal. App. filed Dec. 6, 1916. An electrical thermostatic control adapted for use in incubators and the like.
- 1,267,113. PARTY-LINE TELEPHONE SYSTEM; Winfred T. Powell, Chicago, Ill. App. filed April 27, 1916. Automatic party-line telephone systems in which connections are established through the medium of subscriber-controlled switches.
- 1,267,120. ELECTRODE; Ferdinand A. Rudolf, New York, N. Y. App. filed Aug. 15, 1916. Provides suspended electrodes of such construction that the loss of

precious metal values in the refining process is practically eliminated and the deposit of the desired metal is substantially pure.

- 1,267,131. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE SYSTEM; Arthur E. Smith, Evanston, Ill. Has for its object the provision of a system in which phantom circuits are employed for establishing connections.
- 1,267,141. TOTALLY SUBMERGED ELECTRODE; Harry G. Stout, New York, N. Y. App. filed July 26, 1916. Forms the plates and constructs the tanks in which the plates are held so that all the plates are totally submerged beneath the electrolyte when in use.
- 1,267,148. IGNITION MECHANISM FOR INTERNAL-COMBUSTION ENGINES; Harry Randolph Van Deventer, Sumter, S. C. App. filed Dec. 19, 1914. Has for its purpose the provision of an igniter bracket upon which a magneto may be mounted.
- 1,267,156. CONTACT-MAKING VOLTMETER; Fred H. Winter, Schenectady, N. Y. App. filed March 1, 1917. Relates to contact-
- making voltmeters in which electromagnetic holding means are employed to prevent chatter of the contacts.
- 1,267,165. FIRE-ALARM PROTECTIVE DEVICE; Mario Arnava, San Francisco, Cal. App. filed July 24, 1917. Relates to that class of fire-alarm signal stations in which a booth is provided having a door automatically locked.
- 1,267,173. ELECTRIC HEATING DEVICE; Arthur Francis Berry, Ealing, England. App. filed Nov. 28, 1916. An electric heating device comprising a grid-like structure.
- 1,267,181. ELECTRIC CIRCUIT-CONTROLLING SWITCH; Frank J. Camatta, Tonasket, Wash. App. filed Feb. 7, 1916. A cut-out switch for use in connection with electric current meters.
- 1,267,198. ELECTRIC METER; Evan Evans, Berlin, Germany. App. filed Feb. 10, 1914. A type of electric peak meter in which the armature is subjected to a constant counter-torque corresponding to a definite and predetermined rate of consumption of energy.
- 1,267,199. INCANDESCENT-CATHODE ARC DEVICE; Charles V. Ferguson, Schenectady, N. Y. App. filed Sept. 20, 1915. Relates to electrical discharge devices of the incandescent cathode type having a gaseous filling.
- 1,267,213. DEMAND-LIMITING APPARATUS; Chester I. Hall, Fort Wayne, Ind. App. filed April 26, 1916. Provides a demand-limiting device which will interrupt or modify the current flow in an electric circuit.
- 1,267,214. POSITION INDICATOR OR RECORDER; Chester I. Hall, Fort Wayne, Ind. App. filed June 15, 1916. Devices for reproducing or indicating the movement of a primary movable member at some point more or less remote from the primary member.
- 1,267,216. MOTOR CONTROL; Williams S. H. Hamilton, Schenectady, N. Y. App.



1,267,338—Trolley Wheel

- filed July 6, 1917. Relates to multiple-unit control of the pilot motor type.
- 1,267,222. SAFETY TOP FOR SWITCHES; Charles H. Hill, Schenectady, N. Y. App. filed Nov. 13, 1915. A safety device for knife-blade switches to prevent them being closed accidentally.
- 1,267,223. PROTECTIVE DEVICE FOR TELEPHONE CIRCUITS; George H. Hill, Schenectady, N. Y. App. filed Nov. 13, 1915. A device which will automatically ground the telephone wires and will also interpose a positive barrier at the entrance to the telephone jack so that the telephone plug cannot be inserted.
- 1,267,232. MOTOR WINDING; Willem C. Korthals-Altes, Schenectady, N. Y. App. filed March 16, 1916. An improved arrangement of the stator winding for three-phase motors.
- 1,267,247. ELECTRIC COUPLING; Herbert D. Meeker, Niskayuna, N. Y. App. filed June 16, 1914. An automatic electric coupler designed for use upon moving vehicles arranged as trains.
- 1,267,251. METHOD OF MAKING METAL RINGS; Thomas R. Murray, New York, N. Y. App. filed Nov. 1, 1917. Making metal rings from flat bars or plates of metal in such a way that the ring when completed will be truly circular.
- 1,267,254. ELECTRIC WELDING MACHINE FOR MAKING METAL RINGS; Thomas E. Murray and Harry E. Woodrow, New York, N. Y. App. filed Dec. 10, 1917. Refers particularly to making rings or other endless shapes of metal.
- 1,267,255. APPARATUS FOR MAKING METAL CHAINS; Thomas E. Murray, New York, N. Y. App. filed Dec. 29, 1917. The apparatus comprises electrodes constructed to hold the link sections in suitable grooves in their opposing faces.
- 1,267,256. METHOD OF AND APPARATUS FOR ELECTRIC WELDING; Thomas E. Murray, New York, N. Y. App. filed Jan. 21, 1918. Apparatus for producing a projectile having means for guiding the same during flight.
- 1,267,258. ELECTRICAL WELDING APPARATUS FOR PIPE COUPLING; Thomas E. Murray, New York, N. Y. App. filed Feb. 16, 1918. Apparatus for welding reinforcing rings to pipe couplings.
- 1,267,259. METHOD OF AND APPARATUS FOR ELECTRIC WELDING; Thomas E. Murray and Joseph B. Murray, New York, N. Y. App. filed March 9, 1918. An apparatus comprising two electrodes and means for simultaneously preventing lateral expansion of both of said electrodes during the welding operation.
- 1,267,266. ELECTRICAL MEASURING INSTRUMENTS; Willard E. Porter, Lynn, Mass. App. filed May 26, 1916. Instruments of the D'Arsonval type.
- 1,267,273. SEAT INDICATOR FOR THEATERS; Harry L. Rogers, Philadelphia, Pa. App. filed Sept. 17, 1915. Provides an indicator associated with each row of seats in a theater, the indicator being placed on the end of a row at a point so as to be seen from the rear of the building.
- 1,267,293. GUN; James G. Veteto, Amity, Ark. App. filed Oct. 15, 1917. Provides a magazine gun adapted for firing electric cartridges.
- 1,267,317. ELECTRIC GLASS FURNACE; John O. Erskine, Steubenville, Ohio. App. filed Nov. 21, 1917. Provides a glass-melting furnace or tank wherein the heat employed is produced by the conversion of electrical energy.
- 1,267,324. AUTOMATIC MOTOR STARTER; Hubert F. Krantz, Brooklyn, N. Y. App. filed Feb. 18, 1916. Provides an automatic device governing the lapse of time before the current is taken through the motor fuses.
- 1,267,338. TROLLEY WHEEL; John Longenecker and L. G. Stockberger, Hiram, Ohio. App. filed April 4, 1917. An improved wheel for the transmission of electricity to vehicles, the wheel comprising two sections.
- 1,267,342. CURRENT-COLLECTING DEVICE; Thomas W. Varley, New York, N. Y. App. filed Oct. 3, 1913. Provides a current-collecting or brush device that shall have a visible means for indicating the relative pressure of its brushes.
- 1,267,347. PROCESS OF ELECTRICAL REDUCTION; Charles H. Fulton, St. Louis, Mo. App. filed July 25, 1917. Consists in mixing a reducing agent with the substance to be reduced so as to form a loose granular mixture.
- 1,267,349. DRY-CELL BATTERY; Ralston F. Smith, Cleveland, Ohio. App. filed Jan. 4, 1918. Provides a dry-cell battery construction which will be economical of manufacture and will embody in the performance of its function a maximum of efficiency.

THEY CALL THEM **DEVIL-HOUNDS**
BUT THEY ARE SIMPLY
HOUNDING
THE **DEVIL**

OUR MARINES

Victor Perard

Electrical World

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Commission Control of Power Supply

ESTABLISHING a priority list for power consumers was the onerous task that suddenly loomed before the California Railroad Commission. Even under the most favorable conditions the arbitrary announcement of who might and who might not buy power would be sure to develop opposition and probably litigation. Fortunately a better plan has been developed, and although some California industries may later suffer curtailment, they will first have an opportunity to co-operate in the reduction of waste, and in the event that further restriction becomes necessary will still have the right to a final hearing before the Power Administrator. If arbitrary action had been taken, there would remain to be settled the question of whether a priority list could be legally enforced when opposed on the grounds of confiscation. Should litigation be instituted by consumers, it will be handled by the commission and not by the power companies. However, litigation is unlikely under the plan of transferring power conservation problems to a separate bureau under the direction of an administrator. The plan has the advantage of enlisting the interest and co-operation of all affected parties and establishes a precedent for action by state utility commissions in line with the policy being followed by federal bureaus.

Our Marines the Devil Hounds

WITH this issue each reader will receive a copy of a war poster, "Our Marines." Newspaper dispatches recounting the exploits of these men in France say they fought so tenaciously and to such good effect that the enemy nicknamed them "the devil hounds." This, of course, is very gratifying to us at home; but if these men are to persist and conquer, we here must do our part, not only in keeping them supplied with war materials, but in hounding the devil at home no matter in what shape he appears. Otherwise our sacrifices may be to no avail. The world-German war has resolved itself into an economical and technical strife. Not that our ideals are one whit less righteous, but that technical experience and professional skill are now as important as military perfection. Of every man possessing a technical education a peculiar service is expected. First, the government needs engineers in various branches of the service both at home and abroad. Then it expects that those great economies which only skilled engineers can produce will be forthcoming in this country and that engineering thought

will be concentrated on the problems with which we are confronted abroad. Efficiency is as much a requisite to our national life as it is to our national salvation, and the greatest proponents of efficiency are our engineers.

Respond Promptly with Facts on Rates

TWO points bearing on the public utility situation stand out clearly in the discussion and negotiations of the times. One is that the utilities are not entirely self-governing and they cannot, therefore, solve their problems by their own independent action; they must have sympathetic co-operation from the outside. The other is that if no authority will take the definite responsibility of helping the utilities, if every constituted authority is to go on the mistaken theory that while the thing ought to be done, some one else ought to do it, the utilities are in a sad plight of orphanage.

Legally the authority and the responsibility rest largely, if not entirely, upon the state or municipal officials who are the regularly constituted supervisory powers in public utility matters. But it is very far from a purely legal issue, for the condition of war gives the federal government usurping powers which it is using in its best judgment to carry on to victory. In the federal government program a new standard of importance is set up, and questions become of major or minor rank according as they have to do definitely with winning the war or with matters of, for the time being, less consequence. We must as one nation work all elements co-operatively. It is necessary for the federal government to segregate these questions in every detail of its program, and no one would have it otherwise. It is equally desirable that state and municipal authorities should concur in the national program. The utilities constitute at this time an issue which positively touches the war program, and they are in real need of consideration as vital elements in the conflict.

President Wilson turned aside from his other heavy burdens of care to say: "It is essential that these utilities should be maintained at their maximum efficiency and that everything reasonably possible should be done with that end in view." We urge any lukewarm individuals to observe closely that the President, a master of English, said "essential." Not "desirable," not "important," not a mere matter of routine to be attended to if there was no other business pending, but *essential*. And he said "maximum efficiency"; he is satisfied that simply to run the plant in any old way

would not whip the enemy. And the other striking phrase of President Wilson's letter to Secretary McAdoo is just as impressive: "I hope that state and local authorities, where they have not already done so, will, when the facts are properly laid before them, respond promptly to the necessities of the situation." This puts the obligation, so far as the President can do it, squarely up to the utilities to lay the facts before the constituted rate-regulating authorities. And he would have the authorities respond, not after a delay of two or three years shall have let the emergency grow cold, not when the patient is ready to inter, but *promptly*.

With the moral support of the President, Secretary of the Treasury McAdoo and Comptroller of the Currency Williams, the state commissions and local authorities have not the shadow of an excuse for inaction. They know that electric rates have gone down for years; they know that costs have gone skyward under war conditions; they know that the result is one which no prudent business man or householder would regard calmly in his own affairs. It is right up to the rate-regulating authorities to do their part in keeping these invaluable public servants at the high mark of efficiency.

We declare that in the main the electric utilities which need help have laid or will lay the facts "properly" before the authorities. Their managers know full well that they are more than a cog in the war machine; they are a prime driving power in that machine. They are not asking that things which are not so shall be taken as facts; they ask only that the high costs which are as prominent as the nose on a man's face shall be recognized as elements in rates.

A Suggestion for Fuel Economy

THE necessity of the utmost economy in the use of fuel is gradually being brought home to all operators. Through all of the discussion before the convention of the N. E. L. A. last week that thought was constantly recurring.

Exactly in line with various recent discussions of fuel economy was the description by L. A. Stenger in the *ELECTRICAL WORLD* of May 25 of experiments on the combustion of coals carrying large quantities of dust. Everybody is getting at present about such coal as is available, and no one can longer count on selected high-grade fuel of uniform size. Mr. Stenger's experiments were directed chiefly to the air flow through fuel beds composed, on the one hand, of clean coal and, on the other, of coal carrying much dust, meaning by dust particles up to $\frac{1}{8}$ in. (3.2 mm.) in diameter. Although the general effect of dust in choking air supply is familiar, the extent to which it may do this and the disastrous effect on efficiency, as disclosed by Mr. Stenger's figures, are somewhat surprising. The immediate effect of dust, particularly if it settles in layers and is not uniformly disseminated, is to choke the passage of air so much that the combustion in ordinary furnaces is very unsatisfactory. Wetting the coal aggregates the dust in lumps or attaches it to the larger pieces of coal so that the particles no longer pack and obstruct the air. Even after drying so much of the dust sticks together and to the rest of

the coal that the aggregate burns more freely than before wetting.

The most striking effect brought out was the degree to which dust injures the fuel efficiency. One of the experiments showed that a dust-free coal of only 9900 B.t.u. gave much better results than a dusty coal of 12,000 B.t.u. Of course, in suitably designed furnaces one can burn almost any kind of fuel with fair economy, but in attempting to fire dust-bearing coal in ordinary furnaces there is certain to be considerable loss. Even under very favorable circumstances the dust is still an embarrassment in obtaining efficient combustion. Poor combustion means not only lowered efficiency but lower boiler capacity. Mr. Stenger's suggested remedy for dealing with this troublesome matter is simple and in plants of considerable size ought to work out very well. It is merely to crush the coal as received to a uniform rather small size and then to screen out thoroughly the dust. The crushed coal would then be used in the ordinary furnaces, while the dust would be pulverized and fed to boilers equipped with suitable combustion chambers as indicated recently in these columns. In this way the dust instead of obstructing the combustion of the normal coal would itself be burned at an efficiency quite up to all that its B.t.u. value should imply.

Building a Mountain Transmission Line

THE topography of our western coast country is a constant stimulus to the constructing engineer. He there has to meet conditions of very various and troublesome character within a comparatively short space, and he has generally succeeded admirably in rising to the situation. A thoroughly typical case of the unusual things that have to be done in the Pacific Coast transmission systems is described in our current issue. The great solar observatory on Mount Wilson needed power in excess of the modest amount which could be furnished from its original oil-engine-driven plant. The peak is somewhat more than a mile high. Oil as well as all the other supplies had to be hauled to the top, and in winter the road is sometimes impassable. Therefore it became necessary to tap a power circuit, and the nearest available one, belonging to the Southern California Edison Company, was a 15,000-volt circuit about seven miles (11.2 km.) away in an air line, most of the distance being over mountain tops and wild canyons. So over peaks and canyons the line was carried, and because of the contour of the country the larger part of it was strung in spans averaging more than 2000 ft. (914 m.), sweeping over canyons and carried at sharp pitches up the mountain side.

As the amount of power to be transmitted was not large, the line conductors are of 5/16-in. (7.9-mm.) seven-stranded steel cable. The weight of the up-hill long spans being too severe for ordinary insulators, the line was carried on three regular strain insulators in series, which gave an ample factor of safety both in mechanical strength and in insulating power. As a still further efficient innovation, these long and difficult spans are supported at the ends by three 40-ft. (12.19-m.) wooden poles in tandem, heavily guyed. The trail was so crooked that these had to be transported, with the tops well pitched into the air on a trestle carried by the truck, otherwise they could not have

made the curves. Our illustrations give a vivid idea of the efficient resourcefulness of the engineers of the Southern California Edison Company, who built the line. The power transmitted is received at a substation at the observatory, where it is converted into direct current for use in the delicately controlled motors necessary for the observatory service. It only needs to be added that the line has been in operation six months and has gone through several severe storms without the slightest difficulty. So much for the temperament that makes its own precedents.

Methods of Protective Lighting

AS OUR war industries increase in volume and importance there is added risk of malicious interference with them by the enemy, whether aliens who have escaped internment or alleged neutrals who make it their business to interfere with the production of war materials. The old adage that an arc lamp is as good as a policeman is one constantly to be borne in mind in the protection of war plants against criminal malice. Mr. Magdsick's article on this subject last week excellently summarized the methods which have been found most practical in dealing with the somewhat intricate problem of protective lighting. They followed closely the suggestions of Mr. Leigh of the Military Intelligence Bureau, who has made a specialty of this plant protection and is at the head of that work for the government. Broadly, the dangers to an industrial plant are either external or internal. The external dangers are chiefly those concerned with arson, and incidentally with the damage of finished material within reach by any available means. These external dangers are, on the whole, the more serious because of the greater opportunity for mischief on the part of the workmen actually employed in the plant than on the part of outsiders seeking to break in. Most of the damage that has been done, and it is very serious in the aggregate, is chargeable to what the police call "inside jobs," ranging from sabotage to fires and explosions. Only when the strong arm of the law falls heavily upon the enemies of production will this condition cease.

For protection against damage from the outside, good lighting around buildings and yards, bright enough to disclose quickly the presence of interlopers, is all important. Just how it can best be carried out depends very largely on the local situation. The two general schemes of operation are by means of floodlamps and powerful distributed sources in suitable reflectors. To what extent each of these should be employed depends on the nature of the area to be guarded and the scheme for guarding it. Immediately around buildings there is probably nothing better than well-

placed large incandescent lamps in reflectors adapted to light the buildings without throwing too much glare in the eyes of the guards. The task of lighting industrial buildings is rendered much easier if they are not too dark in hue, a light-colored concrete, for instance, being very much better than brick. The chief usefulness of floodlamps is in reaching out and illuminating long approaches, extensive stretches of protecting fence and other spaces where for one reason or another it is inconvenient to place lamps, or for that matter to locate guards. A guard under or behind a floodlamp gets an admirable view of its illuminated track. Unless the lamp be placed fairly high he may be bothered by the glare if executing a patrol through the illuminated region. In general it would seem most practical to use floodlamps with guards placed with reference to the lamps rather than to the space lighted. Of course, along water fronts and similar situations floodlighting is likely to do excellent service.

Inside lighting needs to be thorough rather than very brilliant. The chief thing is to have no dark corners where an evilly disposed person may lurk out of the watchman's view. The interior must be lighted so that, either by direct illumination or by seeing a silhouette against the light, a guard may spot instantly the presence of any unauthorized person. For the inside protection lighting therefore big lamps are not essential or generally desirable, but rather well-distributed lamps so placed as to cast no troublesome shadows and to free the eye from glare. In general, then, proper protective lighting is likely to consist of illumination of boundaries and approaches either by distributed lamps or carefully placed floodlamps as convenience may dictate; lighting of the buildings themselves chiefly by moderately powerful units placed high to avoid glare, and, finally, inside illumination well distributed, of moderate intensity and designed with special reference to the avoidance of shadowed spaces which interfere with the watchman's vision. On the whole, the interior lighting is practically quite as important as the exterior.

Storing Coal for Next Winter

SINCE only by constant repetition does a thought finally become fixed, we again bring up the subject of the storage of coal. Elsewhere in this issue there appears a letter from the Fuel Administration which speaks for itself. Dr. Garfield is also quoted as saying that there will be lightless nights and heatless days this coming winter. The coal shortage is a very real thing, and all prudent men will heed the warning. Central-station companies cannot afford to be negligent in this matter. If they can get coal, they should by all means do so and store it to the limit of their resources.

IN THE next issue there will appear abstracts of the papers to be presented at the Atlantic City convention of the American Institute of Electrical Engineers, which is to be held on June 26, 27 and 28. An article by James R. Cravath outlining some of the central-station commercial possibilities contingent on the coal situation

The Coming Issues

will soon appear, as will a short description of two government nitrate plants now in the process of erection and a discussion of the relation of the war to power factor. There is also scheduled an article on utility rates. These will be in addition to the regular operation and commercial and management sections of the paper.

John W. Lieb's Presidential Address

Discussing "The Electrical Industry in War Service," the Retiring President of the National Electric Light Association Expresses in Vigorous Terms Our Determination to Support the War Program

The address of President Lieb "with singular clearness and in the broadest spirit reflects the attitude of the association and its members toward the great problems which are confronting our country at this crisis in the world's history.

"It is clearly our duty, as he so admirably indicates, to use every possible human effort, to make every sacrifice and to devote our time to the supreme business of the moment—the winning of the war, to the successful conclusion of which every true American should be pledged."

[From the report of Samuel Insull, Joseph B. McCall and Charles L. Edgar, the committee on the presidential address of Mr. Lieb, made before the annual convention at Atlantic City on June 13 and 14.]

"A YEAR ago last May, after a long period of patient endurance of unfriendly provocations and brutal violations of international agreements," began Mr. Lieb, "our country decided to draw the sword and come to the support of the gallant nations, now our heroic allies, who for three long years had been fighting desperately against a powerful and conscienceless enemy. No nation ever unsheathed the sword with greater reluctance, with greater justification and in the defence of nobler ideals. We were certainly not the aggressors, and we entered the fight with a clear conscience animated by a righteous purpose.

"It has taken us a whole year to appreciate the nature of the titanic struggle that is taking place overseas, 3000 miles away, and we are only just beginning to visualize the part we are called upon to play and the aid we must render to bring this terrible conflict to a victorious conclusion. Our industry was not slow to recognize the active and important service which it would be called upon to render, and at its annual meeting shortly after the declaration of war it made ready for an immediate mobilization of its resources to give every possible assistance to the government.

"As we look back upon the year that has been spent so largely in the work of preparation for our active and telling participation in the conflict, we may find some basis for faultfinding and criticism, but if we take a broadminded survey of the whole field and consider all the circumstances and conditions surrounding our national life, we must come to the conclusion that what has been accomplished is nothing short of miraculous; and we have reason to marvel at the stupendous scale on which the deep and broad foundations have been laid for a structure adequate to support the temple of victory which, in co-operation with our valiant allies, we shall rear no matter at what sacrifice of life and treasure."

EXTENT OF THE INDUSTRY

Mr. Lieb then showed the great extent of the wider electrical industry and of the electric light and power portion. Including the electric railway, the telephone and telegraph systems, the electric light and power systems and the manufacturing enterprises on whose output these enterprises are dependent for their apparatus and equipment, the industry gives employment

to over 920,000 men, represents an invested capital of about \$10,750,000,000 and an output valued at \$2,675,000,000 per year. The most recent statistics available indicate that in the electric light and power branch of the industry there are employed approximately 125,000 men with an invested capital of \$3,000,000,000 and doing an annual business of roughly \$575,000,000.

INTERCONNECTIONS

The first of the important problems discussed by Mr. Lieb was the interconnection of the regional generating and transmission systems. In discussing this he said:

At the present time there is imperative need that our member companies take an advanced position in this matter, as they have done in so many other directions, in order that every possible advantage may accrue to the nation and its war necessities.

Where demonstrable economic and service advantages are obtainable from such a plan of operation, if the utility companies themselves do not take the initiative in their consummation it will surely be done under some form of governmental control, as the nation must obtain for itself in these times all the advantages which may contribute notably to the solution of the one great aim and object of all enterprises and business at present—the winning of the war!

The member companies of this association . . . conspicuously among all the national industries have known how to obtain from their employees the enthusiastic loyalty and co-operation which have been the foundation of the high standards of service they have been able to maintain and on which their prosperity and the good will of the public which they enjoy have been largely built up. This devotion to duty of the employees is an essential prerequisite also to successful co-operation between extensive interconnected systems.

GENERAL ECONOMIC CONDITIONS

In citing the general facts as to the increase in cost of rendering service, Mr. Lieb commented: "Every other industry in the country, with the conspicuous exception of the steam railroads, has been able to meet similar conditions by an increase in the price of its product, and we have therefore experienced increases of 100 to 200 per cent and even more in the cost of all natural and manufactured products."

Discussing commission control, he added:

The commissioners have not shown the flexibility and alacrity in raising rates that they have become accustomed to show in the almost continual process of lowering them during the past decade.

But it is not only the shareholders that have seen a curtailment of their return on their investments and the deterioration of their property; the public also has suffered in impaired service, in curtailment of facilities and in the inability of utilities to provide funds for extensions and expansion to meet the demands of the public for additional service.

The situation is most serious and requires the earnest and urgent consideration of the national government.

The extraordinary conditions under which the electrical industry is now operating should call for the most liberal and responsive treatment of the applications for service which are overwhelming many utilities for such important

war service as navy yards, arsenals, shipbuilding, munition and nitrate plants, cantonments, etc.

It is not only difficult to finance these extensions, but the apparatus and supplies are hard to get; their cost is double and treble pre-war prices, labor is scarce and demands continually higher compensation, with the result that generating plants are becoming overloaded and the transmission and distributing circuits inadequate. Moreover, many of these demands for service are of a temporary character, often difficult to define as to amount and duration of service required, for which, particularly in direct government service, guarantees as to revenue to be expected are not obtainable. On the whole, the utilities throughout the country have responded splendidly to the demands made upon them.

It is not, however, amiss at this time to issue an appeal to every central-station company in the country to go to the very limit of its power in meeting the urgent requirements of the government and to respond in a spirit of patriotism and sacrifice to the needs of the nation.

COAL PROBLEMS

Utility managers, said Mr. Lieb, are looking forward with much concern as to what the coming winter may have in store for them on the serious problem of adequate coal supply. Discussing the causes, Mr. Lieb said in part:

It was indicated by some authorities that the coal famine was due to a shortage of labor at the mines; by others the reason assigned was lack of coal cars; by others it was attributed to a breakdown in the transportation system, and again it was held that the seat of the trouble was at the railroad terminals at tidewater. A more conservative opinion assigned a cumulative cause, in which each of these factors played a constituent part of greater or less importance, some being the relation of cause and effect.

It would require a more searching investigation than any that has yet been made to determine the effect which the prices fixed at various times by the government or previously by voluntary agreement had on the coal mined. But the difficulties experienced were not alone from scarcity of coal but also from the irregular and generally inferior quality.

In discussing the efficiency of central-station plant operation, Mr. Lieb expressed the opinion that it will be impracticable to obtain at this time any noteworthy improvement in power-house fuel economy from any radical improvement in operating methods, as a measure of fuel conservation. He continued:

The outlook for savings in other directions is not, however, quite so discouraging. There are certain possibilities in the saving of fuel from the joint operation of neighboring plants which may, through "linking up," improve their load factor and utilization factor and achieve economies due to the operation of the most efficient units of both plants the bulk of the time, and the operation of the most efficient units fully loaded in one of the plants the remainder of the time. It must not be assumed, however, that it will always be found easy to carry out such interconnection, for the outlying districts of each, if joined, will hardly permit considerable interchanges of current, and the extension of tie lines into sections of sufficient capacity will require an engineering study of each individual case.

Much has been said and written recently of the possibilities of joint operation between central-station systems and isolated or private plants operating within the same territory. It does not need demonstration that the coal consumption in the isolated plants is generally from two and a half to four or five times the amount of coal required to produce the same quantity of electrical energy in the central station. The private plant usually requires more or less steam for heating or for the operation of auxiliaries, which may be obtained wholly or in part from the live steam of the boilers supplementing or taking the place of the exhaust steam. These figures would in such cases be somewhat dependent in their relative values upon the conditions presented by each individual case; but the fact re-

mains that on the whole there would be a notable coal saving in the operation of all the requirements throughout the territory for light and power from the central electric station with local steam heating for individual cases where it cannot be obtained from a central heating system.

Consideration has also been given to the joint operation of the street system and the private plant, but this plan presents such practical and economic difficulties that it can hardly be considered practicable.

PREVENTING WASTE

Showing that the companies fully co-operated in enforcing sign-lighting restrictions, Mr. Lieb, after mentioning the industrial curtailment, called attention to the daylight saving law, which he urged be made operative all the year.

Development of our stupendous unused national asset in water powers was urged by Mr. Lieb.

Consumers should be advised, Mr. Lieb said, to use "every care not to waste light and to avoid excessive and unnecessary use of light in interiors and limit to reasonable proportions the use of advertising, display and purely decorative exterior illumination.

"As to the use of carbon and 'gem' lamps, it has been found that while the demand for these less efficient types is constantly decreasing, there is still a certain demand for these lamps and particularly for the least used carbon lamps for particular services, such as in construction work, garage and inspection use, etc., where only the more robust carbon filament is able to resist the effects of vibration and rough handling."

LABOR CONDITIONS

Calling attention to the great rush of enlistment and volunteering and to the calls of the National Army, Mr. Lieb said that it was not these that caused serious concern, but the withdrawal from service in response to the inducements offered by munition factories, shipbuilding plants, navy yards, power factories, nitrate plants and the construction camps of cantonments, warehouses, etc.

Expressing sympathy for the position of the clerical staffs under the burden of high cost of living, Mr. Lieb discussed the position of women and of crippled soldiers in industry. Mr. Lieb went in detail into the question of rates and rate increases, saying in part:

In the applications that have been made to public service commissions by member companies for increased rates it has been noted that in many cases they have taken the shape of the addition of a service charge to the normal or a reduced charge for energy.

Where a service charge is introduced into the rate schedule it should not be considered as a temporary war measure, as it implies a fundamental change in the basis of rate making and a modification should be made only with a view to substantial pressure.

Increases, if temporary and made as a war measure, should take the shape of a surcharge, percentage increase or flat addition to the maximum rate or base rate, whatever it may be, so that its elimination at the proper time may not cause a new dislocation of the whole rate structure.

It is gratifying to note an increased responsiveness by regulatory bodies with less insistence when considering application for rate advances on all the forms of procedure usually applied in rate cases and a readiness to use short cuts and common sense approximations in place of the dilatory, expensive and labor-causing processes of appraisal, valuation and other forms of exhaustive investigation considered necessary under normal conditions. It has been found that in general regulatory bodies have been loath to grant increases in the maximum rate but have been more responsive to make increases in the industrial or class rates, increases in the power rates being granted with little hesitation.

Long Spans Facilitate Mountain Service

Steel Cables Are Utilized and the Sag Is Increased Wherever This Is Found to Be Possible—Special Dead-End Construction Is Employed for the Purpose of Withstanding Stress

BY N. B. HINSON

Department of Distribution Southern California Edison Company

INCREASED demands for power at the Carnegie Institute Observatory on Mount Wilson, 16 miles (25.7 km.) from Los Angeles, recently made it necessary either to extend the oil-engine-driven generating plant which has been supplying energy or to purchase central-station energy. Extension of the isolated plant was not looked on with much favor, how-

ever, because the oil has to be hauled up the mountain, which is 5886 ft. (1794 m.) high, over a road 9½ miles (15.3 km.) long. Furthermore, in winter there are times when the roads are impassable, so that oil has to be stored to tide over periods of poor delivery. Providing service from the nearest central station involved difficulties too, but, after studying various routes and making estimates of the cost of construction to see if the line was feasible, it was found preferable to the alternative method considered.



FIG. 1—DEAD-END AT MOUNTAIN TOP

Cross-arms carry busbars; air-break switches on nearby pole are operated from ground; the choke coils connect with underground circuits; at the left are the engine house and motor room.

The nearest power line, which belonged to the Southern California Edison Company and was operated at 15,000 volts, was about 7 miles (11.3 km.) away by air line measurement or 12½ miles (20.1 km.) by road. All but 3 miles (4.8 km.) of the road was over rugged mountains. Some of the canyons are 2000 ft. (609.6 m.) or more deep, and the mountains are heavily wooded in places with pine trees 100 ft. to 150 ft. (30.4 m. to 45.7 m.) tall.

It was impracticable to build a regular pole line along the road; therefore a line was strung as nearly straight as possible between the point of interconnection and the observatory. This involved some long spans across canyons, practically the whole route consisting of seven long spans. The average span is 2071 ft. (631 m.), the longest 3263 ft. (994 m.), that is, measured horizontally between poles, and the greatest difference in elevation is 945 ft. (288 m.) with a horizontal span of 2293

FEATURES OF CONSTRUCTION

To support the lines on these long inclined spans, some of which are also subjected to ice, sleet and snow, special conductors, insulators and supports have to be used. The line conductors consist of 5/16-in. (7.9-mm.) Siemens-Martin extra-galvanized seven-strand steel cable. Tests were made on samples of the cable to determine their elastic limit and maximum strength, which averaged 4800 lb. (2177 kg.) and 7800 lb. (3538 kg.) respectively. The minimum sag employed allows for a stress equal to two-thirds of the elastic limit, a 30-mile (48.3-km.) wind pressure and 2 in. (5.1 cm.) of ice on the three upper spans, but no ice on the other spans. The reason for this is that the two upper spans are on the north side of the first range and the rest of the line is on the south side, which is not subjected to sleet or ice. Wherever the sag could be increased without reducing the ground clearance below an allowable value it was done.

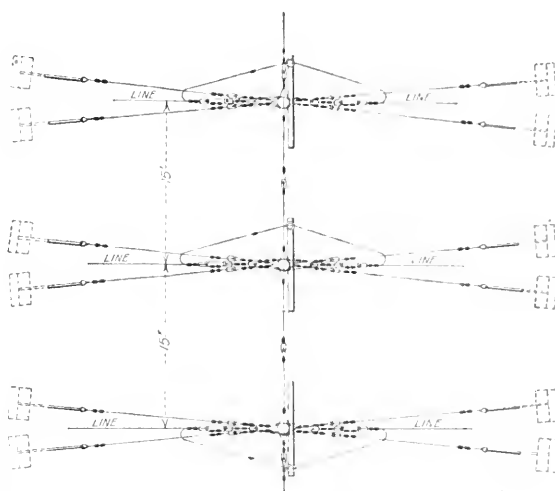
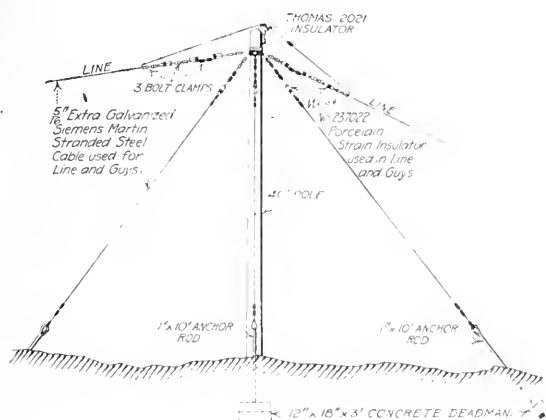
If standard suspension insulators had been used, the



FIG. 2—DEAD-END AT TOP OF FIRST LONG SPAN

mechanical factor of safety would have been very low; for this reason it was decided to use strain insulators in series. Three Westinghouse 6600-volt type PS insulators were therefore connected in series, the insulators in each string being joined with each other and the cross-arms with cable similar to that used in the line.

Two three-bolt clamps were employed in making these connections. The jumpers between dead-end points are supported on pin-type insulators. This construction possesses the advantage that should an insulator break the line will not drop. According to tests made on the strain insulators, the dry flash-over voltage of a single unit is 52,000 volts, the wet flash-over is 14,000, and the maximum strength is 17,760 lb. (8052 kg.).



FIGS. 3 AND 4—DEAD-END CONSTRUCTION FOR 15,000-VOLT LONG SPAN

The line is supported at the end of each span by three 40-ft. (12-m.) poles which have been shaved, treated and painted. They are set 6 ft. (1.82 m.) in the ground, 15 ft. (4.57 m.) apart and are anchored in four directions. On the extra-long spans two anchors are used on each pole, the anchors consisting of reinforced-concrete blocks 12 in. by 18 in. by 26 in. (30.5 cm. by 46 cm. by 66 cm.) with 10-ft. (3-m.) galvanized rods, 1 in. (2.54 cm.) in diameter. The guy-wire material is similar to that used in the line. One strain insulator is placed in each guy.

In order to transport the poles through the winding mountain roads a special rack was built on a truck over the driver's seat so that the poles could be supported on the truck with the tops pointing in

in 5000-ft. (1524-m.) lengths it was not necessary to make any splices in the spans.

The line in the valley is of standard construction, consisting of 300-ft. (91.4-m.) spans and 0.25-in. (0.63-cm.) guy wires for conductors. In the foothills the same type of construction is used, but the spans are longer. The entire line loss is less than 2 per cent. Probably there will never be much increase in load. The line is protected with electrolytic lightning arresters at the lower end and graded shunt-resistance multi-gap lightning arresters at the top. Electrolytic arresters could not be used at the top owing to the great variation in temperature and the very low temperature during the winter months.

The substation at the top of the mountain is built of concrete and is situated in the side of the hill. Fifteen-thousand volt cambric-insulated cable inclosed in con-

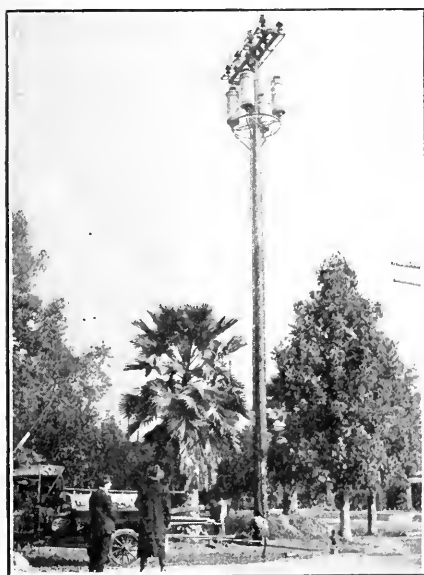


FIG. 5—ELECTROLYTIC LIGHTNING ARRESTERS MOUNTED ON ONE POLE

This installation is near the substation at the foot of the mountain. The 15,000-volt lines enter the substation as underground lead-covered cables.

the air over the driver's head. The butts rest on the bed of the truck. This arrangement permitted turning the truck around curves which could not have been negotiated if 40-ft. (12-m.) poles had been transported flat. Five poles were carried at a time. At all points

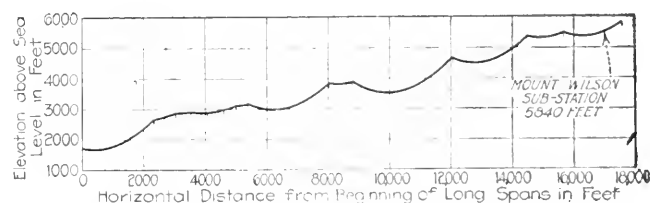


FIG. 6—APPROXIMATE PROFILE OF LONG-SPAN LINE

duit runs from the overhead line to the transformers. A pole-top switch with fuses and choke coils is provided at this station, while at the lower end of the line is an automatic 15,000-volt oil-break switch. Two motor-generator sets in the observatory substation convert the three-phase, 50-cycle, 200-volt current from the transformers to direct current, which is essential for the work in the observatory. The isolated plant, which includes a storage battery, is still in use and will help to supply energy if any line interruptions should occur. Three-phase local service is furnished to a hotel and

camp near the observatory at 2200 volts from a step-up bank of transformers in the substation.

The line was built by the regular construction crew of the Pasadena district of the Southern California

Edison Company and has been in operation about six months. No trouble of any kind has been experienced, although it has been subjected to two severe wind storms.

Vigorous Fuel-Saving Campaign

Critical Condition of Coal Supply for Next Winter Led to Organized Plans for Economy in Power and Lighting in New England
—Improvement in Boiler-House Practice

NEW ENGLAND faces a critical coal-supply situation next winter, and energetic efforts to forestall a famine are under way with Fuel Administrator James J. Storrow of Boston in the lead. A campaign is on to arouse the industrial plant owner to the vital importance of the economical use of coal. Meetings have been held at Boston, Worcester and elsewhere in the interest of fuel saving, and it has been "put up" to the manufacturers that a total of at least 3,000,000 tons must be saved this year by more efficient plant operation.

WATER SHIPMENTS FAR BEHIND

In a statement which Mr. Storrow issued recently he points out that every economy possible must be practiced since the demands for coal for the calendar year will be greater than they were during 1917 and because water shipments up to the present time are far behind the rate at which they should be coming in if the total amount of coal required (34,000,000 tons) is to be received. Practically two-thirds of this should be delivered by water, but it is doubtful whether this quota can be delivered by boat as all vessels that are available must be used for transporting expeditionary forces overseas. Still the forces at the front must be supplied with food, clothing and munitions. While the railroads have just about met the estimated requirements, it is doubtful whether they can make up any shortage incurred by poor deliveries so far, especially when inclement weather sets in. The situation is made more serious than last year also by the fact that no reserve stocks are on hand as there were at the beginning of the winter of 1917.

In view of the existing conditions, Mr. Storrow has appointed a committee of prominent engineers who will aid the Fuel Administration in carrying out a carefully prepared plan of reducing coal consumption in industrial plants. The committee consists of Dr. Ira N. Hollis, president of the Worcester Polytechnic Institute; Charles T. Main of Boston, president of the American Society of Mechanical Engineers; George P. Gilmore, Fall River; Arthur T. Safford, Lowell; Joseph A. Skinner, Holyoke, and W. G. Starkweather, Boston. Every manufacturer is requested to appoint a permanent factory fuel committee, selected from executives and foremen, and to engage the temporary services of a consulting engineer to advise the committee in the following work: (1) Increasing the efficiency of steam and power generation; (2) equalizing the load on the power plant and reducing to a minimum all friction and idle machine loads; (3) economizing in the use of steam for heating and process work; (4) reducing artificial lighting to a minimum.

Work along the foregoing lines has already been undertaken by several manufacturers with a resulting saving of from 10 to 33 per cent of the coal used. A booklet outlining the fuel-saving plan has been prepared for distribution by the Fuel Administration, and copies have been mailed to manufacturers with pledge cards. The booklet contains four reports showing the actual methods and results of fuel saving in four Massachusetts industrial plants, and it requests that each manufacturer eliminate all waste in the use of both steam and hydroelectric power and advise the Fuel Administration as to his willingness and extent of co-operation.

The economies which different plants have effected have resulted from efforts along many lines, including improvements in methods of heating, changes in the use of steam, modification of process methods, etc., but only such practices as effect the generation of steam, development of power and the utilization of electrical energy will be referred to here.

IMPROVEMENT IN BOILER-HOUSE PRACTICE

The general manager of the Crompton & Knowles Loom Works, Worcester, Mass., reports: "On taking up the matter at the beginning of the winter we felt that it was necessary to have a suitable organization for carrying on our fuel conservation policy, and we therefore appointed from our foremen and executives a so-called shop fuel commission.* A little later we appointed a shop fuel administrator, so to speak, whose business it is to follow up the various methods inaugurated, to see that the best results are accomplished therefrom, and also to see that continued interest is maintained."

Among improvements which have been made in boiler-house practice are the following: (1) Raising temperature of feed water by return of condensation. The temperature of feed water entering the boilers has been raised from 180 deg. Fahr. to 200 deg. Fahr. thereby. (2) The establishment of better boiler-room practice by putting observers in the boiler rooms for several days and nights to determine rate and efficiency of firing. The usage of coal by half-hour periods, as fired, was recorded for many days and plotted, from which was evolved a better practice as to uniform and more economical firing. (3) The weighing of all coal supplied to the boiler room and only allowing a certain amount of same to be used in definite periods. The remainder of the coal was locked up, so that the fireman had to be economical in the use of the portion that was issued to him. (4) Installation of pin-hole grates and under-grate blowers to allow use of screenings. While

*Consists of boiler-room operator, engineer, factory superintendent, assistant superintendent of power and a general inspector.

the screenings have not been very high grade, there have been many days when through the use of these practically no soft coal was used whatsoever. The screenings are being analyzed and the use of all screenings that show an unusual percentage of dirt and ash is being discontinued.

The Atlas Tack Company, Fairhaven, Mass., has covered the tops of its boilers with asbestos cement $2\frac{1}{2}$ in. (6.4 cm.) thick, lowering the outside temperature 10 deg. thereby. In addition, water columns and high-water and low-water alarms have been installed on all boilers to prevent wide fluctuation of water level and assure better economy. On each boiler is also a boiler efficiency meter which shows the firemen at all times the condition of their fires. This has proved a very useful and economical instrument.

A V-notch recording and indicating water meter has been installed to show the boiler-room force the amount of water evaporated per pound of coal. On account of the limited tube area in the feed-water heater formerly used it was impossible to get the best results from exhaust steam, so the tubes have been replaced by a more efficient set, resulting in a 20-deg. increase of temperature. Economizers are also used. The boiler-feed pumps were repaired and put in first-class condition and all engine valves are set for the highest economy. The company is about to install a 5-hp. motor to take the place of a steam engine to run the economizer scrapers.

Hand-stoker grate bars are being installed which, according to the builders' rating, will give about 50 per cent more boiler rating and about 25 per cent saving in coal. An old cooling tower which was inefficient has been abandoned and a spray-pond condensing equipment substituted. The 3-in. to 4-in. (7-cm. to 10-cm.) more vacuum which can be obtained as a result should lower the coal consumption for power alone about 162 gross tons per year. In addition, all boiler settings and brickwork are being examined for necessary repairs and provision is made for scraping the boiler tubes.

It is thought that the increased efficiency which will result from these changes in 1918 will net a saving of at least 20 per cent in fuel.

EXPERIMENTS WITH ASBESTOS COVERING

At the George E. Keith Company, Brockton, Mass., the engineers have experimented to some extent with asbestos covering on the brickwork of the boiler settings. Undoubtedly this covering will be applied to all the boilers. The covering not only cuts down the loss due to heat radiation, but also stops any air leakage. The company was driven to the burning of screenings because it could not obtain soft coal. In fact, it has been doing so in some of the boilers for two or three years with good results. Small forced-draft blowers were installed to get results, as high as 70 per cent of screenings having been burned with soft coal.

Another saving has been effected by piping all condensation returns to the boilers, thus eliminating the expense of make-up water, as a boiler-feed temperature of about 206 deg. is obtained. It has been made a practice to burn all the scraps and waste from the factories, such as paper, shavings, sawdust, etc. Shortly the company intends to build a central plant which will take the place of three isolated plants. In this it will install automatic stokers, weighing devices for re-

cording the amount of coal used, and coal and ash-handling apparatus.

ECONOMY IN THE USE OF POWER

The Crompton & Knowles Company has minimized the waste of power as follows: (1) Under the direction of a shop fuel commission, the number of idle machines on which belts had not been thrown off was observed by an inspector. Vigorous action with the foremen resulted in the number of machines running idle and wasting power being reduced to an absolute minimum. This was accomplished principally by the installation of hooks to permit the handling of idle belts. (2) The studying of the load on every motor throughout the shop. Where the load was not sufficient to get the maximum efficiency from the machine conditions were changed to make this possible. All cases of motors working underloaded were eliminated. (3) All overtime that involved the inefficient operation of machinery was stopped. (4) The use of large elevators was restricted to actual needs. This resulted in the elimination of several hundred trips throughout the day.

CURTAILING UNNECESSARY LIGHTING

The saving in fuel in connection with the use of lights was large and accomplished in three ways, particularly: (1) By the development of interest on the part of the foremen in connection with the actual inspection at various times of the day of lights used. This resulted in the cutting out of a large number of unnecessary lamps. (2) By replacing carbon lamps with tungsten units. The usage of carbon lights had been continued to use up a stock of these on hand, which practice was discontinued. (3) By reducing the wattage of lamps in places where the existing illumination seemed unnecessarily high. This also resulted in a marked saving.

At the Dennison Manufacturing Company, Farmingham, Mass., a reduction in the general illumination around the plant was made. Where under ordinary conditions the general lighting system would be used the amount of light used under the existing conditions was cut down to the minimum and in some places discontinued. Lamps of lower candlepower were substituted in many cases for a larger-sized lamp; this was especially true in stair towers, toilets, bridges, etc. The time when lights were turned on was curtailed. Sign lighting was discontinued, and the street-lighting and factory yard lights were reduced to a minimum consistent with the safety of the plant and the prevention of accidents to employees. The watchmen were instructed to see that unnecessary lamps were not left burning where night work was going on or at any time outside of working hours. All electric and gas-heating applications were turned off from ten to fifteen minutes before closing time. Lamps of less candlepower were used for all indicating lamps and on instruments in the power house.

In order that the peak load due to lights should be eliminated, all passenger service on elevators was discontinued when the lighting load came on, and certain heavy machines, such as the coal carrier in the power house, paper calenders, machinery in the carpenter shop and certain elevators, were shut down at 4 o'clock or thereabouts. As a result the total power and lighting load curve is practically flat throughout the day.

Readjustment and Reconstruction Commission—III

An Account of the Work That Is Being Accomplished in Great Britain by the Ministry of Reconstruction in Preparation for the Great Changes Sure to Come When Peace Is Once More Established

BY WINGROVE BATHON

Washington Representative ELECTRICAL WORLD

PREVIOUS articles in this series have suggested and urged the appointment by the President of the United States of a readjustment and reconstruction commission, to begin to deal now with vital problems in industry which will be presented after the war. It was pointed out that many other countries, notably Great Britain, have already begun to attempt to solve after-the-war problems, and the suggested personnel of a suitable commission, selected from the ranks of American industry, was presented in the first article in this series, the second article dealing in turn with the suggested personnel for a suitable advisory council, taken from the ranks of government officials, to work with such a commission.

WHAT GREAT BRITAIN IS DOING

It was promised that this third article should describe some of the far-reaching work being done along this line by Great Britain, and this is now done as an evidence that it is necessary for American industry to begin now, through a readjustment and reconstruction commission, preferably the President's own commission, responsible only to him, to prepare to solve after-the-war problems. It may be as well to state at the beginning that this description of Great Britain's Ministry of Reconstruction is taken from the official reports to Parliament of the British War Cabinet, furnished to the present writer for the purpose of this article by Arthur Willert, secretary of the British War Mission at Washington. These reports are inclusive of the year 1917 and have just been sent to Washington.

After tracing the earlier stages of the Ministry of Reconstruction in Great Britain, before the ministry was established by the new ministries act, in July, 1917, and when and during the time the agency of reconstruction consisted of a committee of ministers of the crown, the War Cabinet reported that it was found necessary to establish a Ministry of Reconstruction to continue for the duration of the war and for a period of two years or less after its conclusion. It was declared that a Prime Minister, upon whose shoulders fell the responsibility for the conduct of the war, could not personally assume a day-to-day responsibility for guiding the reconstruction committee's work. It was stated that the government had throughout been aware that as the war continued and its pressure upon every side of the national life increased the intensity of the struggle in itself enhanced the importance of the reconstruction problems which had to be faced, and that Parliament and the country were not slow in realizing that there were coming into existence a series of questions of the utmost importance to which answers must be found, not after, but before, the conclusion of the war.

The functions of the Minister of Reconstruction then appointed, and who assumed office in August, 1917, are defined as follows:

"To consider and advise upon the problems which

may arise out of the present war and may have to be dealt with upon its termination, and for the purposes aforesaid to institute and conduct such inquiries, prepare such schemes and make such recommendations as he sees fit, and the Minister of Reconstruction shall, for the purposes aforesaid, have such powers and duties of any government department or authority which have been conferred by or under any statute as his Majesty may by order in council authorize the minister to exercise or perform concurrently with, or in consultation with, the government department or authority concerned."

In other words, as was brought about during the debate which resulted in the creation of the ministry, the minister in charge does not exercise executive functions. He appoints committees, he initiates experiments, he frames schemes for action with a view to conditions after the war; his powers are not exclusive and do not shut out other departments; he assists the other departments, provides them with information and helps them to "build a bridge which will safely carry us over from war to peace conditions." The British Parliament found that the creation of a reconstruction agency was desirable because various government departments are approaching various problems in their own way, each drawing up reports or memoranda, and that what was needed was a co-ordinating element, not especially attached to the work or to the traditions of any one of the departments concerned. The Solicitor General of Great Britain, speaking in debate, declared that what was needed was "a comprehensive co-ordinating mind, a fresh mind, and at the same time an authoritative mind, who will bring together the several contributions of the various specialized departments."

FUNCTIONS OF THE MINISTRY OF RECONSTRUCTION

The Ministry of Reconstruction was then formed. For the purpose of administration the department was divided into branches dealing respectively with commerce and production, including the supply of materials; with finance, shipping and common services; with labor and industrial organization; with rural development; with the machinery of government, central and local, health and education, and with housing and internal transport.

The Minister of Reconstruction then appointed an advisory council, "representative of all the leading interests concerned in reconstruction, and it is his hope by consulting the council freely and regularly to secure a representative consensus of opinion on any proposal which may be referred to him for advice or which may be initiated in the department." This council is organized very much as the Pan-American financial conference held in Washington at the beginning of the war was organized and very much as the old War Industries Board of the Council of National Defense of the United States was organized. In other words, there

are experts in each line named to serve with government representatives. The council is divided into sections, just as the administration of the Ministry of Reconstruction is divided. It is stated that "the membership of the council has been so arranged that in each section all the principal interests represented on the council should find a place; thus there are representatives of labor on the finance section as well as financiers; there are business men as well as agriculturists on the section dealing with agriculture, and so on."

The meetings of the sections of the ministry and the council are private, but it is known that they have already dealt with the standardization of railway equipment, the post-war rationing of industries, the establishment and functions of trade organizations, the organization of rural information centers, the establishment of industrial courts, house planning from the point of view of domestic economy, the future organization of voluntary women's work, and the conditions required for maintaining a supply of efficient agricultural labor.

WORK OF THE DIFFERENT SECTIONS

The section dealing with commerce and production is investigating: (1) the supply and control of raw materials after the war; (2) financial facilities for British commerce and industry after the war; (3) the preservation of industries which will play an essential part in reconstruction but are in extinction through failure of supplies of material or labor; (4) financial risks attached to the holding of trading stocks; (5) trusts and combinations, with special reference to the protection of the consumer; (6) the establishment of new industries after the war, a committee having been especially appointed to consider this question as far as the engineering industries are concerned, a parallel committee considering the labor questions involved; (7) the volume and nature of the demand for British goods after the war, and (8) improvements in trade organization for the purpose of more economical production, distribution and marketing, and expediting the turnover from peace to war.

The section dealing with finance, shipping and common services is, in conjunction with the Treasury, considering the question of currency and exchange after the war, and under this section an advisory council section is at work on the disposal of government stores after the war.

The section dealing with labor and industrial organizations has agreed with the British Board of Trade and the Ministry of Labor that "a concerted effort should be made to promote in as many industries as possible representative organizations to advise the government as to the views and needs of the industries on the various industrial and commercial problems that will affect them during the reconstruction period. The Ministry of Labor is to proceed with the formation of permanent industrial councils. A conference of trade organizations is being established at the Ministry of Reconstruction, consisting of three employers, three trade unionists and representatives of the Board of Trade, the Ministry of Labor and the Ministry of Reconstruction. The Minister of Reconstruction has decided to refer to the industrial section of the advisory council the question of establishing corresponding organizations in engineering and in railways.

This section (dealing with labor and industrial or-

ganizations) is farther along with its work than any of the other sections, apparently, for reports have been submitted on unorganized trades and works, and probably by now on conciliation and arbitration; a general survey of industrial policy as a whole has been prepared, going into the law and labor in merchant shipping, war-time departures from trade-union practices, industrial courts, industrial structures, apprenticeship, the reinstatement of returning soldiers and sailors and international labor legislation. Furthermore, surveys have been undertaken of industrial methods; inquiry is being made into juvenile employment; the question of army demobilization, it has been settled, makes the Ministry of Labor responsible for the returned soldier or sailor, and the Ministry of Reconstruction is to determine the priority of different trades. A complete list of public works which have fallen into arrear has been prepared so that surplus labor may be usefully and rapidly employed, and the Ministry of Munitions has begun work on the special problems arising out of its work.

The section dealing with rural development is examining: (1) the working of the small-holdings act and the future of urban war allotments; (2) a report made by the forestry committee; (3) the rural housing problem; (4) the organization of county offices for advice on agriculture; (5) tithe redemption; (6) village industries, and (7) the report of the land acquisition committee.

The section dealing with machinery of government, health, education, etc., is negotiating through a committee on the distribution of functions in regard to the formation of a ministry of health and is studying reports which have been made (1) on the functions of the poor law authorities and (2) on adult education.

The section dealing with housing and internal transport, with a view to facilitating work in connection with housing, has set to work committees on (1) supply of building materials, (2) house-building construction, and (3) building by-laws. Special investigations are being made by this section on (1) control of public utility societies, (2) town planning, (3) rings in the building trade, (4) the working of the small-dwelling acquisition act, and a general review of the problem of inland transport is being made, the portions dealing with roads and canals having been completed. Furthermore, the ministry is in consultation with the Board of Trade concerning the future of the railways (including light railways) of Great Britain, and an inquiry has been begun into the question of storage and distribution as essential elements in transport policy.

COMMERCE AND PRODUCTION

In the section dealing with commerce and production the report of the British War Cabinet to Parliament states that the question of the "volume and nature of the demand for British goods after the war" and the question of "improvements in trade organization for the purposes of more economical production, distribution and marketing and of facilitating the turnover from peace to war" are being handled in consultation with the British Board of Trade and the Department of Overseas Trade, and that "a comprehensive scheme of work has been prepared." The desire of the government is to leave the industries to ration themselves under certain general principles for which the government must take responsibility.

A Letter Which Explains Itself

Public Utility Companies Are Urged by the Fuel Administration to Store All the Coal Possible if They Would Safeguard Next Winter's Service

UNITED STATES FUEL ADMINISTRATION

WASHINGTON, D. C.

June 1, 1918.

IN YOUR REPLY REFER TO

D-

Mr. William H. Onken, Jr.,
Editor, Electrical World,
New York City, New York.

My dear Sir:

I am sorry that your letter of the 27th ultimo did not get my attention sooner, but I have just returned to the office today for a few hours before leaving for the West.

We find some disposition on the part of public utilities to be rather indifferent in the matter of storing coal because they expect to rely on the Fuel Administration to take care of them throughout the year because of their importance.

As I have already told you, we, here in the Distribution Division of the Fuel Administration, view this disposition on the part of public utilities with distinct concern. If they knew how much difficulty we are having to supply current needs now during the summer time, they would not feel so certain that they would be taken care of next winter. The fact of the matter is, we shall probably find it necessary to insist that many public utilities store coal during the summer and we will make the coal available for that storage. This is the only way in which we can feel certain that we can put them through the winter without serious danger of shut downs.

I am sorry that I have not time to get you up an article on this line, but the foregoing is a brief expression of our sentiments in the matter.

Sincerely very truly,

UNITED STATES FUEL ADMINISTRATION

By

General Director, Distribution

JDAM-LH

Steel Conductors for Series Circuits

Facts That Determine Choice Between Steel and Copper—A Practical Formula and Its Application to a Particular Case—Most Economical Size of Wire to Use—Other Considerations

BY L. M. KLAUBER

Superintendent Electric Department San Diego Consolidated Gas & Electric Company

ALTHOUGH the use of steel conductors in transmission and distribution circuits has advanced considerably as a result of recent material markets, many companies still hesitate to use the cheaper metal because early experiments in some cases proved failures. Such failures have been both mechanical and electrical. Mechanical failures have occurred owing to rapid corrosion of the conductor or to annealing following short circuits. Most of these cases, however, have been found upon investigation to have involved the use of solid conductors of comparatively small size, such as No. 6 or No. 8 B.W.G., attempts having been made to use conductors similar in mechanical form to the copper superseded. Extra-galvanized stranded steel, on the other hand, has long been extensively used for guys, and its life as a conductor may therefore be closely estimated by any central station, the estimate being based on the performance of guys in the same regions.

Electrical failures have been due to insufficient data on the electrical characteristics of steel conductors, and particularly to lack of consideration of the skin effect in solid conductors, which results in excessive drop at higher current densities. But extensive data on this subject have recently appeared, especially covering the stranded steel largely used in guys, so that the principal uncertainty which now remains has to do with the characteristics of the load, both present and prospective. Obviously, savings through the use of steel result primarily from the fact that in certain classes of lines copper of greater cross-section than is electrically necessary must be used for mechanical reasons. For this reason, an economical steel substitute will have less capacity for increased load than the copper replaced. It is therefore essential in designing steel lines that regulation and losses be closely calculated and that suitable allowances be made for future load increases.

One case in which most of the factors and results may be closely calculated in advance has to do with the use of steel conductors in series street-lighting circuits. In this case current and hours of use are fixed so that losses may be predetermined exactly. Since increased load involves increased pressure per circuit or increase in number of circuits, there is not the possibility of having to replace steel with copper upon acquisition of unexpected new business. Furthermore, there is no possibility of deterioration of the line by annealing during short circuits. If stranded steel guy cable is used, the life may be gaged from previous performances.

FORMULA FOR CHOICE OF CONDUCTOR MATERIAL

It is obvious that the economical choice between steel and copper will depend on a number of factors which are different for each individual case. Of fundamental importance are the costs of the two materials, rates of interest and depreciation and the cost of energy. In general, it may be said that steel will be the cheaper

when the annual fixed charges on a copper line are greater than the fixed charges on the steel line plus the increased energy losses by reason of the use of steel plus the fixed charges on the additional constant-current substation apparatus required because of the greater losses in the steel as compared with copper. Stating this in the form of an equation:

$$F_c C_c - F_s C_s - L(HW + F_c C_c) = X.$$

It will be more economical to use steel when X is positive; when X is negative copper is preferable.

In the preceding equation F_c , F_s and F_c represent respectively the rates of interest plus depreciation on copper lines, steel lines and substation equipment. C_c and C_s represent the first cost of unit lengths of copper

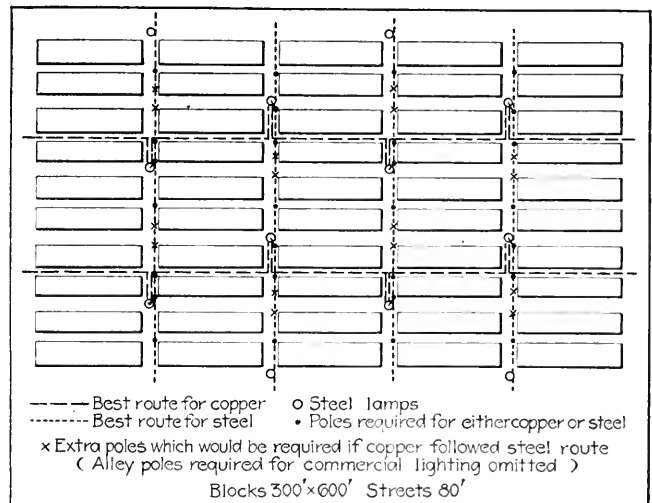


FIG. 1—COMPARATIVE LAYOUTS USING STEEL AND COPPER

and steel lines. This cost must be the cost in place, including overhead expense, since when lines must be removed the total cost in place must be retired from service. C_c represents the first cost of series lighting transformers per kilowatt. L equals the excess loss in kilowatts in a unit length of steel over copper. This quantity evidently depends on the current in the series circuit and the relative resistances of the two conductors at this particular current density, it being remembered that the alternating current resistance of the steel varies with the current density. H represents the annual hours burning in the street-lighting system under consideration. W is the cost of energy per kilowatt-hour delivered at the substation buses; this item should, however, include only those elements of production cost which vary with output (*i.e.*, fuel cost in steam plants).

Were the relative prices of steel and copper to remain in constant ratio with markets fluctuating proportionately, either the one metal or the other would be invariably preferred for certain circuits. This, however, has not been the case, especially under recent ab-

normal conditions, as shown by Fig. 2, which gives the relative costs of steel and copper deduced from the purchasing department records of one central station for the last eight years. It may be seen that the cost of copper wire has varied from about twice to nearly five times the value of steel wire. Under such changing conditions it is logical that sometimes one and sometimes the other metal is more economical.

APPLICATION OF FORMULA TO A PARTICULAR CASE

In order to illustrate the application of the above formula, two cases are assumed, one comparing bare copper with bare steel, the other double-braid weatherproof copper with weatherproof steel. The prices assumed should not be considered as indicative of present costs, since they are rather those which applied some months ago:

In giving values to F_c , F_s and F_e interest is taken at 6 per cent. Bare copper is assumed to have a life of thirty years and a junk value of 40 per cent. (In each

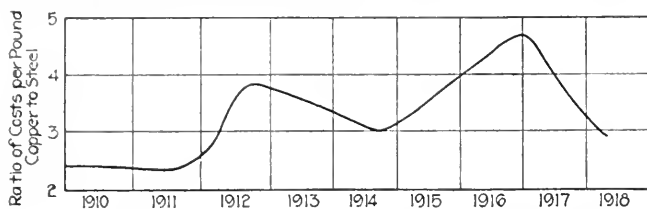


FIG. 2.—FLUCTUATIONS IN RATIO BETWEEN COPPER AND STEEL COSTS DURING NINE YEARS

case the junk value represents the sale price as junk less cost of removal.) Weatherproof copper is presumed to have a twenty-year life and a 30 per cent junk value, since the serviceable life of an insulated conductor is in reality the life of the covering; for, regardless of the life of the metal, it must be removed when the covering becomes abraded. For this service weatherproof steel may be assigned the same life as copper, although the junk value will be zero. Bare double-galvanized steel under normal conditions (away from salt fogs or corrosive fumes) is assumed to have a life of fifteen years and to be without net salvage value. Constant-current transformers are assigned a life of thirty years and a salvage value of 10 per cent. Basing depreciation calculations on the straight-line method and adding interest at 6 per cent, the following conditions exist:

	Weatherproof	Bare
F_c	0.095	0.080
F_s	0.110	0.1267
F_e	0.090	0.090

Practically all series lines are No. 6 copper, so only this size will be considered. The best steel substitute appears to be $\frac{1}{4}$ -in. (0.63 cm.) extra-galvanized standard steel strand. Assuming copper (weatherproof or bare) at 34 cents per pound (75 cents per kilogram) at the storeroom, bare steel at 8 cents (17.6 cents) and weatherproof steel at 11 cents (24.2 cents), adding 4 cents per pound (8.8 cents per kilogram) as the cost* of stringing and 15 per cent overhead, and considering 1000 ft. (304.8 m.) as the unit of length throughout, with bare copper weighing 79.5 lb. per 1000 ft. (118 kg. per km.), double-braid weatherproof copper 100 lb. (149 kg. per km.), bare steel 125 lb. (185 kg. per

km.) and weatherproof steel 155 lb. (230 kg. per km.), the following is true:

	Weatherproof	Bare
C_c	\$43.70	\$34.74
C_s	26.74	17.25

(C_e is assumed to be \$12.50.)

In the determination of L the resistance of copper is taken as 0.395 ohm. Within the comparatively small range of commercial alternating-current series circuits (4 amp. to $7\frac{1}{2}$ amp.) there is little change in the resistance of $\frac{1}{4}$ -in. (0.63-cm.) galvanized steel, the total increase at the higher density being about 3 per cent above the lower. This is less of a variation than that found between individual samples and may therefore be neglected. The 60-cycle alternating-current resistance of $\frac{1}{4}$ -in. (0.63-cm.) extra-galvanized seven-strand standard steel at these densities has been found by various investigators to be from 1.62 ohms to 1.78 ohms per 1000 ft. (5.3 ohms. to 5.8 ohms, per km.). Taking 1.70 as an average, and assuming a 6.6-amp. series circuit, $L = 0.0568$, H may be taken as 4000 for all-night lighting circuits, 2600 for moonlight and 2200 for midnight circuits. W obviously differs for each individual case and is here taken at \$0.005.

Substituting the preceding values in the equation, the following values of X are obtained:

Circuit	Weatherproof	Bare
All-night	0.01	— 0.61
Moonlight	0.41	— 0.21
Midnight	0.52	— 0.10

Thus in each assumed case it will be found more economical to use weatherproof steel rather than weatherproof copper, but bare copper (if line and ordinance conditions permit the use of uncovered conductors) is to be preferred to bare steel.

Assuming the same constants but a 4-amp. circuit, $L = 0.0209$; therefore it will pay to use steel in every instance.

MOST ECONOMICAL SIZE OF WIRE TO USE

Of the various sizes of standard steel strand, $\frac{1}{4}$ -in. (0.63 cm.) will usually be found preferable for series circuits. Smaller sizes lack strength and are not so readily obtainable as the sizes used for guys. Although largely used in multiple circuits where steel is employed, $\frac{5}{16}$ -in. (7.9-mm.) cable will generally be less economical than $\frac{1}{4}$ in. in series circuits. This can be shown as follows: Consider $\frac{5}{16}$ -in. bare steel weighing 210 lb. per 1000 (312 kg. per km.) and double-braid weatherproof weighing 255 lb. (378 kg. per km.). By substituting the same unit prices and depreciation rates as were assumed in the case of $\frac{1}{4}$ -in. cable, omitting fixed charges on substation equipment, as they are of minor importance, and assuming that the alternating-current resistance of $\frac{5}{16}$ in. (7.9-mm.) standard strand is 1.25 ohms per 1000 ft. (4.1 ohms per km.) at the current densities under consideration, the original equation reduces to:

$$1.486 - 0.45I^2HW = X \text{ for bare}$$

$$\text{and } 1.898 - 0.45I^2HW = X \text{ for weatherproof.}$$

Thus for 6.6-amp. series circuits it will be more economical to use $\frac{5}{16}$ -in. (7.9-mm.) strand than $\frac{1}{4}$ -in. (0.63 cm.) cable only when the cost of energy per kilowatt-hour at the substation exceeds the following:

	Weatherproof	Bare
All-night	\$0.024	\$0.019
Moonlight	0.037	0.029
Midnight	0.044	0.035

*There is practically no difference in the cost of erecting copper and steel.

It may therefore be seen that $\frac{1}{4}$ -in. strand is to be preferred in all ordinary cases.

OTHER CONSIDERATIONS THAT AFFECT CHOICE

Of course, in a problem of this nature, involving a choice between copper and steel, or between two sizes of steel, the mere balancing of reduced fixed charges against increased operating expenses is not always the sole controlling factor. Where work is of a temporary character, as for camp or protective lighting, the element of depreciation which operates so strongly in favor of copper is more nearly equal for the two metals, and steel is usually to be preferred. Again, there are occasions when difficulty in raising funds renders desirable a reduced cost of installation, even at the expense of slightly increased operating expenses over a term of years.

There are other cases in which considerable savings may be made in first cost, owing to the increased tensile strength of the steel permitting wider pole spac-

ings. An example of such a case is shown in Fig. 1. It is assumed that blocks are 300 ft. by 600 ft. (91 m. by 183 m.), with 80-ft. (24-m.) streets, and that commercial lighting feeders and mains are run in the alleys. The most economical system of covering the territory with steel takes only about 62 per cent as much line as the copper method shown. Besides, the construction is much simplified at corners and many dead ends and anchors are eliminated. The route outlined for the steel circuit is impossible with copper unless extra poles be added as indicated. This would considerably increase the cost and would be undesirable from a public-policy viewpoint, as it is preferable to have poles only on street corners where they carry street lamps.

On the other hand, with steel conductors it is perfectly feasible and safe to jump 380 ft. (116 m.) from alley to alley in the blocks where street lamps are missing, thus permitting the simplified system of passing back and forth on cross streets.

Stock Worth \$8,203,000 Sold Locally

Pacific Gas & Electric Company's Plan Interested More than 40 per Cent of Employees, and by Means of It 6663 New Stockholders Were Added to the Number Already on the Books of the Public Utility

WITH the increasing difficulty in raising money by public utilities, the plan of selling securities locally is appealing more than ever to utility operators. Generally speaking, money is cheaper and easier in local markets than in the large financial centers. Not many electric utilities have made an effort to place their securities locally. One of the pioneers in this line of activity is the Pacific Gas & Electric Company of San Francisco.

In June, 1914, this company undertook to market an issue of \$12,500,000 of first preferred 6 per cent stock. The method of doing this was so successful that by the close of 1915 not only had the entire issue been sold but permission was obtained for issuing an additional \$2,500,000 as might be needed, thus bringing the total issue up to \$15,000,000. Up to the early part of 1917 \$14,553,000 had been sold, without any underwriting, out of the total issue, of which more than 50 per cent had been sold to employees, consumers and others living in territory served.

The greatest attention to the stock-selling campaign was given in the latter part of 1914. Concentration on sales work was less in 1915 and 1916, and during the past year no sales effort whatever has been put forward. However, subscriptions are now coming in constantly without solicitation. In recent months these have been totaling \$25,000 to \$30,000 per month. The company believes that it is good policy to sell stock to consumers, and even though no sales effort is being made, stock will always be kept on hand to meet unsolicited applications.

The tables show how the sales were distributed over the two and one-half years of activity. The sales by months in 1917 reflect the high degree of prosperity that manifested itself in January and how the investment in stocks suddenly dropped off after our

entry into the European war. It will be noted in the table summarizing stock sales for the four years that the average investment of each purchaser is \$1,231. The total of 6663 purchasers includes about 1750 employees, or 40 per cent of the total number, and includes very few people not served by the company either directly or indirectly.

Since this stock-selling plan was inaugurated the par value of the outstanding stock has increased 40 per cent and the number of stockholders 177 per cent, which is considered a striking illustration of what can be accomplished by distributing the stock in small amounts among a large number of investors.

In describing the methods followed in selling this stock to consumers and employees, A. F. Hockenbeamer, vice-president and treasurer of the company, who originated the plan, has the following to say:

Under date of June 1, 1914, we issued a circular to all officers and employees of the company. Distribution was effected through our local offices, and these offices also handled the subscriptions. On July 24 we issued a circular to all of our consumers. About 260,000 were mailed in sealed envelopes as first-class matter. The circulars inclosed in envelopes were sent to the local offices where the addresses were placed upon them by means of the addressograph machines used in making out gas and electric bills.

On Aug. 15, 1914, we sent a second circular to practically all consumers, but this time the distribution was effected in each district by means of collectors who delivered the circulars as they covered their routes in the performance of their ordinary duties. In some cases special messengers were employed. With this circular we inclosed a return post card giving the consumer an opportunity to indicate whether or not he had sufficient interest in the offering to justify our sending some one to see him or to send him further information. Very few of the post cards were returned, and this part of the plan was a failure.

Just before mailing the circular to officers and employees we had a meeting in San Francisco attended by all heads

of departments, district managers and all principal employees. At this meeting full information was given and everybody present encouraged to ask questions. A similar meeting was held at the time the first circular to consumers was mailed.

Advertisements, which were changed from time to time, were inserted in the principal San Francisco papers and in practically all of our country papers. In this connection a good deal of excellent publicity was obtained in the news columns of these papers. This latter publicity was along legitimate lines as the plan was a novel one and naturally created a good deal of interest. Our managers and a good many of our employees solicited subscriptions. In addition to these we sent out a few men from the head office, not over five or six at any one time, who worked on a commission basis of \$1 per share.

In some of the smaller communities, and in several cities outside of our territory where we had no managers of our own, we made arrangements with local men, usually real estate and insurance brokers, to secure subscriptions on the basis of paying them \$1 per share. These local men were supplied with printed cards to place in their windows and on their counters, and we also used similar cards in our own offices.

We established at the head office a "stock sales department" where the details of the campaign were handled. This department prepared and sent out all circulars and advertisements, handled local agencies, the outside solicitors referred to in the foregoing, and took care of correspondence. At first a commission of \$1 per share was paid regular brokers, but the results were rather meager, as the stock was not as a rule bought by brokers' clients, and after a few months this commission was withdrawn.

On the back of the first circular to consumers appeared a list of 93 banks, these being the depositaries of the company in the cities and towns in which it operates, which, by special arrangement, act as agents for receiving subscriptions and payments. This proved to be a convenience to subscribers and also resulted in a number of subscriptions being received through the direct efforts of the banks. The most efficient service was rendered by depositaries in San Francisco.

As a rule the country banker was actuated more by the desire to keep his deposits intact than by any wish

Newspaper advertising, personal work of local managers and employees and circulars to consumers were the most effective means of making sales. Local agents and outside solicitors accomplished comparatively little. One of the interesting features of the campaign was that most of the stock was bought, apparently, by those unaccustomed to investing in securities. Evi-

TABLE II—SALES OF FIRST PREFERRED STOCK TO EMPLOYEES, CONSUMERS AND OTHERS IN TERRITORY SERVED BY THE COMPANY

	No. of Sales	Par Value Stock Sold
*1914.....	3684	\$2,405,200
1915.....	1712	3,785,100
1916.....	617	1,123,100
1917.....	650	890,000
Total.....	6663	\$8,203,400

*First sales were made in June, 1914.

dences of this were the large percentage of payments made in coin which had evidently been hoarded away.

Mr. Hockenbeamer's conclusions are that at least three conditions must obtain to insure success for a stock-selling campaign of this sort—first, the security offered must be safe and sound beyond question, as it would be suicidal to have anything go wrong with the investment after being widely distributed among customers; second—denominations must be sufficiently small to be within the reach of people of moderate means; third—the yield on the investment must be relatively high, for example, approximately what a good real estate mortgage should return.

Increased Utilities Costs in Oklahoma

The answers to a questionnaire on increased utilities costs sent out to Oklahoma properties show considerable advances in labor, fuel and other materials. The advances in percentages as referred to costs in 1915 were given in a paper read before the convention of the Oklahoma Gas, Electric and Street Railway Association of Oklahoma by Prof. L. W. W. Morrow, director of the School of Electrical Engineering, University of Oklahoma.

Increased labor cost:

	Low	High	Average
Linemen	15	75	50
Engineers	—	70	40
Common labor	20	100	60
Mechanics	17	100	45
Firemen	21	100	51
Office force	—	100	33

Increased fuel cost:

	Low	High	Average
Coal	20	40	25
Oil	100	300	200
Gas	—	100	20

Increased cost of other materials:

	Average
Meters	25
Wire	90
Hardware	70
Lubricating oil	50
Waste	100
Water-treating material	50
Pipe	100

The report shows an increase in operating income, but in every case an increase of operating ratio was reported. Taxation expenses were reported as increased from 3 to 25 per cent.

TABLE I—FIRST PREFERRED STOCK SALES BY MONTHS

	1915		1916		1917	
	Number of Sales	Par Value Stock Sold	Number of Sales	Par Value Stock Sold	Number of Sales	Par Value Stock Sold
January.....	262	\$307,500	131	\$215,700	408	\$723,900
February.....	146	210,800	99	162,500	73	84,100
March.....	111	241,600	125	422,600	66	81,100
April.....	176	334,000	35	25,000	94	19,100
May.....	145	282,100	2	1,300	9	1,800
June.....	231	429,300	1	300		
July.....	145	478,400	1	100		
August.....	108	100,600	2	1,300		
September.....	94	414,500	25	45,500	—	—
October.....	177	508,900	59	75,900		
November.....	79	241,500	39	41,600		
December.....	38	235,900	98	131,300		
Total.....	1712	\$3,785,100	617	\$1,123,100	650	\$890,000

to help secure subscriptions. Having this long list of banks on the back of the circular, however, lent distinction to the offering and undoubtedly helped to impress a good many people. With one exception, no compensation was paid to the banks for their services, although they were to be allowed one-tenth of 1 per cent on all payments handled. The money was to remain with them on deposit until needed by the company. Most of the money is still in the country banks.

War Service of the Electrical Manufacturers

How the General War Service Committee of the Electrical Manufacturing Industry Has Worked with the Government to Promote the Nation's Interests and Bring Victory Nearer

BY ROBERT K. SHEPPARD

In presenting the report of the general war service committee of the electrical manufacturing industry, of which he is chairman and C. L. Collens II, James C. Hobart, J. R. McKee, William W. Nichols and Charles A. Terry are the other members, to the Hot Springs (Va.) convention of the Electric Power Club, held on May 30 to June 1, Mr. Sheppard spoke in part as follows.

THE organization of the electrical manufacturing industry was begun Nov. 28 last at the first meeting of the general war service committee appointed concurrently by you, the Electrical Manufacturers' Club and the Associated Manufacturers of Electrical Supplies, under resolutions suggested by the Electrical Manufacturers' Council and according to plans formulated in September, 1917, at the war convention of American business under the auspices of the Chamber of Commerce of the United States. Our nation has the right to call for, and her industries have the duty to give her, every unit of energy which will propel her enormous war machine most quickly and effectively against her foes. Devoted men, without hope of other reward than a consciousness of loyal service rendered to their fellow-men, have thrust aside their great interests in civil life to put all their wisdom, all their experience, all their organizing powers at the government's service. You find them in the War Industries Board and its divisions and sections, in the Food and Fuel Administrations; you find them in army and navy uniforms, in the Red Cross, in the Y. M. C. A.; you meet them everywhere. They are doing glorious deeds silently and with infinite patience; they are bearing unknowing, unkind, unfair criticism as silently and stoically. Many of them have tasks for the adequate fulfilment of which they should have ready to their hand the knowledge, the resources, the sympathy of an army of specialists, men in every industry who have learned their particular business from the ground up. We owe them our aid.

ORGANIZED INDUSTRY ANSWERS COUNTRY'S CALL

Organized industry, voluntarily preparing itself for every emergency, enlisting itself in unselfish co-operation, summoning every American manufacturer to service, that is the answer already given to the bugle call for intensive industrial mobilization. The electrical manufacturing industry is one of nearly 150 lines of business to begin that united industrial service. That is why your general war service committee was appointed. Its aim is to gear together the hundreds of big and little wheels known as electrical manufacturers, to get all the wheels into the mechanism, to keep them there and in running order so long as there is any possibility of this particular mechanism being a help to our country in winning the war. That truly is more than one job; it is a combination of big undertakings consuming much time and much labor.

There are a multitude of electrical manufacturers who

are not members of either the Electric Power Club or the Associated Manufacturers of Electrical Supplies. The allegiance of that multitude is essential to the fulfilment of your war service committee's duty. Many of those manufacturers have already responded splendidly.

The splendid work which you had done in connecting your branch of our industry with the federal government rendered material assistance to our efforts further to organize the industry. The remarkable service of the wire and cable manufacturers, under the able leadership of Le Roy Clark, gave the federal authorities such a marked example of efficient collective service that equal service in case of shortage of supply would be heartily welcomed at Washington. Under the plan of your committee to organize the rest of the industry into similar groups, such service could be had from any section of the electrical industry.

TWENTY-SIX GROUPS ALREADY FORMED

Already twenty-six such groups have been formed, and several more are in process of organization. Each group has chosen its own committee through which to give its collective service in its special line of manufacture. Groups of manufacturers who hitherto have not found homes in any electrical association, voluntarily applying for places in the organization, have proved to the general committee their eligibility for war service as electrical manufacturers. The groups find their places naturally in two great divisions of the industry, the manufacturers of electrical apparatus and the manufacturers of electrical supplies. In those great divisions staff committees have been organized. They are the connecting links between the general war service committee and the groups. They also serve the dual purpose of co-ordinating the work of the group committees and providing responsible bodies for the discussion of the problems of each large division of the industry in relation to the war needs of the nation.

The wisdom of so organizing the industry has been conclusively demonstrated. Few changes in this form of organization will occur, but its expansion may yet be considerable. This war service organization really amounts to an economic movement, begun under the heavy pressure of an unprecedented need, but destined to benefit our entire industry long after the present demand for its peculiar service has been stilled by the final victory of the Allies.

So useful to the government have been the devotion and unselfish labors of the chairman of the wire and cable committee, whom we mentioned once before in this report, that the recently organized War Industries Board summoned Mr. Clark to be the chief of its newly-created Wire and Cable Section.

Your general committee has consistently urged the war service executive committee of the Chamber of Commerce of the United States to persuade the federal

government to stop the numerous questionnaires which at one time were being sent out from many different bureaus in Washington. Our appeal has met with some success. The War Industries Board has now a central bureau for the collection of statistics.

In the preparation of bulletins your committee sympathizes with the feelings of many executives who are flooded with bulletins on every conceivable subject. Nevertheless, it has seemed best to your entire committee in the last six months to issue six bulletins, making them as concise as possible.

Your committee has considered carefully whether or not it ought to supply the industry with a Washington office, competently manned, for war service. We have consulted many manufacturers who are not now represented there. Group chairmen also have expressed their views. The opinions of them all favor the committee's present plan of administration without a Washington office. Furthermore, this plan is approved by important leaders in war service who are themselves now stationed in Washington, such as the chairman of the war service executive committee of the Chamber of Commerce of the United States. The large cost of having headquarters in Washington would be a waste of financial resources unless and until that agency could be made the repository and disseminating medium for much varied data that have never been possessed by any small group of men in our great industry. For these and other reasons your committee will continue its offices for the present at 50 Church Street, New York City, and put forth its best efforts to strengthen and utilize the services of the group committees.

Much detail of organization had to be completed before the committee could proceed with its most important service to the industry in its relation to government requirements, namely, the compilation of a directory of electrical manufacturers and their products. That directory is now almost ready for publication. In the first part of the book all electrical products are cataloged by classes. To each group was assigned the task of choosing its own classification of the articles in its line and of listing all American manufacturers of those goods as completely as they are known, and provision has been made to add to the list as other makers become known to us. Against each cataloged item are given reference numbers which identify in Part II the manufacturers who make the article. On the same pages with the lists of manufacturers are given the committees appointed by those manufacturers to deal with all government agencies requiring collective service from the groups.

The simplicity and completeness of the scheme is the greatest assurance that it will be used in government departments by the men directly charged with engineering, procurement, inspection and like duties. The directory will enable those men to get quick, direct contact with individual manufacturers, or with all of them, or with the responsible committee who will speak and act for the group collectively.

Compiling the data for the directory has been a big task which could not have been done without the devoted work of the chairmen of group committees, the untiring efforts of W. H. Lanman of New York City and the splendid co-operation which has been freely given in all quarters wherever we have turned for aid.

Applied to an entire industry war service comprises

many varied activities. None can speak more vividly of the imperative and unexpected calls from government quarters than can the members of some of our committees. At the least reckoning, our industry's pledge to war service means:

1. That every facility, including plants that never did government work before, shall be used to maintain maximum production of materials essential to winning the war.

2. To supply the needed articles in the quantity, of the quality required and in the time set.

3. To supply them at moderate prices.

4. To provide engineering data, advice and similar help which the experts of industries are best qualified to supply.

5. To suggest changes or temporary abatements in specifications if pre war standards prevent delivery on time of an adequate supply of the needed articles.

6. To produce essentials at the sacrifice of non-essentials.

7. To remedy existing shortages and prevent impending ones.

8. To aid the authorities in wisely distributing and conserving raw materials, fuel, power and those supplies which have to be imported and are necessarily restricted by shortage of ships.

9. To arrange with the proper authorities so that labor available in our industry may be so distributed as to be most productive.

10. To accept and provide for dilution of labor.

11. To work with those committees of the government which determine priority of production, of fuel distribution and of transportation, to the end that the stream of essential goods may not be impeded.

These and many unforeseen tasks will make up the programs for our committees in the coming months.

The needs for war production of any section of our industry are known best to the men who are actively engaged in it. They know the products, the manufacturing capacities for war service, the available engineering talent, the costs of the goods and numberless details. Those men are on our group committees, and your general war service committee purposes to do all that it can to bring those group committees close to the powers in Washington.

A NEW master has conquered the world, and with weapons so strong and cleaving that he brings every art and industry to harvests not to be imagined a century ago . . . From long before the dawn of history the flame kindler was the commander of human toil, and for ages every stride in civilization but confirmed his supremacy. Yet during the past sixty years that supremacy has ended for good and all, and we see that the flame user but paved the way for bolder feats and deeper insights than were to him possible. Electricity to-day does all that fire ever did, does it better, and then accomplishes tasks infinitely beyond the scope of fire, however skillfully applied.—George Iles.

Development of Electric Searchlamps

The Newest Principle of Operation Consists of Rotating Small-Diameter Cored Electrodes Subject to Increased Arc Voltage in Order to Give a Highly Concentrated and Intense Crater

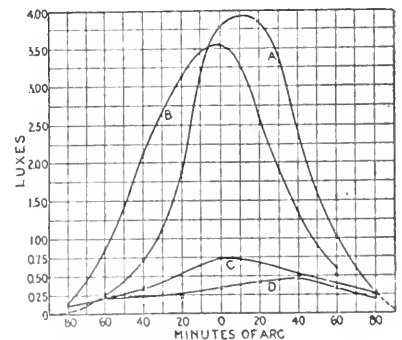
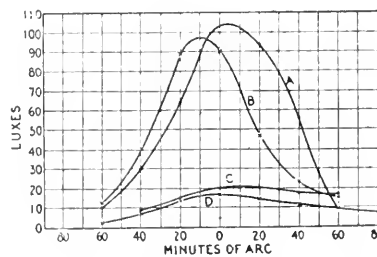
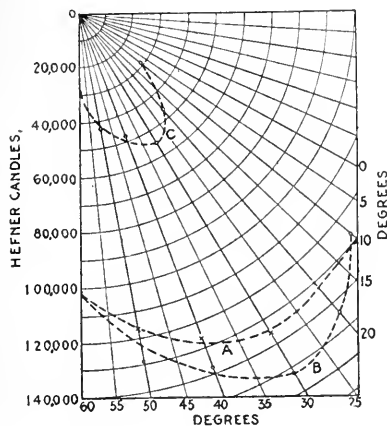
BY LOUIS J. AUERBACHER

ONE of the first uses made of the electric arc light discovered by Davy in 1802 was its application as the luminous source of searchlamps. For such apparatus particularly the discovery of the electric arc signified an enormous step forward. Not only a source of high luminosity was required here, but also, and even more, a high specific intrinsic brilliancy. Therefore the luminous source had to be restricted as much as possible, in spite of its high luminosity, to a minimum surface. This requirement was best met by the arc, whose main source of illumination is the crater.

In the course of the development the arrangement of this luminous source was subjected to many changes. In the first and earliest searchlights the carbons were arranged one above the other, vertical to the optical axis of the reflector or lens. Subsequently they were arranged obliquely to the optical axis, in order to obtain a better radiation of the light from the positive crater. Then the system was adopted of placing the carbons in line with the reflector axis. In this manner probably the most symmetrical radiation of the light upon the reflector is secured. At times the negative carbon in this system was placed at a right angle to the positive carbon, or at an acute or obtuse angle. By this means it was desired to avoid as far as possible the formation of shadows by the negative carbon. It was difficult, with the horizontal lamp, to maintain the crater constantly in a uniform, rectangular position to the optical axis. Consequently directive magnets were employed or the positive carbon was made to rotate slowly

it was soon recognized that the frequent disturbances were mostly caused by the negative carbon. Various attempts were made to remedy this condition. First of all, it was found advantageous to use a negative carbon of an essentially smaller diameter than that of the positive electrode. In this connection reference should be made to the German imperial patent No. 185,216 (1906), Gebr. Siemens & Company, Charlottenburg. According to this patent, a thin carbon rod is surrounded at a certain distance from its burning end by a tube in such a manner that the rod can be easily moved or rotated therein. The tube serves to decrease the resistance in the electrode, besides serving to protect the thin carbon rod from combustion. This arrangement of the electrode is said to give very favorable results, as the thin carbon rod always burns away in the form of a slender point. From this slender point the arc is thrown out in the form of a rather thin ray in the direction of the axis of the rod, its position being stationary. Therefore the crater of the positive carbon is very uniform and the light, it is claimed, is steadier. Furthermore, the slender electrode point does not impede the radiation from the positive crater to any great extent.

The scheme outlined requires the use of comparatively long negative carbon rods which cannot always be arranged conveniently in the space between the reflector and the luminous source. According to the German imperial patent No. 203,549 (1908), Gebr. Siemens & Company, therefore, the thin negative carbon takes the form of a bent rod and likewise, at the front end, is conducted through a protective tube, which



FIGS. 1, 2 AND 3—COMPARISON OF CANDLEPOWER CURVES, AND ILLUMINATION PRODUCED AT 6800 FT. AND 27,550 FT. BY BECK LAMP

Curves A and B refer to the Beck lamp, while C and D refer to old-type searchlamps. The readings for curves A and C were

or rapidly around its axis. Arrangements are also employed in which the carbons, especially the positive carbon, can be adjusted to the proper position while burning without opening the searchlight casing in order to bring the crater into the right position.

When, in the course of time, constantly higher currents were used and the requirements became more and more stringent in regard to the steadiness of the light,

taken in one plane and those for B and D in a plane at right angles thereto.

prevents the combustion of the rod and decreases its resistance. This protective tube may be provided at the end nearest the arc with a protective cap of refractory material. According to this patent, the electrode holder through which the carbon is conducted is cooled from its interior by the application of liquids or gases (air or any other gas desired).

The idea of using as thin negative electrodes as pos-

sible for the same purposes is also found in the German imperial patent No. 255,314 (1910) of Heinrich Beck. However, in this patent the disadvantages of the heavy protective tube which produces disturbing shadows and is very susceptible to destructibility are eliminated. According to this patent, gases or vapors are directed to the burning end of the thin negative carbon, thus impeding the quick combustion of the negative carbon. As the gases employed are usually good conductors of heat, the desirable cooling-off of this electrode is obtained. This enveloping by gas constitutes a sort of economizer, which, however, is transparent and consequently does not impede the radiation of light from the positive crater against the reflector.

It was found advantageous to permit the point proper of the negative carbon to protrude through the gas envelope. The negative electrode is provided with a core composed of material more refractory than the carbon shell, to assure a slender burning end and thus minimize the formation of shadows by the negative electrode.

Another development in which it was also the object to use thin negative carbons is embodied in the German imperial patent No. 210,251, Gebr. Siemens & Company. The negative carbon is provided with a metal coat which melts off before it arrives in the neighborhood of the arc.

While all the patents referred to deal with the improvement of the negative electrode of the ordinary arc, we find in the German imperial patent 215,177 (1908), Gebr. Siemens & Company, an arrangement aiming at the improvement of the positive electrode in the ordi-

is minimized by making the diameter of the positive electrode as small as possible. Thus the crater which remains smaller than the carbon exposes relatively less surface than in other arcs and radiates less heat, it is said. In order to protect the carbon rod against premature destruction, it is incased in a protective tube, as described in patent No. 185,216.

Summarizing all the arrangements described, from

the first application of the Davy arc to the latest and most perfected models, it may be noted that after the initial application practically no change was made in the fundamental principle of the generation of light. The quality of the carbons was constantly improved upon, but it can hardly be said that any essential improvement was made in the specific brilliancy which was obtained in the first searchlight-lamp

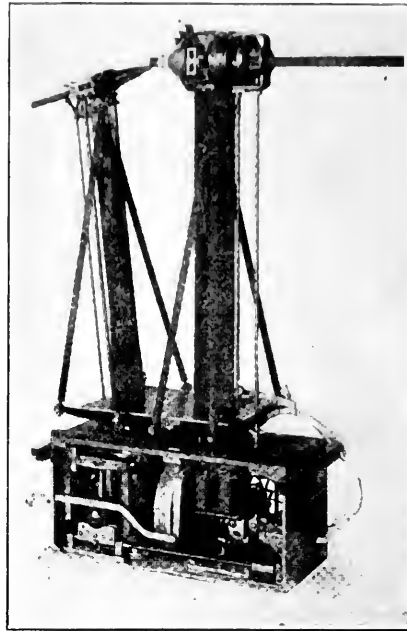


FIG. 5—MECHANISM AND ELECTRODE HOLDERS OF SPERRY LAMP

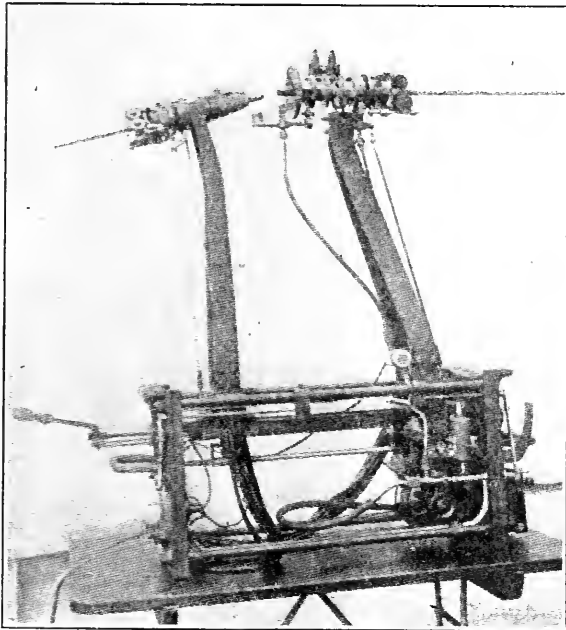


FIG. 4—ELECTRODE HOLDERS AND OPERATING MECHANISM OF BECK LAMP

nary pure-carbon arc. In this arc the positive electrode, as is well known, tapers toward the crater and the entire end of the electrode is at a high degree of incandescence. The highly incandescent conical carbon end, which is mainly heated indirectly by means of the transformation of energy in the crater, radiates a part of the added (conducted) electric energy into heat and therefore decreases the efficiency of the arc. This loss

models. The chief progress has been in increasing the current per lamp and in obtaining at the same time a steady light from the crater. Increase of the current alone, which also has its limit, failed to produce any more luminous searchlights, as the specific brilliancy is not materially affected thereby. In order to obtain a higher luminosity, larger reflectors have to be used, but there is a practical limit to their dimensions.

Thus a temporary condition was changed when Heinrich Beck of Meiningen succeeded by the use of a cored carbon for the positive electrode in producing a novel arc which had hitherto been entirely unknown. In this arc the specific brilliancy of the crater has been increased to such an extent that it is possible to construct searchlight lamps which excel their predecessors in luminosity by 300 per cent and more.

The use of impregnated carbons for searchlights was described before Beck's development in the German imperial patent No. 136,095 (1901), Hugo Bremer, where its disadvantages were also outlined. The light emanates chiefly from the voluminous flame which is produced with such carbons. The total luminosity is great, to be sure, but the specific brilliancy which is the essential thing is not high, since the luminous surface is too large. To avoid this objection Bremer tried to compress the arc mechanically by means of an air current, but it is doubtful whether he was successful.

Beck found that a novel arc is obtained if the positive carbon containing luminous substances is made very thin and required to carry a large current. The diameter of the carbon is smaller than the crater of the pure carbon arc. The arc thus obtained is characterized

by the deep funnel-shape crater, which is filled with luminous vapors of very high specific brilliancy; by positive and negative flames, which are both visible; by the relatively small illuminating power of the flame between the electrodes compared with the luminosity of the crater, and by the high arc voltage, which is approximately 73 volts.

In the United States patent No. 1,086,311 and the German imperial patent No. 274,110 (1912), Beck says

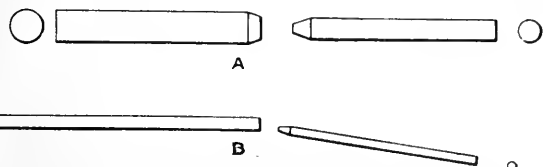


FIG. 6—RELATIVE DIAMETERS OF STANDARD AND BECK ELECTRODES FOR SAME CURRENT RATING (150 AMP.)

that by the use of highly loaded flame-arc carbons two arc conditions are possible for the same current and separation of the electrodes. In the one condition the crater is flat and the voltage amounts to about 43 volts. In the other condition, with the same separation of electrodes, the voltage is about 73 volts and the crater assumes a very deep funnel shape. Beck points out further that the negative and positive flames act reciprocally on each other, the position of the former being an important factor in the establishment of this novel arc. To influence the position of the negative flame very highly loaded flame-arc carbons are used and the negative carbon is placed at an angle with the positive electrode.

According to the German imperial patent No. 262,913 (1910) or the United States patent No. 1,029,787 (1912), Beck cools the electrodes by a current of gas which protects the carbons from premature combustion and prevents injurious leakage of the current from the shell, thus permitting the maximum concentration of current in the crater. By the concentration of current and reduction in radiation due to the deeply hollowed crater an extremely intense heat is obtained in the crater. In this way the vapors in the hollow of the crater are made to emit the maximum amount of light, which in conjunction with the white incandescence of the crater gives an exceptionally strong illuminating action. The negative carbon may be a pure carbon, however. Patent No. 262,913 mentions metallic salted carbons for this purpose, too.

According to descriptions* of the Beck lamp, the positive carbon, arranged in the axis of the reflector, rotates and is guided in a holder provided with ribs for cooling purposes. This holder is stationary and the carbon slides through it, the feed being controlled by a thermostat placed so that the light or heat from the arc is radiated on it only when the crater is at the focal point of the reflector. If the crater shifts out of its correct position, the thermostat closes contacts, thereby putting and keeping the feeding mechanism in operation until the proper position of the crater has again been obtained. The negative carbon is also held in a holder similarly to the positive carbon, arranged at a slight angle to the positive carbon. The burning ends of the carbons and the inclosing shell were cooled in the lamp described by McDowell by hydrocarbon vapor.

According to McDowell, the luminous power of the 44 in. (111.76-cm.) Beck searchlight is about five times greater than the luminous power of the 36-in. (91.44-cm.) standard searchlight and about two and one-half times greater than the 60-in. (152.4-cm.) standard searchlight with pure carbon arc. According to Mr. Wedding, the luminosity of the 110-cm. Beck searchlight at 150 amp. amounts to about 500,000,000 cp.

The searchlamp† developed by Elmer A. Sperry is not very unlike the Beck lamp in its distinguishing features. From an article describing the Sperry lamp it appears that the same electrode dimensions are used as in the Beck lamp, but in the Sperry lamp the carbons burn off more quickly, i.e., 13.5 in. (343 mm.) per minute. In comparison therewith the positive carbon consumption taking place in the Beck lamp when the carbon shell at the tip is cooled by gas is 200 mm. to 240 mm. per hour. Mr. Beck provides for greater carbon consumption (400 mm. per minute) in United States patent No. 1,086,311.

The voltage employed across the Sperry lamp is also about 70 volts, and forced cooling of the electrode holder is employed. This arrangement has also been described in patent No. 203,549 by Gebr. Siemens & Company, as mentioned before. Beck used cooling ribs on his holders. The arrangement of the carbons and the rotary feeding of them are also similar in the Beck and Sperry lamps, likewise the automatic holding in focus of the crater with the aid of a thermostat.

The functions performed by air cooling in the Sperry arc and by the improperly termed gas (alcohol) cooling in the Beck lamp are totally different. In the first the process merely cools the holders, whereas in the second the alcohol flame exerts a direct influence on the arc, confining the light-giving source and thereby reducing wide dispersions of rays.

In the latest patent literature on searchlamps we find United States patent No. 221,917 applied for by Elmer A. Sperry on June 28, 1915, "Method of Operating Flaming-Arc Lights for Projectors." In the opinion of the author, this patent offers nothing new, since from

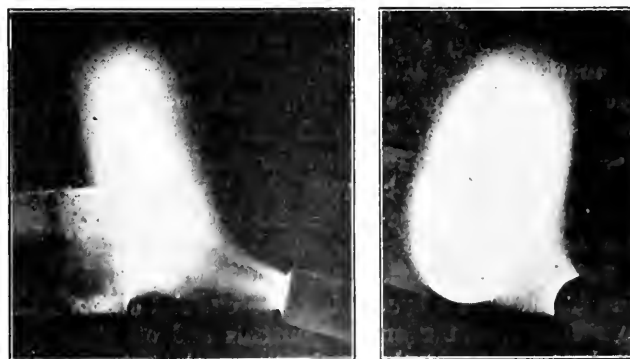


FIG. 7—TWO-FLAME ARC FROM BECK LAMP

the Beck patents we know that a positive flame and a negative flame are obtained and that the negative flame emanates from the negative carbon with great velocity. We also know that a reciprocal action of these two flames exists in such a way that there is, so to speak, a pressure. The inclined arrangement of the negative carbon, as well as the use of cores for the negative carbon with "arc-supporting material," are also known.

*ELECTRICAL WORLD, July 25, 1914; *Elektrotechnische Zeitschrift*, Aug. 6, 1914, and a treatise by C. S. McDowell in the *Proceedings A. I. E. E.*, February, 1915.

†Described in the *ELECTRICAL WORLD* of Sept. 25, 1916

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

AN INEXPENSIVE METHOD OF GROUNDING TO WATER MAINS

Company Which Owns Both Light and Water Utilities Makes Grounding Provisions While Laying Water Pipes

A company in the Northwest which owns both the electric and the water plant in a small city has worked out a scheme of grounding to water mains which it considers better than the method of grounding to a brass plug. When the water mains were being laid, pieces of bare No. 4 copper wire were carefully tinned and sweated into the lead which was used to form the joints between the sections of pipes. One end of the wire was left protruding to afford an easy connection. The ground leads connected to these protruding wires thus are tapped directly into the joints of the water piping. Engineers who discussed the feasibility of the plan before it was attempted felt certain no trouble could result from it. The possibility of the ground wire carrying enough energy to melt the lead in the pipe joint was remote.

BEARING PITTING IN MOTOR-GENERATOR SETS

Two Engineers Differ on Theory of Cause of Trouble but Give the Same Method of Overcoming the Difficulty

Grounds and weak insulation are given as the cause of bearing pitting* by P. A. Borden of the engineering department, Hydro-Electric Power Commission of Ontario, whereas an engineer in a Southern town claims that eddy currents are set up in the iron of the armature structure by short-circuited or otherwise damaged laminations. The latter engineer thinks that if leakage current is the cause it would burn out the coils in a short time. Both of the men say that the best way to remove the trouble is to insert thin sheets of insulating material between the bearing shells and their housings in order that the stray-current circuit may be broken.

Referring to a previous experience, Mr. Borden states that in one case a brush placed on one end of the shaft to reduce sparking on the journals and oil rings fulfilled its service at that end but greatly increased the sparking of the other journal. With a brush placed at each end, the current was so great that the brushes were heated to a prohibitive temperature. Further experiments showed that this current gave readings of several hundred amperes when measured either with a shunted D'Arsonval type meter or with an induction-type instrument through a series transformer. Oscillograph records indicated the current to be a mixture of unidirectional and alternating current, the latter having a periodicity of 60 cycles per second.

In this case the trouble could not have been due to leakage because the machines were operating at a lower frequency than 60 cycles. It was thought that the small electromotive forces responsible for these currents were generated in the shaft and other rotating parts by homopolar induction. The source of reversals was assumed to be an alternating field caused by the changing relative positions of the armature poles and the pole pieces. The generator was an eight-pole machine running at 300 r.p.m., and the armature spider had six spokes. Assuming two spokes to be in line with two north poles, the leakage flux would pass in through those spokes and flow along the shaft toward the bearings, electromotive forces being generated by homopolar induction at these points where the flux had a component perpendicular to the axis of rotation. It may be seen that with an advance of 15 deg. the leakage flux would be reversed by two spokes coming beneath south poles. There would thus be a leakage flux, reversing its direction every 15 deg. of rotation of the armature—that is twenty-four times per revolution, or 7200 times per minute. This flux both by generator and by transformer action would therefore be responsible for 60-cycle potentials.

Insulated sheets were inserted between the bearing shells and their housings to remedy the trouble, and it has not recurred during the seven years which have since elapsed.

COMPACT ROOF ARBOR FOR OUTGOING 2300-VOLT LINES

Large Number of Outgoing Circuits Arranged for Easy Inspection and Maintenance—Tension of Individual Circuits May Be Varied

An unusually well-arranged roof structure for outgoing 2300-volt lines has recently been erected at the Daniel Street station of the Rockingham County Light & Power Company, Portsmouth, N. H. This plant is being remodeled by the Harry M. Hope Engineering Company, Boston, and an important part of the work is the rearrangement of the wiring. An electrical bay on the south side of the station is being altered to carry an extended oil switch and bus structure installation. This bay is only about 12 ft. (3.7 m.) wide, and on account of its proximity to the street could not be extended. The equipment, however, is arranged so that the various circuits can be reached with the utmost ease and safety and without confusion as to their identity.

From the bus and switch structure the outgoing lines are carried in conduit across the bay in floor ducts and thence upward along the face of the wall to distributing centers, from which leads are run to sets of Thoner & Martens disconnecting switches installed in a long bank about 11 ft. (3.35 m.) above the floor. From each switch group the leads are carried through vertical con-

*See also ELECTRICAL WORLD, April 13, 1918, p. 778.

duit lines to conduits at the roof level. Extending above the roof level and protected against the effects of the weather by tile and concrete housing is a steel structure consisting of 8-in. channel inclined sections which carry the dead-ended lines of Fig. 2. These lines are arranged in six horizontal and six vertical groups and are connected to the leads in the conduits by triple-

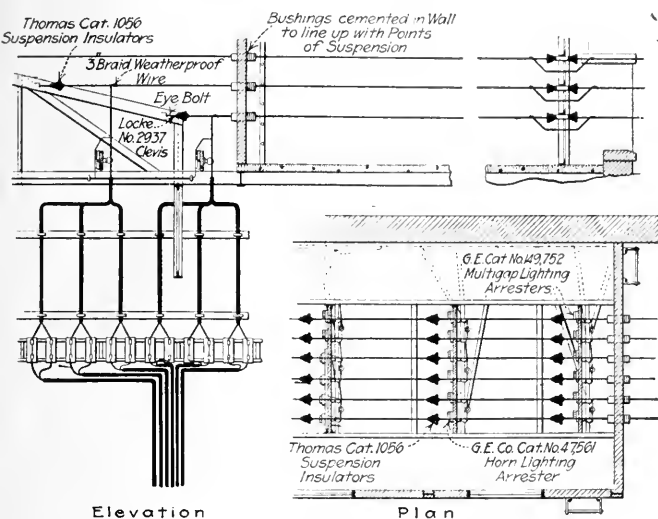


FIG. 1—SCHEMATIC ARRANGEMENT OF WIRING BETWEEN DISCONNECTING SWITCHES AND OUTGOING CIRCUITS

braid weatherproof wire. General Electric Company multigap lightning arresters are mounted in six horizontal groups of six each, slightly above the level of the conduits, and short taps from the outgoing phase wires are connected to the arrester terminals. Locke insulators with wooden pin tops are used to support the weatherproof risers below the lightning-arrester taps,

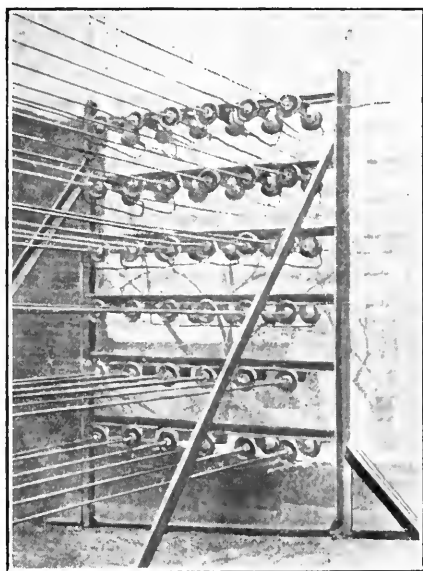


FIG. 2—ROOF TERMINAL STRUCTURE FOR OUTGOING CIRCUITS

and a No. 3/0 B. & S. gage insulated wire is carried as a common return to earth from the arrester sets.

The thirty-six wires forming the outgoing circuits are run horizontally from the wire arbor through Thomas corrugated-wall bushings set into the brick wall of the arbor house and thence to Thomas suspension insulators mounted on the steel framework outside the house on the roof, as shown in Fig. 2.

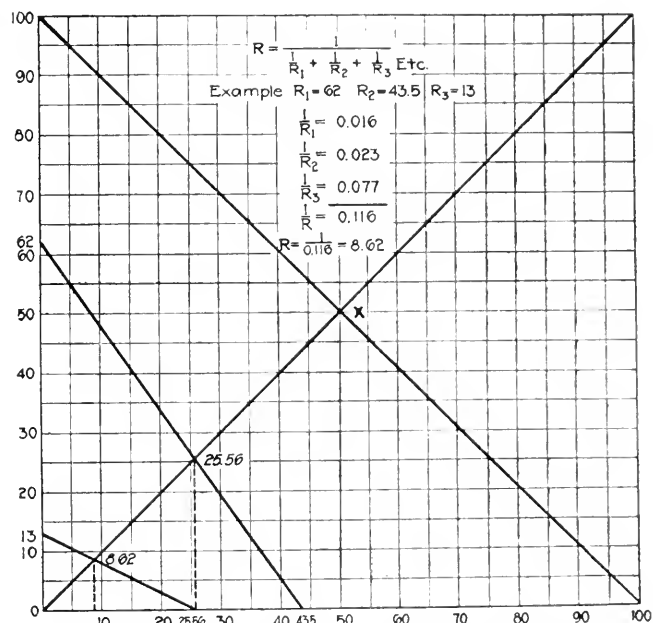
Between each row of horizontal wires the vertical distance is 18 in. (45 cm.), but as the steel framing slopes from rear to front, a free working space is allowed at the taps to each group of outgoing conductors. An operator can vary the tension in any outgoing circuit without interfering with the others. The horizontal spacing between adjacent wires is 12 in. (30 cm.), and the interior of the arbor is very accessible, thus allowing easy maintenance.

RESISTANCES IN PARALLEL DETERMINED GRAPHICALLY*

Simple and Fairly Accurate Method for Finding Resistance of Network Without Detailed Calculation—Accuracy Depends on Size of Chart

BY A. S. L. BARNES

Calculation of resistances in parallel entails a considerable amount of routine work which can be eliminated by means of the graphical system shown here.



ANY NUMBER OF RESISTANCES IN PARALLEL CAN BE DETERMINED WITH A STRAIGHT EDGE AND THIS CHART

This gives a simple method whose accuracy is directly proportional to the size of chart used.

As shown in the accompanying diagram, ordinate and abscissa scales are marked identically on cross-section paper, and a line is drawn from the common zero point at an angle of 45 deg.

If it be assumed that three resistances in parallel are 62, 43.5 and 13 ohms respectively, the ease of determining their total resistance is seen by reference to the chart. The resistance R_1 is measured on the ordinate scale and resistance R_2 on the abscissa scale, or vice versa. These line joining the scale points representing these values will cut the line OX at a point which, projected on either scale, will give their joint resistance in parallel. This new value, 25.56 ohms, if joined to a

*The writer forbears claiming any priority of discovery for this method, though inquiry among several other engineers has revealed no knowledge on their part of the method in just this extremely simple form. Reference to available handbooks, technical magazines, etc., has likewise been fruitless in this respect. On this account the method seemed to be worthy of publication even at the risk of a possible charge of plagiarism.

point on the opposite scale representing R_s , will give a new value, 8.62 ohms, which represents the combined resistance of the three circuits in parallel. This scheme can be extended to include any number of resistances in parallel.

CALCULATING THE LIFE OF INCANDESCENT LAMPS

Obtaining Number of Hours Lamps Are in Service
by Use of Formula Applicable to Systems
in a Stable Condition

BY H. A. SNOW

Engineer Detroit Edison Company

The determination of life of incandescent lamps by the method of noting the time at which the lamps are lighted and keeping a continuous record is cumbersome and not practicable except for laboratory experiments. If a system has reached a stable condition, the average-lamp life may be calculated provided that complete records have been kept. These records should contain the number of kilowatt-hours supplied to the system in any given space of time, the number of lamp burn outs which are replaced during this space of time and the average rating per lamp in kilowatts of all the lamps in service on the system. The formula for finding the lamp life will then be: Lamp life (hours) = kilowatt-hours supplied \div (number of burn-outs \times average kw. per lamp).

The accuracy of this formula can be proved from the fact that in a system that has reached a state of equilibrium the average lamp life equals the total number of lamps burning multiplied by the hours burning divided by number of burn-outs.

The first formula is obtained by multiplying the numerator and denominator by the average kilowatts per lamp. The numerator will be: Total lamps burning \times hours burning \times average kw., which is equal to the total number of kilowatt-hours supplied.

The equation is applicable to any lighting system and may be applied to the entire lighting load of a central station. If the lamp life is known, any one of the other three factors could be determined.

A WAR-TIME EXPEDIENT FOR SUPPLYING SERVICE

Standard Distribution Transformers Connected Inside Delta Transformer Bank to Serve as Boosters Where Proper Units Were Not Available

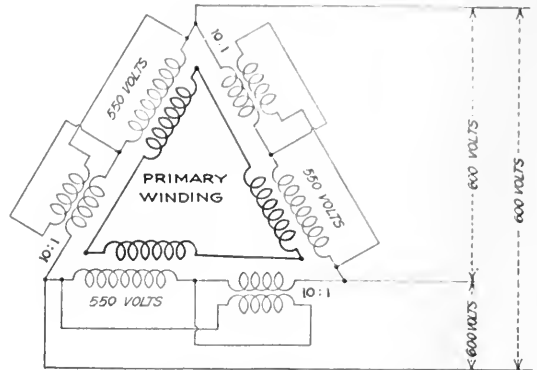
BY J. R. BALDWIN

Being called upon to serve a customer having 600-volt apparatus and having only 550-volt transformers without taps for the service, a Southern power company employed the following scheme to get the higher voltage: Three 50-kva., 1100/110-volt distribution transformers were connected so that the low-voltage windings were in series with each of the 550-volt transformers, the high voltage (1100-volt) windings being connected across the 550-volt terminals of the large transformers. The connections are shown in the diagram reproduced.

By connecting the distribution transformers directly across the secondaries of the larger transformers as

shown, the boosting voltage was brought in phase with the large transformer voltage and added directly to it.

The current in the delta is not so large as the line current, being equal to the line current divided by 1.73, and hence smaller transformers were used than could have been used if they had been connected



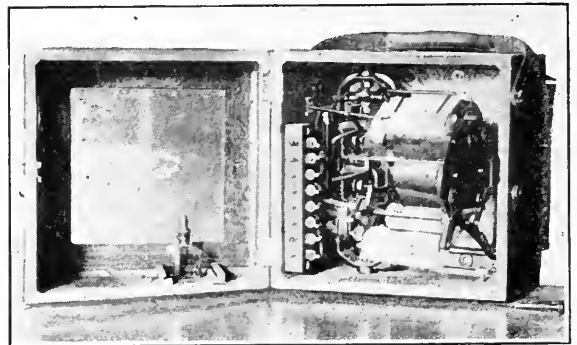
SUPPLYING 600 VOLTS FROM 550-VOLT TRANSFORMERS MADE
NEW EQUIPMENT UNNECESSARY

in the lines. No fuses were connected in the high-voltage sides of the distribution transformers as the voltage on these windings would reach an excessively high value if open-circuited, the action being similar to an open-circuited current transformer. This installation has given excellent service for a period lasting more than six months.

INCREASING ACCESSIBILITY OF CURVE-DRAWING METERS

Meter Case Sawed Diagonally Facilitates Maintenance and Adjustments—Chart Roll Can Be Replaced Without Loss of Time

To increase the accessibility of the interior mechanism of a curve-drawing meter used by the Cumberland County Power & Light Company, Portland, Me., the meter case was sawed diagonally into two parts as shown in the illustration presented herewith. When the case is opened on a bias, the clock mechanism and paper carrier project enough to bring them within easy



ROLLS CAN BE QUICKLY REPLACED DURING A TEST

reach for repairing, ink-well refilling, etc. When a test is in progress the roll can be quickly replaced. The instrument was originally fitted with a hinged cover and considerable time was wasted in reaching the mechanism.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

CLASSIFICATION OF SALES DEPARTMENT EXPENSES

Records of Eastern Company Show that Profit of
Department Is Covering All Expenses and
Leaving a Satisfactory Margin

With the increasing effort on the part of central stations to eliminate the waste in the routine of administration and develop sales department work to a point where it will be self-supporting, the question of expense classifications becomes important. The following figures from an Eastern central station are therefore interesting. This company maintains a sales department under which it operates a very complete electric shop. It also is very active in the sale of electric motors through its power engineers. In 1917 the total selling expense amounted to \$78,049.24, which was classified under the following heads:

	Per Cent
Salesmen's salaries.....	42
Salesmen's expenses	3
Stationery and printing.....	1
Postage	1
Telephones and telegrams.....	4
Rent	3
Miscellaneous supplies and expenses.....	3
Electric shop expense.....	29
Main office and three branch offices.....	5
Newspaper advertising	3
Miscellaneous advertising	1
Promotion work	5
Total	100

The gross profit on the sale of merchandise by this organization last year amounted to \$58,822.53, not including motors. This means that the sale of merchandising alone is already carrying 75 per cent of the entire sales department. In 1916 these sales covered 50 per cent. By including the profits of the power department the entire expenses of the selling function were covered last year, however, with a very satisfactory profit.

THE PUBLIC AS PROTECTOR OF LABOR AND CAPITAL

Pacific Coast Company Undertakes Educational
Work to Show Citizens Their Relation
to the Public Utility

In an effort to educate the public to the relation that exists between the people, the city and the utility, the Puget Sound Traction, Light & Power Company of Seattle, Wash., has been running occasional paragraphs in *The Electrogram*, the bulletin which the company distributes to the public. The latest, entitled, "Public Must Protect Employees and Investors," follows:

The public has a right to expect from a utility the best service possible at the lowest cost possible under the most efficient management, taking into consideration, of course, the conditions and cost elements involved; but the public loses sight of its own interests if it fails to recognize the

rights of the utility's employees and of the investors whose money has made the existence and operation of the utility possible.

The public needs the service, and in response to that need the utility came into existence. It was created to furnish the service the public requires. That at once created a community of interest between the public and the utility, and that interest is a fixed factor in community development. It was necessary first to find investors to construct the utility and workers to operate it. The operation is essentially for the benefit of the public.

The employee has a right to wages that will conform to the value of the service rendered—not to the company, but to the community. He is entitled to fair treatment and to a fair attitude on the part of the public toward the utility in which he is interested as a worker.

The investor is the real foundation stone of the organization. Without him there could be no utility, and without the utility the public would be without service, which would force the community to stagnate and to cease to expand and develop.

So when the public compels the investor to suffer by treating him as if he were an outsider not entitled to consideration it loses sight of its own interests.

No community can afford to destroy the confidence of investors in its fairness and integrity.

COMPANY'S EXPERIENCE WITH EMPLOYEE LOAN FUND

Amount of \$200 Laid Aside for the Emergency Use
of Employees in Sums Which Range
from \$10 to \$50

Some time ago the New Bedford (Mass.) Gas & Edison Light Company instituted a loan fund for the assistance of employees who might be in need of a little extra money to meet emergencies. The fund consists of the sum of \$200, which has been laid aside by the executive committee to be loaned to employees who on account of illness or for some other good reason have got behind in the payment of their regular expenses. The money is issued in sums of from \$10 to \$50 upon receipts signed by the employee, with the understanding that from one to two dollars a week will be taken out of his weekly pay to reimburse the company for the money advanced. No interest is charged.

The receipt is given to the employee after the full amount has been restored. In commenting on the working out of this idea, Charles R. Price, treasurer of the company, gives these interesting details:

We have had several occasions calling for the use of this fund. While it was started to help in particular emergencies, we have applied it for some half dozen of our employees. Our first case was one of the line gang who had been injured and, while his pay through the insurance and this company was kept up to the full amount, his wife was obliged to go to the hospital to await the expected baby and the three young children at home had to have a housekeeper to look after their daily wants. These expenses were beyond the daily receipts of the employee and the allowance afforded was very welcome.

Another case was where one of our employees had recently moved from another city and needed some extra

money in order to move his furniture and start housekeeping in a proper way. Another case was that of a man who had started housekeeping with a very meager allowance for furniture and had an opportunity to purchase an outfit from an acquaintance who was leaving the city. Another loan was to a man who wanted to enlist but owed several bills about the city for clothing, etc.

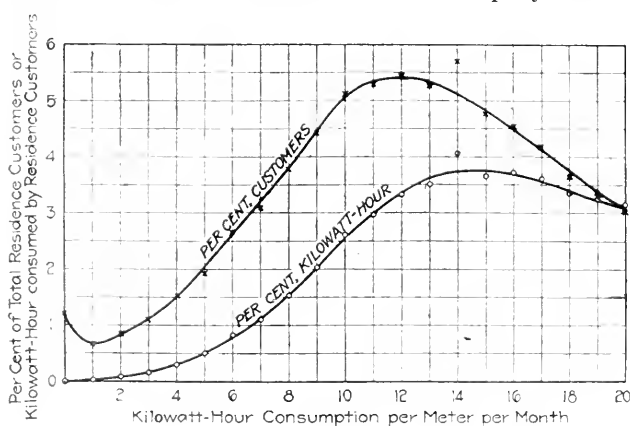
It is the practice of this company to pay all employees full wages if injured in our work for the two weeks that are not covered by the insurance policy and to assist them through the period of convalescence. We have also kept up the pay of all employees who enlisted or have been drafted into the service, paying their families the difference between the government pay and what they were receiving while in our employ.

ANALYSIS OF CONSUMPTION BY SMALL LIGHTING CUSTOMERS

Of Residential Customers 71½ Per Cent Use Less than 20 Kw.-Hr. Monthly as Against 34 Per Cent of Commercial Customers

In preparing a new lighting rate for presentation before a public service commission, a central station found it necessary to analyze the monthly consumptions of small lighting customers. A year's business was taken as a basis in order to eliminate discrepancies between winter and summer requirements, and the customers consuming 20 kw.-hr. or less per month were tabulated in groups by consumption and further divided into residence and commercial classes.

The curves (Figs. 1 and 2) show the results of this analysis, the figures being transformed to a percentage basis. Taking first the curves for residence lighting customers, it will be noted that, eliminating the unusual number of customers having a consumption of 14 kw.-hr. per month (this being the only point which does not fall close to a smooth curve), customers having a monthly consumption of 12 kw.-hr. exceed the rest in number, while the energy curve reaches a maximum at about 15 kw.-hr. It is interesting to note that customers falling into this class (20 kw.-hr. per month or less) constitute 71.5 per cent of the total residence lighting customers on this company's lines.



FIGS. 1 AND 2—ANALYSES OF RESIDENCE AND OF

than the small residential customers. But 34 per cent of the commercial lighting customers fall into the group having a monthly consumption under 20 kw.-hr., and their consumption aggregates only 3 per cent of the

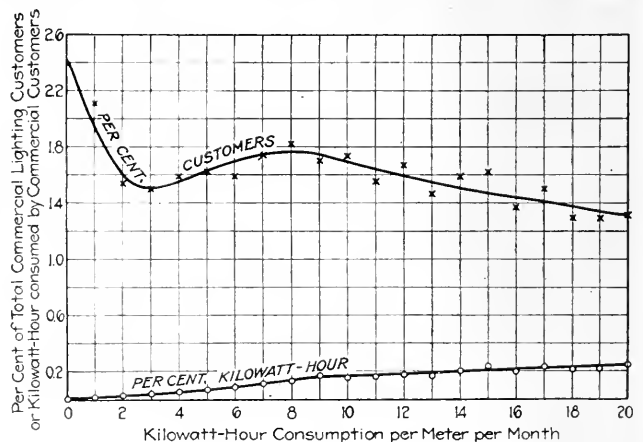
TABLE I—DATA ON RESIDENCE LIGHTING CUSTOMERS

Monthly Consumption, in Kw.-hr.	Per Cent of Total Residence Lighting Customers	Per Cent of Total Energy Consumed by Residence Lighting Customers
0—20	71.5	43.9
21—30	17.0	21.3
31—40	5.7	10.1
41—50	2.3	5.3
51—60	1.1	3.0
61—70	0.6	2.1
71—80	0.4	1.5
81—90	0.3	1.1
91—100	0.2	1.0
101—150	0.4	2.7
151—200	0.2	1.6
Over 200	0.3	6.4

TABLE II—DATA ON COMMERCIAL LIGHTING CUSTOMERS

Monthly Consumption, in Kw.-hr.	Per Cent of Total Commercial Lighting Customers	Per Cent of Total Energy Consumed by Commercial Lighting Customers
0—20	34.0	3.0
21—30	10.8	2.6
31—40	7.5	2.5
41—50	5.6	2.4
51—60	4.5	2.4
61—70	4.0	2.5
71—80	3.3	2.3
81—90	2.7	2.2
91—100	2.1	1.9
101—150	7.8	9.1
151—200	4.6	7.5
201—250	3.5	7.4
251—300	2.4	6.3
301—350	1.8	5.6
351—400	1.2	4.2
401—450	.9	3.4
451—500	.5	2.2
Over 500	2.8	32.5

total for commercial lighting customers. In the particular district here considered commercial lighting customers were 16 per cent as numerous as residence lighting customers; however, their total requirements



COMMERCIAL LIGHTING CUSTOMERS' CONSUMPTION

Their aggregate consumption amounts to 43.9 per cent of the energy taken by all residence customers. The relative importance of the higher classes of residence customers from the standpoint of numbers and energy requirements is shown in Table I.

As might be expected, the small commercial lighting customers are, relative to the rest of their class, of less importance both as to numbers and requirements

aggregated 83 per cent of the consumption of the residence customers. This is of course due to a number of large consumers. The minor importance of the small commercial lighting customers as compared with those of higher consumption is illustrated in Table II.

The city district from which these figures were taken has a population of about 90,000. There are no private plants.

TEN VITAL POINTS FOR ELECTRIC RANGE SALES

In Addition to a Proper Education of Salesmen and Customers, the Central Station Must Always Stand Ready to Serve

BY F. J. ALLEN

Electric Range Specialist, Westinghouse Electric & Manufacturing Company

There are at least ten vital points which every central station should take under consideration when considering the question of range campaigns. A thorough co-operation of the commercial, engineering, construction and bookkeeping departments is the first necessity. The heads of these departments should meet and have a complete understanding of what the central station is contemplating, so as to make the necessary adjustments in their respective departments to give the greatest assistance possible.

The next step is to prepare the selling force. In this connection it is suggested that the assistance of a specialist from the factory be secured. It is essential that the men be sold on the idea of cooking by electricity, its great conveniences, economy and cost. This leads to vital point three, namely, a thorough instruction as to the construction, operation and care of the range. The specialist will undoubtedly lay emphasis on the fourth vital point, that the sale of the range consists of three distinct steps, the sale, the demonstration and the servicing.

Next, the interest of the public must be aroused. Nothing appeals to the public more than demonstration lectures, and here again the support of a factory specialist is advisable. The cooking of an entire meal before an audience of carefully selected "prospects," during which a lecture is given as to the economies, conveniences, fundamental differences and cost of electricity as compared with coal or gas, is an attractive method of procedure. The presentation for inspection of the finished meal at the completion of the lecture is the crowning event of the demonstration. Care should be taken to see that a complete list of those attending the lecture is made for follow-up purposes.

A systematic method for following up these prospective customers is highly essential and can best be handled along the card-index system plan. For every "prospect" there should be a card, and the result of each visit should be listed thereon. When a range is purchased this card should go into the "sold file," and upon it should be kept a detailed report of the operation and servicing of the range, dating from its installation and demonstration. It will be found that this record of dealings with the customer will often prove highly valuable in handling complaints, etc.

It is generally admitted that a deferred-payment plan is necessary. However, whether purchased for cash or on deferred payments, it is advisable to have the buyer sign an agreement according to the plan of purchase, as the signing of such an order has a psychological effect.

The necessity of sufficiently heavy wire and proper transformer capacity is obvious; but in addition every range should be thoroughly explained as well as the fundamental difference between cooking with coal and with gas or electricity. Nearly all ranges are accompanied by instruction books.

Number nine in the vital points is particularly im-

portant, for there is nothing like satisfied customers as a means of desirable advertising. There are bound to be questions arise from time to time regarding the cooking of certain foods, and the author has found that the best solution of these was obtained by getting the different users of the range together. Clubs have been formed of all the purchasers, they electing a president and a secretary. Weekly meetings are held at the homes of the members, the first hour being given over to general discussion of successes and failures. Each member brings a written report on a small card previously given out by the secretary, setting forth the ingredients and electric instruction for the most satisfactory dish she has prepared during the week. These cards are filed at the central station as a "ready recipe" reference for members of the club. The hostess then prepares and cooks some favorite dish as an object lesson for the other members of the club. The meeting is written up in the local papers, and the advertising secured thereby is of the highest character.

The observance of all the foregoing points will have little weight unless the central station equips itself with the necessary parts for quick replacement of any portion of the equipment which may prove defective.

GETTING DELAYED METER READINGS BY POST CARD

Customers Are Asked to Mark the Position of the Meter Hands in Cases Where Reader Could Not Get the Record

Much time is lost by the meter reader through customers not being at home when he calls. In order to get around this difficulty the Twin State Gas-Electric Company of Brattleboro, Vt., asks the customer to read his

10,000 1,000 100 10

Will you kindly assist us in obtaining a reading of your meter by marking the position of the hands on your meter on the illustration and mailing us this card.

Date of Reading _____

Meter Number _____

Name _____

Address _____

POST-CARD METER RECORD

own meter when the company's reader has not been able to do so on his regular calls.

If the meter reader cannot get in, he slips an addressed post card, like the one shown, under the door or puts it in the mail box. This delayed-meter-reading card requests the customer to mark the position of the hands of the meter on the card and mail it to the company. The same consumer is seldom asked to make his own meter reading for two consecutive months; therefore any inaccuracy in the customer's reading is corrected by the company's man on his following visit. Experience shows that the consumer much prefers this method to having his bill figured on the basis of last year or to being billed for two months next time. Space on the card is provided for the date of reading, the meter number and the name and address of customer.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Types of Induction Motors.—J. W. KIRKLAND.—The slip-ring motor is primarily a variable-speed machine and is essential for such purposes as hoisting or variable speed traction. This type is capable of exerting a very high starting torque while taking current approximately proportional to the torque. Practically 90 per cent of the total cost of maintaining motors is in connection with collector rings, brush gear and the external starting arrangements such as liquid starters or controllers. The squirrel-cage motor possesses great advantages over the wound-rotor type for all purposes where the requirements are not for variable speed or exceptionally high starting torque. There are no difficulties in building squirrel cage motors to run at a speed of 1500 r.p.m.—*Journal of South African Institution of Engineers*, April, 1918.

Armature Reaction in Single-Phase Alternators.—F. D. NEWBURY.—A continuation of an article on "Armature Reaction of Polyphase Alternators." The single-phase type of machine can be investigated as to armature reaction in the same manner as a three-phase machine by constructing successive flux diagrams showing the single-phase armature flux during the actual rotation of the field. The effect of lagging current and the cage winding in producing a flux wave is given, together with the armature flux waves taken at several different times. The time and space relations of the flux set up by the armature cage windings are also illustrated when constant armature flux is assumed. A comparison of the result and fluxes shows that the field established by a single-phase cage winding is a rotating field of constant value as in polyphase windings, but the speed of rotation with respect to the rotor is twice that of the rotor speed and the direction of the rotation is opposite to that of the rotor. The effects of armature reaction on generated voltage, the power-factor effects and the results of the armature-flux cage winding are the same for the single-phase as for the polyphase machine with a few exceptions.—*Electric Journal*, May, 1918.

Essentials of Transformer Practice, Part X.—E. G. REED.—The object of this section is to give a general analysis of transformer problems without the use of mathematics. Different types of construction, selection of transformer types and the effect of changing the proportions of a transformer are considered. The ratio of the iron and copper areas and cross-sections to the distributed shell and core types are compared. Two methods of designing are outlined and methods of changing the losses after the transformer has been designed are considered.—*Electric Journal*, May, 1918.

Generation, Transmission and Distribution

Using Volcanic Steam in the Production of Energy.—The province of Tuscany, in Italy, is seamed with volcanic crevasses which emit steam and gas at high

temperatures. In 1916 Professor Luigi initiated a project to use this steam to produce electric energy. It was found impossible to apply it directly to the prime movers without damage to the machinery, but by mixing it with pure water it was found practicable to use it with low pressure or medium-pressure boilers without any harm resulting to the steam turbines. At the present time the cities of Volterra, Massa, Sienna, Leghorn and even Florence are receiving at 16,000 volts and 36,000 volts energy generated by this means in a power house where the installation is composed of 3000-kw. turbo-alternators driven by 4000-hp. turbines. It is proposed soon to extend the application of the system to large steel foundries which are now entirely dependent upon coal. It is too early to give exact figures as to the economic saving that may be looked for, but the promoters evidently expect this to be large.—*L'Industrie Electrique*, May 10, 1918.

Efficient Combustion of Bituminous Coal with Under-feed Stokers.—RUSSEL C. HINE.—In discussing this subject the author considers chiefly the kind, quality and characteristics of the fuel, thickness of the fuel bed, rate of feed, formation of clinker, draft and furnace construction. From an operating viewpoint the over-all efficiency decreases as the amount of volatile increases. The rapid distillation and heating that occurs when the furnaces are forced may result in incomplete combustion if the combustion chamber is not of ample size or if the air supply is not properly regulated. The article contains a curve showing the percentage of volatile in coal and illustrations of under-feed stokers.—*Industrial Engineering*, May, 1918.

Installations, Systems and Appliances

Acid-Proof Alloys.—Some experiments by Dr. R. Irrmann, described in *Metall und Erz*, have an interesting bearing on acid-proof alloys. It has been assumed that electrolytic corrosion tests of voltaic couples of two metals afford an indication as to the corrosion of the alloys of those metals. The investigation by Dr. Irrmann of alloys of copper and nickel, to which tungsten and iron were further added, apparently disproves this assumption. Much depends upon the proportions and the formation of compounds. An alloy of nickel with 20 per cent of tungsten was more resistant to attack by strong hot sulphuric acid than nickel alone, but was difficult to machine and expensive. A voltaic couple of nickel and copper gave an emf. of 0.55 volt, which soon decreased to 0.25 volt. The nickel was dissolved, the copper becoming polarized with hydrogen. An alloy of 47 per cent copper and 4.98 per cent tungsten proved highly persistent and mechanically strong. The electric resistance was greater than that of constantan. Very good results were also obtained with ternary nickel—tungsten—copper alloys. But quaternary alloys, containing also iron, proved far superior to the ternary alloys.—*London Electrician*, April 26, 1918.

Electrophysics and Magnetism

Thermo-Electromotive Force of Some Alloys.—M. A. HUNTER and J. W. BACON.—The measurements were obtained by joining a number of the wires directly to a standard iron-constantan thermocouple with soft Swedish iron wire. The standard thermocouple indicated the temperature of the hot junction. Nickel-chromium-alloy, copper-nickel chromium, iron-nickel, iron-nickel-chromium, nickel-manganese and iron-nickel-manganese curves and tables are presented. Nickel chromium alloys and copper-nickel-chromium alloys will meet all conditions which have been laid down for a satisfactory thermocouple because their curves are approximately straight lines. The materials have a high melting point and resist oxidation very well.—Extracted from paper presented before the American Electrochemical Society, April 28-May 5, 1918.

Electrochemistry and Batteries

Catalytic Action of Carbon in Batteries.—Contribution to the Société Internationale des Electriciens by M. Fery. Depolarization is effected through the action of the air, but the part played by the carbon in this action is somewhat obscure. On first thought it would seem that the only factors of importance in facilitating the catalytic action of carbon in conveying oxygen from the air are the nature of its surface and its porosity. But experiments have shown that the constitution of the carbon is also of importance. Seeing that all catalytic agents are affected by the presence of small impurities, it is hardly surprising that carbons apparently similar differ widely in their behavior. Moreover, certain qualities of sal ammoniac containing traces of iron and lead also hinder the action of catalysis. The presence in the pores of the carbon of a gelatinous film of metallic hydroxide has a deleterious effect. The purity of the carbon is therefore a vital factor. Some results are given for batteries using the special carbons manufactured by the Société Gallot as a result of M. Fery's researches. A battery containing 100 gm. of sal ammoniac with 77 gm. of zinc, and supplying 20.8 milliamperes (0.5 amp.-hr. per day) consumes 1.27 gm. of zinc per ampere-hour, as compared with a theoretical consumption of 1.2186 gm. The efficiency is thus nearly 95 per cent. The consumption of sal ammoniac was also considerably decreased, being only 1 gm. per ampere-hour. If the above current is maintained by adjusting the external resistance, the emf. falls from 1 volt to 0.5 volt in four months, and the cell will then continue in action if the zinc is reversed.—London *Electrician*, April 19, 1918.

Telegraphy, Telephony and Signals

Synchronous Signaling and Safety at Sea.—Recent developments in methods of signaling between ships and shore stations, as well as between ships at sea, with the object of averting collision, were outlined by Prof. J. Joly before the Royal Institution on April 9 and 10. He said that the difficulty attending the use of light signals in foggy weather has been overcome by the use of wireless signals. The latest type of Fessenden oscillator has opened up new possibilities in sound signaling in water, this device enabling the range of audibility to be increased up to 30 miles per hour and also permitting signaling by Morse code by the ordinary telegraphic key. Furthermore, the receipt and emission of signals

can be accomplished by the same apparatus. To these advantages are added the possibility of locating icebergs by reflection of sound and the determination of depth of water beneath moving vessels by echo from the sea bed. The latest development is the employment of wireless telephony. The installation of the radio-phone on the De Forrest system at Point Judith, on the western approach to Narragansett Bay, is the first of its kind. This station communicated its name over a considerable distance and on vessels approaching within the danger zone gave a second warning.—London *Engineer*, April 19, 1918.

Miscellaneous

Relative Resistance of Various Hard Woods to Injection of Creosote.—CLYDE H. TEESDALE and J. P. MACLEAN.—When wood is impregnated with preservatives some species are more easily penetrated than others, so that for proper treatment the species should

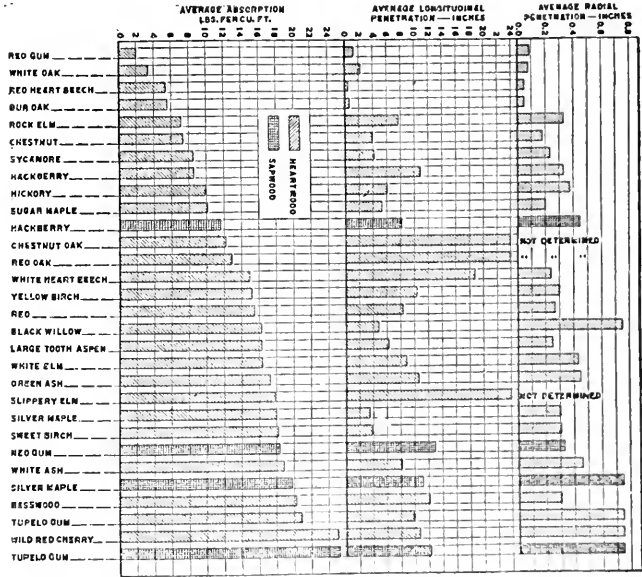


CHART OF ABSORPTION CHARACTERISTICS FOR VARIOUS HARD WOODS

be grouped according to their relative resistance to injection, otherwise part of a cylinder charge might receive a heavy treatment and another part a very light one. The accompanying chart shows the relative absorption characteristics of different kinds of pole timber. A very complete bibliography of departmental publications on this and allied subjects is included.—*Bulletin No. 606, U. S. Department of Agriculture.*

Pulverized Fuel.—(Report of fuel and fuel-handling committee of the Naval Consulting Board.) In addition to the definite economies that have been claimed for the use of pulverized coal as a fuel in stationary practice, there are other advantages which occur in marine installations that help military operations. By a simple and immediate adjustment of the burners powdered coal as a fuel may be made to emit dense clouds of smoke to serve as a screen; in an emergency the ship's boilers may be rapidly forced; a great reduction in the fire-room force is effected as compared with the use of solid coal; the supply of fuel oil in the United States is limited, and a means of conserving fuel oil for naval vessels already equipped to burn oil is necessary.—*Journal of American Society of Mechanical Engineers*, May, 1918.

Reversing Motor-Planer Control

To the Editor of ELECTRICAL WORLD:

Sir: The subject of reversing motor-planer control, covered in the Jan. 12 issue, points out the feature of dynamic braking for every reversal of the platen when the machine is producing work. From this the reader would be inclined to believe that this feature is essential and the only means of operating satisfactorily.

Dynamic braking is not necessary for the most efficient operation, when the planer is in service. With one system particularly familiar to the writer the motor is thrown directly into reverse just before the platen reaches the end of the stroke, but the armature current is limited to a fixed amount by proper proportioning of the resistances. Two starters are used mounted on the same panel. When the table switch is tripped by the "dogs" the motor is started up in the reverse direction on the idle starter, with no loss of time and without first slowing up the platen by dynamic braking. This gives a quicker, smoother and more accurate reverse than with any system using the dynamic brake. It has also been demonstrated with this system that a truer line of reversal is obtained; that is, the point at which the tool stops will be practically along the same straight line at each reversal. On a recent test, a 35-hp. controller of this type showed a variation of $\frac{1}{4}$ in. (0.63 cm.) on a 2-ft. (0.608-m.) stroke, which is closer than can be obtained by dynamic brake. This is often important when working to a recessed shoulder, etc.

In the system mentioned dynamic braking is applied only when the operator desires to stop by push-button or tumbler-switch control, overloads or failure of voltage. This system gives all the desirable features of jogging and hand control when setting up work and a longer life to the contacts.

MONITOR CONTROLLER COMPANY,
W. G. Merowit, District Manager.
Baltimore, Md.

Ventilating Cable Ducts

To the Editor of ELECTRICAL WORLD:

Sir: In an editorial in the April 20 issue of the ELECTRICAL WORLD entitled "Ventilating Cable Ducts" you make the following statement: "The experiments described by Messrs. Keating and Mueller are certainly of considerable value in showing for the first time on a really practical scale what can be done if necessary to keep down dangerous temperature in high-tension cables." The experiments referred to were in connection with the cooling of ducts with forced ventilation, a method studied by the Duquesne Light Company of Pittsburgh, Pa.

Some very careful tests of this kind were made by the writer about fifteen years ago, with the result that the temperature was found to "build up" toward the exhaust end of the conduit and, unless an extraordinary amount of energy was used to drive the air through the ducts at high velocity,

Readers' Views and Comments

higher temperatures of the cable resulted than if the blowers were not running. These tests were made in a 200-ft. (60.9-m.) section of conduit. This "building-up" effect would be much greater where the manholes are the usual distance of 400 ft. or 500 ft. (122 m. to 152 m.) apart.

Beginning on page 233 of Volume XXXIV of the *Transactions* of the American Institute of Electrical Engineers, there is a paper by the writer on "Effect of Moisture in the Earth on Temperature of Underground Cables." The method there described has been adopted by the Niagara Falls Power Company to "keep down dangerous temperatures in high-tension cables" and has been in extensive use for at least six years. Two other large companies at Niagara Falls have adopted the same method of water cooling. No cable failures from electrolysis have been experienced, and if adequate bonding of cable sheaths and ground connections in manholes are provided there will be no trouble from this cause.

The installation of the plant, as well as the cost of operation and maintenance, for cooling cables in ducts by water is very slight compared with the cost of a blower plant.

Niagara Falls.

L. E. IMLAY.

Self-Inductance of Long Reactance Coils

To the Editor of ELECTRICAL WORLD:

Sir: I read with much interest H. B. Dwight's article on "Self-Inductance of Long Reactance Coils" in the issue for Feb. 9. While Mr. Dwight's work is well done and is of academic interest, it falls short of meeting practical manufacturing conditions.

In usual manufacturing it is not possible with present production methods to meet exact conditions except by overwinding a reactance and then adjusting to exact value. According to General Electric Company data No. 14,815-A, which are representative of others, copper wire is subject to variations as follows:

1. Bare diameter 1 per cent high or low down to 10 mils and 0.1 mil higher or lower below 10 mils.

2. Cross-section 2 per cent high or low down to and including 10 mils diameter.

3. Weight 2 per cent high or low down to and including 10 mils.

4. Temperature coefficient 0.00393, or $1/254.5$ per deg. C. from 20 deg. C.

On account of these variations in wire of commercial sizes and the impossibility of exactly determining spacing of wires, especially in small coils, it is not necessary to use any method which has a greater accuracy than 2 to 3 per cent.

Mr. Dwight would use several different formulas for different coil shapes. Here the error of taking the wrong formula is possible, which means elaborate checking of all results.

I have found it convenient to use a universal formula and curves based on theoretical and empirical considerations. The formula and curves are given by Brooks and Turner in Bulletin 53, University of Illinois. The Brooks-Turner formulas and curves have been checked and found to be correct for all usual engineering and manufacturing problems.

H. E. WEIGHTMAN,

Chicago, Ill.

Engineer.

Conserving the Small Water Powers of Alabama

To the Editor of ELECTRICAL WORLD:

Sir: There are three kinds of natural material resources which the nations must conserve, and more especially should the United States and our allies at the present time use drastic means along all lines of conservation in order to win the war within the next three years. The non-renewable resources, such as coal, ore, oil, gas, phosphates, manganese, etc., in which utilization, even though without any waste, necessarily diminishes the supply for future generations, form the first class. The self-renewing resources, such as forests, which time will replace for future generations, form the second class, and water power forms the third. If water power is not utilized, it is wasted, with no good results to anybody, and instead of restriction, as with the other classes, the greatest possible use should be advocated.

Alabama is wonderfully blessed with numerous small streams where from 10 hp. to 200 hp. could be developed, and the number of large streams is great compared with most other states. Small streams which can find enough storage to produce 50 hp. ten hours a day for manufacturing purposes are saving fuel at the rate of nearly 400 tons a year and thereby rendering a great service to coal conservation.

We have to-day in our state more than 800 water-power developments ranging from 6 hp. to 50 hp., and more than eighty developments ranging from 50 hp. to 200 hp. This is only a beginning, because the future possibility for large and small water-power developments in Alabama is really great. We are now witnessing the progress of the project at Muscle Shoals, which will ultimately generate 50 per cent more horsepower than is now produced at Niagara Falls. As fuel is scarce and many power stations are greatly inconvenienced in getting their coal supply, it seems to be the proper time to diminish restriction all down the line and to use public authority so far as possible to encourage the development and utilization of every bit of water power which can be commanded.

WILLIAM L. WHITE, B.Sc., M.E.

Testing Engineer T. C. I. & R. R. Co.
Laboratory, Ensley, Ala.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

CALIFORNIA'S COMMISSION ACTS IN POWER CRISIS

Takes Over the Distribution of Electricity in Central and Northern Sections and Appoints a Power Administrator

The Railroad Commission, with the approval of the electrical power companies interested, has taken over the administration of electric power in northern and central California to meet war emergencies. In connection with this action the commission has created a Department of Power Administration, to be in charge of H. G. Butler, for five years assistant chief engineer of the commission.

The power companies have agreed to have their entire output pooled and distributed by the Railroad Commission so as best to serve the need of all consumers in the present crisis, as outlined in these columns last week. The expenses of the Power Administration will be borne by the power companies. Administrator Butler has announced that no power priority list has been adopted and that effort will be made to avoid the necessity of such a list by the utmost conservation of power.

If it becomes necessary to create a priority list, this will be done only after consultation with the Food and Fuel Administrations, the Emergency Shipping Board and the Federal Reserve Board. It is hoped that the power pool will improve economy so as at least to postpone curtailment of service.

WAR INDUSTRIES BOARD SEEKS CAPITAL FOR POWER PLANTS

**Bill to appropriate \$200,000,000 to increase power supply in East is sent to Congress—
Frederic Darlington Approves**

The War Industries Board has sent to Congress the draft of a proposed bill to appropriate \$200,000,000 to increase the power supply in overloaded industrial centers of the East. Cities along the Atlantic seaboard in which munitions and materials for war are being manufactured would be the especial beneficiaries under the measure, which has been committed to the care for the present of Representative Kitchen, chairman of the House ways and means committee, on the House side, and of Senator Martin of Virginia, chairman of the appropriations committee, on the Senate side.

The measure, it is understood, was drafted by Frederic Darlington, chief of the power-plant section of the War Industries Board, at the request of Bernard M. Baruch, chairman of the board, and it is said to have the backing of President Wilson.

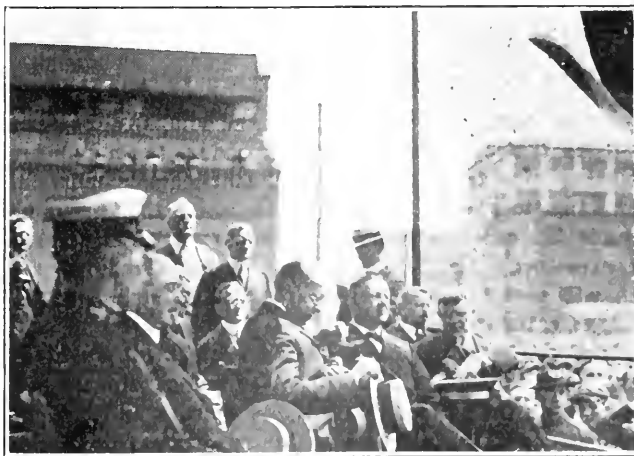
The measure is frankly emergency legislation, made necessary by the apparent need of the industrial section of the East for more power with which to turn

out munitions of war. It is stated in Washington that the power supply of the East is obviously overloaded, and that while different sections of the country are also raising the question of not having sufficient power with which to turn out the munitions and materials needed by the government, it is the intention of the War Industries Board to see that the Eastern section of the country is supplied first, and then endeavor, perhaps by additional legislation and appropriations, to supply other sections of the country.

Until recently, it is stated in Washington, power companies without sufficient equipment and without sufficient funds to purchase equipment had expected to be assisted in obtaining capital and equipment through the War Finance Corporation; but now that that body has ruled in a manner which makes it unlikely that power companies can be so supplied, the need for empowering legislation of a specific and emergency character becomes apparent as one of the necessities for winning the war. It is said in Washington also that some of the power companies have come to see that if they borrow money now for additional equipment which might not be needed at the end of the war they will be doing themselves more harm than good.

It is said in Washington that much more than the \$200,000,000 proposed for appropriation will be needed, inasmuch as in the Pittsburgh district alone, which supplies power for a radius of 100 miles, it is estimated that \$40,000,000 or \$50,000,000 for additional plant facilities might be needed.

Secretary Daniels at the General Electric Works



In his tour of inspection in the Empire State Secretary of the Navy Daniels visited the Schenectady Works of the General Electric Company. With national and State officials he inspected the work being done for the United States Navy Department, paying particular attention to the turbines and turbine gears for destroyers and to the electrical equipment for battleships. At noon Secretary Daniels addressed the 23,000 General Electric employees.

CHARLES L. EDGAR ON WAR AND RATE PROBLEMS

Asking to Have Boston Investigation Postponed
Until Close of the War, He Analyzes
Conditions and Prospects

President Charles L. Edgar of the Edison Electric Illuminating Company of Boston appeared as a witness on June 6 before the Massachusetts Gas and Electric Light Commission in connection with the company's motion to defer the pending rate investigation until the close of the war. He supplemented previous statements regarding the matter as published in the *ELECTRICAL WORLD* of May 18, page 1053, and June 8, page 1186.

Mr. Edgar said first that the shortage of labor in accounting departments was the cause of bi-monthly billings being considered by the larger central stations. He felt that the practice has great disadvantages, tending to increase bad debts and not cutting down accounting work pro rata. Despite the disadvantages, it may be necessary to adopt the plan. The accounting staff shortage is one of the most serious obstacles to a rate investigation under present conditions.

Referring again to the retention of the firm of D. C. & W. B. Jackson of Boston and Chicago to analyze the company's earnings and rates and point out specific prices considered too high or too low, Mr. Edgar said that on account of the inroads of the war into the staff of this firm and the recent commissioning of its heads for government service the report on rates will not be ready for some time.

"If under the circumstances we were going into an investigation such as is intimated by these questions" (presented by the advocates of a rate reduction), the speaker declared, "I am very much at a loss to know what we could do. Apparently, judging by the questions, this is proposed to be as thorough an investigation as has ever been made by anybody. It deserves all our thought and all your thought. . . . Without the help of a firm like that of Mr. Jackson, and with all of us busy on more or less important things, acute things to which we have to give our thoughts, I don't know just what we could do if we had to go on with this case."

HOW CONDITIONS HAVE ALTERED IN A YEAR

A year ago, the witness stated, the company took the position that the time had come to reduce the maximum lighting rate from 10 cents to 9 cents, and a material reduction in power prices was also in sight. This is no longer the case, in view of the extraordinary increase in expenses. Mr. Edgar estimated that daylight saving will cost the company nearer \$400,000 than \$250,000, as estimated at the last hearing.

"Dr. Garfield told us week before last in Washington," said Mr. Edgar, "that he was going to put lightless nights into effect this year on Sept. 1 and that he had no doubt there would be more workless days this winter than last."

The witness was of the opinion that a continuance of the recent dimming order of the police in the New York district would cost the central-station interests

\$1,000,000 a year. The same situation may be met in Boston at any minute.

Commissioner Schaff intimated that the company's staff might meet the demands of the investigation without the need of calling in outside assistance.

Mr. Edgar said that a reduction of 1 cent per kilowatt-hour in the present Boston price would mean about \$400,000 decrease in revenue. He had not considered the question of making a tentative maximum price for a certain period, feeling that in due course the company will have to satisfy the commission that not only should there be no decrease, but that there should be an increase, and probably a large increase, in all prices. Another million dollars of income should be obtained from existing customers within the next year or two, taking into consideration the prices that will have to be paid for coal and the loss of income from conditions beyond the company's control, such as industrial shut-downs.

THE COAL CLAUSE WILL NOT COVER ALL THE LOSS

"We will get quite a lot out of our coal clause," he said, "but we cannot get it all. We cannot even get all that we should in that way in connection with our coal, because some of our contracts tie us up for a year, and we have some longer contracts. But if we could put our coal clause on to our business we could get back half of the loss expected. The other half, if we get it, has got to come out of existing customers. . . . In normal times it is entirely possible, in my opinion, for your board, for the petitioners or for the company to decide, if prices are to be changed, where they should be changed. I think it is entirely impossible in these abnormal times for either your board, the petitioners or ourselves to determine where the prices should be changed scientifically at present.

"The whole theory of the rates is that they depend upon precedents, things that have grown up. For example, a city that had 90 per cent of its business light and 10 per cent power would have an entirely different ratio between the power and light prices from a city that had 90 per cent power and 10 per cent light. Our company is to-day in the position of not knowing what our ratios are from day to day. Our output yesterday was 25 per cent ahead of last year. . . . Now, the output of yesterday cannot, in my opinion, be figured by anybody as a proper basis of rates for the future."

In the past, Mr. Edgar intimated, rate reductions in unsaturated territory have generally been recouped in net earnings within twelve to eighteen months. The entry of the country into the war has made previous standards of prediction more or less unreliable, in view especially of the greatly increased prices in labor and supplies and the possibility of almost confiscatory taxes to help carry on the war. Under normal conditions the great bulk of new business obtained by the Boston company comes during the four fall months. After the holidays the people drift along without making changes in their living arrangements until late in the spring. Then the company in normal times gets a minor boom in new business, after which matters are quiet until after Sept. 1.

A Patriotic Reminder—Have You Bought Your War Savings Stamps?

Last summer, Mr. Edgar pointed out, he was willing to put into effect a reduction in the retail lighting rate from 10 cents to 9 cents and expected that a good part of the loss in net could be recouped by midwinter. A letter to this effect written to G. S. MacFarland, counsel for the petitioners, was introduced. At that time Mr. Edgar declared that if the price was reduced from 10 cents to 9.5 cents the result would be very largely negligible, whereas a reduction below 9 cents, say to 8.5 cents or 8 cents, would be so great as materially to decrease the company's income. The petitioners desired to know why a reduction below 9 cents did not appear feasible to the company last summer, and the answer was that the company felt it wise to offer a reduction large enough to be an incentive to secure new business but not so great as seriously to imperil its net earnings. Had the proposed reduction to 9 cents been made, the company would have utilized the occasion to conduct an extensive advertising campaign for new business; and even if it could have seen its way clear to go to 8 cents within a reasonable number of months at that time, Mr. Edgar felt that it would be good business and undoubtedly to the interest of the company and its customers to make the reduction at two different times and get the benefit of two advertising campaigns. It was then Mr. Edgar's opinion that by such a course the company would get twice as much business as though it had made only one campaign, even though the reduction was twice as much in the one as it was in each of the two.

LOSS THROUGH LOWER RATES CANNOT BE MADE UP

"Last July," said Mr. Edgar, "I thought revenue lost through reduced prices could be picked up. We know now that it cannot be. We know that the government will not let us pick it up. I have been told in the last two weeks that the government was going to stop the manufacture of appliances, heating devices and ranges, which will mean a great dropping off in new business. We are told that the general policy of the government is going to be to stop extensions. If we cannot make extensions we cannot get people to take more light, and if we cannot sell heating devices it means that our new business is going to be stopped. I am speaking now of the business that is reflected in the retail rates. I am not speaking of the war business. That is going ahead enormously, but if we cannot pick up our business we cannot get our income back by a reduction. We cannot do any advertising.

"It would be very bad judgment for us to go out and have an advertising campaign for new business, especially when we are short of money. Everybody knows we are short of money, and we cannot boom business and then refuse to take new customers; we are refusing them to-day by the hundred. It is inconceivable to me that anybody would suggest that we can afford reducing retail prices in the light of what is happening. The whole situation is in a very feverish condition. I think we know something about rates, and I think personally I know something about rates; but I would not know how to go at it at the present time, because if you pass upon the matter from a determination of conditions, conditions can change to-morrow."

Mr. Edgar said that up to Oct. 1, for six or eight months after the declaration of war, the company was going along about normally. The gross earnings were increasing 6, 8 or 10 per cent, and the net were increasing in like proportion. In November, 1917, the output dropped from 10 or 12 per cent increase to about 6 per cent. The earnings still kept up. In December the increase was only 6 per cent, and in January it dropped to minus 2 or 3. For three months the figures were minus. In April, 1918, there was an increase in gross earnings of about 5 per cent. For the first time in the history of the company its net earnings are running less than the year before, the reduction running roughly from \$23,000 to \$40,000 per month.

The coal clause has been applied to all except the company's "A" rate (retail lighting), and even if all the power customers could be billed at present on the coal clause basis, the company would make no extra profit, but would get back the exact expense to which it has been put more than it would have had to meet if it could have secured coal at the prices of 1916. At present the cost of coal is about \$2 per ton above the 1917 prices, and it will probably reach \$3 extra (against 1917) before the end of June. Mr. Edgar said that the New England Power Company has been negotiating with the Edison company for the supply of 30,000,000 kw.-hr. per year to the former by the latter during periods of low water. Mr. Edgar said that he thought the Boston Edison 10-cent rate might have to be raised to 12 cents in future, in view of the advances in prices apparent throughout the country, and especially as evidenced in the recent horizontal increase in railroad rates of about 25 per cent.

Frederick Manley Ives, counsel for the Edison company, addressed the commission during the hearing upon the recognition by other regulative tribunals of the desirability of postponing rate investigations of an exhaustive character during present war conditions.

Granville S. MacFarland, counsel for the petitioners for a rate inquiry, took issue with the company's contention that the present is not a proper time in which to carry through a rate investigation of the scope proposed. The commission took the matter under advisement.

MISSOURI UTILITIES GO BEFORE STATE COMMISSION

Resolution Recounting Present Difficult Conditions
Presented by Eighty Representatives of
Public Service Properties

About eighty representatives of Missouri public utilities presented to the Public Service Commission at Jefferson City on June 10 a resolution which was prepared at the convention of the Missouri Association of Public Utilities at St. Joseph on May 17 and 18. It said that the commission should recognize as fair the operating ratios which existed before the war.

Those who addressed the commission and the utility men were Colonel P. J. Kealy, Kansas City; J. H. Van Brunt, St. Joseph; H. Spochrer, St. Louis, and E. C. Deal, Springfield.

PLEA MADE FOR HIGHER RATES IN INDIANAPOLIS

Testimony Begun on Petition of the Two Companies
for Authority to Add a War Surcharge
to Their Energy Prices

A surcharge of 1 cent or $1\frac{1}{2}$ cents a kilowatt-hour on all electric energy furnished in Indianapolis may be asked by the Merchants' Heat & Light Company, which began the presentation of evidence June 17 before the Indiana Public Service Commission on its petition for authority to make a surcharge.

J. W. Fesler appeared as attorney for the Merchants' Heat & Light Company, and Charles N. Thompson and Elmer E. Scott as attorneys for the Indianapolis Light & Heat Company. Samuel Ashy and Thomas D. Stevenson entered appearances for the city of Indianapolis.

The attorneys for the city filed an answer to the petition in which they said that the petitioners "are not entitled to make a normal profit in these abnormal times, and that they should be required to stand their full share of the burden of the war, without transferring the same to their patrons through increased rates."

Mr. Fesler expressed the opinion that without any surcharge whatever, and with an estimated increase of $6\frac{1}{2}$ per cent in the volume of the company's business, and counting the increased cost of coal and other items at operation, the deficit of the company would reach \$677,000 next year.

The Indianapolis Light & Heat Company introduced a brief to support its contention that it should be granted a new surcharge, which would more than recompense it for the financial loss when its present authorized surcharge of 5 mills for each kilowatt-hour of energy consumed becomes ineffective following June 30. Under the existing surcharge, \$214,238 additional revenue above pre-war rates had been made possible during the year ending June 30, 1918, two months being estimated. Of this electric consumers paid \$194,382, and steam heating, \$19,855.

While gross operating revenue increased over the corresponding period last year, there has been no increase in the average price per kilowatt-hour sold, and there have been heavy increases in costs of operation and in fixed charges. In addition, the requirements for extensions, additions and betterments to take care of the increased demands during the past year have required the company to spend \$1.92 for each dollar of increased revenue received.

The increasing price of coal, which cost \$2.945 a ton during the two months ended June 1, 1918, was discussed, and then the company declared that the operation of Indiana's new prohibition law decreased its revenues annually approximately \$26,000 a year. This estimate was based on the loss of business in April.

At the hearing on Wednesday it became apparent that the commission intends to authorize an increase in electric power rates, especially a higher rate for large consumers, in proportion to the increased cost of coal, labor and materials.

This outlook developed when calculations by the commission and the witnesses for the Merchants' Heat & Light Company showed that the switchboard cost per kilowatt-hour for the year ending June 30, 1918, would be 9.71 mills, without allowing for cost of distribution or interest on investment, or about 1 mill more than

some of the large consumers would pay on the rates before the surcharge of 5 mills was authorized by the commission last year.

The surcharge of 5 mills authorized last year applied to all energy except that used in homes. The companies are asking for a new surcharge on residential as well as commercial energy.

BANKERS INVESTIGATING PUBLIC UTILITY RELIEF

Committee of Four Named in New York at Suggestion of Governor Harding of Federal Reserve Board—\$100,000,000 Plan

At the suggestion of W. P. G. Harding, governor of the Federal Reserve Board and managing director of the War Finance Corporation, a committee of four New York bankers has been formed to investigate financial needs of public utilities with the object of preparing a plan by which capital may be furnished for them. The committee is: James N. Wallace, president Central Union Trust Company; Charles H. Sabin, president Guaranty Trust Company; Thomas W. Lamont of J. P. Morgan & Company; Frederick Strauss of J. & W. Seligman & Company.

The committee is considering the organization of a corporation with \$100,000,000 capital. This corporation would purchase utility securities, and its notes would be discounted by the War Finance Corporation. Bankers throughout the country would subscribe to the stock. This would distribute the risk and also serve to encourage active co-operation from all sections. Adoption of this plan would do away with the necessity of amending Section 7 of the War Finance Corporation law.

The War Finance Corporation announced on June 19 that it would loan directly to the Brooklyn Rapid Transit Company \$17,320,000. The advance is based on a plan requiring holders of the company's notes due on July 1 to exchange not less than 70 per cent of the face amount of the notes for new three-year 7 per cent notes of the company.

MANUFACTURERS ALERT TO THE STEEL SITUATION

Control of Distribution of All Manufactured Steel Products and Pig Iron Touches the Electrical Manufacturers

Control by the War Industries Board of the distribution of all manufactured steel products and pig iron touches directly the question of operation of electrical manufacturing industries during the war. The electrical manufacturing industries are doing a large amount of work directly or indirectly for the government. More and more they are converting their output to essential products.

Manufacturers are now studying their manufacturing processes with great care so as to conserve raw materials, and especially those in which shortage exists or threatens. They are also studying their business in order to determine definitely what is essential war production and what belongs to the less essential classes.

Great War Savings Stamp Drive in Indianapolis



The \$5,000,000 war savings stamp drive in Indianapolis and Marion County was inaugurated by Theodore Roosevelt before 15,000 people on June 11. The largest cash register in the world was erected by the side of the office building of the Merchants' Heat & Light Company, the busiest corner in Indianapolis.

MORE EFFICIENCY IN STEAM-PLANT OPERATIONS

Papers Presented by Eskil Berg and D. W. R. Morgan Before Joint Meeting of Engineering Societies in Chicago

"The Advantages of High Pressure and Superheat as Affecting Steam-Plant Efficiency," by Eskil Berg of the General Electric Company, and "Condensers," by D. W. R. Morgan, engineer condenser department Westinghouse Electric & Manufacturing Company, were the topics of papers presented before a joint meeting of the Chicago Section, American Institute of Electrical Engineers, the electrical section and mechanical section of the Western Society of Engineers and the Chicago Section of the American Society of Mechanical Engineers at Chicago on June 17.

Mr. Berg strongly favored the adoption of higher pressures and higher temperatures than are now considered standard in this country in order to improve plant efficiency. He especially favored higher pressure. His paper was replete with data showing the possible saving in fuel which can be made through these processes. As indicative of the character of these data, Mr. Berg presented a table showing that a plant operating with 800 lb. boiler pressure and 800 deg. superheat, containing turbines 85 per cent efficient and boilers 88 per cent efficient, could produce 1 kw.-hr. on 11,750 B.t.u.

Mr. Morgan described the improvements in the art of condenser building which have been made by the Westinghouse company. He also predicted that the war would probably make it necessary for central stations to use more jet condensers and to use steel tubes or tubes of other than bronze metal in surface condensers in order to conserve for actual war uses metals more sorely needed.

In the discussion, Harold Almert, consulting engineer, who has been appointed by the State Council of De-

fense to see that coal is burned economically in Cook County, stated that Chicago and the remainder of Cook County alone consumed 33,000,000 tons of coal annually. He expects to make a 10 per cent saving on this consumption by asking increased diligence in the larger plants and taking such steps as are necessary to guarantee better efficiency in the 90,000 small plants operating in the district.

The remainder of the discussion was largely confined to questions which were answered by Mr. Morgan and Mr. Berg. Among those who took part in the discussion were C. V. Kerr, M. J. Kermer, A. D. Bailey, F. R. Wheeler and Mr. Heald.

Answering a question on the cost of high-temperature and high-pressure equipment, Mr. Berg expressed the opinion that after development charges have been eliminated this equipment will be cheaper than that now produced for standard pressures and temperatures.

Mr. Morgan in his closing remarks urged attempts to go from 28 in. to 29 in. (71 cm. to 73 cm.) of vacuum, thus effecting a saving of 4 per cent.

WASTEFUL USE OF ELECTRICITY MUST STOP, SAYS DR. GARFIELD

Complaints Have Been Made that Excessive Illumination Still Prevails and that Signs Are Sometimes Lighted in the Daytime

Fuel Administrator Garfield warns the public against prodigal and unnecessary use of electricity for outdoor advertising purposes and other display illumination.

Reports made to the Fuel Administration by state and county administrators and letters received from individual observers are to the effect that owners of theaters and other establishments frequently turn on their display signs and outdoor lights during the daylight hours and that both municipalities and individuals have returned to the habit of excessive illumination.

The Fuel Administrator said this waste must be stopped. Unless official reports show that display illuminations are kept within reasonable bounds and are limited to the hours of darkness, the suspension of the so-called "lightless night" order will be revoked and even more stringent restrictions will be ordered against all forms of outdoor lighting and display illumination.

IN PAST wars victory was thought largely a matter of purely military strategy. Under our highly organized system of to-day the whole weight of the nation must back up with its full resources military and naval action. . . . We are building ships not alone for the war but for the future of world trade. . . . The building of ships, the mining and distribution of coal, the production and conservation of food products and other important war necessities are all vital to the nation's needs during these trying times. We may make mistakes, but we are moving forward and getting results. If each of you will do your part, putting your country above everything else, we will win.—Edward N. Hurley, before the National Coal Association.

PROGRESSING TOWARD THE RECONSTRUCTION COMMISSION

Plan for Such an Agency to Prepare for Vital After-the-War Problems Is Under Consideration in Washington

Following the presentation in the *ELECTRICAL WORLD* of a concrete plan for a proposed Readjustment and Reconstruction Commission, to be appointed now by the President of the United States, to deal now with problems which will be presented to American industry after the war, it has become known in Washington administrative circles unofficially that a plan for a readjustment and reconstruction agency is under consideration.

The Council of National Defense has been studying the subject for a long period, with a view to co-ordinating various government activities in Washington which have had readjustment and reconstruction for their object. When President Wilson recently set up the War Industries Board, under the chairmanship of Bernard M. Baruch, as a separate agency, divorcing it from the Council of National Defense, the latter organization was left with but little work to do. There is reason for the belief that the Council of National Defense has resolved to undertake the work of readjustment and reconstruction, if permitted to do so by President Wilson, and there is also reason for the belief that the President will assent, under the urging of Secretary of War Baker, chairman of the council, acting in behalf of himself and the other five members of President Wilson's cabinet who compose the Council of National Defense.

In Washington official circles there is an impression that this would be logical inasmuch as a number of cabinet officials have begun making public details of readjustment and reconstruction ideals upon which their departments and bureaus have been at work, and there is ground in Washington for the strong belief that if the Council of National Defense is authorized by the President to begin work on readjustment and reconstruction problems, W. S. Gifford, director of the council, will not only set to work at once to co-ordinate all the work in the various departments but will undoubtedly call into consultation and activity at Washington men in private industry.

The subject is now being discussed in Washington, and letters and telegrams are being received urging the creation of such an agency at once.

Philip H. Gadsden, chairman of the National Committee on Public Utility Conditions, strongly indorses the idea of action, saying:

"The great lesson which this war has impressed upon every one is the efficiency resulting from great concentration of capital and labor. The benefits derived by the nation for war purposes in the mobilization of practically all the industries of the country will not be lost sight of when peace comes. To deal properly with such a radical change in our economic policy will call for all the wisdom at our command. Nothing could aid so much in the proper solution of such a problem as a thorough and comprehensive study of it in advance, such as you suggest."

From the Permutit Company, engaged in water rectification and general sanitation, New York, comes this letter, signed by Samuel Robert, president:

"As we see it, there can hardly be room for doubt

as to both the usefulness, and, indeed, the necessity, for work of the nature referred to, and that this work should be done as quickly and as thoroughly as possible.

"We can think of no better way to prepare the groundwork essential to the proper accomplishment of this vital project (vital to the future benefit of the industries of this great country) than by having a commission appointed as quickly as possible for the express purpose of investigating the necessary steps to prepare for its accomplishment."

Charles F. Lang, president of the Lakewood Engineering Company, Cleveland, Ohio, writes:

"While our company is working night and day on war service for the government, and is constantly endeavoring to expand its usefulness in this direction, all our planning is being done with a view to world-trade conditions after the war, for we feel that we but dimly realize the demands which world trade will make upon American manufacturers in the reconstruction period immediately following the war.

"And we also recognize the period of tremendous readjustment which must take place in our own country. National conditions and national ideals are entering a violent revolution rather than a slow evolution, and I sincerely trust that the very constructive program suggested by you will receive serious consideration and prompt action on the part of the government; for the problems involved are not merely national, but world problems, and individual thinking by individual business men is hopeless—the nation must think and plan as a nation."

From the great merchandising house of William Filene Sons Company, Boston, this letter, signed by Edward A. Filene, its president, who is chairman of the war shipping committee of the Chamber of Commerce of the United States, has been received:

"If the bulk of the reconstruction planning is left to separate classes and interests, we shall come to the end of the war with a series of reconstruction programs. Business will have a program; labor will have a program; agricultural interests will have a program; banking interests will have a program; socialists and holders of related theories will have a program. And at the very moment when unity of purpose and promptness of action will be vital to the welfare of the country we shall be obliged to pay the price of costly delay incident to the harmonizing of these several programs.

"It is clearly the wise policy to create a government commission so thoroughly representative of all classes and interests that it will command the support of all classes and interests. If such a commission collates its facts, formulates its conclusions, and submits them in advance to the most exhaustive criticism from all possible angles, we shall be able to get most of the work of compromise out of the way by the end of the war and arrive at the time of action with a unity of purpose and policy otherwise impossible.

"I realize the question of tactics and timeliness involved in any proposal to-day not related to the immediate job of prosecuting the war; and yet the war will end some day, and whether that time be one year or twenty years from now, the time will be none too long for the analysis of the complicated problems that underlie the return of our social, industrial and political life from a war basis."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

A. I. and S. E. E., Philadelphia Section.—On June 15 the Philadelphia Section of the Association of Iron and Steel Electrical Engineers held its annual outing at Valley Forge with sight-seeing and athletic sports.

Electrical League of Cleveland.—H. L. Schneider was elected president, Mathias Turner vice-president, George S. Crane treasurer and L. J. Darrah secretary at the meeting of the board of directors of the Electrical League of Cleveland on June 10.

A. I. and S. E. E., Pittsburgh Section.—H. L. Uhlend, power and mining engineering department of the General Electric Company, will read a paper on "Electric Welding" before the regular meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers at the Hotel Chatham to-day (June 22). The paper will deal with electric welding opportunities.

British Columbia Association of Electrical Contractors and Dealers.—On June 4 the British Columbia Association of Electrical Contractors and Dealers held a regular monthly meeting in Vancouver, B. C. President C. E. E. Williams was in the chair. Capt. W. J. Conway of Vancouver was made secretary-treasurer. The next annual meeting will be held in Victoria about the middle of August.

New York Jovian League.—At the annual outing of the New York Jovian League at the Hotel Shelburne, Brighton Beach, it was shown that a good time could be had and a good dinner enjoyed without going against the wishes of the Food Administration. When the rejuvenation was held four men were initiated by First Tribune G. V. W. Piez. Among the entertainment features were the "review" and dancing.

American Society for Testing Materials.—The twenty-first annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 25 to 28, at the Hotel Traymore. Among the important items on the program are the report of the committee on magnetic properties of steel, C. W. Burrows chairman; topical discussion on "Co-operation in Industrial Research"; report of committee on lubricants, C. P. Van Gundy chairman; "Internal - Combustion Engineering—Lubrication and Lubricants," by P. H. Conradson; report of committee on refractories, A. V. Bleininger chairman; "The Necessity for Inspection and Testing of Refractory Bricks," by C. E. Nesbitt and M. L. Bell, and the report of committee on electrical insulating materials, C. E. Skinner chairman.

California Co-operative Campaign Gathering.—A "get-together" dinner under the auspices of the California Electrical Co-operative Campaign was held in San Francisco on June 7. John A. Britton, vice-president and general manager Pacific Gas & Electric Company, acted as toastmaster. Other speakers were L. H. Newbert, chairman of the advisory committee of the California Electrical Co-operative Campaign and manager of the commercial department Pacific Gas & Electric Company; H. C. Reid, president California Association of Electrical Contractors and Dealers; Samuel Kahn, president Pacific Coast Section of the National Electric Light Association; Frank R. Devlin, member California Railroad Commission; A. B. C. Dohrmann, president Dohrmann Commercial Company; S. M. Kennedy, general agent Southern California Edison Company, and Albert H. Elliott, secretary Pacific Division Electrical Supply Jobbers' Association.

New York State Association of Electrical Contractors and Dealers.—The first annual meeting of the New York State Association of Electrical Contractors and Dealers is to be held at the Grand Union Hotel, Saratoga Springs, N. Y., on June 24 and 25. Among the important papers to be presented are "The Scientific Adjustment of the Weight Scale," by L. K. Comstock; "The Responsibilities of the Electrical Press," by O. H. Caldwell, editor of *Electrical Merchandising*; "The Part of the Central Station in the Goodwin Plan," by Alexander Anderson; "The Jobber," by C. R. Russell of the Esco Electric Supply Company, Albany, N. Y.; "The Manufacturer," by J. Nelson Shreve of the Habirshaw Electric Cable Company; "Accounting Costs and Overhead," by Messrs. Coles and Watters of the Lord Electric Company, and "The Advantages of Separate Cost Planning of Different Departments," by F. A. Mott of the Wheeler-Green company, Rochester.

A. I. E. E., Detroit-Ann Arbor Section.—At the regular annual meeting of the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers W. A. Hirt, production department of the Detroit Edison Company, spoke on "Plotting for Economy." The main feature of the paper was the presentation of a method based upon elementary calculus for determining maximum efficiency of a combination of power generating units for any range of load. The deductions from analyses of input-output or so-called characteristic curves are interesting from the operating engineer's viewpoint, and it seems probable that the knowledge gained will be utilized in future design. Although the deductions made in the paper are based upon mathematical analyses and the use of graphs, the treatment of the subject has been with special regard to the necessities of daily plant operation. Empiric methods are touched upon, showing application of this method by a combination of the use of arithmetic and simple drafting methods.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Scope of Employee's Duties.—It was outside the scope of the duty of a yardmaster of a coal company in admitting an employee of a light company to inspect a meter to engage in a dispute with him relative to the demerits of their respective employers in the course of which he was provoked into killing the inspector, and on these facts appearing in an action brought against the coal company for damages because of the murder, the coal company was entitled to a peremptory instruction, according to the Supreme Court of Tennessee (202 S. W. 935).

Contributory Negligence.—Where plaintiff's intestate, while climbing a pole to remove a wire for his employer, came into contact with defendant's defectively insulated high-voltage wire, which passed about eight inches from the pole, and was killed, the fact that deceased was not wearing rubber gloves, as required by his employer, when within reach of live wires, does not constitute contributory negligence as a matter of law, according to the New York Supreme Court in *Bell versus General Electric Company* (170 N. Y. S. 170). Where decedent's death was caused by coming in contact with defendant's defectively insulated high-voltage wire while climbing a telephone pole for his employer and it was not proved that he grasped the wire, but from his injuries it appeared that he fell upon the wire, contributory negligence was for the jury.

Jurisdiction of Appeal from Commissioner's Decision.—On an appeal to the Circuit Court from an order of the State Public Utilities Commission authorizing a change of telephone rates, where the chairman of the commission, being present in court, refused to file a transcript of the proceedings, the court had jurisdiction of his person, and could punish him for contempt, the Supreme Court of Illinois held (119 N. E. 423). Where the commission has entered an order authorizing a telephone company to change its rates and the city has appealed therefrom, jurisdiction is conferred on the Circuit Court under direct statutory provision to hear and determine the matter of the appeal, when a copy of the notice of appeal, with proof of service, is filed with the clerk. In an appeal from an order of the commission authorizing a telephone company to change its rates the transcript of the commission is essential under the law, provided that no new or additional evidence be introduced in any proceeding on appeal from any decision or order of the commission, but that the appeal is heard on the record thereof.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Coal Cost and Rates.—In allowing the Seymour Electric Company to increase rates the Wisconsin Railroad Commission held that analysis of operating performance indicated average efficiency as regards coal consumption, that the mechanical efficiency of the utility's plant did not differ materially from other small plants in the State, and that the allowance made for labor was sufficient to provide for continuous operation as desired by the city, though should the fuel and labor situation become worse curtailment of hours of service may become necessary.

Return from Energy Sales Found Inadequate.—Deciding that the Cross Plains Electric Company should have authority to raise rates, the Wisconsin Railroad Commission held that analysis of the earnings and expenses indicates that for the year ended June 30, 1917, the company failed to earn more than 5.3 per cent on its estimated value, and that the elimination of receipts from sale of fixtures, wiring, etc., would wipe out entirely the surplus available for returns during such year. The company declared that it was losing money on farm consumers owing to transformer losses, that the greater proportion of its profits came from house wiring and sale of fixtures, a business it was no longer engaged in, and, in general, that it was losing money because its lighting and power rates were too low in proportion to the cost of doing business.

Communities Served from One System.—Approving new rates for the Wisconsin Gas & Electric Company at Union Grove, the Wisconsin Railroad Commission said in part: "The principal contention of those consumers who complained of the rates in effect for residence and commercial service was that in Corliss, a much smaller place than Union Grove, electric consumers received service from the respondent company at lower rates than those in the latter community. In regard to the practice in vogue in many parts of the State of serving all communities tied in on one transmission system at the same rates, it is apparent that unless the original rate schedules are carefully determined, the expense of serving certain communities will be borne in part by one or more of the others. If the rates in effect in Corliss are equitable for that community, then the same rates will not be sufficient to cover the operating expenses including fixed charges on delivering energy to Union Grove. At the hearing the company proposed certain rates for residence and commercial lighting service. Inasmuch as the proposed rates offer considerable reductions for even the average use of en-

ergy, we believe that they should be put into effect and given a trial."

Rate Increases in Illinois.—In an order effective from May 1 the Public Service Commission of Illinois has granted almost in its entirety the petition of the Illinois Traction System for emergency relief for electric railway, electric light and gas companies in fourteen Illinois cities. The commission allows 6-cent fares in Cairo and Jacksonville, elimination of tickets and straight 5-cent fares in Bloomington, Decatur, Danville, Champaign, Urbana, Galesburg and Quincy. Increases in rates for gas ranging from 10 to 25 cents per 1000 cu. ft. are allowed in Decatur, Danville, Champaign, Urbana, Galesburg and Jacksonville. Electric increases of approximately 1 cent a kilowatt-hour are allowed in Bloomington, Galesburg, Normal, Decatur, Danville and Jacksonville, while smaller increases are allowed in Cairo and cities in which the Madison County Light & Power Company operates. The order in brief says that this is an emergency case, and that it is the duty of the commission in each case to determine what may be reasonable rates for public and utility alike. The new rates are not to remain in effect beyond six months after the termination of the war and may be rescinded before that time if the commission decrees.

War Necessities.—In its recent decision allowing 10 per cent increase in various rates of the Philadelphia Electric Company the Pennsylvania Public Service Commission said in part: "The testimony shows that the companies interested have entered upon a very large construction and extension program designed to meet the extraordinary demand for energy which has arisen in this district during the last year and a half and particularly since the declaration of war. The district served by these companies, especially by the Delaware County Electric Company, contains an unusually large number of new plants, the maximum operation of which is absolutely essential to the welfare of the country. These plants and the population dependent on them are relying upon the applicant companies for a continuous and adequate supply of energy, and it seems to this commission that its first duty is to assure the production of this energy upon terms which are reasonable to all who are concerned in it. We are convinced, however, of the necessity for increasing the rates to the extent of 20 per cent and are of the opinion that an increase of 10 per cent for the services in question will be sufficient to accomplish the ends which we have outlined above. There can be little doubt that the sales of the companies will be greatly increased during the coming year, and that certain economies in operation will be effected by the installation of the improvements which are being made. These facts, together with the 10 per cent increase we are authorizing, should assure the companies of an income sufficient to meet the increased operating expenses and leave a fair return upon the property."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Failure of Car Supply for Coal.—The Eastern Utilities Coal Company calls attention to the continued failure of coal transportation, as evidenced by conditions at its properties. The normal car supply should be at the rate of 266 cars per month, and at no time during the past seven months has the supply been 50 per cent. The actual record is as follows: November, 129 cars; December, 80 cars; January, 52 cars; February, 70 cars; March, 101 cars; April, 118 cars; May, 124 cars.

Milwaukee Wants to Increase Its Street Lighting.—An appeal will be made to the Capital Issues Committee of the Federal Reserve Board at Washington to permit the city of Milwaukee to go ahead with its municipal lighting distribution proposition. At a recent meeting of the council Alderman William I. Green said that the \$250,000 approved by the committee was not sufficient to carry on the work, and he introduced a resolution asking the board to permit the entire bond issue of \$500,000 to go through.

Work of Naval Consulting Board.—The Naval Consulting Board, which was created nearly three years ago, when Secretary Daniels invited Thomas A. Edison and eleven leading technical societies to nominate representatives who should constitute it, thus concentrating for service the engineering and inventive talent of the country, has up to date acted upon more than 65,000 inventions of all kinds. A special board to consider inventions for army use has recently been created, known as the inventions section of the General Staff.

Summer Courses in Electrical Engineering.—The College of the City of New York is offering at a nominal fee as part of its summer session courses in elementary electrical engineering, telegraphy and telephony. The purpose of the first course is to give a clear idea of the main underlying principles and methods of electrical engineering, the methods of constructing, installing, operating and maintaining motors and generators of various types and certain other of the simpler forms of electrical apparatus. The courses in telegraphy and telephony appeal to men seeking positions or advancement with telegraph and telephone companies and are given in co-operation with the Western Union Telegraph Company, the Western Electric Company, the New York Telephone Company, the American Telephone & Telegraph Company, the Kellogg Switchboard & Supply Company and the Automatic Electric Company. Prof. Paul Klapper is the director of the summer session of the college.

Otto J. Hawley, assistant chief engineer of the Public Service Company of Oklahoma, has resigned to go to San Francisco.

Max Thelen has resigned as chairman of the California Railroad Commission to become surveyor of contracts for the War Department at Washington.

L. V. Purtne, who was formerly chief engineer of the Public Service Company of Oklahoma at Tulsa, has been transferred to the Dallas office of the American Public Service Company.

Edward Lane, who was formerly connected with the Des Moines City Railway Company, is now in charge of the power plant of the Kansas City (Mo.) Electric Light & Power Company.

Frank E. Hanchette, who has been with the Edison Electric Illuminating Company of Brooklyn for the past six and a half years as chief electrical inspector in the operating department, has resigned and will devote his energies to the marine field under the government shipbuilding program, a line in which he has had a broad experience.

Frank Espy, former assistant to the general manager of the American Gas & Electric Company, New York, has succeeded Hugh Montgomery as general manager of the Atlantic City Electric Company. Mr. Espy was formerly general manager of the Ohio Light & Power Company, Newark, Ohio. Mr. Montgomery has been transferred to the New York office.

Charles F. Howe, consulting engineer of Macon, Ga., who has been for many years identified with the water-power development in Georgia, has been commissioned as major in charge of the public utilities at Camp McClellan, near Anniston, Ala. Major Howe was one of the first to recognize the importance of hydroelectric power to the industries of the South and was the originator of what is now known as the Central Georgia Power Company. This company has a large development on the Ocmulgee River midway between Atlanta and Macon. He was its chief engineer during the period of construction and for a number of years thereafter, and is now largely interested in other water-power developments in this and other states.

Leon C. White has been promoted from superintendent of the electric light and power department of the Twin State Gas & Electric Company, Brattleboro, Vt., to superintendent of operation of all departments in the company. Mr. White was born in Brattleboro in 1880 and received his education at the local high school and correspondence school. He first engaged in the electrical contracting business, entering the employ of the Brattleboro Gas Light Company as chief electrician in 1903. When this company was purchased by the Twin State Gas & Electric Company in 1906 he was appointed superintendent of the electric light department, which position he occupied until he was recently placed in charge of the electric, gas and street railway departments of the company.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

William J. Hammer, consulting electrical engineer, New York City, has received the commission of major in the National Army and is stationed at the War College, Washington, D. C., in the inventions section of the war plans division of the General Staff. Major Hammer has been a consulting electrical engineer since 1889. He is a fellow and past-president of the American Institute of Electrical Engineers and has affiliations with a number of other societies.

Henry I. Harriman, president of the New England Power Company, has been re-elected president of the Boston Chamber of Commerce. Mr. Harriman's work for the chamber has been greatly appreciated during the past year, and he undertook it at considerable personal inconvenience in view of the administrative problems brought to his desk as the chief executive of the largest hydroelectric system in the Northeastern States. As it is exceptional for the head of the chamber to hold office for two successive terms, Mr. Harriman's re-election is to be regarded as high evidence of appreciation for the service rendered by him in this capacity. He has worked in close co-operation with James J. Storrow, New England Fuel Administrator, and with the executives of other public utility organizations which are doing much to conserve fuel and meet the pressing difficulties of power supply under present severe conditions. As recently stated in the *ELECTRICAL WORLD*, Mr. Harriman's partner, Malcolm G. Chase of Providence, R. I., has lately taken office as Federal Fuel Administrator for Rhode Island.

Obituary

Charles R. McKay, consulting engineer for the Union Gas & Electric Company, Cincinnati, Ohio, was instantly killed on May 14 in an automobile accident near Cincinnati. Mr. McKay was graduated from Johns Hopkins University, Baltimore, in 1893. He was first engaged as construction engineer for the Pioneer Power Company of Utah and for the Ontario & Daly Silver Mining Company of Utah. During the time he was thus engaged he also served as a member of the Board of Electrical Award of the Chicago World's Fair. He came East as superintendent of the Sprague Electric Elevator Company and later became chief engineer of the Sprague Electric Company. In 1900 he went to Cincinnati as district engineer for the General Electric Company, remaining until 1907, when he became manager of the

electrical and gas departments of the Toledo Railways & Light Company. Two years later he became manager of the Union Light, Heat & Power Company at Covington, Ky., and on the consolidation of this company and the Union Gas & Electric Company of Cincinnati he became manager of the lighting department and chief engineer of the parent company. About a year ago he resigned to devote his entire time to the duties of chief electrical engineer of the construction of the new power plant in Cincinnati. In 1908 he was elected president of the Ohio Electric Light Association, and at one time he was chairman of the Toledo Section of the American Institute of Electrical Engineers.

William Johnson Jenks, electrical engineer and a recognized leader among patent experts in this country, died at West Bridgewater, Mass., at the age of sixty-five, on June 1, after an illness extending over several years. Mr. Jenks was one of the organizers of the library of the A. I. E. E., which now forms a part of the library of the United Engineering Societies, and served for many years on the library committee. He was educated at Pierce Academy, Middleboro, Mass., and began his business career as a newspaper reporter on the *Brockton Advance*. He became a telegraph operator in 1872, from which date he was continuously engaged in electrical work. From 1878 to 1883 he developed and managed at Brockton one of the early telephone exchanges. From 1883 to 1885 he was associated with the Edison Electric Illuminating Company of Brockton as manager. This Brockton plant was the pioneer Edison three-wire underground installation in the history of the electric lighting art. In July, 1885, he accepted the position of manager of the incandescent department of the American Electric Manufacturing Company, with headquarters at New York City, and in October of that year started the first Edison "municipal" system for the lighting of streets by incandescent lamps and Edison dynamos of 1000 volts to 1200 volts at Portland, Me. This was in many respects a new departure in electric lighting. In the summer of 1886 he was engaged by the Edison Electric Light Company as manager of its municipal department, and in the course of the succeeding three years he gave considerable attention to working out the details of this system of high-tension incandescent street lighting. He was also appointed director of the standardizing bureau of the Edison company, and in that capacity assisted in perfecting the methods of distribution and the apparatus manufactured and sold by the Edison factories. From about Sept. 1, 1889, until his last illness he gave practically his entire time to the patent litigation carried on by the Edison Electric Light Company, the General Electric Company and associated electrical patent interests. In addition to his membership in the American Institute of Electrical Engineers he was connected with many other of the engineering and scientific societies.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

CHANGES MADE IN HOSKINS HEATING APPLIANCE SCHEDULE

The Best Discounts That Are Enjoyed by Any Particular Class of Trade Are Given to the Federal Government

A number of changes in the Hoskins schedule on domestic electric heating devices go into effect on July 15. The changes in price are mostly increases, although a decrease from \$7.50 to \$6 goes into effect on 3½-lb. to 6½-lb. plain base multiple-heat irons.

The misunderstanding that has arisen so many times regarding vertical toasters has been cleared up so that those without rack will list at \$5 while those with rack will list at \$5.50. Grills advance from 50 cents to a dollar, according to type. Radiant radiators advance on the 660 watts or less sizes from \$7.50 to \$8.50.

Provisions are made in the new schedule for maximum discounts to the government on all appliances. Formerly the government enjoyed a smaller discount than the central stations. Now, however, where the material is billed direct to the government the discount is 42, 3, 2, 2 net, on appliances, and 25, 10, 10, 5 and 2 net on ranges.

Provision also is made under the new schedule for allowances on returned merchandise. A manufacturer after July 15 may take an obsolete appliance of his own make, sold prior to Oct. 15, 1915, in exchange, provided that it is taken in exchange for a device which has at the time superseded the one returned and that he makes an allowance for the returned device not greater than 10 per cent discount from the net price at which the new device taken in exchange is sold to that particular customer. It is further provided that no advertising or other intensive selling campaign shall be based on this exchange proposition.

A paragraph is added explaining the position of a holding company and how it can operate under the schedule.

RESTRICTIONS TO BE PLACED ON JOBBERS' STEEL STOCKS

As a Result of Conference with War Industries Board Jobbers Will Make Regular Monthly Reports

To what extent jobbers' stocks should be protected by the government has been receiving the attention of the War Industries Board. It is well known that jobbers, particularly those engaged in the electric supplies business, have depleted their stocks repeatedly on government orders without being able to obtain priorities for replenishment.

A meeting to discuss this situation was held on June 13 in Washington by the War Industries Board, which hardware, machinery, pipe and affiliated jobbers were invited to attend. As a result a committee probably will be appointed to supervise and apportion steel for jobbers' stocks.

After the meeting on June 13 the War Industries Board authorized the following:

"Representatives of the board have been in conference this afternoon with representatives of jobbers in hardware, machinery and kindred lines. Fifty or more men from all branches of the trade were present, representing all the large organizations in the trade, large individual concerns and some affiliated lines. The trade pledged full and hearty co-operation with whatever the board might request. Specific suggestions were volunteered by the trade for directing the flow of stocks into essential uses.

"Special consideration was given to the subject of organizing a small committee to represent all branches of the trade and all sections of the country and to sit in conference with the Priorities Committee, the Director of Steel Supply and other officials of the War Industries Board needing its advice or assistance in apportioning steel to hardware jobbers or in maintaining, increasing or reducing dealers' stocks. This plan was favorably received, and it seems probable that it will be put into effect by the industry as a whole.

"A form for monthly reports by jobbers of the quantities sold of the several classes of goods handled was placed before the meeting by the Director of Steel Supply, together with another form on which should be reported orders placed with mills during the same period. The jobbers will undertake to know accurately the uses to which goods distributed by them are to be put and to discourage the undertaking of work not immediately essential, the postponement of which will help to relieve the non-war demands for iron and steel. It is anticipated that this report system can be put into effect to cover from June 1 on, thus furnishing the Director of Steel Supply and the Priorities Commissioner with monthly figures which will be of material assistance in their work."

EASIER CONDITIONS OF LAMP STOCK CONSIGNMENTS

Certain Producers Working on Quantity Production Basis Are Now Urging Distributors to Increase Local Supply

Ever since the distribution of incandescent lamps has been on a consignment basis manufacturers have worked on the maximum customer turnover basis. With a comfortable stock on hand manufacturing thus kept pace with demands which, except for seasonal variations, were fairly constant.

Two years ago this policy was carried still further, and consignees were not allowed to amass a stock larger than necessary to take care of their immediate requirements. The increased demand and the inability of the producers to meet it so seriously reduced stocks that this measure was resorted to.

Since that time, however, the situation generally has cleared considerably, and as a result the policy of producers in regard to stock limitations has in certain instances had a complete reversal. Some producers now encourage distributors to take as many lamps as they can find storage place for locally. The intention of these producers is to amass as large stocks about the country as is possible.

Evidences are seen of a heavy lamp demand coming this winter, and precautions are now being taken where possible to anticipate this condition with adequate stocks. Furthermore, these producers are imbued with the quantity production idea and believe that the factory must run at its maximum capacity even though a surplus accumulates. This is the way, it is felt, to keep the cost of production down to a minimum.

One concern whose output is an influential factor in the market stated that it had not accumulated any great stocks excepting on standard sizes and types. Surprise was expressed to hear that any factory had a surplus. On miniature and auto lamps the admission was general that the factories are still far behind in filling orders. The government's orders are taking a great deal of the output. Therefore it was impossible to say, if present conditions continue, when they could meet the full requirements of the trade. With these producers no larger stocks or extended time

could or would be given any one. If actual needs can be taken care of and shortages avoided, it is the best that can be done.

In the case of a manufacturer who specializes on standards only, it was ascertained deliveries were behind three and four months. This company works on the two and three months' arrangement. Instead of increasing or distributing a large quantity of lamps it was drawing in or scaling down stocks which were carefully watched and regular reports on this condition insisted upon. This company also stated that while it was increasing its production, which was due to the time of year, one of its plants at least would be shut down the first two weeks in July to overhaul the factory and give the employees a vacation. It was learned that some companies were not able to provide jobbers and dealers with more than a two months' stock of lamps. They had not caught up as yet with the requirements of their trade, consequently no stronger stocks could be furnished.

THE WEEK IN TRADE

EVERYWHERE the demand for electrical supplies is of substantial proportions in spite of the maintenance of prices at the present high levels. The peak, of which so much was heard only recently, the line that few believed would be passed, is being ignored. Advances on not a few lines still continue to be made, and no one seems to know how high the figures will go. It is certain that jobbers whenever possible are accumulating stocks on staples, anticipating heavy sales, if not in the immediate future, at least not far distant.

Conduit conditions are very unsatisfactory. The situation is approaching a very acute stage. Standard sizes are depleted and shipments are overdue. The supply of motor fans, particularly in certain sizes, is undoubtedly short and in the East is causing anxiety. West and South stocks are reported as adequate. In New England the movement of washing machines is active and stocks are getting low. On the Pacific Coast industrial material is in lively demand. The new prices on heating appliances go into effect July 15.

The labor shortage is being severely felt in all parts of the country. In the Pacific Northwest the so-called "work or fight" order is stripping jobbers and dealers of necessary employees. Building operations in the same section, particularly residential, are passing all records. In the South large industrial enterprises, calling for important electrical equipment, are on foot. Collections are fairly good, keeping pace with sales, and outstanding accounts are being considerably reduced.

NEW YORK

An advancing market always brings surprises, and current conditions would seem to be no exception. Stocks are of various sizes on heavy staples. Some jobbers are in an enviable position, and others are wondering what will happen next. For example, in certain lines buying has been of the anticipatory order, and where foresight tempered with judgment was exercised the accumulation of much-needed goods in a few hands is one of the surprises. It is said some large distributors, having a line on the market for salable merchandise, parted with their holdings at what was considered a sacrifice, in order to make a quick turn—to their regret now. Others, looking a little farther, still hold their stocks.

Some further changes in prices are reported. Difficulties of getting goods for future operations are growing more serious. Transportation obstacles prevail to an alarming extent, with the embargoes more frequent and not lifting so frequently. Between Philadelphia and New York and intermediate points delivery delays are very frequent.

Financially the trade is sound. Collections from commer-

cial accounts are quite good. No breach in credit firmness is noticeable.

PORCELAIN.—Shipments are coming in slowly and stocks are rapidly absorbed. Orders on delivery for four weeks from Trenton, N. J., have not yet arrived. The embargoes are more restrictive in this stretch of territory, it is said, than anywhere else.

FANS.—There are evidences locally that the supply of 12-in. and 16-in. fans is scant. One manufacturer is sold up on his output; a second is in bad shape for contract delivery, goods promised in March just coming through. One of the largest fan-distributing firms, particularly in the smaller sizes, will have its output curtailed 40 per cent owing to factory conditions. Some others are just about cleaned out, as material is said to be unobtainable for further production.

INDUSTRIAL LIGHTING FIXTURES.—The demand is brisk and the selling movement active. An advance of about 10 per cent was made within the past month.

HOUSEHOLD SPECIALTIES.—The advance of at least \$1.25 on sewing machines to the trade goes into effect July 1. This means a retail price increase of \$2.

LOCUST PINS.—Within a month or so locust pins have been marked up by \$4 on 100 to 500 lots, and lots of 1000 by a trifle over \$5. There is apparently an ample supply in stock, with the future uncertain.

LINE HARDWARE.—All malleable iron, japanned and galvanized brackets were advanced from 10 to 15 per cent on June 5. Malleable iron brackets are difficult to get.

COVERED WIRE.—Deliveries on No. 14 wire from a nearby plant are delayed weeks at a time and this is said to be affecting selling conditions on this number. No further increase is noted on rubber-covered and weatherproof.

HEATING APPLIANCES.—One of the leading distributors is sending out advisory notices to the trade respecting next winter's expected shortage of fuel and gas. It is therefore self-evident, according to this high authority, that ample stocks of plate warmers, grills and radiators should be provided to meet the anticipated emergency.

COLLECTIONS AND CREDITS.—On government accounts collections are prompt. Commercial bills, nevertheless, are quite good. Credits receive rigorous treatment, and little disposition is shown to be lenient on business suggestions of any risk.

CHICAGO

Another shell plant has been authorized for Chicago by the government. This news is viewed with considerable interest by the local trade, particularly at this time, as it comes simultaneously with a report from the Illinois Manufacturers' Association that 200 small factories have been forced to shut down because of lack of steel. The general situation in steel is occupying a great deal of attention in the trade. The report which J. L. Replogle sent to the steel mills stating that the steel supply committee of the War Industries Board is not concerned about any one getting steel except the plants engaged in government work, in which case priority orders are issued, seems to have covered the situation rather fully. At the present time there is also an undercurrent of agitation on the difficulties of public utility financing. Important bankers in this section are taking an active interest in the situation, and the belief seems to be that some method will be found for permitting utilities to secure relief either by means of increased rates or otherwise. Definite talk about higher traction fares in the city of Chicago is reported daily in the newspapers. Electrical supply jobbers report that business has improved during the last week. There have been practically no changes in prices, although it appears certain that the coming two or three weeks will supply numerous examples of this. While the jobbers are fully aware of this situation, their customers do not appear to be taking advantage of the present opportunity to get in stock before the increases. Telephone companies are the one exception.

CONDUIT.—The jobbers foresee a situation wherein conduit is going to be impossible to get excepting for actual government needs.

FANS.—The spell of hot weather during the last week was not of long enough duration to produce much movement in fans, but no one is despairing of the situation yet. A little hot weather, however, would be welcomed.

SCHEDULE MATERIAL.—While the jobbers were pretty well protected on the recent advance in schedule materials, their customers were not. The old policy of informing all customers in advance of price increases seems to be rapidly dying out among the jobbers.

RESALE GOODS.—Jobbers' stocks of resale merchandise appear to be good, with the exception of washing machines. Manufacturers' deliveries to the jobbers are poor, however, and give promise of being worse.

OFFICE EQUIPMENT.—Such office accessories as telephone brackets, push-buttons for buzzer systems and goods of this class have exceeded the capacity of the factories.

ELECTRIC RANGES.—The total volume of business in electric ranges to date for 1918 is about the same as for the preceding year, with an exceptionally good prospect for exceeding last year's record when all the returns are in.

BOSTON

The volume of trade continues to be maintained at a high level, and thus far there is little evidence of a summer recession. May was a particularly good month for local jobbers. Railroad congestion still hampers deliveries, and until some of the new locomotives and cars ordered by the federal authorities get into service little improvement is anticipated. Central stations are overwhelmed with war work, but are doing almost nothing in the way of commercial expansion unless related to war supplies. Small appliances are in considerable demand, and there is an improvement in the sale of portable lamps within the past fortnight. Collections are fairly good at present and are apparently unaffected by the war savings stamp campaign, an entirely different matter, of course, from the Liberty bond campaign work.

Stocks are understood to be large at present, owing to the vigorous efforts of the jobbers to anticipate demands and keep ahead of the transportation situation. Labor conditions are unsettled at this writing, a strike of electrical workers having been called in the Boston district in direct violation of an agreement to stand by the finding of H. B. Endicott, chairman of the Massachusetts Food Administration. The central stations are maintaining their service without interruption. A 10 per cent increase in the pay of hour and piece workers goes into effect July 1 at the Lynn factories of the General Electric Company. Recent price changes include an advance of 8 per cent in electric loading machines built by the Conant Machine Company, Concord Junction, Mass., and a 10 per cent advance on Century motors.

FARM LIGHTING SETS.—Business is brisk and a larger turnover is expected this year than last. Prices have shown no change since March. Stocks are prepared for prompt shipment. One dealer has two carloads of sets in his basement and three more on the way, while the factory has material enough on hand at this time for the production of 50,000 sets.

FANS.—Cool weather still holds back the flow of fans to the consumer's sockets. Unless a hot spell comes soon this year's business may run below anticipated totals. The psychological effect of a hot wave in late May or early June is much better for fan sales than warm spells in mid-summer. Sales are being made to Chinese laundries, though these were held up for some time by the price increases of this year. Stocks are ample for the present.

WASHING MACHINES.—These are selling very rapidly. One of the largest central stations in New England has sold out its entire stock and is now drawing upon consigned machines.

PORTABLE LAMPS.—A spurt in retail demand has developed within the past fortnight. Practically all the business is renovation work in fixtures. Stocks are very large. Prices are being shaded in some cases to capture summer business, but the results are not as yet very satisfactory.

WIRE AND CABLE.—Stocks are fairly large up to 500,000-circ. mil cable, rubber-covered, with quotations around 32 cents per pound. Weatherproof is quoted around 30 cents. Most of the business is governmental. Little change in prices is quoted.

TRANSFORMERS.—From 10-kw. up stocks are uneven. A 10 per cent advance went into effect June 7 on the leading makes of transformers. Deliveries are being quoted on a three to five months' basis.

ATLANTA

Government requirements and news emanating from Washington are the foreshadowing features in trade this week. The agreement reached between the War Industries Board and the American Iron and Steel Institute virtually places the steel market in the hands of the government. Terms provide that no iron or steel products shall be distributed except in order of urgency as prescribed by the board and after the preferred industries have been served. The out-turn of pig iron recorded for May looks encouraging, being the second largest in the history of the country. The outlook for building operations along normal commercial channels is not so bright, and this class of construction is being further subordinated to more urgent work owing to the scarcity of steel, together with the fact that the government is absorbing about 80 per cent of the cement.

Recent estimates place coal production as falling behind the national demand by approximately 467,000 tons per day. This condition, no doubt, will influence the Fuel Administration to the extent that the long-expected "white list" will be published soon covering essential and so-called non-essential industries. A feeling of uneasiness prevails in this section regarding this measure.

Opinions from men in the electrical industry indicate a still greater demand on hydroelectric companies and a flurry for electric heating appliances such as occurred during last winter. As the East is turning out large quantities of war goods and the freight situation is becoming more serious, it is of considerable interest to note rumors in circulation to the effect that facilities offered by the Southeast will be drawn upon more from now on.

The Doullut & Williams Shipbuilding Company of New Orleans, La., has been organized with a capital of \$1,000,000 for the construction of steel ships. The Consumers' Dye Wood Products Corporation, Mobile, Ala., will erect a plant with a capacity of 1800 bbl. monthly. The Central of Georgia Railway, Macon, Ga., will install a complete electric interlocking signal system. Bertram, Griscom & Company of Philadelphia, bankers, are representing capitalists interested in the Carolina-Tennessee Power Company of Cherokee County, N. C., near the Tennessee line. It is proposed to build a hydroelectric plant on the Hiwassee River developing 60,000 hp. Details are lacking at this time, but preliminary plans call for two dams 150 ft. high thirteen miles apart.

CONDUIT.—The scarcity of conduit is being felt and stocks of ½-in. are badly depleted. A few large shipments for urgent work are long overdue. Although ¾-in. and 1-in. stocks are in better shape, jobbers are exercising considerable caution and scrutinizing all orders carefully.

FANS.—While the movement of fans has been fairly satisfactory, more temperate weather has tended to slow up the feverish demand of last week. The 16-in. is the most popular for general service. Jobbers report substantial sales of ceiling fans to military camps for mess halls and offices. A few jobbers are having railroad troubles and are behind on deliveries of 12-in. and 16-in. sizes.

TEXTILE MOTORS.—Manufacturers state that sales for the first quarter of this year were well above the same period last year and that the volume of business to July 1 will be as good as last year. Better shipments are being promised and excellent deliveries are being made on the four-frame type. Local stocks are in much better shape. This condition is due to improved factory facilities. Business seems to be sustained through the purchase of replacement equipment and individual motors for looms where additions are being made.

SEATTLE

There were no exceptionally large sales or inquiries of importance during the past week and general business conditions continue unaltered. The volume of commercial and domestic sales is well sustained. The volume to the shipyards and industrials shows an increase over the last two weeks and the government buying was a shade heavier. Generally stocks are in a fair condition, although there are shortages reported on some lines, especially in conduit, larger sized lamps and automobile lamps. The latter are practically impossible to obtain. Small motors and larger power apparatus demands are being met. Deliveries from the East are very slow and orders are being placed far in advance. Placing orders in advance holds true in the case of all stocks, accounting for the fair condition of jobbers' stocks. There are slight fluctuations in prices. To-day finds prices steady and at levels reported for a month past.

Labor shortage is affecting all lines seriously. The "work or fight" order is stripping both jobbers and retail houses. It is impossible to obtain warehousemen, male clerks and stenographers. Furthermore, it is believed the order will serve to relieve somewhat the shortage in the shipyards and lumber camps.

Sales to jobbers and dealers are of small consequence. The municipal lighting department of Tacoma will shortly call for bids for furnishing approximately \$20,000 worth of energy-consuming devices, including ranges, water heaters and electric heaters. The number of permits for electrical installations last week shows an increase of considerable proportions over the last three weeks in Seattle and Tacoma. The installation of electric ranges in apartment houses is increasing. Sales of house-wiring devices, including fixtures are increasing over the last two weeks.

The Northwest general contractors predict that the building peak will not be reached until midsummer or early fall. From present indications the summer months will see a volume of residence construction never equalled in the history of the Northwest cities. Constructional activity is not confined to the larger cities, as the smaller towns are building in proportion to the size and needs, which are constantly increasing.

Spruce production in the Olympia peninsula for airplane stock is to be increased by the construction of a mill with a daily capacity of fifty carloads. Initial construction has been started. Credits placed with the new shipyards and allied industrial plants are closely scrutinized. The extension of old credits predominates, but new credits of considerable proportions were placed recently. Collections are satisfactory and keeping pace with sales.

SAN FRANCISCO

Business continues good, though noticeably better in country districts and in the interior cities than in the large coast cities.

New packing plants are being erected in Mountain View and Livingston, Cal., and a new cotton reduction plant in Tucson, Ariz. Counter sales are rather poor. Sales of house-wiring material have picked up slightly. Sales of industrial material are large and of continually increasing quantities, so that constant revision of stock standards is necessary.

Collections are better than they have been this year, not only from dealers, but from industrial plants, which were slower than one might expect during the first few months of the year.

FANS.—The first real hot weather of the year, recorded at 100 deg. through the interior valleys and nearly as high along the coast, has stimulated fan business, which up to this time has not been extraordinarily good. Intensive work by dealers among plants recently erected in their territory will no doubt add to its volume. One San Francisco jobber reports an extremely large order of fans for export to Japan.

HEATING MATERIAL.—Sales of small heating devices are poor, the number of flatirons sold being far less than normal during April, which is usually a good iron month. Sales of other devices are slow, probably because of their comparatively high first cost, due to recent advances, and

the feeling of personal retrenchment engendered by recent war-time demands.

PORCELAIN MATERIAL.—An investigation of stocks and demands for the first few months of this year, compared with the corresponding period of last year, discloses the fact that sales of standard porcelain material, such as split knobs, 3-in. tubes and standard two-wire and three-wire cleats, has fallen off from 50 to 67 per cent owing primarily to the lack of building calling for such wiring. There is very little house building in the country districts, and the factory building specifications are up to date and protective. The government has been doing very little fire-protection construction in the forests this year, and this fact has affected the sale of certain standardized porcelain material.

SCHEDULE MATERIAL.—As before noted, schedule material is advancing in price, because of increased freight rates and increased cost of raw material and labor necessary for assembling it. The latest items to be affected are flush receptacles and parts, which have just advanced 10 per cent for Pacific Coast delivery. Manufacturers who carried Pacific Coast stocks report peculiar demands, especially in the piece parts of separately packed sockets and receptacles, showing that jobbers and dealers are not yet familiar with the possibilities of this plan and are correcting their stocks after a few months' experience under the new condition. This is especially true of brass caps, the demand for which is all out of proportion to the bases.

METAL MARKET SITUATION

Copper Requirements for Wire Manufacturers Hard to Obtain on Commercial Orders

Wire producers are finding it difficult to obtain copper, excepting on priority certificates for direct or indirect war work. The capacity of about every wire plant is largely taken up with government requirements, and when it comes to commercial orders the obstacles in obtaining the basic metal for rubber-covered, cable and weatherproof and other wire products are reported to be trying. Sellers of copper are evidently paying slight attention to civilian demands. Deliveries to seaboard points have not improved. One shipment of five cars of copper took more than five weeks to reach New York from Baltimore.

Copper producers and refiners are scheduled to meet with the War Industries Board again on Aug. 7 to discuss the price situation. They contend that their interests have not received fair treatment in having the official price of 23½ cents a pound reaffirmed until Aug. 15. It is said that if the copper people cannot convince the board of the justness of their claim they may decide it to be advisable to take the matter to the courts for a decision.

Lead is advancing and the demand is strong. An effort is being made to avoid any further rise in prices; otherwise the government may find it necessary to step in and regulate affairs on an equitable basis. Tin is receding in price. The changes in old metals are trifling, with zinc scrap showing a tendency to stiffen a shade on price.

NEW YORK METAL MARKET PRICES

	June 10	June 17
	£ s d	£ s d
Copper:		
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25	26.25
Lead, trust price	7.25	7.82½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	7.60 to 7.65	8.07½
Tin, Chinese*	0.90	0.90
Aluminum, 98 to 99 per cent	Govt. price \$33.00	Govt. price \$33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 13.75	13.50 to 13.75
Brass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	6.00 to 6.25	6.25 to 6.50
Zinc, old scrap	5.50 to 5.75	6.00 to 6.12½

*No Straits offering. †In 50-ton lots or more; carload, 33 1/2 cents per lb.; 1-ton to 11-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft.
No. 14 solid	\$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to + 15%
Coil to 1000 ft.	10% to 15%
	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft.	10% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	List to \$120.00
Coil to 1000 ft.	15% to \$100.00
	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft.	5% to 10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft.	15% to + 10%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft.	10% to 20%

Twin-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft.	15%
	No. 12 Solid
Less than coil	20% to + 10%
Coil to 1000 ft.	10% to 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10% to 24.00c.
1/5 to std. pkg.	8% to 19.80c.
Std. pkg.	25% to 18.75c.

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10% to 20%
1/5 to std. pkg.	List to 20%
Std. pkg.	28% to 34%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.31-.3190	.3275-.3290
Barrel lots	.285-.289	.295-.299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3175-.32	.3275-.33
Barrel lots	.2875-.29	.2975-.30

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	List to \$82.50	\$63.75 to \$67.50
1/2-in. d. stp.	\$78.25 to \$84.00	69.00 to 71.25
1/2-in. s. stp.	List to 110.00	85.00 to 90.00
1 1/2-in. d. stp.	105.00 to 112.00	92.00 to 95.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
1/2-in. single strip	List	\$63.75
3/4-in. double strip	78.25-78.75	71.25-71.75
3/4-in. single strip	List	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	25.00-\$60.00	\$20.50-\$41.25	\$20.00-\$33.00
1/4-in.—	\$28.00-\$65.00	\$22.50-\$45.00	\$22.00-\$36.00

NET PER 1000 FT.—CHICAGO

	Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$36.00-\$55.00	\$25.00	\$22.50
1/4-in.—	\$40.00-\$60.00	27.00	25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/4
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/4
2	.37 1/2
2 1/2	.58 1/4
3	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 1 in.
Less than 2500 lb.	7.3% to 6.8%	7% to 10.7%
2500 to 5000 lb.	6% to 8.8%	9% to 12.7%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	7.3% to 8.8%	10.3% to 11.9%
2500-5000 lb.	9.3% to 10.9%	12.3% to 13.9%

(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price	\$5.00 to \$6.00
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to 30%
1/5 to std. pkg.	20% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28% to 30%
1/5 to std. pkg.	38% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	\$5.50 to \$7.00
1/5 to std. pkg.	\$4.75 to \$5.75
Standard packages, 500.	List, each \$0.07

CHICAGO

	Per 100 Net
Less than 1/5 to std. pkg.	\$7.00
1/5 to std. pkg.	5.75
Standard packages, 500.	List, each \$0.07

LAMPS, MAZDA			
105 to 125 Volts			
Regular, clear:	Std. Pkg.	List.	Each
10 to 40-watt—B.....	100	\$0.30	
60-watt—B.....	100	.35	
100-watt—B.....	24	.70	
75-watt—C.....	50	.70	
100-watt—C.....	24	1.10	
200-watt—C.....	24	2.20	
300-watt—C.....	24	3.25	
Round bulbs, 3 1/4-in., frosted:			
15-watt—G 25.....	50	.53	
25-watt—G 25.....	50	.55	
40-watt—G 25.....	50	.55	
Round bulbs, 3 3/4-in., frosted:			
60-watt—G 30.....	24	.77	
Round bulbs, 4 1/4-in., frosted:			
100-watt—G 35.....	24	1.10	

DISCOUNT—NEW YORK
Less than std. pkg.....List
Std. pkg.....10%

DISCOUNT—CHICAGO
Less than std. pkg.....List
Std. pkg.....10%

LAMP CORD	
Cotton Covered, Type C, No. 18	
NEW YORK	
Per 1000 Ft. Net	
Less than coil (250 ft.)....	\$29.00 to \$33.80
Coil to 1000 ft.....	21.50 to 28.73

CHICAGO	
Per 1000 Ft. Net	
Less than coil (250 ft.)....	\$29.00 to \$30.00
Coil to 1000 ft.....	21.50 to 25.00

LAMP GUARDS, WIRE	
Standard packages from 50 to 150	
NEW YORK	
Net per 100.....	\$21.75
CHICAGO	
Net per 100.....	\$21.75 to \$30.00

OUTLET BOXES	
Nos.	List.
101—A, A1 1/2, 4 S.C., 6200, 320.....	per 100 \$30.00
102—B.A., 6200, S.E., 300, A.X., 1 1/2 4 S.....	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.00
106—F.A., 7, C.S., 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK
Black Galvanized
Less than \$10.00 list..... 30% to 40% 20% to 35%
\$10.00 to \$50.00 list..... 35% to 50% 25% to 45%

DISCOUNT—CHICAGO
Black Galvanized
Less than \$10.00 list..... 40% 35%
\$10.00 to \$50.00 list..... 50% 45%

PIPE FITTINGS
DISCOUNT—NEW YORK
Less than 1/5 std. pkg.....5% to 10%
1/5 to std. pkg.....15% to 20%
Std. pkg.....25% to 30%
DISCOUNT—CHICAGO
Less than 1/5 std. pkg.....10%
1/5 to std. pkg.....20%
Std. pkg.....30%

PORCELAIN CLEATS—UNGLAZED	
Two and Three Wire	
NEW YORK	
Per 1000 Net	
Less than 1/5 std. pkg.....	\$15.80 to \$38.80
1/5 to std. pkg.....	14.80 to 20.00
Standard package, 2200. List per 1000,	\$20.
CHICAGO	
Per 1000 Net	
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000,	\$20.

PORCELAIN KNOBS			
NEW YORK			
Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	4000
	5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85	\$20.70 to \$30.75	
1/5 to std. pkg.....	11.10	24.20	

CHICAGO			
Per 1000 Net.	Std. Pkg.	3500 Std. Pkg.	4000
	5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85	\$30.75	
1/5 to std. pkg.....	11.10 to \$11.40	24.20	

SOCKETS AND RECEPTACLES			
	Std Pkg.	List	
3/4-in. cap key and push sockets.....	500	\$0.33	
1/4-in. cap keyless socket.....	500	.30	
3/8-in. cap pull socket.....	250	.60	

DISCOUNT—NEW YORK
Less than 1/5 std. pkg.....+ 10%
1/5 to std. pkg.....5% to 8%
NET PER 100—CHICAGO
Less than 1/5 std. pkg.....10% to 29.70 cts.
1/5 std. pkg.....20% to 26.40 cts.

SWITCHES, KNIFE	
250-Volt, Front Connections, No Fuse	
High Grade:	
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.90
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	
30-amp. S. P. S. T.....	0.49
60-amp. S. P. S. T.....	0.71
100-amp. S. P. S. T.....	1.70
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.09
60-amp. 3 P. S. T.....	1.81
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK
High Grade
Less than \$10 list.....List to + 10%
\$10 to \$25 list.....15% to + 10%
\$25 to \$50 list.....10% to 14%
Low Grade
Less than \$10 list.....5% to 10%
\$10 to \$25 list.....10% to 25%
\$15 to \$50 list.....15% to 24%

DISCOUNT—CHICAGO
High Grade
Less than \$10 list.....+ 5%
\$10 to \$25 list.....10% to 14%
\$25 to \$50 list.....14%
Low Grade
Less than \$10 list.....5%
\$10 to \$25 list.....16%
\$25 to \$50 list.....24%

SWITCHES, SNAP AND FLUSH			
5-Amp. and 10-Amp., 125-Volt Snap Switches			
	Std. Pkg.	List	
5-amp. single pole.....	250	\$0.28	
5-amp. single-pole, ind.....	250	.32	
10-amp. single-pole.....	100	.48	
10-amp. single pole, ind.....	100	.54	
5-amp. three-point.....	100	.51	
10-amp. three-point.....	50	.76	
10-amp., 250-volt, D. P.....	100	.66	
10-Amp., 250-Volt Push-Button Switches			
	Std. Pkg.	List	
10-amp. single-pole.....	100	\$0.45	
10-amp. three-way.....	50	.70	
10-amp. double-pole.....	50	.70	

SWITCHES, SNAP AND FLUSH—Cont'd
DISCOUNT—NEW YORK
Less than 1/5 std. pkg.....10% to + 10%
1/5 to std. pkg.....5% to 20%
Std. pkg.....23% to 28%

DISCOUNT—CHICAGO
Less than 1/5 std. pkg.....10% to + 20%
1/5 to std. pkg.....List to 20%
Std. pkg.....List to 28%

SWITCH BOXES, SECTIONAL CONDUIT	
Union and Similar—	List, Each
No. 155.....	\$0.34
No. 160.....	.60

DISCOUNT—NEW YORK		
	Black	Galvanized
Less than \$2.00 list.....	20% to 40%	List to 30%
\$2.00 to \$10.00 list.....	10% to 50%	5% to 40%
\$10.00 to \$50.00 list.....	20% to 64%	15% to 52%

DISCOUNT—CHICAGO		
	Black	Galvanized
Less than \$2.00 list.....	25%	20%
\$2.00 to \$10.00 list.....	25% to 50%	20% to 40%
\$10.00 to \$50.00 list.....	25% to 64%	20% to 52%

TOASTERS, UPRIGHT
NEW YORK
List price.....\$5.00 to \$6.00
Discount.....25% to 30%

CHICAGO
List price.....\$5.50 to \$6.00
Discount.....25% to 30%

WIRE ANNUNCIATOR
NET PRICE—NEW YORK
Per Lb. Net
No. 18, less than full spools....\$0.42 1/4 - \$0.65
No. 18, full spools.....0.36 - 0.55

CHICAGO
Per Lb. Net
No. 18, less than full spools....\$0.57 1/4 - \$0.60
No. 18, full spools......50 - .65

WIRE, RUBBER-COVERED, N. C.				
Solid-Conductor, Single-Braid				
NEW YORK				
	Price per 1000 Ft. Net			
	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	
No. 14.....	\$15.00-\$18.00	\$12.50-\$13.00	\$9.85-\$12.50	
12.....	23.25-27.53	20.62-23.26	16.13-22.02	
10.....	32.10-36.47	28.65-30.48	22.40-22.94	
8.....	45.70-51.24	40.26-42.54	31.47-38.99	
6.....	67.38-81.06	61.76-66.35	50.79-60.30	

CHICAGO				
	Price per 1000 Ft. Net			
	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.	
No. 14.....	\$18.00-\$19.00	\$13.00	\$11.50	
12.....	25.33-\$26.28	25.33-\$26.28	20.40-20.93	
10.....	35.01-36.51	30.03-31.26	28.23-29.23	
8.....	48.97-51.57	41.98-44.13	39.42-41.23	
6.....	66.16-88.38	62.43-71.61	56.39-70.70	

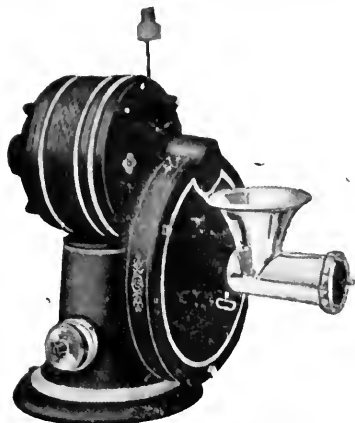
WIRE, WEATHERPROOF
Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.
NEW YORK
Per 100 Lb. Net
Less than 25 lb.....\$35.25 to \$37.85
25 to 50 lb.....31.25 to 37.85
50 to 100 lb.....30.40 to 37.10
CHICAGO
Per 100 Lb. Net
Less than 25 lb.....\$37.00 to \$37.45
25 to 50 lb.....36.43
50 to 100 lb.....35.00 to 35.43

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Motor-Driven Meat and Food Chopper

A compact and easily operated motor-driven meat and food chopper has been placed upon the market by the Enterprise Manufacturing Com-



COMPACT MEAT AND FOOD CHOPPER

pany of Philadelphia. The chopper is directly connected to a $\frac{1}{2}$ -hp. universal motor by means of a solid shaft.

Rheostats for Motion-Picture Projection

For use in connection with a 32-volt lighting plant supplying energy for motion-picture machines illuminated by tungsten lamps, the Ward Leonard Electric Company, Mount Vernon, N. Y., has developed a low-resistance current-regulating rheostat. The tungsten lamps used with the motion-picture machines must have exactly 20 amp. flowing through them at all times



AMMETER ATTACHED TO RHEOSTAT INDICATES EXACT AMOUNT OF CURRENT

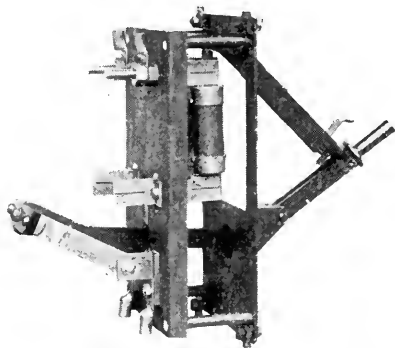
to insure the highest efficiency and longest life. In order to get this 20 amp. it is necessary to reduce the generator voltage by means of a low-resistance rheostat. The rheostat shown herewith is provided with an ammeter

set at the 20-amp. point so that the operator can easily see that the rheostat's lever is in such a position at all times that the meter will register 20 amp.

The first two steps of the rheostat are of high resistance, which permits the lamp filament to heat up before the full voltage is applied, thus assuring long life to the lamp. This resistance also cuts down the current before the circuit is opened, which is accomplished by the rheostat. The rheostat and the ammeter are placed in series with the source of energy and the lamp.

Low-Tension Dead-Front Switch Panel

Owing to their high factor of safety, the dead-front panel switches manufactured by the General Electric Company of Schenectady, N. Y., are especially valuable in factories where switchboards are operated by inexperienced employees. Primarily, these



FUSES ARE NOT ACCESSIBLE WHEN THE SWITCH IS CLOSED

panels are intended as distributing panels for light and power and for generator and feeder panels for small lighting and power plants.

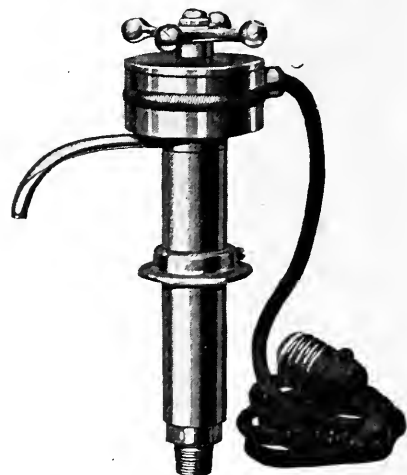
One switch unit, as shown in the accompanying illustration, consists chiefly of a standard knife switch and fuse-clip parts mounted on a slate base and supported by iron studs at the back of a sheet-steel panel. The operating handle has the same general appearance as an oil circuit-breaker handle and is so arranged that it is in the vertical position when the switch is "on" and at an angle of 60 deg. with the panel when the switch is in the "off" position. The operating link passes through both the steel panel and the slate base and transmits the motion from the handle to a lever attached to the cross-bar of the switch. The steel panel of the switch unit is provided with a sheet-steel door which is hinged at the top, allowing it to open

upward as far as the stop on the operating handle behind which it is mounted. This door gives access to the fuses from the front of the panel but cannot be opened while the switch is "on." When this door is open the switch cannot be closed. Fuses can be inspected or replaced at any time, but the operator cannot come in contact with the live current-carrying parts, as the fuses are on the load side of the switch and the fuse clips must be dead before the fuse compartment door can be opened. The switch can be locked in the "off" position by an ordinary padlock. The capacity of the switches is limited by the sizes of 250-volt and 600-volt inclosed fuses as approved by the National Board of Fire Underwriters. Current ratings range from 60 amp. to 600 amp.

Electrically Heated Faucet That Supplies Hot Water

Hot water can be obtained almost instantaneously by means of an electrically heated faucet that is being manufactured by the Electrical Products Corporation, 6 South Calvert Street, Baltimore, Md. This device, as shown in the accompanying illustration, may be attached to any standard plumbing fixture and is ready for operation when the plug is inserted in an electric socket.

One turn of the faucet handle starts the flow of cold water, and the second



A TURN OF THE FAUCET CONNECTS THE HEATING ELEMENT TO ENERGY SOURCE

turn makes the electrical connection and heats the running water. The manufacturers claim that this device will heat 24 gal. (91 l.) per hour to a temperature between 110 deg. and 180 deg. Fahr. This faucet is adjustable

to any water pressure and can be used on either grounded or ungrounded systems of energy supply.

Crane Protective Panels

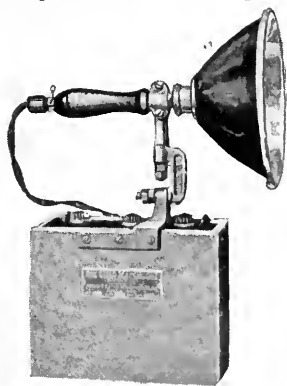
Crane panels which are used as distribution centers and also to protect the electrical equipment of the crane from abnormal conditions that may arise from overload, short circuits, grounds, voltage failures, etc., are being manufactured by the Allen Bradley Company, 495 Clinton Street, Milwaukee, Wis.

All electrical distributing and protective apparatus is mounted on one single panel and is centrally located in the crane cab. Undervoltage protection is given as well as double-pole, time-limit, overload protection for the entire equipment grouped together. The installation includes self-closing overload relays. A push-button station is used to reset magnetic clapper switches. Magnetic clapper switch limit stops for hoist in one or both directions are furnished when specified. Magnetic clapper switches for use in connection with dynamic control may also be furnished when specified. The magnetic switches are arranged for non-closing on overload.

Portable Electric Searchlight for Emergency Work

A self-contained portable searchlight operating on its own power and yet light enough in weight to be carried in the hands has been placed upon the market by the Portable Electric Searchlight Company, 87 Haverhill Street, Boston, Mass. An adjustable bracket permits of the rays being pointed in any direction and has a 7½-in. (19-cm.) adjustable-focus, single-shell reflector made with great accuracy. It burns continuously about two and one-half hours before it becomes necessary to recharge it.

It is especially adapted for electric light companies for locating and re-



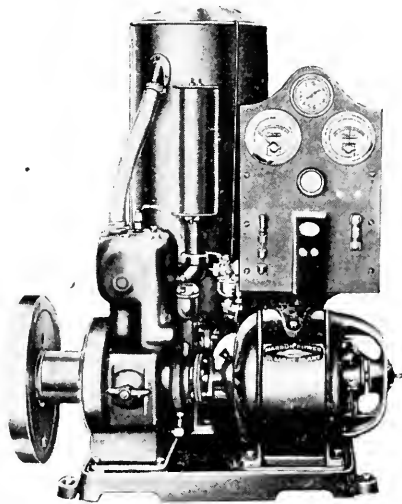
FOR TEMPORARY ILLUMINATION OF OUT-DOOR SUBSTATIONS

pairing trouble on wires and poles, in manholes and for trench work, and it may be used for high-tension transmission lines and towers and for temporary construction and maintenance of outdoor substations.

For work where it is only necessary to light up the immediate foreground the searchlight can be furnished with a wide-angle reflector which throws a very white diffused light instead of a beam.

Dual Purpose Farm Lighting Equipment

Belt power for overhead shafting and direct-connected machinery is supplied, as well as energy for charging batteries and delivering electrical energy, by the farm lighting outfit that is being manufactured by the Marron Manufacturing Company, Rock Island, Ill. The engine, generator and switchboard are all built in the Marron factory and are equipped with Edison batteries. The unit is driven by a single-cylinder vertical engine that is simple in construction and has a housing containing all movable parts. These parts are very easily accessible and may be reached by sim-



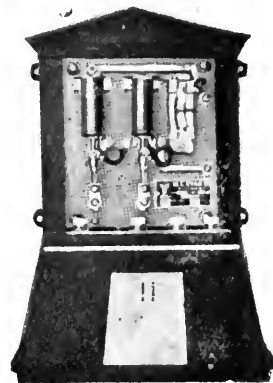
FLYWHEEL MAY BE USED FOR PULLEY FOR POWER PURPOSES

ply removing covering plates. The speed of the engine is controlled by means of a governor entirely inclosed which runs in oil. The board carries a field rheostat, a single-pole, double-throw switch on the ignition circuit, a high-grade voltmeter, an ammeter, a time switch and an automatic cut-out. The feature of the set is the automatic time switch. The batteries are charged for the time set, and the plant automatically cuts off its work. The 1.75-kw. generator is directly connected to the engine shaft by means of a flexible coupling. The over-all dimensions of this plant are 37 in. (94 cm.) long, 27 in. (69 cm.) wide and 44 in. (113 cm.) high, and the shipping weight is approximately 650 lb. (285 kg.).

Magnetic Thermo Flashers for Electric Signs

High efficiency is claimed to be the feature of a flasher operating on a thermal and magnetic principle which is marketed by the M. C. Ryan Company, Phoenix, N. Y. The thermo circuit of

this flasher is independent of the sign load and does not have springs or other moving parts to get out of order. Contacts are made of a special composition of metal and carbon, ⅝ in. and ½ in. (1.58 cm. and 1.27 cm.) in diameter,

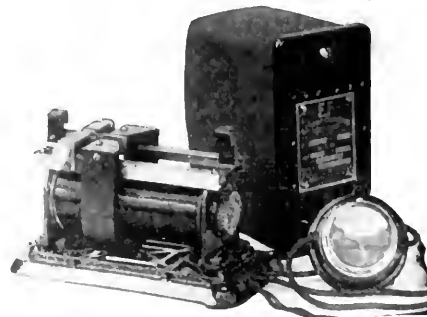


TWO-CIRCUIT FLASHER MOUNTED IN WEATHERPROOF CABINET

respectively giving a non-welding and minimum arcing break. The thermo element has two parallel bars from the same die and stock, in order that they may expand and contract together under any climatic changes. This makes the length of the flash and its duration always uniform in times per minute regardless of the sign load. The accompanying illustration shows a two-circuit, 660-watts-per-circuit flasher mounted in steel weatherproof cabinets. The company also manufactures a four-switch flasher, but this is not mounted in a cabinet.

Rectifier for Charging Storage Batteries

Both the positive and the negative halves of the alternating-current wave are rectified into a steady unidirectional charging current by means of a full-wave magnetic rectifier that is being manufactured by the France Manufacturing Company of Cleveland, Ohio. This device consists of a vibrating rectifier mounted with a variable carbon

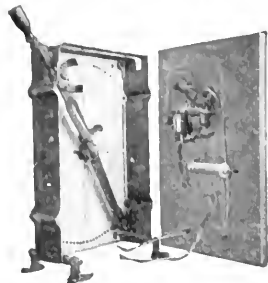


FULL-WAVE MAGNETIC RECTIFIER

resistance unit. The device is especially adapted for charging automobile batteries and may be fitted into an ordinary lamp socket. An ammeter is supplied with the device to indicate the rate of charging.

Inclosed Rheostat for Garages

An interlocking overload and underload release circuit breaker is the feature of a "Universal" rheostat that has been placed upon the market by the Ward Leonard Electric Company of Mount Vernon, N. Y. The overload circuit breaker protects the rheostat, the battery and the entire circuit against excessive current. The underload circuit breaker prevents the battery from

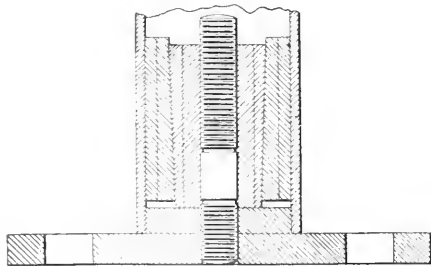


BATTERY CONTROLLED BY OVERLOAD AND UNDERLOAD CIRCUIT BREAKER

discharging back into the lines. The rheostat lever and the circuit breaker are so interlocked that when the circuit breaker is open it is necessary to move the rheostat in a position of minimum charging rate in order to close the circuit. The circuit breaker is entirely inclosed so that it cannot be tampered with by the operator.

Threadless Pipe Fitting

Threading of pipes for use on switch and bus structures is entirely eliminated by means of a rigid and neat-appearing framework fitting that is being marketed by the Railway & Power Engineering Corporation, Ltd., Canadian Pacific Railway Building, Toronto, Canada. A floor flange, shown in the accompanying illustration, consists of a flat casting about 0.375 in. (9.5 mm.) thick, in the center of which is a boss of suitable diameter to fit neatly inside the pipe. A threaded stud is secured in the center of this boss. A triangular wedge with the point toward the flange is attached to this stud. Three small wedges of suitable dimensions and with their outer side curved to the inside diameter of the pipe are placed against



END OF PIPE HELD FIRMLY AGAINST FLOOR FLANGE

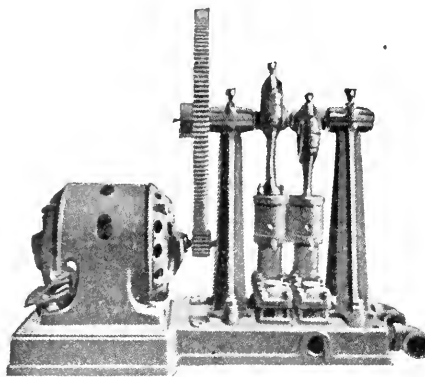
the triangular wedge, the group being then inserted inside the pipe.

A slight movement tending to draw the wedges out of the pipe causes the outer wedges to engage the inner wall of the pipe and the central wedge immediately locks. The fitting is then tightened by turning the pipe or the

flange which bears against the end of the pipe, thus allowing the central wedge to be drawn into close and tightly engaging contact with the outer wedges of the flange so as to force them into rigid engagement with the inner wall of the pipe. To remove the fitting from the pipe it is only necessary to give the fitting a few turns back on the pipe and to give the fitting a tap of a hammer toward the pipe. This loosens the wedges and they can then be slipped out of the pipe. This method of fastening the pipe can be applied to any fitting.

Pumps with Interchangeable Cylinders

A line of power-driven pumps that will pump from 200 gal. to 6000 gal. (757 l. to 22,711 l.) of water per hour against pressures varying from 20 lb. to 125 lb. per square inch (1.4 kg. to 8.8 kg. per sq. cm.), lifting the water from 40 ft. to 250 ft. (12.1 m. to 76.2 m.), is being manufactured by the Midvale Machine Works, Railway Exchange Building, St. Louis, Mo. Each cylinder in these pumps, the number of which ranges from two to twelve,



VALVE OPENINGS EQUAL IN SIZE TO PLUNGER AREAS

with its valve and valve chamber, is a separate and distinct interchangeable unit and can be removed in a short time without interfering with the operation of the other cylinders. This, it is claimed, is a special Midvale feature. The valve openings are equal in size to the plunger area. No packing or stuffing boxes are used. Lubrication is secured by compression grease cups on all bearings. The bases of the pumps are made of close-grained cast iron cast in one piece. The manifold is cast in the base with suction and discharge openings on two sides and one end.

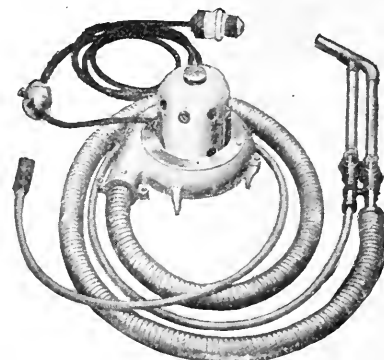
Electrically Driven Grinder for Laboratory Use

For grinding samples of cottonseed cake, linseed cake, corn cake and food-stuffs of all kinds, as well as various sorts of material used in laboratories for analysis, the Bauer Brothers Company of Springfield, Ohio, has developed an electrically driven grinder. It consists of a Robbins & Myers motor with one end head replaced by the

grinder mechanism which is directly connected to the motor shaft. The grinder case opens on a hinge, and all interior parts are readily accessible and easily cleaned. This allows a variety of materials to be ground in the machine without any one sample being contaminated by the others. The outfit is also used where small amounts of materials are ground continuously, and for this service it is provided with a special base which permits a constant flow of material to pass through the mill. The device over all is 24 in. (61 cm.) in height, 16 in. (41 cm.) in width and 25 in. (63 cm.) in length. The hopper is 10 in. (25 cm.) in diameter, and the plates are 8 in. (20 cm.) in diameter. The speed of the motor is 1800 r.p.m., and the total weight is 300 lb. (136 kg.). The outfits are regularly stocked with a 3-hp., 220-volt, three-phase, 60-cycle motor, but can be furnished with the two-phase or three-phase, 110, 440 or 550-volt motors if desired.

Electric-Gas Brazing Torch for Use in Shops

Sometimes it is desired to have an electric torch for annealing and hardening of small tools, brazing, heating soldering irons, heating melting pots, soldering, etc., when there is no compressed air available. To eliminate the necessity of installing an air compressor, the Tyler Manufacturing Company, 64 Pearl Street, Boston, has placed upon the market the "Bantam" electric-gas brazing torch. This device consists simply of a turbine fan driven by a motor connected to the torch, which is supplied with illuminating gas by means of a hose. All that is needed to operate this torch is a source of electric energy and a supply of gas. The torch will develop on illuminating gas a temperature of about 2300 deg. Fahr. The motor will supply a quantity of air sufficient to operate four burners like the one regularly furnished with the torch, and if the torch is equipped with



ELECTRIC MOTOR SUPPLIES ENOUGH AIR FOR FOUR BURNERS

four burners, the manufacturers claim that it will make a very complete small furnace. The device is especially adaptable for use on ships that are not equipped with compressed air. This avoids the inconvenience and delay consequent upon the use of the ordinary gasoline torch.

Trade Notes

THE BODINER ELECTRIC COMPANY of Chicago is represented in the New York territory by John H. Barker, 95 Liberty Street, New York City.

THE WAR TRADE BOARD of Washington, D. C., announces that, effective June 1, telegraph apparatus has been added to the export conservation list.

THE S. W. ELECTRIC COMPANY of New York City has been appointed sole distributor of the products of the William F. Wolff Company, manufacturer of lamp brackets.

THE BLAW-KNOX COMPANY of Pittsburgh, Pa., has removed its San Francisco office from the Rialto Building to the new office and warehouse at 528-530 Second Street. O. B. Pulis is in charge.

DUNCAN BOND of Denver, Col., has joined the sales force of the Packard Electric Company, Warren, Ohio. He will look after the business of the company in his section, with headquarters at Denver.

THE WAR TRADE BOARD of Washington, D. C., in supplement No. 3, publishes a "Cumulative Supplement to Enemy Trading List," revised, containing additions, removals and corrections from March 15 to May 17, 1918.

THE ELECTRICAL MACHINERY SALES COMPANY of Howell, Mich., has recently opened an office in the First National Bank Building of Milwaukee, Wis., to represent the Howell Electric Motors Company in Wisconsin.

CARL GOLIN has resigned as manager and treasurer of the Northwestern Storage Battery Company of Chicago and is now with the sales department of the United States Rubber Company, mechanical division, at Milwaukee, Wis.

JOHN H. BARKER of New York City, handling electrical equipment for factories, has the sole agency in the metropolitan district for the Reliance motor-driven swing saw, manufactured by the Reno-Karthor Electric Company of Cincinnati, Ohio.

THE WESTINGHOUSE LAMP COMPANY of New York City held its annual meeting of the district managers and heads of departments at the Gedney Farm Hotel, White Plains, N. Y., all last week. The sessions were of an executive nature.

THE WADSWORTH ELECTRIC MANUFACTURING COMPANY, INC., of Covington, Ky., is now incorporated under the laws of the State of Kentucky, with a capital stock of \$100,000, for the purpose of manufacturing electrical appliances.

THE GEORGE T. RENKE CORPORATION of New York City has issued a booklet entitled "A Few Facts in Latin-American Export Trade," by B. Joachim. It deals specifically and informally with trade possibilities in that part of the world.

J. P. NICKONOW, formerly with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., and lately with the Russian Artillery Commission, has established himself at 52 Vanderbilt Avenue, New York City, as a designing and consulting engineer.

O. S. LAIR, department manager for the Western Electric Company in various cities of the United States for the last seventeen years, and for the last four years manager of the Los Angeles (Cal.) office of the company, has resigned. Mr. Lair will become associated with the W. Ross Campbell Company of Los Angeles.

THE JEFFERY-DEWITT INSULATOR COMPANY, Huntington, W. Va., which has opened its new plant at Kenova, W. Va., as announced in the ELECTRICAL WORLD for June 8, will continue the present factory at Detroit and enlarge it to meet the demands for manufacturing spark-plug porcelains and other porcelain material of that nature.

A. HUETTER, for a number of years superintendent of the Boonton (N. J.) Rubber Manufacturing Company, is now vice-president and general manager of the Premier Rubber & Insulation Company of Dayton, Ohio. The new plant of the company, completed April 1 and in operation since May 1, is a one-story brick building, 68 ft. by 100 ft., with a separate power house of its own.

THE EMIL GROSSMAN MANUFACTURING CORPORATION of Brooklyn has opened a showroom in the Buick Building, 1733 Broadway, New York City, for the transaction of export business primarily. It will have on display all of the products which the concern manufactures. The

office is under the management of Sidney S. Frank. The executive offices will be continued in the Bush Terminal Building, No. 20, Brooklyn.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY of East Pittsburgh, Pa., has purchased the property, business and good will of the Krantz Manufacturing Company, Inc., of Brooklyn, N. Y., manufacturer of safety and semi-safety electrical and other devices, such as auto-lock switches, distribution panels, switchboards, floor boxes, bushings, etc. The supply department of the Westinghouse Company will act as exclusive sales agent of the products of the Krantz Manufacturing Company, whose business will be continued under its present name. H. C. Hoke of the Westinghouse company, will represent the supply department at the Krantz factory.

Trade Publications

SOCKETS, RECEPTACLES, ETC.—Pass & Seymour, Inc., Solvay, N. Y., is distributing form 1244, discount sheet effective May 18, 1918, of sockets and receptacles, etc.

SWITCHES.—The Ceco switch is described in a circular being distributed by the California Electrical Construction Company, 641 Mission Street, San Francisco, Cal.

FARM LIGHTING SYSTEMS.—The Gray Electric Company of Springfield, Ohio, is distributing bulletin D, describing and illustrating the "Ruralite" farm lighting system.

PORTABLE INSTRUMENTS.—Bulletin 46,018A, issued by the General Electric Company, Schenectady, N. Y., describes construction and specification of its portable instrument type P-8.

FUSES.—The Bussmann Manufacturing Company, St. Louis, Mo., has issued a bulletin describing and illustrating its fuses for all types of electric circuits. This includes plug fuses, cartridge fuses and auto fuses.

ELECTRICAL SUPPLIES.—Catalog 6311 of Hibbard, Spencer, Bartlett & Company, State Street Bridge, Chicago, lists a complete line of electrical specialties. Price lists of these devices are included in the catalog.

RECTIFIERS.—Bulletin 22, issued by the France Manufacturing Company of Cleveland, Ohio, illustrates and describes the use and application of its alternating-current and direct-current battery boosters and rectifiers.

PORTABLE SEARCHLIGHT.—The portable Electric Searchlight Company of 87 Haverhill Street, Boston, Mass., has issued a circular describing, illustrating and showing the use of its Bay State portable electric searchlight.

ELECTRIC COOKING.—The Edison Electric Appliance Company of Chicago has issued a bulletin giving an address by George A. Hughes on "Electricity the Nation's Conservator," which was presented before the Minnesota Electrical Association at Minneapolis on March 12.

PORCELAIN.—The Illinois Electric Porcelain Company, Macomb, Ill., has issued a catalog on electrical porcelain installations in which it features knobs, clevis, switch bases, tubes, strain insulators and telephone and electric light and power insulators for distribution voltage. The catalog contains twenty-four pages and is illustrated.

COOLING TOWERS.—The Wheeler Condenser & Engineering Company of Carteret, N. J., has issued a bulletin showing the Wheeler-Balke cooling tower in numerous designs and capacities varying from a few thousand gallons per hour to nearly a million gallons per hour. Several pages are also devoted to Wheeler-Barnard forced-draft cooling tower. The booklet is well illustrated with actual installations.

CONDUIT FITTINGS.—The Appleton Electric Company, 218 North Jefferson Street, Chicago, is ready to distribute its new 160-page catalog covering its complete line of "unilets" and other conduit fittings. This catalog is furnished in two sizes—that is, standard electrical manufacturers' size and a convenient pocket size. This catalog contains the numbers of new fittings recently placed upon the market by this company. A feature of the catalog is the pictorial index, which facilitates the selection of fittings required for any installation. A catalog in either size will be sent upon request.

New Incorporations

THE ELECTRICAL SUPPLY & REPAIR COMPANY of Hazard, Ky., has been incorporated with a capital stock of \$25,000 by C. E. Carlin, J. B. Hoe and R. L. Cornell.

THE DALLAS (TEX.) PRESTO BATTERY & SERVICE COMPANY has been incorporated with a capital stock of \$5,000 by J. V. Crannell, H. J. Crannell and P. C. Vines.

THE FARMERS' ELECTRO LIGHTING CORPORATION of Aberdeen, S. D., has been incorporated with a capital stock of \$25,000 by Fred P. Tosch, R. H. Garhne and Paul G. Tosch.

THE LALLEY ELECTRIC SHIFTER COMPANY of Detroit, Mich., has been incorporated with a capital stock of \$25,000 by William H. Lallely, Arthur M. Botsner and Henry Kennedy.

THE WADSWORTH ELECTRIC MANUFACTURING COMPANY of Covington, Ky., has been incorporated by George Wadsworth, Harry W. Percival and Alfred Allen. The company is capitalized at \$100,000.

THE TASSIN BATTERY CORPORATION of Norfolk, Va., has been incorporated with a capital stock of \$45,000 to manufacture and deal in electric batteries. The officers are: C. H. Hix, president, and R. H. Baker, secretary.

THE BROOKLYN (N. Y.) ELECTRIC WELDING CORPORATION has been chartered with a capital stock of \$50,000 to do a general contracting and electric welding business. The incorporators are: J. Kjerstad, H. B. Payne and J. B. Morris, 764 Court Street, Brooklyn.

THE SPRINGWATER (N. Y.) ELECTRIC LIGHT COMPANY has been incorporated by Albert W. Howe, Louis J. Hyde and Ebenezer Robinson of Springwater, N. Y. The company is capitalized at \$7,500 and proposes to generate electricity for lamps, heaters and motors.

THE NEW YORK ELECTRIC WELDING CORPORATION of Brooklyn, N. Y., has been incorporated by J. Kjerstad, H. B. Payne and J. B. Morris, 764 Court Street, Brooklyn. The company is capitalized at \$25,000 and proposes to a general contracting electrical welding business.

THE PRINCETON (IND.) UTILITIES COMPANY has been chartered by James C. Johnston, Samuel T. Heston, Jacob L. Knauss and Sampel L. May. The company is capitalized at \$40,000 and proposes to supply light, heat and power and water in Princeton and surrounding country.

THE HANA (HAWAII) ICE & ELECTRIC COMPANY has been incorporated with a capital stock of \$20,000 to generate electricity and to manufacture ice. The ice plant of the Hana Ice Works will be acquired. John Chalmers is president and G. Errett secretary and treasurer.

THE ELECTRIC EQUIPMENT COMPANY of Davenport, Iowa, has been chartered with a capital stock of \$50,000 to sell and deal in electrical fixtures, etc. The officers are: J. S. Kimmel, president and treasurer; F. E. Downing, vice-president, and A. Butler, secretary and assistant treasurer.

THE MONTCLAIR (N. J.) STORAGE BATTERY COMPANY has been chartered with a capital stock of \$25,000 to deal in electrical equipment and to carry on an automobile business. The incorporators are: Helen V. Chambers, Edith L. Woodhead and William J. Woodhead, all of Montclair.

THE WYOMING WATER & LIGHT COMPANY of Mullens, W. Va., has been incorporated with a capital stock of \$50,000 to operate light, heat and water plants. The incorporators are: D. D. Maron, A. W. Daubensneek, D. M. Klein, N. C. Bunch, J. A. Radwan and L. R. Taylor, all of Mullens.

THE BRODY ELECTRICAL COMPANY, 586 Spring Street, West Hoboken, N. J., has been chartered with a capital stock of \$10,000 to deal in electrical fixtures. The incorporators are: Abraham P. Terk of New York, N. Y.; Max Cohen, 78 New York Avenue, Union Hill, and Samuel Brody, Spring Street, Hoboken.

THE CHADBURN (SHIP) TELEGRAPH COMPANY OF AMERICA, of New York, N. Y., has been incorporated by W. P. Allen, 214 St. James Place, Brooklyn; F. A. Whitney, 50 West 121st Street, and J. L. Galey, 39 West Twenty-seventh Street, New York City. The company is capitalized at \$50,000 and proposes to manufacture electrical appliances and to do a general electrical and engineering business.

New England States

EASTPORT, ME.—In the issue of May 11 an item was published stating the Eastport Electric Company, recently organized, is installing a new plant in Eastport. We are informed that this information is incorrect. The town is now served by hydro-electric power.

LOWELL, MASS.—Plans are being prepared by the Lowell Electric Light Corporation for extensions to its power plant to provide space for the installation of new boilers. The cost of the proposed improvements is estimated at \$10,000.

PROVIDENCE, R. I.—The stockholders of the Narragansett Electric Lighting Company have voted to authorize \$1,700,000 in securities, subject to the approval of the Federal Reserve Board. It granted the proceeds will be used to pay for improvements, already made, amounting to \$600,000, and to include the new boiler house, 60,000-hp. turbine, the transmission lines to Westerly and cables to the North End and East Providence; also for additional improvements, which will include four new boilers of 600 hp. each, a 66,000-volt transmission line over the river on towers 150 ft. high, north of Fox Point and East Providence, and a transmission line from Swansea to Warren for increasing the power loads in that section.

Middle Atlantic States

BROOKLYN, N. Y.—Plans have been filed by the Kings County Lighting Company for the construction of an addition to its plant at Fifty-fifth Street and First Avenue. Contract has been awarded to P. S. Lane, 110 West Fortieth Street, New York City. The cost is estimated at about \$10,000.

BUFFALO, N. Y.—Plans are under consideration by the City Council for the installation of a new electric-lighting system in Oak, Vine and Elm Streets. Arc lamps will be used.

COBLESKILL, N. Y.—Bids will be received by D. D. Frisbie, president of board of trustees, Schoharie State School of Agriculture, Agricultural Hall, State and Lodge Streets, Albany, until June 28 for construction, including heating, sanitary and electric work of home economics building at the Schoharie State School of Agriculture. Drawings and specifications, etc., may be obtained at the Department of Architecture, Capitol, Albany. Drawings and specifications may be consulted at the school at Cobleskill and at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York.

GOUVERNEUR, N. Y.—The Village Board has renewed a contract with the Oswegatchie Light & Power Company for a period of five years for pumping the village water supply for \$6,000 per year. Under the previous contract the service was furnished at \$3,700 per annum.

NEW YORK, N. Y.—Arrangements are being made by the Interborough Rapid Transit Company, 165 Broadway, for a bond issue of \$37,700,000 for improvements and equipment, including extensions to power plants, etc., involving an expenditure of about \$2,391,000.

NEW YORK, N. Y.—The New York Edison Company, it is reported, is contemplating the construction of a large electric generating station for the Harlem River, Port Morris section, to cost about \$5,000,000. The company has recently acquired a site bounded by 133rd and 134th Streets, Walnut Avenue and the East River.

OXFORD, N. Y.—Bids will be received by Mrs. Georgiana Griffith, president of the board of managers of the New York State Women's Relief Corps, Oxford, until July 3 for refrigeration plant at the New York State Women's Relief Corps Home. Drawings and specifications may be consulted at the home, Oxford, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

ROCHESTER, N. Y.—Bids, it is reported, are being received by the Bridgeport Tool & Machine Company for the construction of a machine shop, three stories, 60 ft. by 200 ft., on Winston Road, to cost about \$50,000. R. S. Byers, Chamber of Commerce Building, is architect.

FREEHOLD, N. J.—Bids will be received by the County Board of Freeholders until July 3 for power equipment, installation of electric wiring, etc., and new heating system in connection with the erection of the proposed new tuberculosis hospital for the county. A new power house will also be built at the institution. Charles H. Wyckoff is director.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

JERSEY CITY, N. J.—The Jersey City Harbor Service Corporation has applied to the City Commission for permission to build a new marine terminal and industrial plant on a tract consisting of 160 acres in the Greenville section, near the Pennsylvania Railroad terminal, to cost approximately \$7,500,000. Considerable machinery and equipment will be required for the proposed plant. Walter H. Condict, 15 Exchange Place, is representative of the company.

MAY'S LANDING, N. J.—The Bethlehem Loading Company has begun work on the construction of 12 units at its new ammunition works at May's Landing, which will include a new power plant. A new village will be established at the works to be known as Belcoville. The company is affiliated with the Bethlehem Steel Company of South Bethlehem, Pa.

NEWARK, N. J.—Contract has been awarded by the Heller & Merz Company, Hamburg Place, Newark, for the construction of a new power plant, 37 ft. by 70 ft., to E. M. Waldron, Inc., 665 Broad Street, Newark.

NEWARK, N. J.—Bids are being asked by the Day Elder Motors Corporation, 161 Ogden Street, Newark, for the construction of a truck manufacturing plant, 125 ft. by 450 ft., at Colt Street and Clinton Avenue, Irvington. The company manufactures automobile trucks.

DOWNINGTOWN, PA.—Application has been made to the Public Service Commission by the Downingtown Light & Power Company for a charter to install and operate an electric plant to supply electricity for domestic and industrial use in Downingtown.

PHILADELPHIA, PA.—The Coatesville Boiler Works, Morris Building, has the contract for improvements and alterations in the boiler plant of Adolph Weicht & Sons, 730 Rising Sun Lane.

PHILADELPHIA, PA.—The committee on street railways of the City Council has reported favorably on an ordinance authorizing the Philadelphia Railway Company to build an extension from its southwestern electric railway to the Hog Island ship-building plant.

PHILADELPHIA, PA.—Plans have been filed and contract awarded by the St. Joseph's Academy, Chestnut Hill, near Philadelphia, for the construction of a new boiler plant at the institution at the city line and Germantown Avenue. John McShain, 1610 North Street, has the contract.

PHILADELPHIA, PA.—Bids will be received by the United States Marine Corps, Quartermaster's Department, Washington, D. C., until June 25, to be opened by the depot quartermaster, Marine Corps, 1100 South Broad Street, Philadelphia, Pa., for furnishing 50,000 ft. cotton-covered lamp cord and 2000 lb. insulated tape. Proposal blanks and other information may be obtained upon application to the above office or to depot quartermaster, Marine Corps, 1100 South Broad Street, Philadelphia, Pa.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company, it is reported, will petition the War Finance Corporation for a loan to enable it to make improvements to its plans as recommended by the Public Utilities Commission, to include the installation of two new boilers and a rotary converter.

BALTIMORE, MD.—Contract has been awarded by the Bartlett-Hayward Company, Scott and McHenry Streets, to Morrow Brothers for the erection of a one-story addition, 130 ft. by 450 ft., to cost about \$300,000, and a one-story building, 130 ft. by 378 ft., to cost about \$100,000.

BRADSHAW, W. VA.—The Bradshaw Coal Company of Bluefield, recently organized, has taken over the holdings of the Bradshaw Pocohontas Coal Company of McDowell County. New equipment, to cost about \$75,000, will be purchased. Electricity will be secured from the Appalachian Power Company of Bluefield. C. L. Biddison of War Eagle is engineer.

MORGANTOWN, W. VA.—The West Virginia Traction & Electric Company has begun work on the erection of a new transmission system from Morgantown to Masontown to supply energy to the plant of the Elkins Coal & Coke Company.

MULLENS, W. VA.—The Wyoming Water & Light Company, recently incorporated with a capital stock of \$50,000, pro-

poses to operate an electric light, heating and water plant. Among the incorporators are D. D. Maron, D. M. Klein and L. R. Taylor, all of Mullens.

ALEXANDRIA, VA.—The War Department will erect a laundry building, equipped with machinery, at Camp Humphreys, to be located near the base hospital. It is proposed to enlarge the power house at the hospital to enable it to supply steam and power to the laundry.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 24, under specification 3077, for an electric freight elevator at the Navy Yard, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 24, under specification 2967, for improvements to power plant at the Washington Navy Yard, to cost about \$36,000.

WASHINGTON, D. C.—Contracts have been awarded by the War Department to the Air Nitrates Corporation for the construction and operation of nitrate plant No. 3. The two half units of this plant will be located, one at Elizabethtown, near Cincinnati, and the other near Toledo, Ohio. Work on construction will begin at once.

WASHINGTON, D. C.—Bids will be received at the Bureau of Standards, Department of Commerce, Washington, D. C., until June 30 for performing miscellaneous electrical work during the fiscal year ending June 30, 1919. Specifications and proposal blanks may be obtained upon application to the superintendent of the mechanical plant, Bureau of Standards, Washington, D. C.

WASHINGTON, D. C.—To make extensions and improvements necessary that electric power plants may meet the demands made upon them by the war program an appropriation of \$200,000,000 is to be asked of Congress. This step has been decided on by the War Industries Board in answer to the complaints of power companies in the eastern territory that finances are needed with which to expand their plants to meet the increased demand for electricity in the production of war materials. The electric power plants in the following districts are to be proposed to receive financial aid: Niagara, Pittsburgh, Philadelphia, Pa.; Wilmington, Del.; Baltimore, Md.; Newark, Camden and Burlington, N. J.; Alliance, Massillon and Canton, Ohio; Connellsville, Pa., and Claremont, N. H.

North Central States

DETROIT, MICH.—Henry Ford is reported to have acquired mill property in Southfield, together with machinery and water rights, for the purpose of supplying electricity to the foundry being erected in River Forge.

DETROIT, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 10 for the installation of two electric elevators in the United States post office and court house at Detroit. For details see Searchlight Section.

DETROIT, MICH.—Plans are being prepared for the erection of a five-story factory building, 472 ft. by 66 ft., for the Burroughs Adding Machine Company, Second and Burroughs Avenue. The cost of the building is estimated at \$750,000. A. Kahn and E. Wilby, Marquette Building, Detroit, are architects.

SAGINAW, MICH.—The Wolverine Tractor Company, Ford Building, Detroit, is contemplating the erection of a plant in Saginaw. New factory equipment, including a pneumatic riveting plant, lathes, milling machines, drill presses, etc., will be required.

COLLINWOOD, OHIO.—The New York Central Railroad Company is contemplating the purchase of two 10-ton and one 20-ton electric traveling crane and four locomotive cranes for its Collinwood shops.

SPRINGFIELD, OHIO.—Plans have been prepared by the Ohio Electric Company for the removal of its car barns, repair shops and storage house from Columbus to Springfield. Ground has been purchased for the new addition in West North Street and contract has been awarded for the construction of the storage house. Contracts for other buildings have not yet been awarded.

HAZARD, KY.—The Electrical Supply & Repair Company of Hazard is contemplating the construction of a machine and repair plant, to cost about \$20,000.

LOUISVILLE, KY.—Bids, it is reported, will soon be asked by the Louisville Carriage & Taxicab Company, 421 Third Street, for the construction of a garage at Second

and Walnut Streets, to cost about \$75,000. D. X. Murphy & Brother, Louisville Trust Building, are architects.

ANDERSON, IND.—The Hill Pump Company of Anderson has taken over the factory formerly owned by the Wagner Axle Company, which is being enlarged by a foundry, machine shop and boiler house. The foundry will be equipped with three traveling cranes and six jib cranes. The cost of the work is estimated at \$100,000.

DANVILLE, IND.—The Public Service Commission has authorized the Merchants' Heat & Light Company of Indianapolis to issue \$135,000 in bonds and \$40,000 in capital stock for the purpose of taking over the property of the Danville (Ind.) Light, Heat & Power Company.

PERU, IND.—Additional locomotive shops, to cost about \$1,000,000, will be erected at Peru by the Pennsylvania Railroad Company.

CHICAGO, ILL.—Plans have been filed by the Electric Steel Company, South Wood Street, for the erection of a new foundry at 1801-31 West Thirty-first Street, to cost about \$100,000.

MANITOWOC, WIS.—Preparations are being made by the Board of Public Works for the installation of a 1500-kw. turbo-generator unit, with accessories, for the municipal electric-light plant, for which bids have been received.

MORRISVILLE, WIS.—The Board of Education has engaged Edward Tough, architect, 24 East Millin Street, Madison, to prepare plans for a three-room addition to the high school to be equipped for manual training work.

NEILSVILLE, MINN.—Bids will be received by T. A. Thompson, clerk, Nashville, until June 28 for electric-lighting fixtures and a 3-kw., 160-amp. lighting plant for the Neilsville school. William F. Kurke, 31 Huntington Block, Fargo, N. D., is architect.

ALLENDORF, IOWA.—Application has been made to the Board of Railroad Commissioners of the State of Iowa by the Allendorf (Iowa) Electric Company for a franchise to erect and operate an electric transmission line along certain roads and highways in Osceola County for the transmission of electricity for lamps and motors. Electricity for operating the system will be obtained from the transmission line owned by the Ochevedan (Iowa) Electric Company.

SIOUX CITY, IOWA.—Bids will be received by Gardner & Lindberg, engineers, Chicago, Ill., for the construction of a meat packing house, including power house, for the Midland Packing Company, to cost about \$750,000.

ADRIAN, MO.—At an election held recently the proposal to grant a franchise to Mr. Green to install and operate an electric lighting system in Adrian was carried.

ARCHIE, MO.—Contracts have been awarded by the Green Light & Power Company of Pleasant Hill for the erection of an electric transmission line to connect Archie and Pleasant Hill. The cost is estimated at \$100,000.

KANSAS CITY, MO.—Contract has been awarded by the Kansas City Railways Company for the construction of a new substation, 43 ft. by 82 ft., to L. Breitag & Son Construction Company, at a cost of \$25,000.

KANSAS CITY, MO.—The Jansen Ealsbery Laboratories is contemplating the construction of a factory building, 123 ft. by 60 ft., three stories high, for the manufacture of veterinary supplies, to cost without mechanical equipment about \$60,000. The plans provide for electric-lighting installation and electric elevators. Ernest O. Brostrom, Reliance Building, Kansas City, is architect.

MARSHALL, MO.—Bonds to the amount of \$80,000 have been voted for the construction of a municipal electric-light plant. Henrici & Lowry, Commerce Building, Kansas City, are engineers.

RICH HILL, MO.—Bonds to the amount of \$14,000 have been voted for improvements to the municipal electric-light and power plant.

ST. LOUIS, MO.—The Union Electric Light & Power Company is planning to remodel its boiler house, at a cost of about \$15,000.

BELVIDERE, NEB.—Bids will be received by the town of Belvidere until June 28 for construction of an electric distributing system, including three 10-kw., 13,000/2000-volt, three-phase, 60-cycle, step-down transformers, 80-kw. (total capacity) 2200/110/220-volt, single-phase, 60-cycle, pole-type transformers, all provided with oil hangers and blocks, one 5-kw. series transformer with panel and instruments for 6.6-amp., 110-volt, 60-cycle alternating-current house meters and five 10-amp.

meters. The cost of the work is estimated at about \$5,500. Charles F. Sturtevant, Holdrege, is engineer.

CLAY CENTER, KAN.—The municipal electric-light plant was recently damaged by the explosion of a flywheel, causing a loss of about \$40,000.

JUNCTION CITY, KAN.—Bids are being taken (to close soon) by the Union Pacific Railway Company, Union Pacific Building, Omaha, Neb., for the construction of a 20-stall roundhouse, power house, storehouse, including electric wiring, steam piping, etc., in Junction City. R. L. Huntley, Union Pacific Building, Omaha, Neb., is chief engineer.

MANHATTAN, KAN.—The Manhattan City & Interurban Railway Company is contemplating the purchase of a second-hand 200-kw. rotary converter.

NEWTON, KAN.—Bids will be received by Adella Martin, city clerk, Newton, until July 3 for the construction of a sewage disposal plant, including two 300-gal. per minute motor-driven centrifugal pumps and pumping station. Black & Veatch, Interstate Building, Kansas City, Mo., are engineers.

Southern States

BRUNSWICK, GA.—The Butterworth-Judson Corporation, 61 Broadway, New York, N. Y., will install an electric-light and power plant to furnish electricity for lamps and motors to the proposed industrial city development, to cost \$2,000,000, in connection with the \$5,000,000 picric acid plant, which the company is building for the United States government in Brunswick.

JEFFERSONVILLE, GA.—Bonds recently voted for improvements to the municipal electric-light plant and water-works system have been sold, bringing a total of \$15,000. Work will begin at once on the proposed improvements.

MACON, GA.—The Central of Georgia Railway Company has awarded contract to the General Railway Signal Company of Rochester, N. Y., for installation of an electric interlocking machine to operate electrical signals and switches on all tracks entering the Macon Terminal yards. The cost is estimated at \$125,000.

MEMPHIS, TENN.—The Yazoo & Mississippi Valley Railroad Company is planning to install an automatic block system between Memphis and Coahoma, a distance of 65 miles, of which 20 miles is double track. The cost of the work is estimated at \$135,000. A. H. Egan is general superintendent.

BIRMINGHAM, ALA.—The 90-mile transmission line of the Alabama Power Company from the power plant in Walker County to the government development work at Muscle Shoals has been completed. The company is now building a 30,000-kw. extension to its Warrior reserve steam plant, which is to be completed by Oct. 1.

WYLLAM, ALA.—The sulphuric acid plant of the Steel Cities Chemical Company, it is reported, will be rebuilt by the construction department of the Virginia-Carolina Chemical Company of Richmond, Va. The plant, it is understood, will be enlarged and will cost from \$150,000 to \$200,000.

DREW, MISS.—Bonds to the amount of \$15,000 have been issued for the installation of an electric-light plant.

GREGORY, ARK.—The Gregory Gin Company, recently organized, is reported to be in the market for power plant and cotton ginning machinery, to cost about \$8,000.

GARBER, OKLA.—The installation of new equipment, to cost about \$20,000, is reported to be under consideration by the Garber Light & Ice Company. William Musser is interested.

OKTAHA, OKLA.—The Oktaha Mill & Elevator Company is planning to install a new plant and equipment, to cost about \$6,000.

WAURIKA, OKLA.—Arrangements are being made by the Consumers' Light & Power Company for the installation of new electrical machinery at its local plant. The proposed improvements will double the output of the power house.

GALVESTON, TEX.—The plant of the Brush Electric Company at Twenty-sixth and Post Office Streets was recently damaged by fire, causing a loss of about \$75,000.

Pacific and Mountain States

AUBURN, WASH.—The City Council has granted the Valley Gas Company a franchise to install a distribution system

and furnish electricity in Auburn. The franchise provides that the work must start before Jan. 1, 1919.

BELLINGHAM, WASH.—The Southwestern Engineering Corporation of Bellingham is contemplating the construction of a power plant in the Mount Baker district. The proposed plant will replace the present plant. The first unit will have a capacity of 75 hp.; the second unit of the same horsepower will be built in the fall.

SEATTLE, WASH.—Plans have been prepared for the erection of a three-story school building and garage 120 ft. by 250 ft. on Queen Anne Avenue for the Seattle Engineering School, Inc. Catalogs of steam, gas and electrical engineering equipment are desired. Sherwood D. Ford, Lyon Building, is architect. William T. A. Faulkner is president.

SPOKANE, WASH.—Preliminary plans for the buildings in connection with the proposed plant of the Washington Tire & Rubber Company, to be erected on Sprague Avenue, east of the city, have been completed. It is proposed soon to construct four buildings, including the main factory building, 300 ft. by 100 ft.; a service station, 50 ft. by 50 ft., and office building, 50 ft. by 60 ft. The power house will be attached to the main building.

SPOKANE, WASH.—The contract for complete electrical equipment of the Titan Feature Film Corporation plant and studio, located near Spokane, has been awarded to the Alexander Electric Company. The plans provide for a complete steam power installation, wiring a number of buildings of Titan City and also special lighting for the indoor stage. Exhaust steam from the generating plant will be used for heating the buildings. The plant will be capable of maintaining 6000 25-watt lamps. J. Don Alexander is president of the Alexander Electric Company.

TACOMA, WASH.—The City Council has passed an ordinance authorizing Hamilton F. Gronen, light and water commissioner, to contract for energy-consuming devices, such as electric heaters, ranges, water heaters, etc., amounting to \$20,000.

FRESNO, CAL.—The Board of Trustees has adopted a resolution authorizing the installation of the electrolit lighting system in extension on Van Ness Avenue to the southern entrance of the city.

LOS ANGELES, CAL.—The installation of new ornamental standards on Broadway, between First and Tenth Streets, and California and First Streets, is under consideration by the City Council.

OAKLAND, CAL.—The construction of an electric railway by the Emergency Transportation Company to connect the plant of the Moore & Scott shipbuilding concern with the San Francisco-Oakland Terminals Railway on Eighth Street has been approved by the city of Oakland. The cost is estimated at \$20,000.

SAN FRANCISCO, CAL.—Application has been filed by E. E. Lindsey of San Francisco for 30 cu. ft. per second of the waters of Buck's Creek, tributary to the North Fork of the Feather River in Plumas County. The proposed project will consist of a timber crib dam 20 ft. high, 75 ft. wide on the bottom and 25 ft. wide on the top, and a flume and ditch 4 miles long. The plans provide for a development of 4750 hp. under a 1400-ft. head, at a cost of about \$153,000.

SONORA, CAL.—The Gold Ridge Mining Company is considering plans for equipping its mines for electrical operation.

SHELBY, MONT.—Contract has been awarded to the Two Miracles Concrete Company for lighting the town, to cost about \$6,000.

CRIPPLE CREEK, COL.—Plans are being considered by the Golden Cycle Mining Company for the construction of a new electric power plant at Pikeview, near Colorado Springs, to cost about \$200,000.

STERLING, COL.—The installation of new street lamps in Sterling is under consideration by the City Council. The Colorado Power Company is rebuilding its local lines and will furnish electricity to maintain the new lamps.

GREEN RIVER, WYO.—Bids are being asked by the Union Pacific Railway Company, Union Pacific Building, Omaha, for the construction of a 20-stall roundhouse, one-story machine shop, power house, storehouse, including electric wiring, plumbing, etc., at Green River, Wyo. H. L. Huntley, Union Pacific Building, Omaha, Neb., is chief engineer.

VALMORA, N. M.—Extensions and improvements are being made to the Valmora Sanatorium, involving an expenditure of about \$100,000. The plans provide for the construction of a power plant and a large reservoir.

Canada

WINNIPEG, MAN.—Tenders will be received by the chairman of the Board of Control, Winnipeg, until June 27 for furnishing and erecting a 10,000,000-gal motor-driven pumping unit, complete with switch-board, wiring, pipe connections, etc., for the McPhillips Street pumping station. Plans and forms of specifications, etc., may be obtained at the office of the city engineer 223 James Avenue, Winnipeg.

TRURO, N. S.—Preparations are being made by the Town Council for the installation of an electric plant, to cost about \$40,000.

HAMILTON, ONT.—Plans have been prepared by the Board of Control for the

construction of a market house, including a refrigerating plant, to cost about \$100,000.

OTTAWA, ONT.—Tenders will be received by John A. Pearson, architect, and J. O. Marchand, associate, Centre Block, Parliament Hill, Ottawa, until July 2 for lighting fixtures required in the construction of the Parliament Buildings. Plans and specifications and further information may be obtained at the office of P. Lyall & Sons Construction Company, Ltd., Ottawa, Ont.

REGINA, SASK.—A by-law providing an appropriation of \$175,000 for a new electric generating unit and other improvements to the municipal electric-light plant has been passed. J. Russell Ellis is acting city engineer.

Miscellaneous

MAUI, HAWAII.—W. D. Stone, manager of the Hawaii Telephone Company, who has charge of the reorganization of the Maui Telephone Company, recently taken over by the Mutual Telephone Company, has recommended that in addition to an expenditure of \$50,000 for the wire system, another \$25,000 be expended in new buildings and equipment. A new central is to be established at Makawae, where a new building, to cost \$3,000, will be erected for that purpose. A new exchange will also be erected in Hana, and the Pau and Lanaina centrals will be remodeled and put in a state of satisfactory repair.

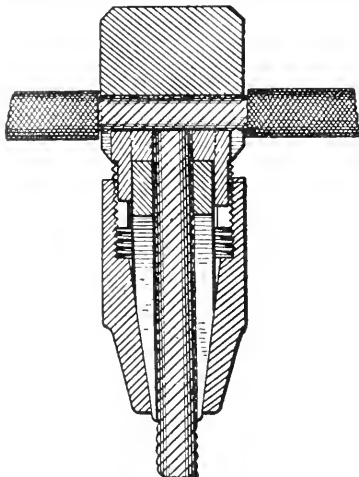
Record of Electrical Patents

Notes on Recent United States Patents

App. filed April 16, 1917. Object is to supply regulatable evaporating means suitable for producing a constant supply of vapor to any inclosure.

1,267,613. MEANS FOR HOLDING BATTERY ELEMENTS; Frank E. Whitney and Martin Melia, Philadelphia, Pa. App. filed July 27, 1916. Will automatically close up any spaces which may exist so that the separators, electrodes, etc., shall be maintained in the most intimate contact.

1,267,620. DRY BATTERY; Ferdinand P. Bauman, Kunsnacht, Switzerland. App. filed Feb. 18, 1916. Relates to plate electrodes and carbon electrodes impregnated with impervious substances.



1,267,959—Connector

1,267,641. RESISTANCE BODY; Georg Egly, Berlin-Treptow, Germany. App. filed Feb. 21, 1914. Electrical resistance bodies which are made preferably from a material known under the name of "silic" consisting essentially of silicon and carbon.

1,267,642. REGULATING RESISTANCE; Georg Egly, Berlin-Treptow, Germany. App. filed Dec. 5, 1914. A regulating resistance having the shape of a segmental cogwheel in which the cogs carry the contacts.

1,267,653. ANODE CONNECTOR; Julius H. Gillis, Toronto, Ontario, Canada. App. filed Oct. 15, 1917. Uses aluminum connectors in electrolytes.

1,267,671. TIMER DISTRIBUTOR; George L. Lang, Newark, N. J. App. filed Oct. 28, 1914. A timer for eliminating "back fires" on a reverse motion of the engine.

1,267,700. RADIATOR; Will R. Savage, Omaha, Neb. App. filed Aug. 21, 1913. An electrically heated radiator.

1,267,706. VACUUM REGULATION; Homer C. Snook and Edwin W. Kelly, Oak Park, Ill. App. filed June 11, 1915. Means for regulating the degree of vacuum of an X-ray tube or other vacuum tube.

1,267,726. RHEOSTAT; Henry J. Wiegand, Milwaukee, Wis. App. filed March 8, 1915. Rheostats of the type known as held regulators.

1,267,727. HOISTING AND CONVEYING APPARATUS; Emory J. Wilson, Cleveland, Ohio. Applied to locomotive crane construction.

1,267,801. PROCESS FOR WELDING TUNGSTEN INGOTS; Carl A. Pfanstiehl, Waukegan, Ill. A process wherein fine particles of metallic tungsten are compressed in a suitable die or mold to form an ingot.

1,267,816. INTERRUPTER MECHANISM. John R. Stark, Racine, Wis. App. filed July 16, 1917. Devices for alternately making and breaking an electric circuit.

1,267,827. ELECTRIC DISCHARGE DEVICE; Willis R. Whitney, Niskayuna, N. Y. App. filed Nov. 6, 1914. Devices to suppress local disintegration or erosion of the cathode.

1,267,846. BATTERY GRID; Clarence H. Cable, Topeka, Kan. App. filed June 25, 1917. Provides an adequate support for the active materials.

1,267,858. INCLOSED-ARC DEVICE; Charles V. Ferguson, Schenectady, N. Y. App. filed July 3, 1916. Devices in which an arc is operated between an incandescent cathode and an anode.

1,267,879. RHEOSTAT; Nils D. Levin, Columbus, Ohio. App. filed Aug. 17, 1915. Provides a resistance device which will have all of its parts compactly arranged.

1,267,888. INCANDESCENT CATHODE DEVICE; George S. Meikle, Schenectady, N. Y. App. filed Aug. 15, 1916. A refractory cathode adapted to operate at incandescence in a gaseous medium.

1,267,919. CONTROLLER; Karl A. Simon and Arthur J. Hall, Wilkinsburg, Pa. App. filed April 4, 1914. Controllers for governing the operation of dynamo-electric machines.

1,267,930. ELECTRIC LOCOMOTIVE; Norman W. Storer, Pittsburgh, Pa. App. filed Nov. 5, 1915. Relates to the arrangement of the trucks embodying the running gears of electric locomotives.

1,267,959. CONNECTOR; Robert A. Becker, Poughkeepsie, N. Y. App. filed Nov. 27, 1916. The end of the tap or branch line is securely held in firm, binding relation with the main cable.

1,267,973. ELECTRIC RESISTANCE DEVICE; Lewis W. Chubb, Edgewood Park, Pa. App. filed Jan. 6, 1915. Provides a resistance device with effective and rapidly operating cooling means.

1,267,976. METHOD AND APPARATUS FOR THE ELECTRICAL REDUCTION OF ORES; Bayard G. Cobb, Dawson City, Yukon, Canada. App. filed May 23, 1913. A method of balancing or controlling the arc.

1,267,978. ELECTRICAL RESISTANCE; John Collinson, Manchester, England. App. filed March 4, 1915. The grids are made of sheet metal which may be either punched, "expanded" or otherwise treated to afford a lengthened path for the current.

1,267,984. IGNITER; Frederic H. Davenport and Howard H. Manning, Meadville, Pa. App. filed June 22, 1914. An igniter with an automatic means for advancing the spark, with devices for controlling the maximum of the advance.

1,267,991. IGNITION DEVICE; Arthur Dickerson, Salt Lake City, Utah. App. filed June 28, 1916. Ignition devices for internal and combustion engines.

1,268,018. CARBON BRUSH HOLDER; J. H. Knight, Fort Worth, Tex. App. filed March 6, 1917. A resilient means for automatically adjusting the carbon brushes.

1,268,031. MOLDABLE MATERIAL; James A. McCoy, Wilkinsburg, Pa. App. filed March 30, 1915. Process of making molded articles that comprises mixing an inert filler with a vegetable oil.

1,266,702. SIGNAL APPARATUS FOR AUTOMOBILES; Bert W. Miller, Boise, Idaho. App. filed Aug. 14, 1916. Apparatus to be actuated by the operator for indicating the direction in which the vehicle is traveling.

1,266,711. STRAIN INSULATOR; Bentley A. Plimpton, Victor, N. Y. App. filed Jan. 25, 1917. Affords a cementless connection between a metal cap, stud or connecting member and the insulating portion of the usual type of strain insulating unit.

1,266,714. TELEPHONE METERING SYSTEM; Charles V. Richey, Washington, D. C. App. filed July 11, 1914. Eliminates mechanical complications and substitutes electrical and electromagnetism means.

1,266,777. PHONOGRAPH; Nelson C. Durand, Newark, N. J. App. filed Sept. 25, 1914. A telephone receiver in the telephone circuit is so mounted as to be capable of being positioned in operative relation to an ordinary phonograph recorder.

1,266,779. ELECTRIC SAFETY LANTERN; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Oct. 16, 1914. Construction to insure against the ignition of gases or other combustible materials.

1,266,780. STORAGE BATTERY; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Jan. 20, 1917. Prevents batteries from becoming sluggish in action under certain conditions.

1,266,798. COMMUTATOR; William I. Hallock, Los Angeles, Cal. App. filed April 3, 1917. A timing apparatus for controlling the ignition spark of an internal-combustion engine.

1,266,801. SWITCH-CONTAINING PLUG CONNECTOR; George H. Hart, West Hartford, Conn. App. filed June 20, 1916. Connectors for connecting electric flatirons and other heating appliances in circuit.

1,266,811. BREAKER ARM FOR IGNITERS; Joseph E. Johnson, Meriden, Conn. App. filed Jan. 20, 1917. Relates to igniters for internal-combustion engines.

1,266,814. CURRENT-SUPPLY APPARATUS; Heinrich H. M. Kammerhoff, Orange, N. J. App. filed Dec. 13, 1912. A portable lighting apparatus for use in mines.

1,267,210. ELECTRIC MOTOR CONSTRUCTION; George Gillaspay, Joplin, Mo. App. filed March 17, 1915. Embodies a hollow casing constituting a handle and an electrically operated motor of improved construction snugly fitted within the handle.

1,267,400. METHOD OF TREATING ELECTRODES FOR ELECTRIC WELDING; James H. Gravell, Brooklyn, N. Y. App. filed Oct. 20, 1917. Consists in applying a thin coating of a metal with a low melting point to the bearing surface of the electrode.

1,267,436. SIGNALING DEVICE; Louis W. Martin, New York, N. Y. App. filed March 14, 1917. Provides a simple, compact device which may be worn on the hand, arm or other portion of the body of the user, and through which ocular signals may be given by flashing lights.

1,267,463. ELECTRODE FOR ELECTRIC WELDING MACHINES; Gustave H. Schlommo-dau, Cincinnati, Ohio. App. filed Oct. 8, 1917. Consists of a compound electrode comprising essentially a steel center or core and a copper shell of good conducting material.

1,267,480. ELECTRIC WELDING APPARATUS; Edmund J. von Henke, Lynn, Mass. App. filed Oct. 8, 1917. An electric welding or riveting apparatus adapted for use upon plates.

1,267,481. AUTOMATIC SWITCHING OR CIRCUIT-BREAKING DEVICE FOR ELECTRIC WELDING OR OTHER METAL-WORKING APPARATUS; Edmund J. von Henke, Lynn, Mass. App. filed Oct. 8, 1917. Avoids the use of connecting wires between the welding or metal-working portion of the apparatus and the transformer itself.

1,267,491. HUMIDIFIER; Daniel H. Young and Charles H. Porter, Manchester, Iowa.

Electrical World

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Number 26

Financing Problems Will Be Solved

JUST how and when electric utilities will get the definite government aid in financing which they expected is not plain at the moment. The prospect is not discouraging, because the matter is too vital to the integrity of the national position to be long neglected. We have every faith that in some way the problem will be solved. The first shock resulting from the interpretation of the act creating the War Finance Corporation by the directors of that emergency body served the good purpose of focusing the attention of bankers on the crisis. Now we are at a point where it is seen by Washington and by Wall Street, as well as by the public utility operators themselves, that concerted action must be taken to prevent dangerous potentialities from running too far.

The practical question of financing covers broadly two classes of necessities. One is that of the maturity of outstanding securities or the funding of short-time bank loans; the other is that of providing for construction cost on plant or line extensions required for war or community uses. In many cases these will have to be cared for separately or by different government or private agencies. The two classes, however, are somewhat intermingled. Neither one can be disregarded safely. And all acute financing necessities under war conditions lead inevitably to the rates.

The directors of the War Finance Corporation are not culpable for desiring that utilities which go to them shall be able to stand up financially. As bankers, as good business men, as lenders of government funds, they naturally want to take a minimum of risk, to get a maximum of protection. What we think they have failed to appreciate is the purely emergent character of the situation they deal with. When the government is at war and ordinary business and commercial practices are suspended it is not the time to be a stickler for the normal rule. You simply can't keep things normal. But the fact that the War Finance Corporation directors want to be assured of sound earning capacity in utilities may after all be effective in strengthening the will of state commissions to grant speedy relief in rates.

In measuring dollars we should keep foremost in mind the strident fact that purchasing power has changed. The return on the new investment to-day is much less than fair when that investment has to depend on a rate which has not been increased to square with present costs. The dollar invested does not buy so much equipment or apparatus as it did. The output of the equipment or apparatus is measured in the kilo-

watt-hours, but the revenue from the kilowatt-hours is inadequate unless it is as much greater in proportion than the old rates yielded as the investment and operating cost is greater than the old cost would have been. In brief, if a given new investment in line or apparatus yielded 8 per cent under the old conditions, it would yield say 2 or 3 per cent with present costs, assuming no advance in rates.

These figures are of course subject to variation for individual properties. They are qualified by the consideration that they apply to the new-investment proportion of a company; and that equity of return may be secured either by a large advance in rate for those served by the new property or by a smaller average increase for all customers, whether served by old or new property. But the main argument holds, that rate of return on the investment is a diminishing quantity unless consumers' rates are figured with fair allowance for the costs of operation and extensions under war conditions.

Development of Aerial Power Cables

PRESENT conditions have demanded very rapid increase of power distribution on a large scale. The conditions are commonly enough met by ordinary high-tension construction, but many cases, particularly in thickly settled parts of the country, arise in which this ordinary construction cannot be conveniently used. For some years past the need has been met in such instances by the use of leaded and armored aerial cables such as have already been described in these columns. The paper presented by E. B. Meyer before the A. I. E. E. convention gives an admirable summary of current practice in this highly specialized line. Experience has proved that ordinary leaded cable is too heavy for convenient use, and as a result of much study a special type of cable (armor over reinforced rubber insulation) has been developed which is some 50 per cent lighter than the equivalent leaded cable and seems to meet admirably the somewhat difficult requirements.

The cables are carried on messenger wires, following the usual practice of the earlier telephone cable, and by thorough grounding of this and connecting it also with the armor of the cable proper it is found that the protection from lightning is excellent, in all probability considerably better than would be obtained by the usual forms of line construction. Most of the existing circuits are of 15,000 volts and less, but the same methods have been successfully applied up to 26,000 volts, and there seems to be no reason why still higher powers could not be employed. The Public Service Electric Company

of New Jersey, which has developed this method of line construction, has now in service nearly 25 miles (40.2 km.) of high-tension cable, some of which has been in use for the past seven years with a very striking degree of success. The results, in fact, have been so gratifying as to lead to considerable recent extension of this cable construction, which, without superseding the simpler and more general methods, has certainly a considerable field of usefulness.

America's Electrical Energy Supply

A GAIN the profession is indebted to Dr. C. P. Steinmetz for a most suggestive and striking discussion of the sources of energy available for industrial use. He views the subject in the large, considering the national resources of coal and water power as a potential whole. We have vast stores in this country of undeveloped coal fields and undeveloped water powers, but the total of the latter is, according to Dr. Steinmetz's figures, unmistakably less relatively to the utilization of fuel than one would at first thought suppose. Computing the total water power of the country through mechanical integration, so to speak, of the rainfall and heights above sea level, with due allowance for wastage of every kind in water rendered unavailable, it turns out that twenty-four-hour power of 230,000,000 kw. is approximately the final limit of utilizable energy which can be derived from water power between 30 deg. and 50 deg. north latitude on this continent. The startling bearing of this figure is that it is only about equal to the present total energy consumption of the country and but little more than the total allowance of annual energy produced from coal. In other words, great as is this potential power, it is not enough, even if all utilized, to supply materially more than the present needs of the country were the coal supply to fail, let alone the requirements at some point in the future when there will actually be a serious fuel shortage due to exhaustion of our resources.

A large part of the available hydraulic energy is in comparatively small units, and as Dr. Steinmetz points out, it needs a radical, although perfectly feasible, simplification of methods in order with reasonable economy to collect this scattered energy into a general source of distribution. Of the total potential hydraulic supply by far the larger part is, temporarily at least, economically unavailable. As fuel costs rise, either from actual exhaustion of the supply or by the stern compulsion of deep and difficult mining, more and more of the smaller and less promising water powers will become practically useful; but when that evil time approaches it is safe to say that the energy requirements of the country will have increased at so rapid a rate that even complete utilization of the water powers will afford small measure of relief. It is instructive thus to cast forward and endeavor to see to what ends the failing fuel supply may lead us.

At the present time all the great civilizations of the world lie in climates where mankind stands in sore need of fuel merely for necessary heating. A serious fuel shortage would render a large part of the now civilized world practically untenable by humankind through a large part of the year. As such a period arrives civil-

ization must adjust itself to the new conditions, either by drifting permanently southward to more genial climates or by trying grimly to hold its own by the utilization of every available form of energy.

Dr. Steinmetz very properly called attention to the enormous unutilized solar energy, many times in amount all other sources combined. Numerous attempts have already been made to utilize solar energy, with a fair degree of success. The practical limitation is not in the present somewhat crude apparatus, which is susceptible of great improvement, but in the average cloudiness of a large part of the earth's surface. Solar radiation is chiefly available in the two great though somewhat ill-defined dry belts north and south of the equator, running, for example, through Egypt and Arabia, across our own Southwest and far beyond the Pacific in a strip of continental Asia. In this area one can even now obtain a horsepower eight hours a day from about 100 sq. ft. (9.2 sq. m.) of mirror surface, a figure which can doubtless be improved. It should be noted, however, that the chief available source of solar energy lies in rather low latitudes and not in the regions which are now the centers of the world's activity. Again this condition points to the ultimate drift of population and of great civilizations to lower latitudes, to the regions where in fact the ancient empires grew and flourished before mankind drew upon the earth's stored fuel supply for warmth. One can well imagine such a drift, associated perhaps with marvelously developed north and south transportation to take advantage of the great fertile country during its annual period of usefulness.

Whatever there may be in such speculations, it is at least very plain from Dr. Steinmetz's figures that if our energy requirement goes on increasing for the next century at anything like the present rate, steps more radical than hydraulic development must be taken to keep pace with the world's needs. This does not, however, excuse mankind from failing to develop the resources of hydraulic power for all they are worth, thereby putting off the evil day in which the ultimate dilemma must be faced.

The Perennial Off-Peak Problem

THE central-station operator should read with keen interest James R. Cravath's consideration of the relation of the coal situation to the station loads. Next winter we are going to pass through a situation perhaps more serious than that of last winter. The zone system inaugurated by the Fuel Administration will help to a certain extent at the cost of relatively small inconvenience in burning unwonted kinds of fuel. It will not, however, remedy the shortage of coal due to lack of mine production and the difficulties of transportation, which are steadily increasing. The combined effect of war and fuel shortage has been to increase station loads very considerably, in fact, to an extent which keeps one guessing as to whence machine capacity can be derived. Almost the first effect of the increase in fuel costs has been to put a heavy handicap on small isolated plants, many of which were already, perhaps unwittingly, running at costs high compared with central-station service. Not a few of them have discovered the truth of the situation, and steadily more

and more isolated plants are shut down and their loads transferred to the general service available. We have more than once noted the desirability of meeting the difficulties of the situation by interconnection of public service companies on a large scale so as to take advantage of all the available aggregate capacity and of the total diversity factor.

Mr. Cravath lays special stress on the desirability of getting off-peak load both to increase the general efficiency of the station and to conserve machine capacity. Under present circumstances new equipment is both costly and difficult of attainment, and every possible effort should be made to utilize to the utmost both the generating capacity and the copper installed. This means coming to as nearly a full twenty-four-hour load as ingenuity can suggest. Mr. Cravath's hint as to taking over isolated-plant load through the summer is a good one where it can be applied. The main trouble is that not all systems have valleys in the load curves during the day, and it would mean additional load imposed upon the central stations through war conditions. Any off-peak scheme is practical and if properly handled will lead to prices of power so reasonable that in many instances it would pay the manufacturer to see if he could not arrange to work efficiently without calling for heavy power at the time of maximum peak. With the present tendency toward a general eight-hour day, this particular problem is somewhat simplified; but its solution is a task which belongs as much to the manufacturer as to the central station, and possibly the final effort will have to be made by the Fuel Administration. Certain it is that we are "up against" another season of shortage and must meet the situation thoughtfully and cheerfully.

Protection Against Flashovers

THE A. I. E. E. convention paper by J. J. Linebaugh and J. L. Burnham deals with a matter of particular importance in heavy railway service. Generators or synchronous converters of very large output are now and then exposed to most serious short-circuit conditions. If these are not too severe, the circuit breakers take care of the situation successfully, but there comes a time when even the brief short circuit permitted by the breaker is sufficient to cause arcing at the brushes which becomes continuous in a flashover. A great deal has been done to check this tendency by a strong commutating field, and with a considerable measure of success. Yet as machines have grown bigger and bigger, and as heavier and heavier demands have been put upon them, the dangers seem to have outrun the protec-

tion so far as this particular measure is concerned. The authors of the paper here considered set themselves the task of producing as complete protection against flashover as engineering skill could furnish, and they appear to have reached a degree of success that is most gratifying.

To a certain extent the tendency to flashover can be resisted by barriers between the brushes, just as it has been often checked in switches by a similar device. But this alone has never been fully successful, since in the case of very violent short circuits the arcing would get out of control even in the brief period required to get the ordinary circuit breaker into action. The line of improvement adopted by Messrs. Linebaugh and Burnham is twofold—first, to cut down to the utmost possible extent the time of operation of the circuit breaker, so that a flashover arc would have scant time to start, and, second, as an auxiliary measure, to furnish barriers to prevent arcing from brush to brush under the severest conditions of practice. Considering the fact that direct-current railway machinery is now built both for very high output and large voltage, the importance of these protective devices is self-evident. The authors, in fact, did a large part of their testing in connection with a 2000-kw., 3000-volt motor-generator set in railway service, which involves a constant threat of severe short circuit.

The chief form of improvement was directed to speeding up the circuit breakers to the utmost limit attainable. The ordinary big breaker begins to act in about 0.15 second, which is far too long a period of short circuit for safety against flashing. The authors therefore set out by careful mechanical design to get a very quick-acting breaker. As finally developed, it included a powerful spring actuating the relatively light moving parts, a tripping coil acting on a hair trigger, which opened the main trip on a movement of one-thousandth of an inch, and finally a series blow-out coil powerful enough to keep pace with the enormously rapid opening, reaching in fact under extreme conditions 150,000 ampere turns. By this ingenious combination it was possible to provide a high-capacity breaker which would open in rather less than a hundredth of a second. Even this speed was not quite sufficient to avert all danger with an open commutator, but the addition of a carefully designed set of barriers fulfilled all the requirements so that even the biggest generators could be adequately protected. The reader will find in this paper both many interesting details of the carrying out of the work and the results obtained by oscillograms and instantaneous photographs of the incipient arcing, as well as the data relating to miscellaneous researches of a highly promising character.

MUCH has been said about conservation of fuel by assuring efficient

combustion, but not enough attention has been directed to the benefits that can be derived from efficient utilization of the steam which is generated at the expense of coal. While turbines will maintain a high efficiency if properly cared for and operated, the steam economy will be greatly impaired if they are neglected. In a coming issue, therefore, the principal causes of impairment of economy will be discussed and suggestions given on how the trouble may be

The Coming Issues

detected and prevented in the future. Another article will refer to experiments which have been conducted with a lightning arrester that works on a different principle from those now in use. The instruction course that an Eastern university is giving to state inspectors on illumination requirements in industrial plants will be outlined, and in line with the general economies now practiced in central stations the method used by one company in economizing in poles and conductor expense will be described.

What Commissions Are Doing on Rates

Attitude of Various State Regulatory Bodies on Questions of Rate Increases Due to Higher Costs of Operation and Effect of War Conditions—Fuel and Labor Are Vital Points

This continues the series begun in the issue of June 8, 1918, showing the attitude of public service commissions on rates. It will be followed by other articles in later issues.

RATE cases which go before the state commissions under war conditions are extraordinary emergencies and are generally so recognized by the authorities. Under these circumstances the commissions appear to be disposed to minimize the usual preliminaries and requirements of costly and delayed appraisal and investigation and to grant relief without serious delay. Only by reducing the time of handling these cases can they in fact afford relief promptly. Any return to the old practice of devoting years to a rate case would fail to meet the emergency nature of the crisis.

POSITION OF NEW HAMPSHIRE COMMISSION

From the New Hampshire Public Service Commission a representative of the *ELECTRICAL WORLD* obtained the following:

Increased cost of operation is the basis of rate raises so far permitted by the commission, but in cases where other factors make an extended investigation necessary the mere fact of increase in operating cost might not in itself be sufficient to justify permitting the scheduled advance to go into effect.

Particular rate changes have been allowed to go into effect without the disapproval of the commission, and in general it may be said that each schedule is treated by itself, with due regard to the possibilities of discrimination against other users of service.

Since April 1, 1917, four increases in electrical rates have gone into effect; none has been rejected. Public hearings were held upon the cases of the Plymouth Electric Light Company and the Rockingham County Light & Power Company, Portsmouth, relative to increase in price to 20 cents per kilowatt-hour in the former instance and the establishment of a coal clause in the latter. The Twin State Gas & Electric Company, Dover, established a coal clause during the period (5 mills per kilowatt-hour, power only). There has been no general opposition to these rate changes except that the Plymouth case was heard at length. At present the commission has under consideration the schedule of the Rockingham County company for rate advance through service charge.

The Plymouth case was the only one since April 1, 1917, which required an extended investigation. It is not known at this date whether the proposed service charge of the Rockingham County company will be permitted to go into effect without investigation. This depends in large measure upon whether a statutory complaint arises relative to the proposed schedule prior to the expiration of the thirty days' period which must elapse after filing before the new rate may become effective.

Roughly, the increases in lighting and power rates are of the order of 10 per cent each, but it is difficult to state accurately the percentage advance in revenue

to be derived from rate changes, in view of the number of factors in rate structures to be taken into account.

Not over 7 or 8 per cent of the electrical utilities under the commission's supervision filed rate schedules looking toward increased revenue in the above period.

Predictions are uncertain, but in general it may be assumed that the commission looks upon the war as the dominant factor in present operating cost increases. Presumably there will be some recession of costs after the close of hostilities, but the commission is not disposed to set a limit to this recession more than to express its doubt as to the return of prices of fuel and labor to the ante-war levels.

VIEW TAKEN BY WYOMING COMMISSION

H. A. Floyd, secretary Wyoming Public Service Commission, says:

"In a few cases we have authorized electric utilities to increase rates on a showing of increased cost of operation where the operating cost had increased to such proportion that the utility was really suffering. In two different cases we have approved these increases for all classes of consumers. In two other cases we have permitted utilities to increase with their power consumers only.

"We have had within the past six months applications for rate increases from four electric utilities. In one of these utilities permission was granted to increase the rates approximately 10 per cent; in another case, where there had been competitive plants and a rate war, an advance of more than 200 per cent was allowed on general lighting consumers, about 25 per cent on cooking and electric appliances and more than 100 per cent on power consumers. The other two utilities were permitted to increase upon their power consumers, by and with the consent of the consumers, the increased cost of fuel amounting to between 10 and 25 per cent.

"About 10 per cent of the electrical utilities under our jurisdiction are seeking certain advances in their rates. From our study of the general conditions we are of the opinion that the situation at the present time is partially a war emergency, but that there may be a period of at least two or three years after the war before the situation will be as normal as it was in 1917 or previous years. The greatest difficulties which the electric utilities are encountering are the two items of fuel and labor—fuel having advanced in a number of cases as high as 400 per cent and labor advancing from 25 to 100 per cent. Under the latter item less efficiency is being secured with the advanced cost of labor than in previous years."

NEVADA LITTLE AFFECTED

F. O. Broili, chief engineer Public Service Commission of Nevada, sends the following in answer to our inquiry:

"Our State is a small one in the matter of number of

inhabitants. With that in mind we would answer your questions as follows:

"We have one case, that of a water company, before us for an increase in rates owing to decrease of the population in the community affected. We have made no decision as yet in the above case.

"We have received no application for increases in rates of electric utilities. We know of none that are contemplating asking higher rates. As practically all of the power here is produced from water-power plants, we do not feel that there will be any material change in the cost of power as far as this State is concerned, and such as is likely to develop in this State will probably be due largely to labor conditions, and this matter will probably adjust itself after the war."

APPLICATIONS IN UTAH

T. E. Banning, secretary Public Utilities Commission of Utah, writes:

"Increased rates are authorized upon a showing as to the increased cost of operation, where it is also shown that the public utility has not in the past earned in excess of a reasonable return upon the investment. No discrimination has been shown as between different classes of consumers. Where increases have been granted they have applied to all classes of service.

"Only six applications have been received for permission to increase electric rates within this State during the past fifteen months. Five applications have been granted and one is pending. Where increases have been granted utilities furnishing metered service, the increase has averaged 20 per cent. In one instance a change from flat to meter rate was authorized, and the minimum charge increased from 50 cents to \$1, or 100 per cent. No applications have been rejected. One application is pending before the commission. Approximately 10 per cent of electric utilities in this State are seeking higher rates.

"It is impossible at this time to state definitely whether increases granted and sought will become permanent or if they will be subject to deduction after conditions return to normal. Each case is handled solely upon its merits, and rates will be subject to review at a later date."

ACTION TAKEN IN MARYLAND

Benjamin T. Fendall, secretary Maryland Public Service Commission, writes to the ELECTRICAL WORLD:

"I am directed to advise that under the public service commission law this commission has no power to suspend the application of increased rate schedules pending investigation as to the reasonableness of the rates and charges therein contained, the only requirement in this respect being that the rate schedule be filed with the commission not less than thirty days before the effective date thereof. The utilities under the jurisdiction of the commission, therefore, formulate the schedules and file same with the commission, the schedule automatically becoming effective on date provided unless in the interim the commission should have conducted an investigation into the reasonableness of the increased rates and found same to be in violation of the law, in which case the commission must enter its order establishing reasonable rates for the future.

"Since Jan. 1, 1917, changes in the electric rates have been made by twenty utilities, which is about half the total number of electric companies under the jurisdic-

tion of this commission, and it is practically impossible to give you any estimate of the average increases that would be of any value to you whatsoever.

"Practically all of these utilities have increased their rates to all classes of users, the only exception being in the case of the Consolidated Gas, Electric Light & Power Company of Baltimore, which, of course, is a much larger one than any other electric utility in the State. The Consolidated company has not increased the rates for domestic service or for small commercial consumption but has added a fuel rate adjustment clause which is applicable to the larger users of the company's service.

"There has been no formal case filed with the commission respecting the reasonableness of any of the increased rates except in the case of the Consolidated company. Hearings in this case have been concluded, and the matter will be argued before the commission.

"The commission prefers not to hazard a guess as to whether or not the utilities will go back to their pre-war conditions in all respects upon the termination of the war."

APPLICATIONS IN INDIANA

Carl H. Mote, secretary Public Service Commission of Indiana, writes as follows:

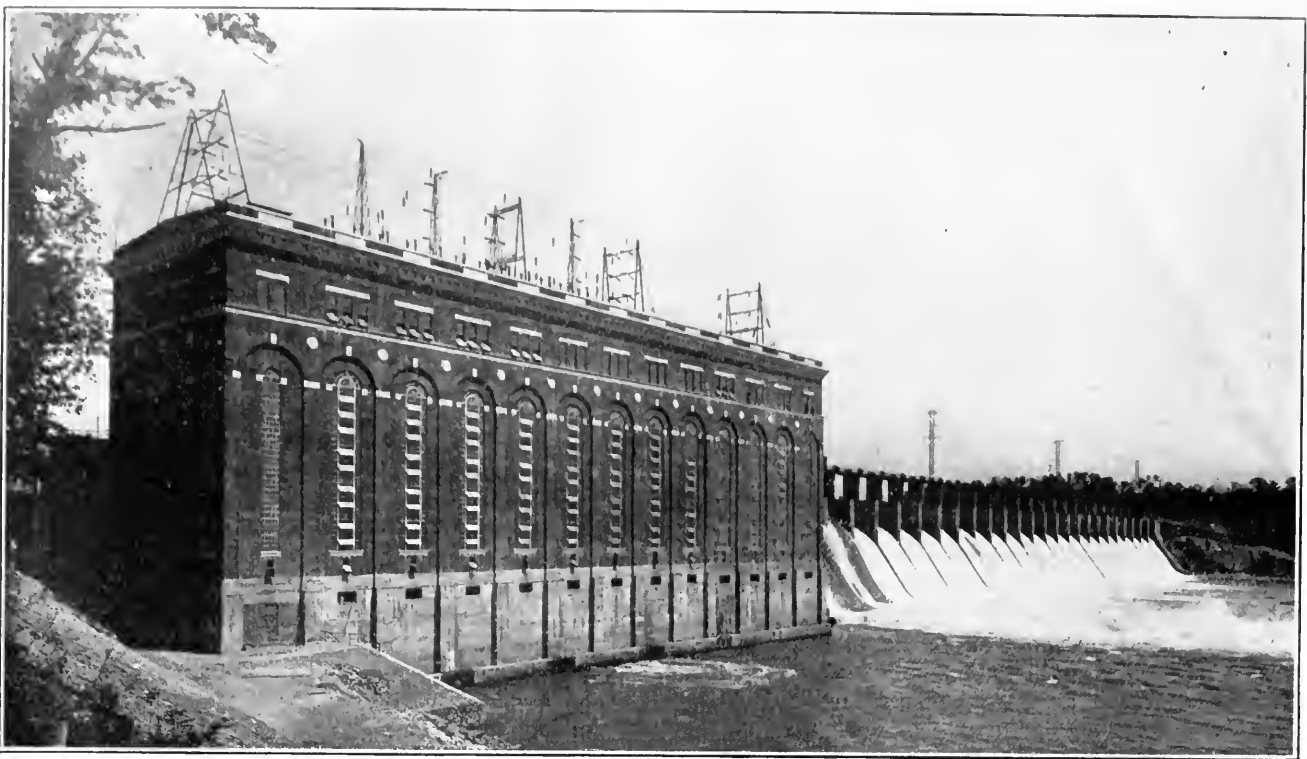
"We have authorized a great many electrical utilities to increase their rates on a showing of increased cost of operation. This increase has been granted in the form of a surcharge without any disturbance of the permanent rate structure, and the surcharge is made to expire at a given date, say one or two years from the date granted. Generally speaking, increased rates for electric energy or surcharges have been applied at a flat rate upon power, though several increases have been authorized upon all schedules. The Merchants' Heat & Light Company of Indianapolis and the Indianapolis Light & Heat Company were authorized to add a surcharge of 5 mills per kilowatt-hour to all bills for light and power except bills for energy furnished to domestic consumers.

"The commission has granted approximately eighteen applications from electrical utilities to increase rates and has denied seven petitions of this character. No advance, I believe, has been greater than 5 mills, and the amount has ranged downward.

"Probably five or six petitions from electrical utilities have been filed quite recently which ask for increased rates.

"Every increase authorized by this commission since the declaration of war is made to expire at a given date or with the end of the war. We have no reason for believing that the general operating conditions of electrical utilities will be changed permanently by present conditions. In fact, increases have been authorized particularly on account of the increased cost of coal, labor and material, all of which are certain to recede at the close of the war.

"I may say that, in addition to the petitions heretofore referred to, the commission early last year received a petition from the Indiana Electric Light Association on behalf of its membership for authority to add a surcharge of 30 per cent to all bills for all kinds of service. This petition was dismissed, and the membership of the association were directed to file individual petitions which would be considered upon the individual merits of each petitioner."



COOSA RIVER STATION OF ALABAMA POWER COMPANY, FROM WHICH ELECTRICITY FOR NITRATE PLANT NO. 1 IS OBTAINED

Electricity for Government Nitrate Plants

Two Plants Now in Process of Erection in Alabama Will Have Steam Stations Pending Hydroelectric Development on the Tennessee River at Muscle Shoals

THERE are under construction near Sheffield, Ala., two government nitrate plants, one employing the synthetic process, the other the cyanamide process. While for years there has been a systematic effort made to have the government permit the development of the waters of the Tennessee River at Muscle Shoals for the purpose of manufacturing nitrates, nothing has been done and probably nothing will be done until after the war on any hydroelectric development there for nitrate purposes. Meanwhile the nation is engaged in war and has need of nitrates for munition purposes. The exigencies of the case therefore demanded the erection of steam stations for the supply of the necessary electricity, even though water-power sites exist in the vicinity. The accompanying map will give some idea of the size of the government reservations and their proximity to the proposed hydroelectric plants on the Tennessee River, one of which it is expected will be erected after the war. Three dams are contemplated: Dam No. 1 for purposes of navigation only and Dams Nos. 2 and 3 for the development of electricity.

Nitrate plant No. 1 now being constructed from an appropriation of \$20,000,000 will use a synthetic ammonia process. Part of the ammonia will be oxidized to nitric acid and the final product will be ammonium nitrate. The output in terms of nitric acid is to be 200,000 lb. a day, and the electricity will be supplied by the Alabama Power Company, which has a hydroelectric station on the Coosa River and an auxiliary steam sta-

tion near the mouth of a coal mine on the Warrior River.

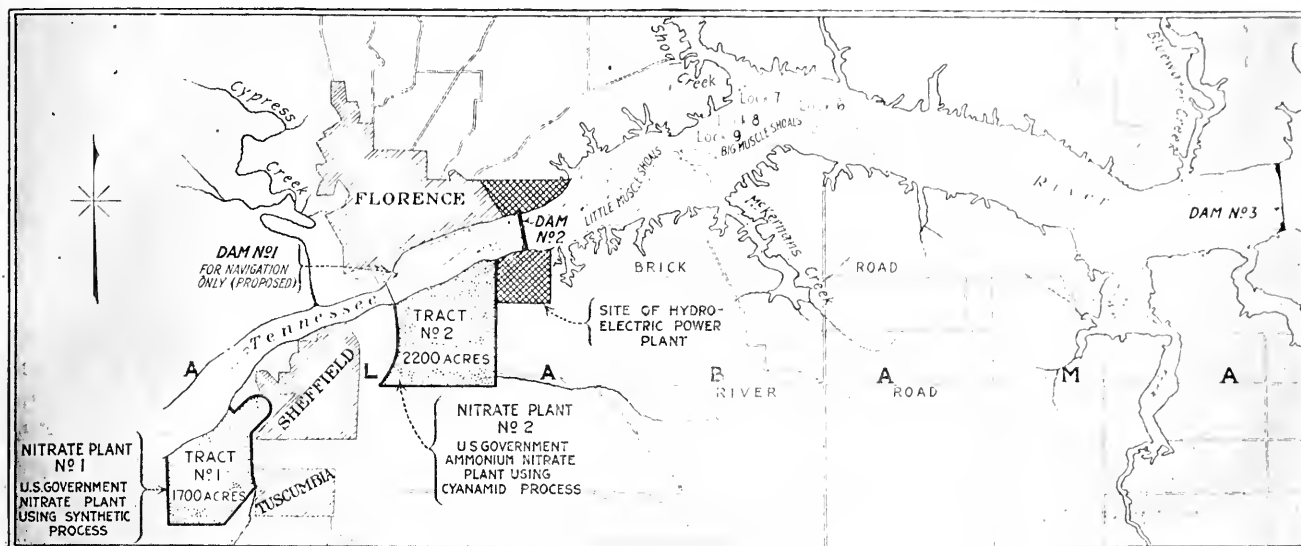
Nitrate plant No. 2 is being built by the Air Nitrates Corporation acting as agent of the Ordnance Department. The process used will be identical with that employed in the present plants of the American Cyanamid Company. The limekilns will burn 350,000 tons of lime per annum and the coke dryers will handle 100,000 tons. Carbide furnaces will fuse the lime and coke, after which the product will be cooled, ground and placed in ovens of one ton capacity, for treatment with nitrogen. The liquid-air plant for nitrogen production will have a greater capacity than that of all similar plants now existing in the United States and the Dominion of Canada.

The cyanamide, which contains from 20 to 21 per cent of nitrogen, will be cooled, ground, placed in autoclaves and treated with steam, to produce ammonia. In the cyanamide process this gas when mixed with air is passed through a heated platinum screen, whence the nitrogen is oxidized by catalysis. The oxide gases are then cooled and absorbed. One-half of the ammonia produced in the autoclaves will be thus oxidized and combined with the rest of the ammonia for the production of ammonium nitrate. The power requirements will be 60,000 kw., to be supplied from a steam turbo-generator station erected at the plant. Electricity from this steam station will, however, be superseded by electricity from a hydroelectric plant to be erected subsequently at Muscle Shoals.

The government, in addition, has under contemplation the erection of two other nitrate plants in Ohio, one at Elizabethtown and the other at Toledo. Both plants combined will have an output equal to Nitrate

power requirements will be met by existing central stations in the vicinity.

It is of interest to note in this connection that the steam turbines required by the government for its vari-



MAP OF GOVERNMENT NITRATE-PLANT RESERVATIONS AT MUSCLE SHOALS, ALA.

Plant No. 2, located at Muscle Shoals in Alabama. While no definite decision has yet been made relative to the Ohio plants, it is generally understood that the

ous nitrate and munition plants have been commandeered from the central stations of the country, the government to substitute other units for those taken.

Relation of Coal Situation to Central-Station Load

Off-Peak Service with Attractive Rates Is Urged for Those Isolated-Plant Customers That Are Forced Through Fuel Conditions to Take Electric Energy Supply from Power Company

BY J. R. CRAVATH

NO CENTRAL-STATION man needs to be told that the present coal situation is having a very strong tendency to build up central-station load. The load is coming fast enough; in fact, too fast. The central-station manager is in much the same position as a cautious man learning to run an automobile. He is concerned not so much with keeping the thing moving as with how to steer and control the "gol-durned thing" so that it will not run away with him and cause a wreck. The question is how to handle the additional load with minimum investment and plant extension rather than how to get the load.

Before attempting to discuss the best ways of handling the load which is being thrown upon central stations as a result of the present coal situation a few words as to how and why the load is coming are in order. The increase in coal prices since the beginning of the war has tended to make central-station power more economical than power generated in small plants, where before the balance was about even or in favor of the small plant. This is because the cost of fuel is usually a much larger percentage of the total cost of power in a small plant than in a large economically managed central station. For example, a 10 per cent increase in coal prices means more to a small plant where the coal cost is 50 per cent of the total than in a cen-

tral station where the coal cost is, say, 10 per cent of the total. This is given merely as an example to illustrate the point and not as any average figure for isolated versus central-station plant economy. In this connection it must be remembered that difference in pounds of coal required per kilowatt-hour in the two plants is not necessarily a measure of the difference in fuel costs, as the small plant frequently has to burn more expensive fuel, so that the difference in coal costs per kilowatt-hour is considerably more than the difference in plant performance.

The uncertainty of coal supply throughout the winter and the absence of storage facilities also tend strongly to make the isolated-plant owner seek central-station power. Many isolated plants are not so situated that they can maintain adequate storage to tide over winter months, and they are faced with the possibility of a worse coal famine than last winter. Even where storage can be used, the cost of putting coal in and out of storage materially runs up the total coal cost and acts as the equivalent of an advance in price.

The zoning system of the United States Fuel Administration whereby the plants in any given locality will be required to use coal from mines nearest to that locality and save long shipment will force some plants to use a lower grade of fuel than formerly. As much of

the high grade smokeless fuel has been used for domestic purposes rather than steam-plant purposes through the Middle West, this new system will not affect central-station loads as much as the reduction in coal tonnage shipped might indicate. The principal use of anthracite and high-grade West Virginia smokeless coal through the Middle West has been by small domestic consumers and by large buildings in big cities. As these buildings will have to have heat in any event, they will be obliged to equip to burn whatever fuel they can get, and therefore the influence that the change will exert on the power load is somewhat in doubt as yet.

The general principles which should be followed by central-station companies in meeting this increasing load situation are simple. The added load should be kept off of the present peak-load period as much as possible. Make existing apparatus carry this new load to as great an extent as may be and save investment in additional plant. The interests of the company's stockholders and of the United States are identical in this respect, because saving in central-station investment means saving in men and materials much needed elsewhere for war purposes.

In the past central stations have made special off-peak rates, but inertia and dislike to change established customs have prevented many customers from taking advantage of these, even though there may have been no real good reason why they should not. These war times are helping us to pull ourselves out of many bad ruts of conservatism, and now of all times would seem to be the opportunity to advance the off-peak load idea more fully than ever before.

THE OLD QUESTION OF THE OFF-PEAK LOAD

This brings us around to the old question of what classes of load can be made off-peak. The taking over of an isolated plant furnishing lighting—for instance, for office or apartment buildings—offers an opportunity for off-peak load only in the way already indicated as having been adopted by some large buildings. This is to throw the entire power and lighting load onto the central station during the summer time. By allowing the central station to carry the load at all times except during the prohibited peak period the isolated-plant owner can make a very material reduction in fuel consumed even if his plant cannot be entirely shut down.

Where the isolated plant to be shut down is one operating an industry which does not have to run twenty-four hours per day the periods of shut-down for that industry can be regulated, prejudice and custom to the contrary notwithstanding. Public service commissions in the past have usually required public utility companies to give services wherever demanded, if given according to the rules of the commission. Were an industry to demand central-station power and insist upon taking it during peak period, paying the regular rate therefor, the central station could not, under past rulings, refuse it. However, it will not do to assume that customers will insist on regular peak power where it is not absolutely necessary for them, or that regulating commissions will not recognize the present special war conditions and require some concession on the customer's part where this is feasible.

The analysis of the operating and investment costs necessary to make a proper off-peak rate should have been made by every central station before this, but if

not, now is the time, if ever, to make this analysis.

The first thing in such a study is to determine what is the real peak which it is desirable to avoid. It is also necessary to consider whether this peak is likely to be shifted by conditions of the immediate future. In determining what is the peak which is to be avoided a good criterion is to see whether the cutting off of any given peak would result in a lessening of the total station capacity required to supply the load on the system. On systems where the peak is of short duration during the maximum months of November and December a schedule which would call for the shutting off of off-peak power only a few hours per year might make possible carrying considerable additional connected load. One must always remember, however, that the tendency of central-station load is toward broader peaks as the diversity of load increases. If care is not taken in formulating the off-peak hours, the off-peak load itself may sooner or later contribute to a broadened peak. One must look ahead to these possibilities in establishing an off-peak schedule.

The investment required to supply an off-peak load as compared to a peak load involves an analysis of the extra investment required to supply an off-peak load over and above the investment if the off-peak load were not there.

Beginning at the consumer's end of the distribution system, the meter and service wire investment is the same for an off-peak as for a peak load customer of a given size. The transformers on an alternating-current system may be usable both for peak and off-peak customers, but in the case of large power customers frequently this transformer investment is peculiar to the individual customer, just as are the service connections and feeders. Feeders will usually be usable by both classes of customers, the same being true of substations and transmission lines. Of course, no two consumers are situated exactly alike, and it is necessary to strike some kind of an average just as in making other rates. The power-station equipment is obviously usable by both classes of customers.

This brings us to a rather fine point in rate making, which is whether the off-peak customer should pay part of the fixed charges on investment which is needed anyway to serve the regular peak customer. On one side is the argument that the addition of the off-peak customer does not add to the company's investment in certain items and therefore the off-peak customer should not be charged with it. On the other side is the argument that since both the off-peak and the peak customer enjoy the benefits of the investment it should be in some way divided between them, though by no stretch of the imagination could it be justly claimed that an off-peak customer should pay as much per kilowatt of maximum demand as a peak-load customer. If the principle of making rates according to true costs is followed, the off-peak customer will evidently have to pay a portion of the fixed charges on the investment required to serve him and the peak-load customer will have to pay a similar portion and in addition all of the fixed charges on the special peak-load investment required to serve him. To state the matter in another way, below a certain load-curve line the investment charges would be divided between these classes of customers, and above that line the investment would be chargeable altogether to the peak load customer.



"WASTEFUL DELIVERY METHODS CAN NO LONGER BE TOLERATED. SHORT-HAUL, MANY-STOP DELIVERIES ARE THE FIELD OF THE ELECTRIC TRUCK. EIGHTY-FIVE PER CENT OF CITY HAULAGE CAN BE ACCOMPLISHED BY THE ELECTRIC VEHICLE"

The Electric Vehicle as a War Measure

Offering an Economical Solution for an Important Part of the Nation's Big Transportation Problem, It Presents an Opportunity to the Central-Station Industry of Which Every Advantage Should Be Taken

BY JAMES H. MCGRAW

This address was made by Mr. McGraw at the Atlantic City convention of the National Electric Light Association, June 14.

TRANSPORTATION is one of the vital problems of the day. It deserves the attention of the biggest men in every industry. War has enormously increased congestion in factories, on railroads, in warehouses and terminal yards and on our city streets. We have more raw materials and more products to handle with fewer men, and with the need for real economy in handling costs.

More minds are being concentrated on transportation than ever before. Government officials, Washington bureaus, the War and Navy Departments, as well as engineers, central-station men, electrical engineers in industrial plants—all are considering parts of the problem.

TRANSPORTATION CONDITIONS

A brief survey of transportation problems in this country brings striking facts to light. Forty-five per cent of the population live in 11 per cent of the area of the United States. This restricted area includes the New England States, New York, Pennsylvania, New Jersey, Maryland, Ohio, Indiana and parts of Illinois and Michigan.

Of all goods made in the United States, approximately 70 per cent are made in this area. This concentration of population and manufacturing brings naturally a congestion of traffic that is little realized until a tremendously added burden is put on it by war needs.

Within the congested area is a still smaller zone which to-day is the red-flag zone of the government departments. In this zone, which borders the Atlantic and extends from Baltimore to Maine, there are no raw materials, no bituminous coal, no iron or other basic supplies. To get these raw materials into this region they must go through four gateways—Williamsport, Altoona, Shippensburg and Baltimore. To get coal and basic supplies into the great manufacturing district of New England, where there are so many war plants,

there are three gateways—the Harlem River, Poughkeepsie and Albany.

We must win this war with our present main equipment. We haven't time to build more gateways, more railroads, more trunk lines. The so-called red flag zone the next year will require 90,000,000 tons of bituminous coal, 80,000,000 tons of hard coal. All this product must go through the four gateways.

What does this mean? Broadly, it means that we must concentrate our attention on auxiliary means of transportation to move goods faster and transfer goods more quickly at this point. Every freight car must count. According to lately gathered statistics, we need 150,000 cars for replacement alone. The government ordered 100,000—a tremendous order, it is true, but only a part of what is needed to handle materials.

Electricity offers three means of auxiliary aid to the steam railway freight problem at this time. Various classes of hoists and transfer cranes and platforms operated by electricity are in use. Second, there is the industrial electric truck, a low-body, small-wheel vehicle which is being used for transfer work in government yards, docks and terminals, munition factories and so forth, and third, commercial electric trucks for short-haul, many-stop deliveries from warehouse to merchant, from merchant to customer.

In all these fields the electric vehicle is now performing work of direct help in war service, and there is a very real opportunity to extend this development tremendously.

Electric industrial trucks are being used more extensively than is generally realized in direct government work. Hundreds of trucks are in use at embarkation and debarkation points. Practically all goods going into France are handled at some point by electric trucks. Special trucks with crane and hoist attachments have been developed. Because of the nature of the work, it is not possible to describe these applications in detail.

The average cost of operating an electric industrial truck of this kind, including tires, battery upkeep, mechanical repairs, charging, drivers' wages and in-

terest on investment, is between \$5 and \$6 a day. In many instances one truck will do the work of four to six men. In one instance a truck saved eighteen men a day. These trucks have a speed of 5 miles (8 km.) an hour loaded and a capacity of two tons. They are particularly serviceable in operating in munitions factories because the risk of fire is practically negligible. These trucks are being built by hundreds. There are estimated to be 5000 in use to-day.

Specialized electric trucks for government service have also been built for hospital supply wagons and ambulances at base hospitals. An electric kitchen wagon also has been built. Electric tractors are in operation at the navy yards and supply depots for hauling ammunition cars.

WAREHOUSE AND TERMINAL HANDLING OFFER CHANCE

The war has especially shown the inefficiency of our methods of handling goods out of cars, across platforms and into warehouses. Goods are handled and re-handled without regard to time or labor. This is one of the biggest parts of our transportation problem.

It should be a matter of pride to realize that electricity at the terminals and gateways is helping to move goods more cheaply and faster. The industrial electric truck, the electrically driven overhead crane, the hoist and telfer systems operated by electricity, the night illumination, are all factors in this problem.

Electricity is helping to get the job done, and the demand for the industrial electric truck for this work is ahead of the supply, although the trucks are being turned out by several manufacturers. For loading and unloading steamships the electric industrial truck has found a place, not only because it saves time and labor but because practically every other type of power vehicle is eliminated from both docks and steamships by insurance companies on account of fire risks.

ELECTRIC TRUCKS IN MUNITION AND OTHER FACTORIES

Industrial electric trucks are helping to get work done in munition factories and arsenals. They have revolutionized the methods of handling goods in many plants. These factories need to-day to increase output by every possible means. They also need to conserve men, both laborers and mechanics. The industrial electric truck replaces men, speeds up production and is so simple a mechanism that it requires little skilled attention.

As a concrete example of what an industrial truck will do the Packard Motor Car Company has three electric industrial trucks handling scrap material from the lathes and presses where formerly forty-eight men were required.

Electric transportation in the factory is simply another example of the widening use of electricity in industries. Central-station service and the motor drive have been adopted. The power engineer from the central station has had an opportunity to act as an electric engineer of transportation and to point out to the factory manager just what electricity can do for transportation to his factory.

Local delivery methods are getting the same overhauling as railway, terminal and factory systems. Men are growing scarcer. Wasteful delivery methods can no longer be tolerated. The problem is part of the complete city transportation needs.

The Commercial Economy Board of the Council of National Defense has just issued a booklet entitled "Economy in Retail Service." The Council of National Defense as a whole also has made this statement: "The Council of National Defense has given its formal approval to all measures designed to facilitate the use of motor trucks in transportation wherever they can be utilized. It is urging all communities as far as possible to adapt the motor truck to their local needs and encourage its use in any way to help existing transportation problems." In neither of these pronouncements is direct reference made to any type of motor truck, but the general idea of replacing horse-drawn trucks and, perhaps more important, antiquated delivery systems is being widely promoted.

The booklet issued by the Commercial Economy Board is part of a broad program started in 1917 to show how economies introduced by voluntary co-operation of business would release men, materials, equipment and capital for carrying on the war. The work in retail deliveries was undertaken primarily to conserve labor, to make it unnecessary for merchants who lost delivery men through the draft and other war causes to replace them out of supplies available for shipbuilding, farming, railway transportation and other war work. A careful survey of the whole country was made among retail and wholesale merchants.

Several of the findings of this survey point particularly to present opportunities for the electric vehicle to meet the problem of local delivery under war conditions. In Massachusetts it was found that 5230 stores, about half in the State, operated 4473 vehicles. Of these, 3129 were horse-drawn and 1344 were motor trucks. This general proportion of horse-drawn and motor-propelled trucks holds for the country.

A second point in this general investigation worth the attention of the electrical industry is the relative importance of this transportation cost as an element in the merchant's total cost. In the city of Washington the delivery costs for bakery products averaged 19.8 per cent of gross sales; for dairy products, 12.1 per cent; for ice cream, 14.9 per cent; for coal and wood, 15.2 per cent; for ice, 45.6 per cent, and for food products, as a whole, 7.4 per cent.

SHORT-HAUL, MANY-STOP DELIVERIES THE FIELD

The report contains definite suggestions for changing the methods of delivery. It points out that short-haul, many-stop deliveries generally provide the best service to the customer, and it suggests plans for working out such systems. This, of course, is the ideal field for the electric vehicle. Ninety-five per cent of the work done by horses on the street can be done by motor trucks. Eighty-five per cent of the city haulage can be accomplished by the electric vehicle. Figures compiled many times show the inherent economy of the electric used in place of the horse-drawn wagon. A light truck will move a single-horse wagonload of goods a mile for 1 cent (energy at 3 cents per kilowatt-hour). Gasoline for that same mile would cost 3 cents and oats for the horse 5 cents. And this is only one element in the cost.

All of the coal used in the Hudson Terminal Building in New York City is hauled from Jersey City by two 5-ton electric trucks. By hauling the coal from storage and buying in large volume, the company saves \$45

per day. The ferry charges were reduced several dollars a day because the electric truck for the same capacity was about three feet shorter than a gas truck and so came in a lower class. The cost of handling fuel is one of the elements in our fuel supply that are receiving careful analysis. The electric truck with a suitably adapted body is an economical solution of the problem. In one case now being investigated one 5-ton truck with different detachable bodies could replace both horse-drawn and gas equipment, eliminate surplus equipment and effect a saving of about 35 per cent to 40 per cent.

I have briefly summarized the way in which electricity is a part of the transportation problem to-day.

GENERAL ADVANTAGES

The general advantages of the electric vehicle as a part of the big transportation problem may be summarized as follows:

Manufacture. — Simplicity of design, requiring few parts; almost total absence of machined steel in power plant; need of skilled mechanics reduced to a minimum.

Operation. — Skilled mechanics unnecessary; young and old, men and women, are successful operators.

Maintenance. — Few parts and absence of reciprocating features assure maximum uninterrupted service with minimum supervision and repair, thus releasing skilled mechanics for more vital war work.

Operating Costs. — Lowest for work accomplished of all forms of mobile transportation.

Fuel.—Energy for battery charging taken off-peak.

Conditions abroad are not the same as in this country. We are not yet faced with the drastic shortages in liquid fuel and operators that have faced our Allies. The fact remains, however, that the electric vehicle has filled a very definite place in the transportation development abroad. For example, there have been six times as many "electrics" put into service in England alone during the last three years as in all the time before. Electric vehicles have been adopted for han-

dling municipal work, for example, in eighteen towns and cities, for garbage collection, road construction, street cleaning and coal deliveries. The Midland Railway has about 110 electric trucks in service, and the Great Northern Railway has eight 3½-ton trucks. American electric trucks displaced the entire horse unit in Leeds, thirty-three horses and sixteen vans.

The Electric Vehicle Section of this association has been working with the French High Commission in New York looking forward to the manufacture of the electric vehicle in France as a part of the great problem of reconstruction and water-power development under way in that country.

Norway is to-day an active market for the electric vehicle, both commercial and pleasure cars.

CENTRAL STATION'S RÔLE

This discussion has been undertaken to bring before this association, not the detail economies of the electric vehicle, which are well known, but the opportunity that the central stations of the country have to aid the government by taking an active part in helping to solve the transportation problem as a whole. The central stations to-day are furnishing light, heat and power to meet war needs and to conserve men and materials in the commercial and domestic life of the nation.

The transportation problem needs the attention of our biggest electrical men. Transportation to-day is handled with tremendous losses. The movement of freight to-day is a transportation engineering question. As an engineering question the electrical industry

will play a large part in solving it. The supply of electricity for the big developments to come, in cheapening the cost of handling goods in terminals and warehouses and in cutting the cost of deliveries on our city streets, is worth the attention of every central station in the nation.

The electric vehicle to-day offers an economical solution for an important part of our big transportation problem.



THE ELECTRIC VEHICLE COMING INTO ITS OWN

The electric vehicle is classifying itself, coming to its own, by a situation that is brought about not by the vehicle itself but by national economics. This is a time when the thought of the nation is concentrated on the cost of distribution. Our cost of distribution when compared with the cost of production has been extraordinarily wasteful. Undoubtedly the electric vehicle promises to play a large part in the solution of our terminal problems. These problems to-day are of the greatest national importance, and when the victory is won we shall need still more the best of terminal facilities to develop and carry on the stupendous international trade with which we hope to be overwhelmed.

The port of New York cannot liberate itself with sufficient rapidity. We have streets filled with horse trucks, and inefficient methods of getting materials away from terminals. There is a clinker in the grates of the transportation problem. We must devise means of getting rid of it so as to keep a lively draft and keep up circulation.

In my judgment, looking at it in its broadest aspect, I believe the key to the solution of this problem and the clearing up of the terminal condition lies in the electric vehicle.—*From the discussion of "The Electric Vehicle as a War Measure," by J. W. Lieb, Past-president of the N. E. L. A.*

Power Factor and the War

Present Conditions All Over the Country Due to the National Emergency, Make It More than Ever Essential to Obtain Maximum Use from Equipment
One Way Is to Improve Power Factor

BY WILL BROWN

Electric Machinery Company, Minneapolis, Minn.

CENTRAL-STATION companies formerly avoided discussing the subject of power factor because it involved some complications in rates and metering. But "times change and men change with them." We are at war. Waste must be eliminated.

The cost of transmission lines is greatly increased by low power factor. For example, the number of pounds

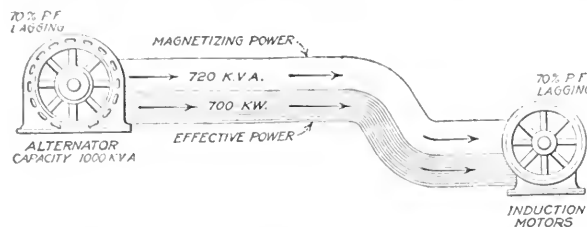


FIG. 1—MORE USELESS THAN USEFUL CURRENT CIRCULATES WITH 70 PER CENT POWER FACTOR

As a result larger conductors and switching equipment are required, the apparatus supplying energy must be larger, and maintenance of constant voltage is more difficult.

of copper required on a transmission system operating at 70 per cent power factor is at least 33 per cent more than is required if the system operates at 90 per cent power factor; but very often the nearest standard-size wire (or gage) may considerably exceed the exact requirements (in circular mils). Thus the percentage of cost may be largely increased, in some cases to the extent of 60 per cent. That is, if the system at 90 per cent power factor requires 100,000 lb. (43,360 kg.) of copper, the system at 70 per cent power factor requires 159,000 lb. (72,120 kg.) of copper, it being understood that both are 60-cycle systems with the same line drops, operating at full capacity and carrying the same rated kw. load. Think of it! Nearly 60 per cent more copper used to carry reactive current.

One can go further into this matter of waste caused by low power factor by considering the two systems compared below, each having 3000 kw. in motors. System A operates at a power factor of 90 per cent lagging (3333 kva.), whereas system B operates at a power factor of 70 per cent lagging (4285 kva.). Both deliver the same power, viz., 3000 kw. The initial costs of the two systems are as follows:

	System A	System B
Generators*	\$34,200	\$44,100
Transmission lines	45,000	72,000
Transforming and switching equipment	7,000	9,250
Motors, etc.	35,400	35,400
Total	\$121,600	\$160,750

*Prime movers not included.

Nearly \$40,000 worth of additional equipment must be installed to enable system B to operate at 70 per cent power factor and still carry the same kw. load as system A at 90 per cent; and this is by no means all the waste involved, for there is a constant loss due to greater heating caused by the low power factor.

The proper use of synchronous motors—that is, for the type of duty for which they are adapted—will go a long way toward relieving conditions of low power factor. Synchronous motors for power-factor correction should be installed as near as possible to the causes of lagging power factor. The reactive current then circulates between the induction motors and the synchronous motors only, and the generators and distributing lines are relieved thereof.

There is another way of looking at the value of improving power factor which should be particularly interesting at this time, and that is that larger loads can be carried without increasing the generating, transforming or distribution facilities if the power factor is raised. This may afford the quickest way of providing for increased production since it does not involve the purchase, delivery or installation of a large amount of equipment. As an example of what can be done along this line attention may be called to one plant which was operating at an average power factor of 72 per cent lagging and which was driving about 1400 hp. of induction motors of various sizes ranging from 1 hp. to 200 hp. It became absolutely necessary that a large motor be added to the line for driving a compressor. The alternators were already loaded to the safe overload capacity. A 500-kva. synchronous motor was added to the system to drive the compressor (about 280 hp.). By overexciting the motor so it would run at a power factor of 42 per cent leading it was possible to raise the power factor of the system to approximately 90 per cent. The same alternators are now driving the original 1400 hp. of motors plus the 280 hp. used for the compressor and are actually generating less kva.

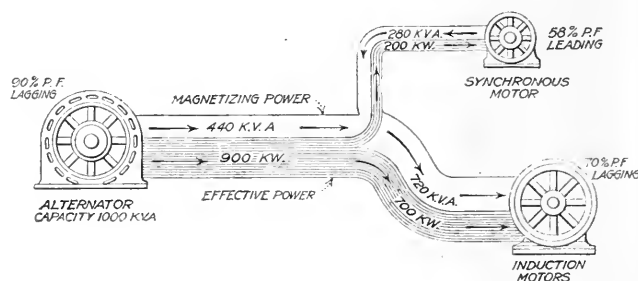


FIG. 2—MIXING SYNCHRONOUS APPARATUS WITH INDUCTION MOTORS REDUCES USELESS CIRCULATING CURRENT

The synchronous equipment can also carry load and permits using smaller conductors, switches, etc., or at least allows using the reserve capacity for other purposes. Reserve capacity is also released in the energy-supply apparatus.

than before. Under the new conditions it requires only 1400 kva. at 90 per cent power factor to serve nearly 300 hp. more equipment than under the former condition when the alternators were delivering 1460 kva. at 72 per cent power factor. (See Fig. 1.)

Serving war industries has brought many problems to central-station companies, since munition factories are

almost invariably bad offenders as regards production of low power factor. For instance, one of the large government arsenals has a generating plant of its own with a capacity of about 8000 kva. In addition to this it also receives power from the local central-station company. The present power factor at the switchboard is about 70 per cent to 75 per cent lagging. A new ordnance factory is about to be added, known as the "field and siege plant." This new plant will be equipped with 4000 kw. of induction motors, but the average power required of these motors when they are all running will probably not exceed 1500 kw. This will mean very poor power factor, possibly 55 per cent to 60 per cent lagging or even lower. Consequently there will be a serious problem for the central-station company unless something is done to raise the power factor of the government plant. To correct the conditions the plant engineers are considering using synchronous motors of relatively large kva. capacity to drive a number

Rubber factories as a rule suffer from poor power factor, caused by many large induction motors running at part loads. It seems reasonable to believe that in the near future synchronous motors will be quite widely used for rubber-mill drive. This will increase the efficiency of the entire plant and remove the necessity for large condensers. Some form of magnetic clutch is necessary both for starting and for safety reasons. Already there are a number of installations of this kind, and synchronous motors are proving their ability to handle the large fluctuating loads on the line shafts in rubber mills.

A certain rubber company obtains a rate from the central station based on a maximum demand of approximately 8000 kw. at a power factor of 90 per cent. Should this power factor drop to 70 per cent, the rubber company is penalized at the rate of \$1 per kilowatt per year on the maximum demand for that month. In order to maintain power factor at 90 per cent the company has installed two condenser sets with a rating of 2000 kva. each.

WHEN TO USE A SYNCHRONOUS MOTOR

Wherever a large, constant-speed load is to be driven the very first question asked should be: "Can a synchronous motor be used to drive this load?" If starting and running conditions are such that this is possible, the question ought to be answered in favor of the synchronous motor. The matter should be viewed both from the standpoint of motor efficiency and also from the broader viewpoint of overhead cost for delivering power. Following is a typical case as outlined by a prominent central-station manager.

A centrifugal pump requiring 400 hp. and with a speed of approximately 600 r.p.m. was to be driven by an alternating-current motor. There were to be a number of other smaller motors at this plant. If a 400-hp. induction motor was installed, it was estimated that the average power factor of the load would be 70 per cent lagging. The average power factor of the load with a 400-hp. synchronous motor driving the pump would be over 90 per cent power factor. The comparative efficiency of the two motors was considerably in favor of the synchronous unit.

The following table shows that nearly \$14,000 more initial investment* would have been required of the central-station company to serve the load if the 400-hp. induction motor had been installed than was necessary with the synchronous motor installed:

Transformer substation	\$430.00
2300-volt service	215.00
13,000-volt distributing system.....	1,806.00
Step-down substation (50,000 volts to 13,200 volts)....	774.00
Transmission lines, 50,000 volts.....	8,600.00
Step-up transformers, 13,200 volts to 50,000 volts.....	774.00
Generators	1,290.00
Total	\$13,889.00

On a basis of 10 per cent for interest and depreciation this would mean an annual charge of \$1,389 against the induction motor when compared with the synchronous motor.

Under the conditions the central-station company absolutely refused to furnish power for this load unless a synchronous motor was used.

The writer recently sent out a questionnaire to many central-station companies furnishing power loads in

*Based on total kilovolt-amperes required with both arrangements.

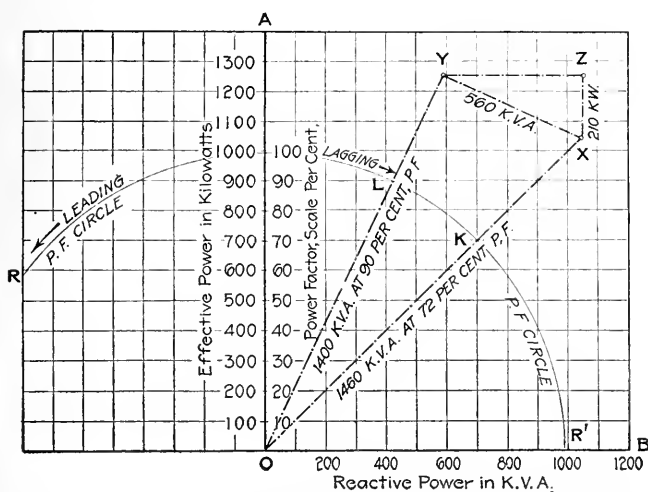


FIG. 1—VECTOR DIAGRAM SHOWING EFFECT OF RAISING POWER FACTOR FROM 72 PER CENT TO 90 PER CENT BY SYNCHRONOUS MOTOR

The synchronous motor rated at 500 kva. is delivering 210 kw. of mechanical power at the same time that it is correcting the power factor of the system. The original system was delivering 1460 kva. of which only 1350 kw. was being used usefully for mechanical power. After the addition of the synchronous motor the system delivered 1260 kw. of mechanical power, while the apparent kva. was reduced from 1460 to 1400. By similar diagram any one can figure the size of the synchronous condensers required to produce the desired power factor on his lines. It can be seen by the diagram that it rarely pays to raise the power factor above 90 per cent as the amount of condenser capacity required is very large in proportion to the increase of effective kw. which can be secured.

of air compressors which are to be installed. No doubt one or more other synchronous condensers will be necessary.

The reason why the induction motors are so much too large for their work is primarily found in the fact that the motor voltage is 550, which is an unusual voltage for induction motors, so that it was difficult to find in stock the right size motor for each purpose. The buyers picked up motors where they could find them, often taking a 50-hp. motor where one of 25 hp. would have been sufficient for the load.

From an engineering viewpoint it is much better to buy a motor just large enough for its average load, and if in the future it should be necessary to drive a heavier load, the old motor can be replaced with one of larger rating. Much money can be saved by such practice in the first cost of the motor, the higher efficiencies secured, and from the standpoint of generating and delivering power.

manufacturing districts, and it was really startling to see how rapidly changes were being made in regard to power-factor regulation.

One large manufacturing company near Chicago which is a large user of power received a bonus for one month of more than \$1,300 as a result of maintaining a power factor better than 95 per cent. In contrast to this, a rather small company using power was penalized \$1,900 last year for low power factor. It is interesting to note that this concern was operating a motor-generator set consisting of a 150-hp. induction motor driving a direct-current generator. Owing to the fact that the maximum load of the generator was never more than 40 kw. or 50 kw. and generally much less than this, the power factor on this induction motor was very poor. If this had been a synchronous motor of similar rating operated at its full kva. capacity, the power factor of the interior system would have been so raised that there would have been no penalty imposed. Thus in one year's time a saving of \$1,900 would have been effected, or more than enough to pay for the motor.

One of the large power companies in Ohio has the following clause in its contract:

When the current supply is alternating and the greater part of the load is power and the billing demand exceeds 75 kw., the company reserves the right to test the power factor of the consumer's load, and if the average power factor is greater than 75 per cent, then the demand shall be reduced in accordance with the following formula: Billing demand = kilowatt demand as measured \div average per cent power factor \times 75.

If the average power factor is less than 60 per cent, then the demand shall be increased in accordance with the following formula: Billing demand = kilowatt demand as measured \div average per cent power factor \times 60.

The company will make without charge a power-factor test at the consumer's request once a year, if his demand exceeds 75 kw. By power factor is meant the average power factor under normal operating conditions.

A number of companies in Illinois operating under the Illinois Public Utilities Commission incorporate the following clause in power contracts:

"Should the power factor fall below 80 per cent, the energy as metered shall, for billing purposes, be subject to an increase in the ratio of 80 per cent to the actual power factor as used."

The following clause is quoted from an Indiana company's contract:

"The primary charges will be increased by 1 per cent for each 1 per cent the power factor on the entire load decreases below 75 per cent at any time."

THIS war is one of nations—not of armies—and all of our 100,000,000 people must be economically and industrially adjusted to war conditions if this nation is to play its full part in the conflict. The problem before us is not primarily a financial problem, but rather a problem of increased production of war essentials and the saving of the materials and the labor necessary for the support and equipment of our army and navy.

—Woodrow Wilson.

SUDDEN SHORT CIRCUITS OF A.-C. GENERATORS

Mathematical Notes That Supplement the Derivations and Explanations Given in Previous "Electrical World" Articles on This Subject

BY N. S. DIAMANT

FOR the benefit of operating or designing engineers interested in actual quantitative results and detailed derivations regarding sudden short circuits of alternators, the following notes are given:

Derivation of equation (1), ELECTRICAL WORLD, May 18, 1918, page 1028: See footnote (4) and *Transactions A. I. E. E.*, Vol. 34, equations (3), (4) and (5).

Derivation of equations (2) and (3), page 1029, follows from the solution of:

$$M i_1 \sin \omega t + M i_2 \sin [\omega t - (2\pi/3)] + M i_3 \sin [\omega t - (4\pi/3)] + L_f i_f = N_f [\Phi_{fsc} + (\Phi_f - \Phi_{fsc}) e^{-a_f(t-t_1)}] \quad (10)$$

$$M i_1 \sin \omega t + L_a i_1 = (N_a \Phi_a \sin \omega t) e^{-a_a(t-t_1)} \quad (11)$$

and two other expressions similar to (11) for the other phases, where $\omega t = 0$, $\omega t_1 = 0$, $i_f =$ (unknown) field current, $i_1, i_2, i_3 =$ (unknown) armature phase currents, $a_f, a_a =$ attenuation factors of field and armature respectively, $L, M =$ self and mutual inductance respectively.

After some algebraic transformations and the substitutions given below, equations (2) and (3) are obtained. $\lambda_f = L_f - (3/2 \times M^2/L_a) =$ total leakage inductance reduced to field.

$N_f \Phi_f = L_f I_f =$ total field flux.

$$D = (L_f - \lambda_f)/\lambda_f = (L_a - \lambda_a)/\lambda_a.$$

For further details as to the algebraic procedure see May 18 issue, pages 1028-1032, and June 1 issue, pages 1126-1129.

Boucherot's "memoire" should be consulted where single-phase and two-phase alternators are considered. The three-phase sudden short-circuit equations are given by the writer for the first time in the ELECTRICAL WORLD and involve certain assumptions, such as that the mutual inductance between phases is negligible and that the sustained short-circuit armature flux = Φ_{assc} , is zero, etc. The reader will see the reason for these and appreciate their relative importance by going through the mathematical derivation for himself. If $\Phi_{assc} = 0$, i_f is given by (2) as before plus the following terms:

$$- (\lambda_a/M) \{ D - D e^{-a_a(t-t_1)} \} I_{ssc},$$

which are clearly negligible.

As stated before, single-phase sudden short circuits between line and line or line and neutral present certain peculiarities. Boucherot gives the following equations for the armature and field currents for a machine without amortisseur winding:

$$i_a = I_{ssc} \left[\cos \theta_1 e^{-a_a(\theta - \theta_1)} - \frac{\cos \theta}{L_f - (L_f - \lambda_f) \cos^2 \theta} \left\{ \sqrt{L_f \lambda_f} + (L_f - \sqrt{L_f \lambda_f}) e^{-a_f(\theta - \theta_1)} - (L_f - \lambda_f) \cos \theta \cos \theta_1 e^{-a_a(\theta - \theta_1)} \right\} \right] \quad (12)$$

$$i_f = \left[\frac{I_f}{L_f - (L_f - \lambda_f) \cos^2 \theta_1} \right] \left[\text{Same expression as in parentheses for } i_a \right] \quad (13)$$

Nitrogen Fixation and Conservation of Fuel

A. I. E. E., in Annual Convention at Atlantic City, Also Considers Transmission and Distribution Problems and Protection of Apparatus—Timeliness Is a Characteristic of the Proceedings

TWO subjects which have been made prominent on account of the war—nitrogen fixation and conservation of fuel by utilization of water power—were discussed at the Atlantic City convention of the A. I. E. E. this week. Other subjects that are especially timely in that they bear on the provision of reliable service, the protection of circuits and apparatus and the possibility of getting along without attendants were also considered. All except five of the papers presented are abstracted in this section. Information on the subjects not considered in this issue—aerial cable construction, pre-charged condensers, sustained short-circuit phenomena and automatic operation of hydroelectric plants—has been given in previous issues of the ELECTRICAL WORLD.

AMERICA'S POTENTIAL SUPPLY OF ELECTRICITY

Proposal to Generate Electrical Energy at Source of Supply and to Collect as Well as to Distribute It Electrically

In a timely paper presented at the Atlantic City convention of the A. I. E. E. Dr. Charles P. Steinmetz pointed out the national failure to develop the many small hydraulic power sites and also the extravagant use of fuel for heating purposes. He suggested that the solution of the problem of the economical development of more water powers and waste-steam plants lies in the adoption of the induction generator.

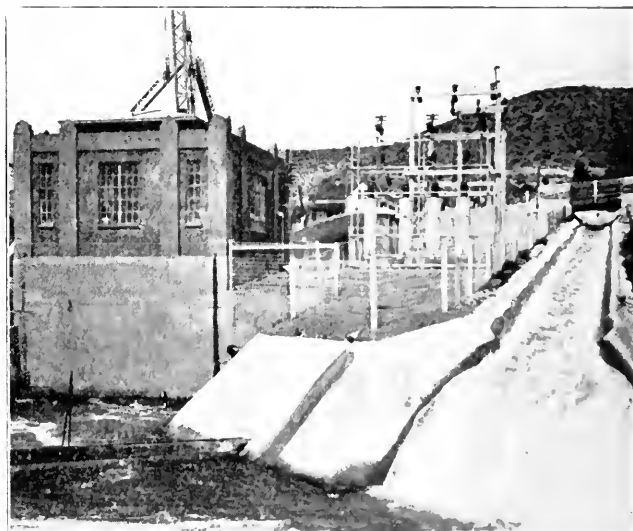
Dr. Steinmetz estimates that the coal requirement is now increasing at the rate of 56,000,000 tons per year and that the demand for 1918 will reach 867,000,000 tons, which represents about 867,000,000 kilowatt-years of energy. Of this total he estimates that 217,000,000 kilowatt-years is actually used. The total hydraulic energy available per year, computed from a study of rainfall between 30 deg. and 50 deg. latitude, is represented by about 380,000,000 kilowatt-years. At 60 per cent efficiency the total potential hydraulic energy usable would be 230,000,000 kilowatt-years, or just about sufficient to supply the national energy requirement for 1918. However, hydraulic energy can never replace coal entirely as a source of energy. This is a strong argument for efficient methods of using coal. A source of energy which is practically unlimited, if it could only be used, is solar radiation. This is probably the great source of energy of the future, about 130,000,000,000 kw. of power in the form of solar heat being available between 30 deg. and 50 deg. latitude.

SIMPLIFICATION OF HYDROELECTRIC PLANTS

The modern hydroelectric plant has become very complicated on account of the many auxiliary devices required for the electrical equipment and is not usually economical for capacities less than 1000 hp. But it is well known that the greater part of the national water-power supply is confined to comparatively small areas

at high altitude. In order to utilize these power sites, therefore, it is necessary to devise a simplified hydroelectric plant for capacities below 1000 hp. Some different and very much simpler type of generating station must be evolved before attempting to develop economically these thousands of small hydraulic powers, to collect the power of the mountain streams and creeks.

The hydroelectric station may be greatly simplified by the elimination of the low-tension busbars, making a permanent connection between the generator and transformer. The hydraulic governor may also be omitted from the turbine, permitting the generator unit to run continuously at full load. Finally, the induction generator should be substituted for the synchronous generator now commonly employed. The station thus becomes a comparatively simple one. But it must not be forgotten that the simplicity of the induction-generator



ATTENDANTLESS INDUCTION-GENERATOR PLANT AT NACHES, WASH.

By connecting a number of plants like this together power can be developed from small streams at relatively low cost

station results from the relegation of all the functions of excitation, regulation and control to the main synchronous station of the system. The induction-generator stations thus are feasible only as adjuncts to at least one large synchronous station.

Induction-generator plants may ultimately be made automatic in operation, requiring only occasional attendance and inspection. It should be possible to collect electrical energy from these plants just as energy is now distributed electrically and thus to utilize the great number of water-power sites now unavailable.

Regarding the operation of such an induction-generator set it may be started as an induction motor, and upon admitting water to the wheel the machine speed rises to full-load value. If the set is running at normal full load and the circuit breaker opens, the speed of the set may rise to a value somewhat less than 200 per cent of normal, but, on closing the switch, the speed imme-

diately falls to a point fixed by the power of the water-wheel slightly above synchronous speed for the induction generator. On the other hand, should the flow of water cease the induction machine slows down to a value slightly below synchronous and continues to revolve as an induction motor. Thus the induction generator lends itself very readily to automatic operation.

With induction-generator operation it is possible that a condition of instability may be encountered. If the generating unit has reached high speed, owing to opening of the circuit breakers, the speed may not fall to the normal full-load value if the turbine torque curve crosses the generator torque line in more than one place. It is very improbable that such a condition would arise in practice, but it should not be overlooked.

Of the hundred million tons of coal burned annually for heating purposes, most is used as steam heat. Dr. Steinmetz proposes to have the multitude of small heating plants develop steam pressures sufficiently high for the insertion of a turbine induction-generator unit in the steam system and thus to generate electrical energy as a by-product. The power would not be generated continuously, but mainly in winter and during the evening. Thus the maximum power generation by such fuel power plants essentially coincides with the lighting peak of the central station. These steam-turbine plants should be made simple and automatic. They might then be connected to the extensive energy collecting lines as in the case of the simplified hydroelectric plants.

ELECTRIC POWER FOR NITROGEN FIXATION

Relative Merits of Direct and Indirect Methods—
Combined By-product Coke Ovens, Generating
Plant and Nitrate Plant Suggested

In so large a field as that of the nitrogen fixation industry there must necessarily arise numerous improvements in the various processes which make it impossible for any one to forecast their future relative economic values. In the opinion of E. Kilburn Scott, who presented a paper before the A. I. E. E., the merits of the arc process of making nitric acid have not been adequately and sympathetically considered. To show its relative merits he points out that the indirect method involves the manufacture of carbide of calcium and its combination with nitrogen to form calcium cyanamide, from which ammonia, and in turn nitric acid, are obtained. The direct method, however, merely consists of combining nitrogen and oxygen from the air by means of the electric arc. In the direct method electric energy is the only factor, whereas by the indirect method a plant of very diverse and complicated character is required.

As a basic load for a power house the direct arc process presents the advantage that it can be established anywhere, because, the raw materials being only air and water, considerations of transportation do not enter into the situation.

It is particularly suitable for off-peak or off-season loads, for there is no fused material to solidify, and little to deteriorate in case of stoppage. Some of the furnaces can be switched on and off like an arc lamp, without detriment to brickwork or structural details or to the process of manufacture.

Because the plants in Norway are very large and only use hydroelectric power, a belief has grown up, that the arc flame process can only be worked commercially on a very large scale and with water power. As a matter of fact hydroelectric power may be a disadvantage because of its distance from industrial centers, for either the factory has to be placed in an out-of-way position, or else the power has to be transmitted over a long transmission line. The suggestion is made that the plants for making nitrates by the direct arc process should be erected at existing power houses to improve the load factor and reduce costs. By making nitrate in a number of centers its transportation to the explosive factories would be reduced, and the risk of interruption of supplies in case of accident or sabotage would be less than having a few very large factories.

An industrial process capable of furnishing electrical energy as well as a supply of ammonia would be ideal, and it so happens that this is the case with a regenerative coke-oven plant. Half the total gas made is available, and this can be easily turned into electrical energy.

OXIDE-FILM ARRESTER REQUIRES NO ATTENDANCE

Contains Neither Liquid Nor Inflammable Material
and Requires No Recharging—Has Been Tested
in Actual Service

The development of the aluminum-cell arrester represented a distinct improvement over the older multi-gap arrester, but it requires periodic recharging and contains an electrolyte subject to freezing, thus de-

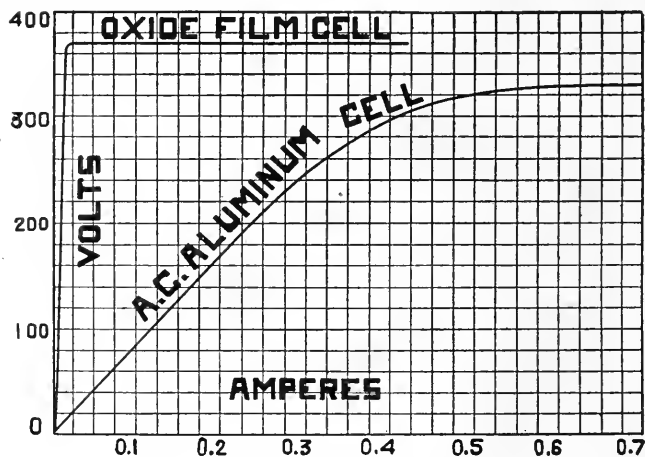


FIG. 1—VOLT-AMPERE CHARACTERISTICS

The oxide film has very small leakage current compared to the aluminum-cell arrester.

manding constant attention. These objections, however, are eliminated in the new oxide-film arrester, which was described at the annual meeting of the A. I. E. E. by Crosby Field and Dr. Charles P. Steinmetz.

The action of the oxide-film arrester depends upon the fact that certain dry chemical compounds can be changed with extreme rapidity from very good conductors of electricity to almost perfect non-conductors by raising the temperature. Lead peroxide may be well utilized because it has a specific resistance of the order of about one ohm per inch cube, depending upon the pressure to which it has been compressed. There

are several other compounds and mixtures of compounds that give the same results as lead peroxide. If these powders are placed between two electrodes and a current passed, the temperature due to the resistance at the contact of the peroxide and the metal will cause the generation of heat locally at the surface. When this heat is sufficient to create a temperature of about

slight impedance to the flow of energy at abnormal voltages.

In all the commercial oxide-film arresters used for alternating current the power factor is nearly unity. For special purposes, however, the power factor can be made anything desired from 10 per cent to unity. This is obtained by combining with the conducting oxide other non-conducting materials.

OPERATION AND TESTS

The oxide-film arrester acts as a counter emf. equal to the normal circuit voltage, freely discharging any over voltage, but holds back the normal machine voltage. Thus the discharge is limited to the energy of the over voltage as in the aluminum arrester, and, like the latter, the oxide-film arrester can continuously discharge recurrent surges, such as arcing grounds, without endangering itself, for a considerable time.

On account of the many disturbances in large electric systems which cannot be completely reproduced in laboratories, the effectiveness and permanence of a lightning arrester cannot be given except by experience in industrial systems. Therefore, after extensive laboratory tests had been satisfactorily completed, the oxide-film arrester was installed in a number of places and has been in successful operation for over three years. It has proved its protective value and its permanence.

Of the tests made on the performance of the arrester it may be sufficient here to give only one, showing the action on a recurrent oscillation. The oscillogram, Fig. 2, was made in the usual manner, a surge or continual oscillation being produced by a large condenser connected to an alternating-current supply and discharging over a spark gap through an inductance. The latter

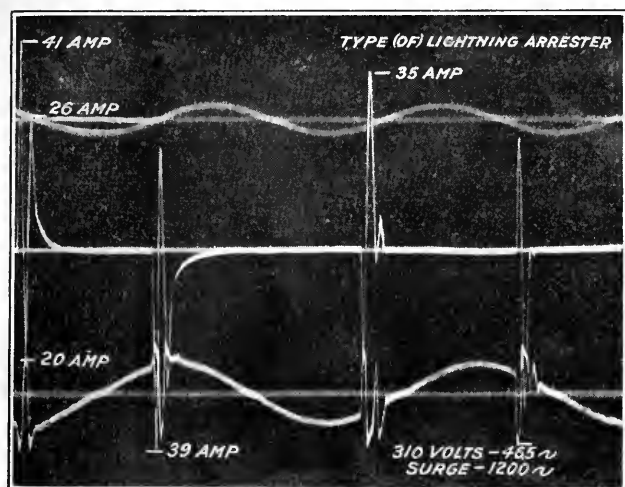


FIG. 2—TRANSFORMER PROTECTED

Top curve—60-cycle timing wave; middle curve—current through arrester; bottom curve—voltage across the circuit, showing limiting action of oxide-film arrester.

150 deg. C. a film of the lower oxides of lead forms, producing a wall of insulation which stops the current.

This method of film formation over any large area is rather irregular, and the oxide cannot, therefore, be used in such a fashion in the commercial arrester. However, any insulating film may be put on the electrodes initially. Materials such as thin layers of glass, water glass, halowax, cloth, balsam, shellac, oil, paints, lead paints, varnishes and lacquers of all kinds may be used, the only difference being the variation with the voltage at which the puncture of the film of insulation occurs.

The commercial lightning arrester consists of two outside sheet metal electrodes, set about 0.5 in. (12.7 mm.) apart, one or both covered with a thin insulating film and the space between the plates filled with some such substances as lead peroxide. The insulating film prevents any appreciable current flowing at a pressure of 300 volts per cell, but as the pressure rises slightly above normal the film is punctured in one or more microscopic points and the lightning discharge meets with practically no resistance and flows to earth. The dynamic current starts to follow, but because of the fact that the insulation was punctured in such fine points the current density near these points is exceedingly great. This results in a localized heating which speedily raises the temperature to a value sufficient to change all the conducting peroxide to insulating litharge. The film consequently reseals, stopping the further flow of dynamic current.

The film can be made of litharge itself or any of the insulating materials named. Several different kinds of electrodes may be used. The insulating film is best formed by dipping in varnish or lacquer highly burnished surfaces of brass, steel or copper. As the ohmic resistance of the arrester during discharge is low, when the insulating film is punctured the arrester offers very

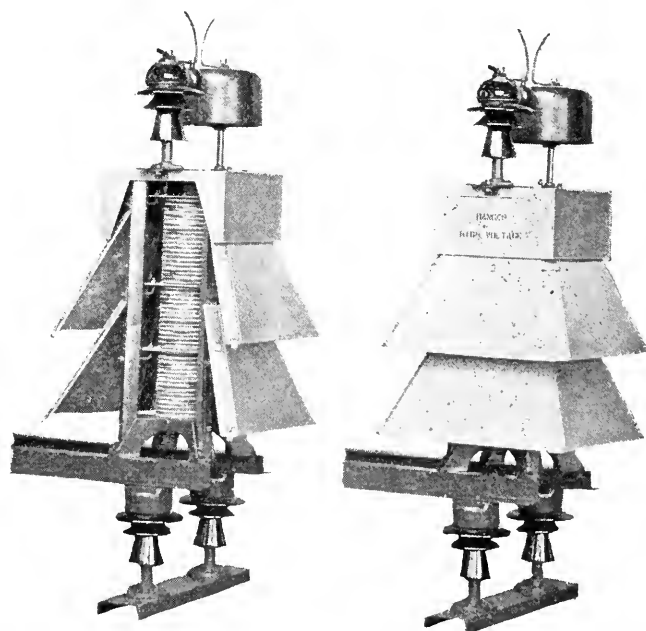


FIG. 3—OXIDE-FILM ARRESTERS EQUIPPED WITH RAIN SHEDS

was chosen so as to give a frequency of 1200 cycles to the oscillation and thereby bring it well within the range of the oscillograph. This surge was impressed upon the apparatus to be protected, a transformer energized by another alternating-current circuit. Fig. 2 indicates conditions with an oxide film shunting the transformer and thereby protecting it. The oscillation

peaks are sharply cut off at a maximum voltage of 60 per cent above the circuit voltage, the value for which the spark was set.

The need of using a spark gap in series with the arrester is the only remaining undesirable feature which the oxide-film arrester shares with the aluminum-cell arrester, the multigap arrester and other types. Against high-frequency disturbances of moderate voltage, however, the only existing protection is the addition to the arrester of a capacity discharge path permanently connected from the circuit to ground. Such capacity path should be without resistance to flatten steep wave fronts and contain a moderate series resistance to dissipate high-frequency energy and stop cumulative oscillations in their beginning. An arrester that would give universal protection should be of the oxide-film or the aluminum-cell type with no spark gap but permanently shunted across the circuit and thus capable of taking care not only of the overvoltages but equally well of steep wave fronts and high-frequency oscillations, even if of lower than the circuit voltage.

IMPULSE PROTECTIVE GAP AN EFFECTIVE APPLIANCE

New Type of "Safety Valve" That Has Auxiliary Electrode Between Horns—Tests Made Give Interesting Results

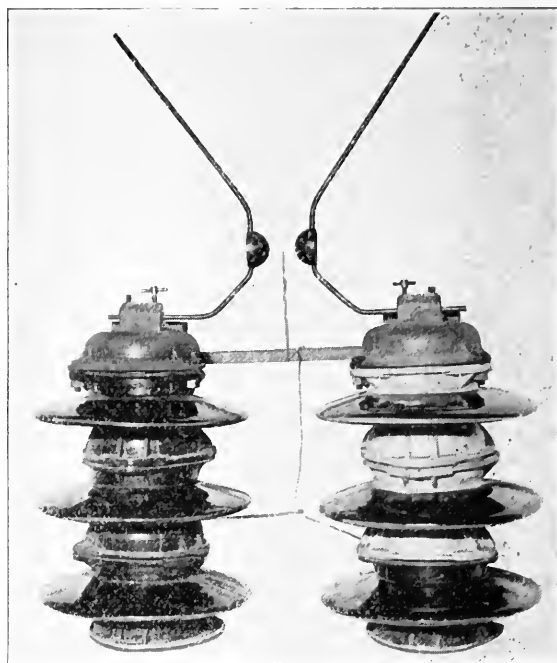
In order to secure adequate protection against line disturbances of steep wave front it is important that a protective gap having the lowest possible impulse ratio be used. A new type of gap which possesses this selective property to a marked degree was described in an A. I. E. E. paper by Chester T. Allcutt. The device is called an "impulse protective gap" because of its particular effectiveness in discharging line disturbances of steep wave front.

In its most elementary form it consists of two gaps in series, each gap being shunted by a relatively high impedance. At line frequency these impedances are proportional to the respective discharge voltages of the gaps which they shunt, but they are designed to change at different rates with changes of frequency. Thus, under the action of a high-frequency impulse, one of the impedances becomes much greater than the other and causes most of the high-frequency voltage to be impressed on one of the gaps. The breakdown of this gap will result in the total voltage being impressed on the remaining gap, which will break down in turn. Commercially, however, it has been found more desirable to have only one gap with an intermediate electrode. A pointed auxiliary electrode gives better results than a spherical or cylindrical one.

Tests on this lightning arrester indicate that the presence of an auxiliary electrode does not appreciably lower the 60-cycle discharge voltage. With the auxiliary electrode in place breaks were somewhat less consistent than with the plain gap, but the irregularities are not of sufficient magnitude to indicate an appreciable lowering of the breakdown voltage. Preliminary tests with impulse voltages to determine the best values for the capacitances and resistances used in the circuits connecting the auxiliary electrode with each horn showed that these two values could be varied through wide limits without affecting the impulse discharge voltage.

In every test made the impulse discharge voltage was less than the 60-cycle breakdown value. With the form of gap having plain horn electrodes the impulse ratio increases rapidly with the larger gap settings, and it will probably become higher than unity for settings in excess of 3 in. (7.6 cm.) When spherical electrodes are used the impulse ratio will remain well under unity even for settings greater than 3 in.

A very great change in the shape of the main electrodes does not affect the impulse discharge voltage to a corresponding degree. However, the shape of the main electrodes will very materially modify the 60-cycle discharge. In view of these facts it is obvious that the lowest impulse ratio will be obtained by so shaping the



AUXILIARY ELECTRODE BETWEEN HORNS IS CONNECTED TO SERIES CIRCUIT OF TWO CONDENSERS AND AN IMPEDANCE BRIDGING GAP

main electrodes as to give the highest possible 60-cycle breakdown voltage. This condition is approximated with spherical electrodes.

Exhaustive tests of the gap have shown it to be superior to the ordinary sphere gap under all conditions. Even under the most unfavorable conditions the new gap gives a high degree of protection.

BALANCED PROTECTION OF CABLE SYSTEMS

Specifications for Split-Conductor Cable—Instantaneous Relays with End Impedances Recommended

Some years ago the Boston Edison company engineers became convinced that line protection devices which function with respect to time, to value of current or to direction of power flow were, in an extensive and rapidly growing transmission network, exceedingly difficult, and frequently impossible, to adjust and maintain in such a relation one to another as to provide for the selective disconnection of any faulty element, without simultaneously permitting the disconnection or shutdown of elements not themselves involved in

the fault. As a result, said W. H. Cole in a paper before the A. I. E. E., it was decided to make use of one or more methods based on the current-balance principle. At first serious consideration was given to the input-output method but this was later abandoned in favor of the balanced-pair method using paired conductors, now quite generally known as "split-conductor" cable. This was done because the balanced-pair method appeared to be less expensive especially when considering duct cost.

SPLIT-CONDUCTOR CABLE SPECIFICATIONS

At the beginning the company was forced to choose between a secondary dielectric of sufficient thickness to withstand successfully at least the star voltage of the system impressed across a dielectric being rapidly weakened by the arc at a fault and a dielectric of minimum safe thickness from a mechanical standpoint but of more than ample value for the normal operating voltage between conductor members. Since the major portion of the secondary dielectric is substantially an idle investment under all normal conditions, it was concluded that any reduction in its thickness with consequent cheapening of the cable is justified, provided a form of protective gear can be devised whereby a failure of the secondary dielectric under any circumstance would not prevent prompt disconnection of the line so affected.

The required form of gear subsequently became available, resulting in the company's standardizing, tentatively at least, a secondary dielectric thickness of 3/64-in. (1.19-mm.) paper for all-around-type, paper-insulated, concentric split conductors for 15,000 volts working pressure; 1/16-in. (1.58-mm.) paper for the same class of conductors for 25,000 volts working pressure, and 5/64-in. (3.96-mm.) paper for both 15,000 volts and 25,000 volts, sector-type, paper-insulated, concentric split conductors. The additional thickness in the sector split type is provided for mechanical reasons.

Owing to the war acceptance of cable not quite up to the pre-war standard has been forced upon users; so more attention has been required in transposing conductors than would usually be necessary in order to secure the desired balance in the completed lines. The Boston company aims to secure impedance balance in completed lines to within one-tenth of 1 per cent. With uniformly well-balanced cable sections this result is ordinarily secured with from one to five transpositions. Its present practice is to use no less than three, dividing the line into four sections.

RELAYS FOR CURRENT-BALANCE PROTECTION

Relays should be instantaneous-overload type, operative on small amounts of energy, hand resetting, and the moving parts should have small inertia. Secondary devices are necessary to close the contacts in the tripping circuit. An auxiliary break in the tripping circuit should be provided to be actuated by the movement of the main switch mechanism. The simple differential transformer is undoubtedly the best device for comparing the currents in the paired conductors.

Since it is absolutely necessary that the scope of the protection shall include the entire line and extremely desirable that line disconnection be effected while the fault current is moderate in value, it is necessary to provide for end-fault protection. This is secured by

the use of so-called end-impedance devices, which include the reactive type and the non-reactive type. The three point per pole or split-contact switch is the best known form of non-reactive type. As the relays must not operate on normal differential currents, it is necessary, in order to produce disconnection of the distant end, that the impedance of one of the current paths be altered with respect to the other to the extent necessary to produce a tripping differential current in the balancing transformer at the distant end of the line.

RELATIVE MERITS OF REACTIVE AND NON-REACTIVE TYPES

The choice of end-impedance devices should be governed by the strength of design, space required for their installation, effect on regulation, effect on switch gear and switchboard design, rapidity of action, cost, etc. From the standpoint of strength of design, the balance appears to be in favor of the reactive type, since it has no moving or wearing parts requiring adjustment or renewal. The space requirement usually is a local consideration. The reactive type in some forms has some effect upon voltage regulation. In any form the effect is not serious, particularly when the growing use of current-limiting reactors is considered.

It is obvious that standard types of switches are adequate with reactive schemes of end protection, but the non-reactive type, as embodied in the split-contact switch, requires a special design of switch. For small capacities this may not be a serious matter, but for larger system capacities the necessity of designing the three-point or split-contact switches so that all three breaks per pole have the same breaking capacity means at least 50 per cent more space per pole on account of the additional pot.

On the whole, it appears, considering the rapidity of action, at least on large systems, that the reactive form of end-impedance device has a distinct advantage over the non-reactive type.

ORDINARY PAIRED CABLE

If the ordinary type of overload relay is used with independent paired conductors, their settings might need to be so high as to preclude operation on section faults, or in any event to prevent the obtaining of the maximum benefit of balanced protection.

In order to obviate the necessity of the high relay settings and at the same time to insure non-operation on through short-circuits, relays have been developed both in this country and abroad, variously called "biased relays," "percentage balance relays" and "ratio balance relays."

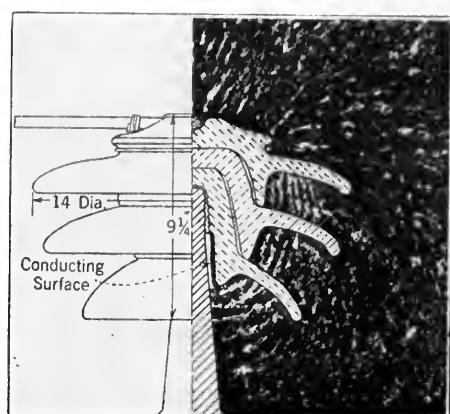
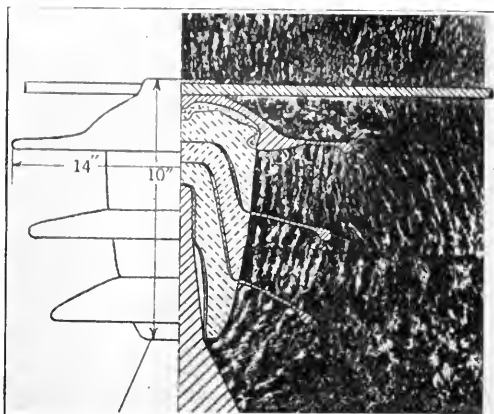
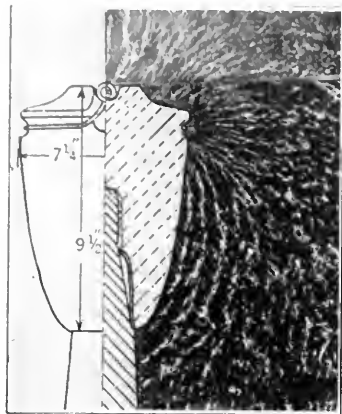
In order to choose correctly the proper winding ratio for ratio balance relays, it is necessary to know what the normal differential current will be under extreme conditions and the percentage it bears to the simultaneous vector sum of the compared currents. Once adjusted for this normal relation, they cannot operate on any value of through current, since the restraining force will then always be in excess of the operating force.

In conclusion, Mr. Cole said: "A sufficient number and variety of actual faults have occurred to demonstrate that full reliance may be placed on the system of protection, provided that the fundamental requirements are met in its design, installation and operation."

DESIGNING INSULATORS FOR BEST FLUX DISTRIBUTION

Electrostatic Field Around Insulators Studied to Give Basis for Constructing More Effective Insulators

The design of an insulator should depend not only upon the practical experience and opinions of operating engineers, but also upon purely theoretical considerations, chiefly distribution of the electric field at abnormal voltages, said G. I. Gilchrest, in a paper read at the recent annual convention of the A. I. E. E. With this in view the author has analyzed the various causes



DIELECTRIC FIELD AROUND THREE INSULATORS OF RECENT DESIGN

of insulator failure and determined by experimental means the shape that insulators should have to be most effective for given conditions.

CAUSES OF INSULATOR FAILURE

Among the principal causes of pin-type insulator failure he cites the following: Improper distribution of dielectric field and surface leakage; porosity; mechanical breakage, lightning, birds and animals short-circuiting line; unequal expansion of metal, cement and porcelain; internal stresses in materials and defective batches.

To visualize the electric field around insulators Mr. Gilchrest supported the insulators so that the plane of the field to be studied was horizontal. Then a piece of fullerboard was fitted over a half section of the insulator in this plane and asbestos particles were sifted thereon. The particles arranged themselves along the electrostatic flux lines.

From studies of this kind he developed several new shapes of insulators, for which the following advantages are claimed:

1. When the insulator is dry the corona and static formations are practically limited to the tie wire and line wire up to flashover voltage.
2. When the insulator is wet no corona or static formation occurs up to flashover voltage. The flashover voltages for given over-all dimensions are thereby increased.
3. The leakage resistance per shell is increased gradually from the head to the center shell. This takes into account the probability of the lower sheds becoming dirtier than the tops. The voltage distribution per shell is, therefore, equal when the insulator becomes dirty and wet and a heavy leakage current passes over the insulator.
4. Since the capacity per shell is about constant, the voltage distribution per shell will be uniform when the insulator is clean and in dry air.
5. Since the distribution of voltage per shell depends upon the capacity current and leakage current, the distribution

of voltage per shell in these designs should be approximately uniform under all operating conditions.

6. The resistance of the insulator to side pull for a given weight and given electrical strength is relatively high. This is due to the feature of the design whereby the flow lines of the electrostatic field and the mechanical stress lines coincide.

7. The design of the individual shells is such that when they are tested before assembly the surface conforms to the electrostatic flow lines. This allows the testing of the individual parts to a higher percentage of service voltage than was possible in case of the individual shells of the older designs.

8. Owing to the shape of individual parts and of the assembled unit, the insulator sheds when hit by stones, rifle balls, etc., break only to a limited extent. The unit, there-

fore, offers a considerable percentage of its original resistance to flashover after the sheds are broken. The same feature tends to protect the insulator from complete failure during the flashover in service.

9. Each characteristic of the insulator which would vitally affect durability in service has been treated uniformly throughout the line.

PREVENTING FLASHOVER AT COMMUTATOR AND BRUSHES

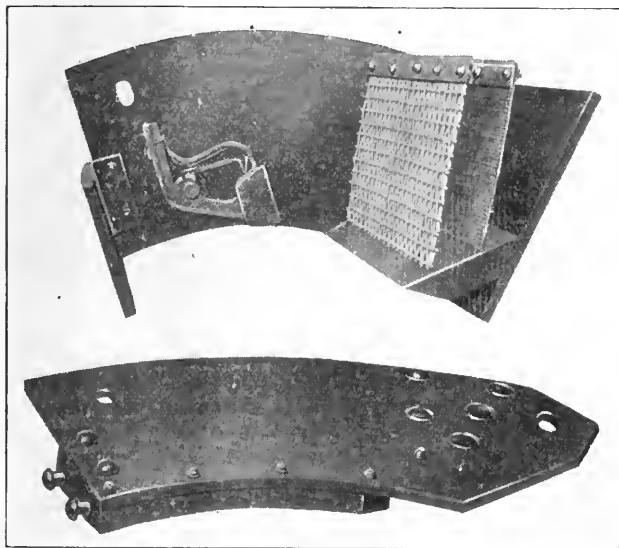
Use of Screen Barriers Between Brushes and Provision of High-Speed Circuit Breakers Effective with Direct-Current Machines

Any means for preventing flashing at the commutator and brushes of direct-current machines must operate very quickly if it is to be effective, said J. J. Linebaugh and J. L. Burnham in their paper before the A. I. E. E. convention. This requirement is met to a great extent by using high-speed circuit breakers or barriers between brushes, but complete protection requires both. The cause of flashover may be reduced by providing magnetic fields of proper strength and distribution to influence the coils during commutation.

With special high-speed circuit-opening devices operating in about 0.005 second, the more sensitive machines, such as 60-cycle synchronous converters, may be short-circuited without flashing over, even though the maximum current is of higher value than would cause flashing with suddenly applied load and ordinary circuit-breaker protection. The speed at which a current breaker must operate to prevent flashing depends on the amount of load through the machine, but tests indicate that, under the worst conditions, it must be quicker than one half cycle of the machine to be protected.

One type of circuit breaker which has been found specially suitable is being used on the Chicago, Milwaukee & St. Paul Railway. It has a laminated contactor which is held closed by an electric holding coil. When the load becomes excessive the current through a series bucking coil offsets the magnetic flux of the holding coil, allowing a spring to separate the contacts.

Automatic substations at Des Moines, Iowa; Columbus, Ohio, and Montieth Junction, Mich., are using barriers which have been found very effective in preventing flashover between brushes. A close-fitting box of fireproof insulating material surrounds each set of brushes and is placed so as to give a small clearance between the box and the commutator. On the side of the box toward which the commutator rotates after leaving the brush a V-shaped "scoop" of fireproof in-



SCREENS AND SCOOPS AT LEFT COOL AND DIVERT ARCS PRODUCED BY FLASHING BRUSHES

insulating material is fastened, preferably having good heat conductivity, pointing toward the brush and having small running clearance from the commutator.

Radially above the scoop, about 1 in. (2.54 cm.) apart, are two metal screens, one coarse and one fine mesh, through which the arc is successively forced and cooled.

TRANSPOSITION OF PARALLEL POWER AND TELEPHONE LINES

"Exposed Line" System Most Important Remedy for Inductive Effect—Limitations of Two Methods Devised

"Of all the means used to reduce the inductive effect between power and telephone circuits the co-ordinate transposition of both classes of circuits is probably the most important," said Harold S. Osborne in a paper before the A. I. E. E. His method has been carefully investigated in California by the joint committee on inductive interference, with the result that a method known as the "exposed-line transposition system" has been developed. Two designs have been completed, called the E and L sections. The first is for a maximum length of 12.8 km. (7.9 miles), the other is best for less than 6.4 km. (3.9 miles).

The E section can be used to co-ordinate with trans-

positions in three-phase power circuits which create for the maximum length of E section 0.8 km. ($\frac{1}{2}$ mile), 4.8 km. (3 miles) or 9.6 km. (6 miles) in the power circuit. It was found possible to design the L section so that it balances a three-phase power line transposed at the quarter-section points.

The exposed line transposition system has been designed primarily for use on toll lines and not for use on joint lines with power distribution circuits.

When large inductive effects are experienced from circuits less than 20 ft. (6 m.) away from a side circuit, the variation in separation between the telephone circuit and the exposing circuits as the side circuit shifts from one pair of pin positions to another must be taken into consideration. The E section is not designed to give a high degree of balance under this condition for all circuits in each eighth section, but does give balance to uniform outside induction effects for most circuits in each eighth section and, with one exception, for all circuits in each half section. Under similar conditions the L section gives a balance for most circuits in each quarter section and for all circuits in each half section.

It should be clearly understood in the use of the telephone transposition sections that it is important to co-ordinate the transpositions in the telephone lines both as regards relative length and as regards relative location of telephone transposition section and transpositions in the power circuits.

REACTANCE OF ALTERNATORS AND ITS APPLICATIONS

Simple Method of Predetermining Reactance Which Is Applicable to Wide Range of Synchronous Machines

The calculation of initial short-circuit currents of synchronous machines may be satisfactorily worked out from design data provided that the constants of the machine can be predicted with reasonable accuracy. A method of predetermining armature reactance applicable to a wide range of synchronous machines has been worked out by R. E. Doherty and O. E. Shirley and was fully explained in a paper presented at the annual convention of the A. I. E. E. The complete scope of the paper may be summarized as follows:

1. To present a reliable, general method of obtaining armature reactance of synchronous machines.
2. To give a simplified general equation, in accordance with standard construction, which will enable the designer to calculate armature reactance quickly by the use of curves and design data sheets.
3. To derive a formula for the calculation of field inductance which is used in the calculation of initial short-circuit currents and to explain the physical phenomena occurring at short circuit.
4. To derive an expression for accurate calculation of armature reaction, taking into account the effect of field distribution.
5. To show the effect of harmonics in the no-load field-flux wave on the field excitation under load.
6. To give a simplified method of calculating field excitation, using armature reactance value previously determined.

"The Engineer Is the Hope of the Nation"

E. W. Rice, Jr., Retiring President of the American Institute of Electrical Engineers, Addressing the Atlantic City Convention, Makes Clear the Part of Engineering in the War

THE vital importance of revising or further extending the activities of the A. I. E. E. so as to help in a speedy winning of the war, and the necessity of looking ahead to the solution of engineering problems which will be involved in the reconstruction work after the war, were important subjects dwelt on at the annual convention of the A. I. E. E. held at Atlantic City on Wednesday, Thursday and Friday of this week.

ADDRESS OF PRESIDENT E. W. RICE, JR.

Mr. Rice, in outlining the value of the Institute, said:

"The engineer is the hope of the nation, not only now, when we are at war, but even more so in the future in the days of reconstruction following the great peace. The engineer may perform valuable service when working alone, but his usefulness and power is manifestly greatly increased when acting in co-operation with thousands of his brothers.

"The Institute is not only a democracy, but is a democracy of educated men, and such men have a heavy responsibility to society at present and in the future. They should be leaders and exemplars for those who have not been so fortunate as to have enjoyed their opportunities. The Institute needs its members and the members need the Institute, that the electrical engineer may fulfill his high destiny."

There has been no material improvement for several years in electrical units such as dynamos, motors, transformers, etc., said Mr. Rice. In the field of thermodynamic engines, represented largely by the steam turbo-generator unit, some improvement has been obtained. While not large, this is doubly important because of the great increase in the cost of fuel. He added:

"Concurrently with this improvement in the turbo-electric machines, great advances have been made in the design and operation of the steam-producing devices—the boilers, auxiliaries and other features of the modern power station. As a result the thermal efficiency has been rapidly improved. The steam turbo-electric unit has not reached its limit of thermal efficiency."

Progress has been made and is still possible in the generation, transmission and utilization of electrical energy.

"Improvement has been effected," said Mr. Rice, "not only by changes in designs of the units themselves, but also by their method of use, based upon the recognition of the fact that the elimination or reduction of the losses at light load will greatly improve the total efficiency, especially when the time of use of the apparatus under load is a small part of the total time.

"It has been estimated, and it seems a conservative estimate, that through the saving in reserve equipment, improvement in load factor and the diversity of different loads, the useful output of groups of large systems may through interconnection be increased about 25 per cent."

The standardization committee has been of inestimable value to the profession and to the industry, Mr. Rice said. "As a result of its work the cost of electrical apparatus to the consumer has been greatly reduced over a number of years and the quality has not been sacrificed but has been improved."

President Rice then referred to the growth of 60-cycle systems, which it is now estimated represent about 70 per cent of the total power supplied in the country. This standardization will hasten the time when a network of the transmission lines, fed by super-power stations, will cover the country.

Reference was made by Mr. Rice to the marked advance in electric furnaces. It is estimated that the number of these in the United States has increased about 40 per cent in the last year and that there are now in operation over five times those of five years ago.

On the work of the electrical engineer in the war Mr. Rice said:

Electrical engineers have been devoting much time to the solution of many war problems. It is not desirable or possible to review such work at present, but when the veil is lifted we shall all be gratified with the result. We must content ourselves with the mere statement that this work has covered means for the detection of the pirate submarine, wireless signaling and telephoning for army and navy and aircraft devices, searchlights of novel design and great power, improved methods in manufacture of ammunition and ordnance, electrochemical work of every description, electric welding, X-ray sets of greater simplicity and accuracy, and many other lines too numerous even to mention. . . . I hope that the time will come when the story may be told, so that the world may realize the debt which it owes to scientific men and engineers, without whose arduous, unselfish and almost inspired work our cause, righteous as it is, would have no chance of a victorious conclusion.

Mr. Rice reverted to his remarks at the midwinter convention on the importance of railroad electrification. In concluding he outlined the essential place of electric power in the war program. The power to operate the war industries, in view of its great economy and flexibility, must be electrical. He continued:

While this country was fortunate in having available a magnificent system of power stations, so great was the magnitude of the demand for increased power created by the war industries that it is estimated there will be a shortage of at least 500,000 kw. of electric power in the Eastern district.

It is vitally important that the great electrical power-producing companies of this country should be helped in every way to meet the heavy demand which is placed upon them, as it has been demonstrated that the quickest, most efficient and altogether best way to meet the demand for power is through the expansion of such existing organizations and installations.

In presenting the president-elect Mr. Rice referred to the fortunate combination of thorough acquaintance with theory and equal familiarity with practice which Professor Adams possesses. Mr. Rice added that his confidence in the future achievements of the Institute was increased by Professor Adams' election to the presidency.

REMARKS OF PRESIDENT-ELECT COMFORT A. ADAMS

Professor Adams, in responding, said that these are not normal times and that Institute proceedings cannot be conducted in the usual way. While he hesitated about suggesting any definite directions along which the Institute activities should be carried, he expressed the opinion that the chief thing to consider now is how the Institute can help in a speedy winning of the war, or, looking ahead, the Institute might consider how to cope with the engineering problems which will be imposed during the reconstruction period after the war. Owing to the rapid revolutionary changes in economic conditions and international relations which the war is forcing, engineers will be more interdependent than ever before in facing new problems. As a result there will be need of co-operative effort among the broadest-gaged engineers of the widest vision. In closing, Professor Adams expressed great optimism regarding the future.

REPORTS OF COMMITTEES

N. W. Storer, chairman of the traction and transportation committee, called attention to the fact that many trunk lines have practically collapsed under war conditions but that electrified lines have not suffered so greatly. Street railways have likewise been hard hit.

Prof. Alexander Gray, chairman of the committee on electrical machinery, suggested that it might be advisable for the committee to serve as a clearing house for suggested changes in standardization rules.

Edward P. Hyde, chairman of the lighting and illumination committee, gave a brief summary of progress in electric illumination, referring particularly to protective lighting and motion-picture projection.

L. E. Imlay, chairman of the committee on transmission and distribution, cited instances of past work and recommended further investigation of insulator problems and electric loss in cables.

Francis A. J. Fitzgerald, chairman of the electrochemistry and electrometallurgy committee, suggested co-operation with the American Electrochemical Society and intense study of hydroelectric development.

A. G. Pierce, chairman of the industrial and domestic power committee, called attention to the tabulation of technical data regarding industrial applications which it has been making and suggested that the committee be broadened or that a new committee be formed to handle the work. This is now of enormous proportions.

Prof. Frederick Bedell, chairman of the committee on electrophysics, urged that steps be taken to maintain adequate teaching staffs to insure continuous output of technically trained men.

D. W. Roper, chairman of the protective devices committee, recommended that an investigation of lightning arresters and protective devices for tie lines be pushed to a conclusion and that relay nomenclature and ratings of circuit breakers be standardized.

K. A. Pauly, chairman of the committee on application of electricity to mines, urged co-operation with the American Institute of Mining Engineers.

S. G. Rhodes, chairman of the instruments and measurements committee, stated that no new development work along purely commercial lines is being undertaken by manufacturers.

Prof. Ernest J. Berg, chairman of the educational

committee, presented a synopsis of electrical engineering courses in various colleges and suggested how some colleges might better them.

H. A. Hornor, chairman of the marine committee, called attention to the proposed use of oil-engine-driven generators and motors for ship propulsion and urged closer co-ordination of the work of the various committees.

The subject of education was discussed at length by Prof. W. I. Slichter, Dr. C. P. Steinmetz, Prof. V. Karapetoff, W. L. Upson, Prof. Samuel Sheldon and N. A. Carle. Among the principal points brought out were the possibility of developing personality, the psychology of successful education, the need of "punch" and natural ability to supplement education, the importance of inspirational power in instructors, the fact that colleges attempt to teach too many or unnecessary subjects, and the need of transferring credit from manufacturer to central station or vice versa for education secured in cadet courses.

WEDNESDAY AFTERNOON SESSION

On Wednesday afternoon the following papers were presented: "Split-Conductor Cables—Balanced Protection," by W. H. Cole; "Overhead Cables," by E. B. Meyer, and "The Applications of Theory and Practice of Transmission Systems," by G. I. Gilchrest. Abstracts of Messrs. Cole and Gilchrest's papers will be found on pages 1371 and 1372.

Among those who took part in the discussion of balanced protection were P. M. Lincoln, E. B. Meyer, J. R. Craighead and O. C. Traver. In these discussions it was said that split conductor cable can be made for 7 to 10 per cent more than ordinary cable when used more extensively, but that cost should not be a major consideration. The points cost 10 to 15 per cent more. Several agreed that the carrying capacity is not reduced by the construction. Mr. Traver said that one large operating company could release \$1,000,000 worth of cable by operating its system in parallel, a practice permitted with balanced protection.

Considering the use of aerial cable, several speakers called attention to the possibility of the sun's rays limiting the rating of aerial cable if the outer covering is dark. Unequal expansion of the cable and messenger wire might cause separation of the points, it was said, although Mr. Meyer maintained that no trouble had been experienced from this cause. The rating of other circuits in series also limits the carrying capacity of the cable. Among those who took part in the discussion were W. A. Delmar, J. B. Taylor, Philip Torchio and J. A. Johnson.

In the discussion of insulator problems Prof. C. F. Scott emphasized the necessity of studying the electrostatic field around insulators in developing efficient designs and suggested that higher voltage lines might be supported on pin insulators if the design suggested by Mr. Gilchrest gives the results expected. Prof. V. Karapetoff explained how electrostatic flux can be studied with molten paraffine and lycopodium seeds after allowing the paraffine to harden. L. W. Chubb pointed out that it is not necessary to consider refraction of electrostatic flux if insulators are properly designed. Mr. Gilchrest closed by saying that pin-type insulators of the type he mentioned in his paper are being considered for 110,000-volt lines.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

BRAZING PIPE JOINTS TO STOP STEAM LEAKS

This Method Found Especially Satisfactory for Small Connections Needed to Unite Measuring Instruments—Eliminates Inaccuracies

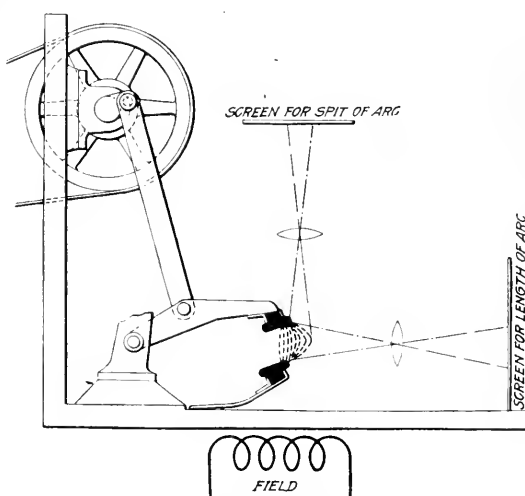
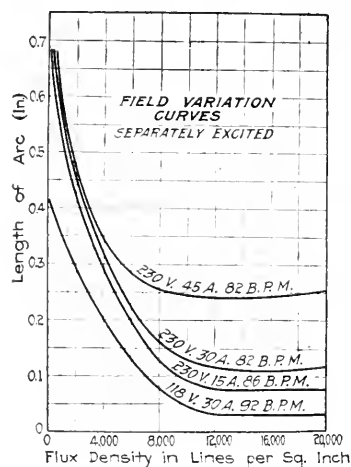
One of the jobs that require careful attention when steam-measuring instruments are being installed is that of connecting the joints in the small pipes leading from the steam mains to the instruments. Many companies which are now installing boiler-room instruments so as to obtain an accurate check on the efficient use of coal discover that unless their pipes are carefully installed they are liable to become leaky at the joints. The Iowa Railway & Light Company of Cedar Rapids, Ia., when it installed additional instruments in its steam plant brazed all of the joints in the small connecting pipes with the effect that no trouble has been encountered and that the instruments give correct readings.

DETERMINING LABOR COSTS OF POLE LINE EXTENSIONS

Advisability of Extending Line to Consumer Decided Upon by Method That Is Applicable Regardless of Prevailing Prices of Labor

BY A. G. DRURY

In order to find out if it will pay to supply a prospective consumer with electric energy it is always well to determine beforehand the cost of material and labor.



From a study of the time required to perform various line construction operations the author has concluded that the following units are conservative for checking estimates: Loading and unloading one pole, 2 man-hours; haulage per mile, 15 man-hours; digging and setting one 35-ft. (10.6 m.) wood pole, 4 man-hours; equipping one four-pin cross-arm with pins and insulator and attaching to pole, 2.5 man-hours; stringing and tying 100 ft. (30.4 m.) of conductor to insulators, 2 man-hours.

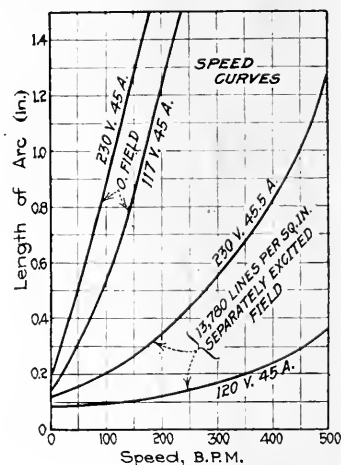
While the time required for the different items of construction may seem liberal, consideration must be given to the fact that some time is lost both at starting and afterward.

EFFECT OF MAGNETIC FIELD ON CIRCUIT-BREAKER ARC

Apparatus Designed to Reproduce Action of Opening Circuit Breaker and to Determine Density and Length of Arc in Varying Field

BY A. M. HOLCOMB*

To determine definitely the values of the density, length, etc., of the arc occurring when a circuit breaker is opened, some means must be worked out whereby the properties of the arc may be observed. The apparatus developed for this purpose, which is shown in Fig. 2, consists of two carbon contacts so linked that they can be steadily opened and closed by means of a belt-driven pulley. Two lenses and screens are placed so that the image of the "split" and length of the arc



FIGS. 1, 2 AND 3—APPARATUS FOR STUDYING EFFECT OF MAGNETIC FIELD ON CIRCUIT-BREAKER ARC, WITH RESULTS OF A TEST

The labor cost has risen to such an extent recently that the old methods of estimating this cost have grown obsolete. A rule that can be applied at any time is one that uses the man-hour as a basis of cost—that is, the number of men multiplied by the hours they work. This figure may be multiplied by the prevailing wage.

will be projected on screens. They can then be measured and the actual length calculated. Calibrated field poles were placed near the arc with their current controlled by a rheostat.

*Extract from thesis by Shetler and Gartia, Case School of Applied Science, Cleveland, Ohio.

Non-inductive loads were used in making the tests, the results of which are shown in Figs. 1 and 3. The former curve shows the effect of varying the field strength when the breaker is operating at a steady speed. The curves of Fig. 3 show the effect of opening the breaker at different speeds. The current was left on for only one or two contacts so that the contacts would not become red and the gap filled with conductive vapor.

By referring to Fig. 1 it may be seen that the arc length varies indirectly as the voltage, current and field strength, but no benefit is obtained by increasing the field strength beyond 12,000 lines per square inch. The gap chamber was comparatively open, and the noise of break at low densities sounded like a slight puff, whereas at high densities there was a slight bark. As nothing resembling an explosion occurred, there is no disadvantage in having a magnetic blow-out.

The results plotted in Fig. 3 illustrate the fact that no advantage is obtained by opening the breaker quickly. The tests do not show excessive or short-circuit conditions, but depict only the effects on the magnetic field when the breaking occurs on moderate overloads.

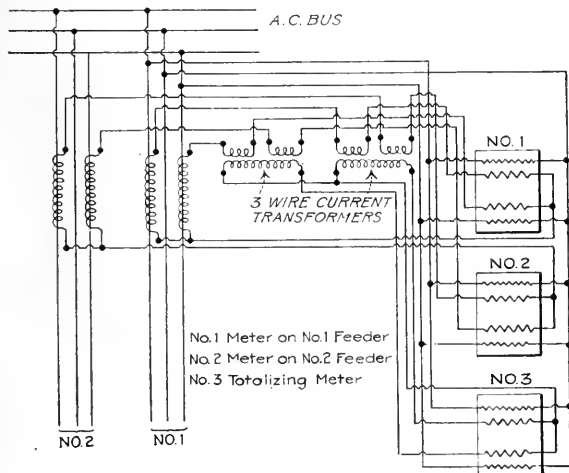
ADDING ENERGY CONSUMPTION OF TWO SEPARATE SERVICES

Three-Wire Transformer Interposed in Current-Coil Circuit of Individual Meters Used as Means of Measuring Energy Collectively

BY JOSEPH N. MCCLURG

Foreman Meter Department, Scranton (Pa.) Electric Company

The total energy of two or more services that cannot be tied together may be conveniently determined by the method shown in the accompanying illustration. This system can be used advantageously when the consumer wishes to know the cost of serving each of several plants whereas the company is interested only in the total energy consumed.



THREE-WIRE CURRENT TRANSFORMERS TOTALIZE CURRENT IN TWO SERVICES

The service meters for each plant are connected in the ordinary manner except that three-wire transformers are interposed in the current-coil circuits. The primaries of each leg of the transformers are connected in the same phase. The secondaries of both of these transformers are connected in multiple with the current coils of the totalizing meter, and therefore

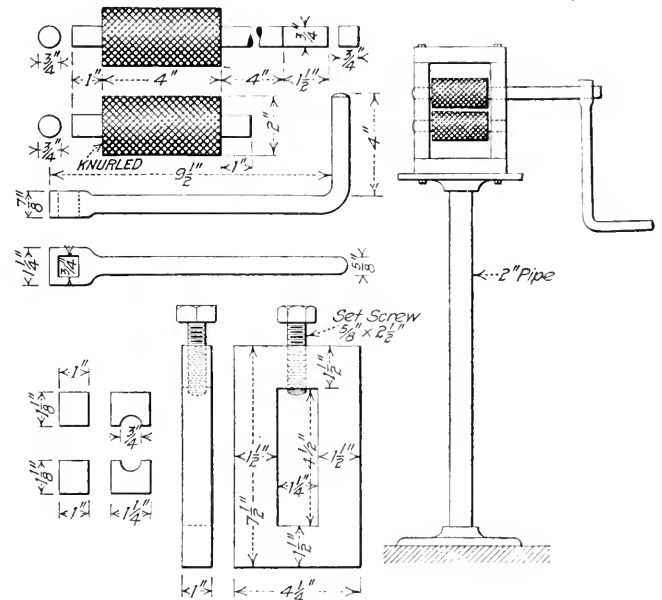
the meter will record the total energy consumed by the two distribution systems. The potential coils are connected in the ordinary manner.

METHOD OF FLATTENING LEADS FOR ARMATURES

Inexpensive Tool Provides Efficient and Quick Means for Shaping Conductors to Enter Commutator Lugs

BY FRANK HUSKINSON

Flattening copper wire without producing the hardness or brittleness usually caused by hammering the leads can be accomplished by the machine shown in the accompanying illustration. The device consists simply



MACHINE HAS SMALLER NUMBER OF PARTS AND CAN BE EASILY MADE IN THE SHOP

of two knurled rolls mounted on an iron stand. The copper lead is inserted between the holes and the handle is turned, thus drawing the lead between them and flattening it. The machine is inexpensive to make and is portable, so that it may be placed near the armature.

SPONGE-FELT INSULATION FOR STEAM LINES PROVES VALUE

Formation of Icicles on Pipe in Winter Indicated that Its Exterior Was Not Heated Appreciably by Radiation

A 2200-ft. (670-m.) length of outdoor pipe line 6 in. (15 cm.) in diameter transmitting steam having a temperature of 466 deg. Fahr. has been successfully insulated from the low temperature during the winter months by a combination of sponge and hair felt. The sponge is placed next to the pipe and covered with the hair felt. The hair felt will not withstand high temperature but makes an excellent intermediate or superficial covering. The total thickness of the heat insulation on this line is 3 in. (7.6 cm.), and tests show that the outside temperature is only slightly above that of the air with the latter at 22 deg. Fahr. In the winter icicles formed on the line.

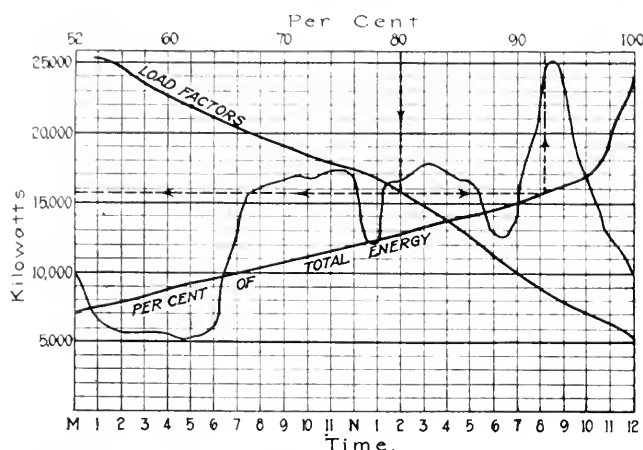
CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

LOAD-FACTOR BASIS FOR PURCHASING ELECTRICITY

Analysis of Central-Station Load Curve Made to
Determine the Best Conditions for
Buying Energy

A form of analysis of central-station load curves which may be useful in certain computations indicates the load factor of the energy block below any limiting



LOAD CURVE DRAWN TO PERMIT ANALYZING CONDITIONS THAT
SURROUND PURCHASE OF ENERGY

kilowatt load and the proportion of the total energy which the block below the limit represents.

Assume that a central station is considering the purchase of energy from a hydroelectric transmission company on a load-factor basis and that to obtain a

RELATION OF LOAD FACTOR TO PURCHASE OF ENERGY

Limiting Kw.	Kw.-Hr. Above Limit	Kw.-Hr. Below Limit	Load Factor	Per Cent Below Limit
25,300	0	326,900	53.8	100.0
25,000	190	326,710	55.0	99.9
24,000	670	326,230	56.7	99.8
23,000	1,540	325,360	58.9	99.5
22,000	2,780	324,120	61.5	99.1
21,000	4,510	322,390	64.2	98.6
20,000	5,660	321,240	66.9	98.3
19,000	7,010	319,890	70.1	97.9
18,000	9,020	317,880	73.5	97.2
17,000	12,690	314,210	77.0	96.1
16,000	22,180	304,720	79.4	93.2
15,000	33,100	293,800	81.5	89.8
14,000	46,900	280,000	83.3	85.6
13,000	61,300	265,600	85.0	81.1
12,000	76,900	250,000	86.8	76.5
11,000	93,600	233,300	88.4	71.4
10,000	111,000	215,900	90.0	66.0
9,000	128,900	198,000	91.7	60.6
8,000	146,800	180,100	93.8	55.1
7,000	165,000	161,900	96.3	49.5
6,000	184,200	142,700	99.1	43.7
5,100	204,500	122,400	100.0	37.4

permissible rate necessitates purchase at a load factor higher than the natural load factor of the system. In other words, a certain amount of energy during peak-load hours must be generated by steam. An average

daily load curve is drawn in the usual way. Successive peaks are cut away (presumed to be transferred to the steam plant), and the load factor and quantity of energy in the remaining block are plotted against kilowatts in the manner indicated.

For instance, with the load curve shown, to purchase energy on an 80 per cent load factor basis all peaks above 15,700 kw. must be carried by the steam plant; 92.4 per cent of the energy will be purchased and the remaining 7.6 per cent steam-generated. The curves are computed in a simple manner as indicated in the tabulation. Areas of the peak, or series of peaks, above each 1000-kw. line are measured by means of a planimeter, or by counting squares on cross-section paper, and translated into kilowatts, as indicated in the second column. The area above the line is taken rather than that below, as the former is smaller and may be determined with less liability of error. It is ordinarily best to measure by 1000-kw. zones and to take the summation of the zones above each limit. The kilowatt-hours represented by the integration of the curve below each limit are then determined by subtraction from the total (column 3) and the load factor (column 4) by the usual formula.

This form of analysis is particularly necessary where a rate of the following general form is offered:

ASSUMED VARIATION OF RATE WITH LOAD FACTOR

Load Factor, per Cent	Rate per Kw.-hr.	Load Factor, per Cent	Rate per Kw.-hr.
60 to 64.9	\$0.008	80 to 84.9	\$0.006
65 to 69.9	0.0075	85 to 89.9	0.0057
70 to 74.9	0.007	90 or over	0.0055
75 to 79.9	0.0065		

Assume that peak-load energy can be generated by steam at \$0.01 per kilowatt-hour. We may pick off from the curve the percentages purchased and generated by steam for each rate and load factor offered, and from these readily determine the following average costs per kilowatt-hour:

VARIATION OF UNIT COST WITH LOAD FACTOR

Load Factor, per Cent	Average Cost per Kw.-hr.	Load Factor, per Cent	Average Cost per Kw.-hr.
60	\$0.00801	80	\$0.00631
65	0.00753	85	0.00651
70	0.00706	90	0.00703
75	0.00661		

From which it is evident that purchase on an 80 per cent load factor is most advantageous for the particular set of costs and shape of load curve that have been under review.

EFFECT OF APPLIANCE LOAD IN SPARSELY SETTLED DISTRICT

Appliance Load Rather than Lamp Load as Controlling Factor in Establishing Maximum Demand in Outlying Residential District

In some residential sections served by the St. Joseph (Mo.) Railway, Light, Heat & Power Company only a 2-kw. transformer is justified from calculations based on the number of sockets or number of lamps served. However, it has been noticed in such districts that on Mondays and Tuesdays the trouble department answers a large number of complaints caused by blown transformer fuses.

This is taken to indicate that the load produced by the labor-saving appliances, such as washing machines and electric flatirons, is considerably in excess of any peak lighting load that may come on a transformer. To eliminate the necessity of such frequent trouble calls over-fusing is sometimes resorted to. These conditions are met with in the sparsely settled parts of the outlying residential district of the city.

TRADE ACCEPTANCE HELPS CENTRAL-STATION BUSINESS

Under Plan Worked Out at Columbus Contractor and Manufacturer Finance 50 per Cent of Sales of House Wiring and Appliances

In the latter part of last year the Columbus (Ohio) Railway, Power & Light Company discontinued the sale of electrical appliances and the wiring of old houses on the partial-payment plan. The matter was considered for a month or six weeks, and at that time it was decided to continue as before, but finally the condition became such that the management issued an order to stop such sales, and this order was immediately put into effect.

As a real new-business department does not enjoy having its means of doing business eliminated, Mr. W. A. Wolls, new-business manager, said before the commercial men of the Ohio Electric Light Association, his department at once set about to find ways and means whereby it could again produce business for the company. Upon investigation it was found that the trade-acceptance plan of financing would meet the requirements. Inasmuch as the company enjoyed the best of co-operation with the electrical jobbers and contractors, a plan for the wiring of old houses was submitted to them whereby the company would give to the contractor a contract to wire a house and on completion of the work would present his bill to the company with a trade acceptance attached ready for the signature of an authorized officer of the company. This trade acceptance would be returned to the contractor. The trade acceptance is made payable in 120 days. The contractor discounts the trade acceptance with his bank at the rate of 6 per cent per annum, whereas formerly the company would discount all bills at 2 per cent for cash. The contractor's revenue for the work done is exactly the same as it was before the use of the trade acceptance. This plan has been in successful operation for the last two months.

In regard to the sale of electrical appliances on the partial-payment plan, the company, Mr. Wolls

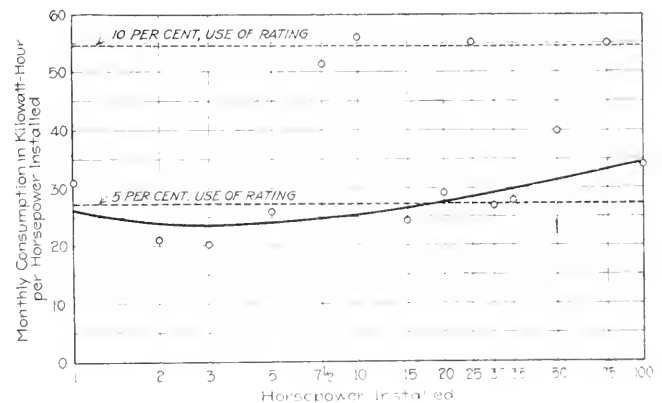
stated, formerly sold appliances on the basis of 10 per cent down and the balance in ten equal monthly installments. The company has now arranged with the customer a new basis of approximately 25 per cent down and the balance in six equal monthly payments; and with the manufacturers of the larger appliances, such as washing and ironing machines and vacuum cleaners, a basis whereby they accept in payment trade acceptances payable one-third in 60 days, the balance in 90 and 120 days.

Under the foregoing arrangement the wiring of houses and the sale of appliances is done on the basis of 50 per cent, financed by the electrical contractor and the manufacturers of appliances and 50 per cent by the company. This plan, Mr. Wolls states, is a war-time necessity.

AVERAGE SMALL-MOTOR ENERGY CONSUMPTIONS

Majority of Groups Used Approximately 25 Kw.-Hr. per Connected Horsepower, or About 5 per Cent Use of Rating

A Western central station recently analyzed the energy consumptions of its smaller power customers in order to determine the incomes which might be expected from future extensions. The customers were grouped by connected load, and the consumptions for



ENERGY CONSUMPTIONS OF SMALL POWER CUSTOMERS

Nominal Hp.	Limits	Horsepower Months	Kw.-hr. Consumption	Kw.-hr. per Hp.-Month
1	1 — 1 1/2	843	25,803	31
2	1 3/4 — 2	1,220	25,704	21
3	2 1/2 — 3 1/2	1,120	22,677	20
5	4 — 6	8,753	230,683	26
7 1/2	6 1/2 — 8 1/2	1,684	87,328	52
10	9 — 12	2,512	140,376	56
15	12 1/2 — 17	2,725	65,840	24
20	17 1/2 — 22	2,196	64,614	29
25	22 1/2 — 27	3,622	198,034	55
30	27 1/2 — 32	1,934	52,006	27
35	32 1/2 — 42	6,133	173,651	28
50	42 1/2 — 62	6,218	246,015	40
75	62 1/2 — 88	1,107	225,880	35
100	88 1/2 — 112	5,013	166,970	33

each group were tabulated for a number of months. It is interesting to note that the majority of groups consumed approximately 25 kw.-hr. per horsepower, connected per month, or about 5 per cent use of rating. The remainder consumed close to 55 kw.-hr. per horsepower per month. The latter figures were probably caused by a few customers of high load factor.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in
the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Limits to Alternator Voltage.—F. D. NEWBURY.—

For fifteen years the maximum voltage for which generators have been wound has remained practically the same. To-day 13,200 volts is the highest standard generator voltage used in this country. There are several reasons why generator voltages have not increased. The first is that as the voltage passes 20,000 volts (requiring a test voltage of approximately 40,000 volts) the weight and cost of the generator increase rapidly and soon become greater than the combined cost of an equivalent lower voltage generator and transformer. Another reason is that the elimination of the transformer subjects the generator to the direct shock of all the abnormal voltage waves originating in the transmission system. Experience has shown the necessity of heavily insulating the turns of the transformer nearest the terminals—in fact, the first few turns are insulated from each other as effectively as the coils are insulated from ground. This protection is impossible in the generator unless each coil has only a single turn, but this would result in a prohibitive number of slots for the voltages under consideration even with the largest units and the highest speeds. The danger from abnormal voltages when the generator is directly connected to the transmission line is such that relatively few generators are so operated. The third reason is that circumstances have not favored the use of very high-voltage generators. Breakdown of 10,000-volt generators insulated with treated cloth has not been rare. The failures are due, first, to the chemical effect on cloth or paper of corona or static discharge that often accompanies the higher voltages, and, second, to the serious increase in dielectric loss that occurs in many cloth and paper insulations under the combined influence of high voltage and high temperature. The danger from corona is, roughly, a function of voltage alone; consequently high-voltage generators of all sizes are involved. The danger from dielectric loss is a function of both voltage and operating temperature; thus small generators with relatively low internal temperatures are immune while large turbo-generators in which the internal temperatures are usually in excess of 100 deg. are subject to this danger. With the higher generator voltages electrostatic stresses sufficiently high to break down air often occur, particularly at points and corners such as the edges of projecting laminations in the slots and the edges of the core ventilating ducts that are ground potential. The "static" or corona that results is accompanied by the formation of nitrous oxide and nitric-acid gases, which after a time disintegrate the vegetable insulation. On the other hand, mica is practically unaffected under conditions thus far encountered in practice and, so far as the author is aware, has never failed from this cause. Synchronous motors and generators are better adapted for the higher voltages than are induction motors.—

Sibley Journal of Engineering, Cornell University, May, 1918.

Generation, Transmission and Distribution

Bibliography of Petroleum.—Countries and regions in which petroleum is found are pointed out, and transportation, storage and distribution, properties of oil and their determination, utilization and legal regulation regarding its use are discussed.—*Bulletin* 149, Department of Interior, Washington, D. C.

Regulating Combustion in Modern Furnaces.—L. CONGER.—A consideration of this subject as applied to equipment with artificial firing and mechanical grates. The author lays particular stress upon the importance of proper ventilation. To obtain the necessary variation in the speed of ventilating apparatus in central stations using three phase current there are three processes to choose from: (1) To transform the three-phase current into direct current and to operate the ventilators by direct-current shunt motors; (2) to transform the three-phase current into two-phase current by a Scott transformer and to connect each phase to a monophase variable-speed motor, thus permitting an equilibrium of the two circuits; (3) to install three-phase variable-speed motors with collectors. The author favors, as the most flexible and economical method, the use of direct-current motors.—*Revue Générale de l'Electricité*, May 25, 1918.

Feeding Monophase Electrometallurgic Ovens from Three-Phase Distribution Systems.—E. PIERNET.—The author examines the means of avoiding disturbances produced when the conditions in electrometallurgical plants necessitate feeding monophase ovens from three-phase networks.—*Revue Générale de l'Electricité*, May 18, 1918.

Traction

The Loetschberg Railway.—LUCIEN PAHIN.—A long article on this electrified railway in the Bernoise Alps, Switzerland, which constitutes an international route to the Simplon tunnel and will be an important factor in traffic between the north of France and both Belgium and Italy. The section between Spiez and Brigue, extending 73.8 km. (45.8 miles), is described in detail, including the power houses, distribution system and electric locomotives, the latter of 2000 hp. and 2500 hp. Interesting figures regarding the energy consumption are given.—*Revue Générale de l'Electricité*, May 11, 1918.

Installations, Systems and Appliances

Repulsion and Mutual Inductance of Reactance Coils with the Same Axis.—H. B. DWIGHT.—The article contains curves and gives examples of how the inductance of reactance coils can be found by the use of the curves. The curves also indicate the mechanical forces which may exist between reactance coils. These are compared with test values.—*Electric Journal*, May, 1918.

Industrial Controllors, Part XVII.—H. D. JAMES.—This article describes controller systems for mine hoists. Mine hoists are divided into two general classes, namely, those for coal mines and those for metal mines. The equipment is classified as contactor controllers, liquid controllers and voltage controllers. Besides describing and illustrating these three types of controllers, safety devices and brakes are also considered. The question of whether the advantages of automatic control of hoists, designed to stop the cars at either limit of travel and discharge their load, is adequate to make up for the complicated design and extra cost involved is also discussed.—*Electric Journal*, May, 1918.

Wires, Wiring and Conduits

Solution of Polyphase Network Problems by Using Symmetrical Co-ordinates.—C. L. FORTESCUE.—The author points out that unsymmetrical systems of co-planar vectors may be represented by symmetrical systems of the same number of vectors, the number of symmetrical systems required to define the given system being equal to its degrees of freedom. In the first part of the paper, which consists of three parts, the author deals with the resolution of unsymmetrical groups of numbers into symmetrical groups. These numbers may represent rotating vectors of systems of operators. A new operator, termed the sequence operator, is introduced, which simplifies the manipulation. Formulas are derived for three-phase circuits. Star-delta transformations for symmetrical co-ordinates are given and expressions for power deduced. A short discussion of harmonics in three-phase systems is given. The second part of the paper deals with the practical application of this method to symmetrical rotating machines operating on unsymmetrical circuits. General formulas are derived, and such special cases as the single phase induction motor, the synchronous motor-generator and phase converters of various types are discussed.—Abstract of paper presented before A. I. E. E., June 28, 1918.

Electrophysics and Magnetism

Magnetization of Iron in the Absence of Hysteresis.—WINTHROP R. WRIGHT.—The magnetic characteristics of five steels, arranged in decreasing order of carbon content, were obtained at temperatures ranging from 20 deg. C. to the magnetic transformation point. The anhysteretic magnetization curve at a given temperature has three characteristics distinguishing it from the ordinary magnetization curves. The curve has no point of inflection, its slope at the origin is apparently infinite, and it does not intersect any other curve taken for a second temperature. Examination of empirical equations which have been proposed for anhysteretic magnetization showed that they represent the curve only very approximately.—*Michigan Technic*, May, 1918.

Electrochemistry and Batteries

Effect of Iron Sulphate in the Electrolytic Precipitation of Copper from Sulphate Solution with Insoluble Lead Anodes.—EDWARD F. KERN.—Solutions of copper sulphate containing varying quantities of iron sulphate were electrolyzed with insoluble lead anodes at different temperatures and with different current densities, in order to determine the effect of the iron salt present on the current efficiency of copper deposition at the cathode. The lowering of efficiency was found due

to adduction of ferrous sulphate to ferric sulphate at the anode, and reduction of ferric sulphate to ferrous sulphate at the cathode. Results are given quantitatively.—Extracted from paper presented before the American Electrochemical Society, April 28, 1918.

Experiments with the Copper Cyanide Plating Bath.—FRANK C. MATHERS.—Current yields at the cathodes were generally lower than those at the anodes, which necessitated the making of regular additions of sodium cyanide to the baths. Sodium carbonate and perhaps sodium sulphate are valuable additions. A more concentrated solution than usually employed is recommended because the higher current can be applied and the thicker deposits obtained without bad edges or corners and the cathode yields are higher.—Extracted from paper presented before the American Electrochemical Society, April 28 May 5, 1918.

Telegraphy, Telephony and Signals

Signals from Central Stations to Customers.—PIERRE TRICHARD.—The author proposes a system of signals to users of electricity based on very slight periodic variations of voltage above and below normal. By using the phenomenon of resonance these signals could be received upon a voltmeter or upon a combination of two voltmeters. Transmission of the time and the multiple recording of energy consumed are two of the uses to which they could be put. In addition, as has actually been done, they would provide a means of giving the alarm in case of a threatened air raid.—*Revue Générale de l'Electricité*, May 18, 1918.

Miscellaneous

Copper and Aluminum in Germany.—Discussing the statements made recently by an official of the British Aluminium Company, a leading German newspaper observes that it is no secret that Germany has embarked upon the production of aluminum on a large scale during the war, although opinions differ as to whether the German works will be able to meet international competition after the war. It is considered certain, however, that the reported increase in the British production of aluminum, proceeding simultaneously with a very large augmentation in the output of copper in the period succeeding the war, will render not improbable some overproduction of the latter metal. If the copper needs of Britain and her allies are estimated at 50,000 tons per month for war purposes, the German newspaper remarks that it is obvious that these requirements will be considerably reduced the moment peace is concluded. This circumstance is regarded as of importance to Germany, as the newspaper states that it awakens the hope that the present exceptionally high prices for copper will fall through this disproportion between supply and demand, and especially that there will be no question that it will be rendered possible for Germany to continue to obtain supplies of the indispensable copper.—*London Electrical Review*, April 26, 1918.

Welding Cast Iron with the Electric Arc.—Economies are being effected in railroad repair shops owing to the successful repair of expensive damaged castings. The article describes the preparation of the material for welding, particular attention being given to the welding of locomotive cylinders, high-pressure cylinders and thin metal that is not subject to heavy stresses.—*Railway Electrical Engineer*, May, 1918.

Measurement of Dielectric Losses by Condenser Bridge

To the Editor of ELECTRICAL WORLD:

Sir: In reading C. A. Butman's interesting article in your issue of March 9, describing the measurement of dielectric losses by the condenser bridge method, the writer's attention was drawn to several apparent errors. On page 502, in the paragraph headed "Formula for the Dielectric Constant," equation (6) is given as an expression for "the dielectric constant or specific inductive capacity." This is obviously an error. The dielectric constant is not a dimensional quantity; it is merely a ratio, as is evidenced by the qualifying adjective "specific." Equation (6) gives the capacitance of the author's condenser with air as the dielectric.

The discussion of the quantity $\cos \theta_r$ in θ_r of equation (12) is ambiguous because the author has apparently allowed r and c to vary simultaneously. In the paragraph on page 503 beginning "The experiments which follow show conclusively" it is stated that where $\theta_r = 90$ deg. there is an energy loss because the condenser has a perfect dielectric. Reference to Figs. 1 and 2 will show that θ_r becomes 90 deg. when the capacitance vanishes or the resistance r becomes infinitely large, constituting practically an open circuit, and the loss becomes zero on that account. On the other hand, θ_r becomes 0 when the condenser has a perfect dielectric with no energy loss.

In arriving at the conclusion on page 505 that "It was also found unnecessary to use a substitution method in measuring the capacity," it would appear that the author has eluded difficulties which have tried the souls of other experimenters when measuring capacitances as small as 0.0001 mfd.; but he has overlooked a splendid opportunity to secure the dielectric constant without being bothered with the calibration of his comparison air condenser. By taking a reading with his sample in place and then a second with the sample removed and his testing frame in air, the plates being set to give the same thickness of dielectric as in the first measurement, the dielectric constant is obtained directly as the ratio of the two readings of the variable resistance of the bridge. However, distributed capacitance is known to exist in resistance coils with the bifilar winding, and few inductors are free from this defect. Mr. Grover's article in the *Bulletin* of the Bureau of Standards points out that these residual capacitances enter directly into the value of dielectric loss obtained. Hence, if values of dielectric loss reliable to five significant figures are required, allowance for these reactances must be made or a substitution method employed. An equivalent of the substitution method could be easily secured by taking readings with the test apparatus used as an "air condenser" with two settings of thickness of dielectric. The best method is, of course, to use resistances of the Curtis coil type, which are very nearly anti-capacity.

Readers' Views and Comments

The author does not state the thickness of the metal plates used as electrodes nor does he make mention of the amount of pressure applied to the sample through the plates; hence it is impossible to estimate the degree of contact between the plates and the sample. It has been the experience of other experimenters that it is impossible to secure perfect contact between the sample and rigid electrodes even under great pressure, so that in testing these samples the measured dielectric constant is apt to be largely influenced by the dielectric constant of the medium in which the apparatus is placed. The Electrical Testing Laboratories use dish-shaped blocks of bakelite accurately aligned by dowels and clamped together with the sample between them. The space on either side of the dielectric is then filled with mercury, which constitutes the electrodes. A somewhat similar device is used at the Perth Amboy laboratory of the Standard Underground Cable Company. Incidentally, the writer knows that the latter company has been employing the bridge method for the measurement of dielectric losses for a number of years, and the results of such measurements by another investigator up to 6000 volts were published in the *Annalen der Physik* a good many years ago. GORDON THOMPSON.

Electrical Testing Laboratories, New York.

To the Editor of ELECTRICAL WORLD:

Sir: The following is a reply to the comments of Gordon Thompson relating to my article on the series inductance bridge.

1. The "formula for the dielectric constant," equation (6), is correct as given. The dielectric constant is the relation between the inductivity of a substance of certain dimensions compared to ether occupying the same space. Inasmuch as the dielectric constant of air is approximately unity, the specific inductive capacity is also given by the same formula.

2. It may make the expression $\cos \theta_r$ in equation 12 more clear to state that the change in r and c is due to a change in the material between the condenser plates. As long as there is no change in the material, r and c will remain constant. When the bridge is balanced there is one and only one value of r and c . If now we consider the hypothetical condition as to what would happen if r did change and c remain constant and vice versa, we will arrive at the given conclusion.

3. It is important to note that the exact mechanism of electric conduction is not known, and that there probably is a difference between a perfect resistance through which no conduction current passes and a perfect dielectric

which will transmit a displacement current. Further experiments are needed, such as tracing the change from a nearly perfect dielectric to that of a poor resistance by changing the temperature of a given substance.

4. Arranging the bridge symmetrically, reducing the capacity of the bridge to the ground to the lowest amount, grounding the bridge as shown in the diagram and placing the vibrator of the galvanometer directly in the circuit (the galvanometer itself being free from ground) showed that no auxiliary bridge like the one used by K. W. Wagner, or substitution method such as used by the United States Bureau of Standards, was necessary. The suggestion of having the galvanometer free from ground was due to Dr. P. Thomas of the Westinghouse research department.

5. Various ways of securing contact were tried, the most satisfactory being the testing frame developed. The brass plates of the frame were about $\frac{1}{8}$ in. (3.1 mm.) thick and were backed with wood so as to be rigid. The end of the micrometer screw was so made as to allow the top brass plate to adjust itself to the nearly plane parallel test samples. The amount of pressure used was sufficient to secure good contact. The method of testing the amount of pressure was the amount of force used in tightening the micrometer screw. The value of the dielectric constant of glass obtained with the bridge and the testing frame was what was to be expected, as judged from results obtained by other experimenters using other methods. It might also be well to point out that, while contact over the whole surface is essential in resistance measurements, in electrostatic (i.e., inductive) measurements it is not so important. It is believed by the author that contact is at a sufficient number of points to provide a good electrical connection. It should not be lost sight of that the testing frame provides a means of testing the dielectric constant of liquids.

6. In case 10,000 volts applied potential is used it is necessary to place the samples in oil to avoid dielectric losses due to corona. As is pointed out, if some other substance besides that directly under test comes into the electrostatic field between the plates of the frame it is liable to influence the value of the dielectric constant.

7. A series resistance bridge was developed by Monash (*Annalen der Physik*, 1907) for measuring the dielectric loss angle, but not the following improvements. The Einthoven galvanometer may perhaps be replaced by a Leeds & Northrup alternating-current galvanometer. The Ayrton-Perry type of variable inductance may be replaced with the less expensive Leeds & Northrup inductometer. The standard condenser made of plates immersed in mica.

A slight improvement could be made by using the Curtis type of resistances as recommended by Mr. Thompson.

CHESTER ARTHUR BUTMAN.
Rockport, Mass.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

CENTRAL-STATION ECONOMIES DISCUSSED AT SYRACUSE

Engineers and Operators in New York State Tell
of Methods for Using Machinery and Material
in the Most Efficient Way Possible

That economies can and must be effected in war time was the keynote of the meeting of the Electric Section of the Empire State Gas & Electric Association at Syracuse on June 21. Delegates who have charge of production and distribution departments in central stations of New York State talked about the labor situation, fuel conservation, 11,000-volt distribution and other important problems that need immediate solution in order to "carry on" the central station in the best way. The member companies were well represented, and every one took part, a roll call being taken as the subjects were discussed.

The consideration of how to use material usually scrapped, especially old duct cable, which can be utilized by splicing, brought out the statement that in Buffalo the later method had been practiced for fifteen years with great success.

It was pointed out how on the Syracuse system an 11,000-volt emergency line had been arranged so that it could be used for a 2300-volt tie line and switched back to its original use if necessary. By this method the energy from the water-power station could be better distributed and considerable generation by steam was eliminated. By utilizing a 250,000-circ. mil cable that happened to be in stock on a distribution system where B. & S. gage No. 0 was the size required feeder regulators and the necessity of buying cable of the correct size were eliminated in Rochester. At Syracuse one man is employed to repair transformer leads and bushings, and by this means the equipment is kept in first-class condition and it is not necessary to send transformers to outside shops except in rare cases.

WOMEN IN INDUSTRY

A discussion of the labor situation brought out the fact that many women were being employed by the member companies with satisfaction. In Buffalo seventy-three girls are being used in the office, where before the war only one woman was employed.

Testing, repairing and reading of meters is accomplished very efficiently in Binghamton. This work is greatly facilitated, however, by the fact that for several years the local company has required the meters to be placed in a central position on the consumer's premises and not much difficulty is encountered in reaching them. It was suggested that the central stations should study the possibility of employment of disabled soldiers in plants and in testing rooms in accordance with the request of the government.

In discussing fuel conservation one engineer told of a case in which the Fuel Administration had written to

the owner of an isolated plant asking him to communicate with the central station to make an arrangement whereby the latter company could take over its load. The Fuel Administrator in Rochester has issued an order requiring that no gas or electric service shall be connected to the lines without his permission.

The effect of daylight saving was discussed by all the companies represented, and in some cases it was stated that plans were being made to induce factories to change working hours so that the peak of the commercial load could be shifted and would not coincide with the lighting load.

Obtaining right-of-way is the greatest trouble met with in serving customers from the rear lot, according to several engineers. In addition, when street lights have to be served from the same primaries considerable underground construction cannot be avoided.

Modern apparatus accounts for efficient operation of the steam station in Rochester, said one of the production engineers of that company. Bonus systems are used for increasing the operation in the engine room and boiler room in this plant.

Farmhouses along 11,000-volt lines can be served economically if the load of several consumers is sufficient to require at least a 5-kw. transformer. All that is required for protective means is fuses and choke coils on the transformer pole. In case lightning strikes the line the reactance of the transformer will choke the discharge back to the substation lightning arresters.

SCOPE AND APPLICATION OF NATIONAL SAFETY CODE

Circular No. 72 Issued by the Bureau of Standards
Intended to Aid Those Interested in
the Code

Circular No. 72 issued by the Bureau of Standards deals with the "Scope and Application of the National Electrical Safety Code." This circular is intended to aid those to whose attention the safety code has been called and those who are contemplating its adoption or use in acquiring the necessary familiarity with intent and scope. The need for the code is explained and examples of personal injuries by electricity are given, most of which will be found avoidable by observance of the rules.

The method of arrangement of the code to promote convenient use and the intended manner of application of the code by engineers and inspectors are briefly explained. A short summary is also given of the provisions of each of the four principal parts of the code. According to an announcement issued by the bureau, as the code is being adopted on trial by many administrative bodies and public utility companies, it is expected by the bureau that this circular will facilitate its introduction and aid in its interpretation.

Motor-Operated Bell Chime at Boston Store



Electrical advertising by a bell chime connected with a master clock is effectively utilized at the Filene Store, Boston, Mass., on the busiest street corner in New England. Four bells constitute the chime, which rings on the hours and half-hours according to the Westminster schedule. The chiming and striking are accomplished by an electrically controlled let-off tower clock mechanism installed in a corner of the store behind the bells. The mechanism is controlled by a regulator wall clock which also energizes the magnets in the movement of the bracket clocks. The magnet control current is supplied by Samson batteries.

WATER-POWER COMMITTEE AGREES ON A NEW BILL

Special Committee of the House of Representatives
Decides to Recommend Legislation Similar
to Administration Bill

The special committee appointed in the House of Representatives to consider all proposals for water-power legislation has completed its work and has agreed upon a bill which will be presented to Congress probably early in July. The bill is practically identical with what was known as the administration water-power bill, which was made the subject of hearings that have been reported in the *ELECTRICAL WORLD*.

In its essential features the bill provides for a federal power commission consisting of the Secretaries of War, Agriculture and the Interior. The President is to designate the chairman of the commission, which is to issue licenses for the development of water-power projects, the term of the license not to exceed fifty years. Licenses may be altered only upon mutual agreement between the licensee and the commission after notice of thirty days.

The licensee is to pay the United States "reasonable annual charges in an amount to be fixed by the commission." The original provision of a charge of not less than 10 cents per horsepower-year has been eliminated, and provision has been made for the readjustment of the charges at periods of not less than ten years in case the project includes dams owned by the

United States. Licenses may be issued without charge for small projects of not more than 50-hp. capacity. In case licenses are issued to states or municipalities charges are not to be assessed on such power as may be used directly by the licensees.

Provision is made whereby the United States may recapture the project upon not less than two years' notice from the commission by paying to the licensee his net investment plus reasonable severance damages for property of the licensee not taken. The original definition of net investment is retained. The bill also contains the original options regarding the disposition of the project at the end of the fifty-year license period and relating to the regulation of rates of service and character of securities.

A new provision was written into the bill requiring the licensee to maintain out of surplus earnings, if any, accumulated in excess of a specified rate of return upon the net investment, amortization reserves to be held until the termination of the license or applied periodically in reduction of the net investment. The license may provide that any balance or surplus earnings shall be used in reduction of rates and annually returned to the consumer.

INCREASING FACILITIES TO MEET WAR-TIME DEMANDS

New England Power Company Expects to Expand
Its Total Rating by 40,000 Kw. Before Next
Winter, Partly by Interconnection

Forty thousand kilowatts of additional capacity will be available before next winter on the system of the New England Power Company to meet the demands of war industries, according to plans outlined by President Henry I. Harriman on June 20. This increase will in part be secured through interconnection with the lines of the Shore Line Electric Railway in Connecticut and with the system of the Edison Electric Illuminating Company of Boston at Dedham, Mass., supplemented by the addition of a 12,500-kva. steam turbo-generator and four boilers to the central station at Uxbridge, Mass., by the rewinding of the generating units in the No. 5 hydroelectric station of the power company near the Massachusetts-Vermont line on the Deerfield River, and by the addition of new boilers to the plant of the Narragansett Electric Lighting Company of Providence, R. I.

Mr. Harriman stated that at present the New England Power Company's entire output of hydroelectric energy is being sold. The increasing demands for power in industrial New England resulting from war activities render it absolutely necessary to procure 40,000 kw. in addition to present available capacity before winter. The high cost of equipment and construction renders it essential to combine resources as fully as possible, conserving both capital and fuel. The Shore Line Electric Railway of Norwich, Conn., which has a central-station business in that district, is building a new plant of 25,000-kva. rating on the Thames River, about halfway between New London and Norwich. This will supersede four or five small and inefficient steam plants now operating the road, some of which consume in excess of 4 lb. of coal per kilowatt-hour. These stations are interconnected by 33,000-volt lines. It is proposed to build a new line connecting the Shore Line

system with the New England Power Company's dispatching headquarters at Millbury, Mass., just outside Worcester, the New England company building that part of the line between Millbury and the Connecticut boundary, at an estimated cost of about \$102,000.

This interconnection will enable the Power company to utilize the reserve capacity of the new Shore Line plant, which is equivalent to the rating of one 12,500-kva. unit, the initial installation providing for two turbines of equal capacity. This station is now under construction by the Harry M. Hope Engineering Company of Boston, piling and foundation work being in process. Mr. Harriman said that the total load of the Shore Line company is about 7500 kw., and that the construction of the new plant was hastened by the high cost of coal and by the necessity for supplying energy from the Shore Line plant to a boat-building establishment at New London. It has been agreed that if the Shore Line company will build a transmission line from its present system to the Massachusetts state line the New England company will purchase energy from the former for probably more than six months of every year, and the Power company will also supply the Shore Line load from midnight to morning, this totaling about 1000 kw. and being too small to permit of the economical operation of a 12,500-kva. unit.

ARRANGEMENT AT PROVIDENCE

Arrangements have been made with the Narragansett Electric Lighting Company, Providence, R. I., to install four additional boilers at the main generating station on tidewater at Providence, thus providing 10,000 kw. not previously available and enabling the full turbine capacity of this company to be utilized. The interconnection with the New England system through the Rhode Island Power Transmission Company, the affiliated organization's line, will enable energy to be interchanged as may be required. The Providence station is at present the largest steam plant connected by high-tension lines with and supplying energy to the New England system. It is now planned to tie the latter into the Boston Edison system by the construction of a 19-mile (30.5-km.) high-tension line from the Sudbury hydroelectric plant of the Metropolitan Water & Sewerage Board to the Dedham substation of the Edison company. This line is to be designed to transmit from 10,000 kw. to 15,000 kw. in off-peak energy. This interconnection will call for the laying of another cable between the Dedham substation and the L Street station of the Boston company, and it is expected that these interconnections will be permanent and useful after the war as well as at present.

Recently the New England Power Company was offered a 12,500-kva. steam turbine for immediate delivery, the manufacturers having received a cancellation order from another purchaser. The unit was at once accepted, and shipped for installation at Uxbridge, where the existing central station is interconnected with the hydroelectric system. Four 500-hp. boilers have been purchased, and to provide for this equipment the boiler house will be extended 60 ft. (18.2 m.) and the turbine room 30 ft. (9.1 m.). The turbine was purchased at a cost of about \$201,000, and could not have been obtained for service this fall had it been ordered in the usual way.

At the No. 5 station of the Power company three double units are in service, delivering 25-cycle energy at one end for the Hoosac Tunnel electrification of the Boston & Maine Railroad and 60-cycle energy at the other for general use. These machines were installed about six years ago. Mr. Harriman stated that, like many units of earlier build, these generators were designed along very liberal lines with respect to material. Recent advances in insulation practice have made it possible to increase the output of many units by rewinding. The company needs additional peak capacity, and it has been ascertained that by installing new coils the capacity of the three units can be increased by a total of nearly 6000 kva., and at a cost of \$3 per kilovolt-ampere for the coils alone. Other changes in the station bring the estimated cost of the enlargement to \$83,765. A new 6000-kw. unit would cost around \$20 per kilowatt at present prices, and at least \$10 per kilowatt two or three years ago. If a new unit were to be installed it would be necessary to enlarge the station building and provide new gates and a new penstock. The present waterwheel is large enough in each case to drive the double generating set connected to it, even after rewinding the coils.

Mr. Harriman said that prices of electrical equipment are nearly double those of two years ago and that the labor cost in installation often equals the cost of the equipment itself to-day, or nearly so. Most of the construction work of the Power company, together with the engineering, is performed by the affiliated Power Construction Company, only a nominal profit being sought to cover actual costs. This arrangement is convenient in view of the doubtful authority of the Power company to act for other companies as an engineering or construction organization, especially on work outside the State. The New England Power system is being connected with the Fall River Electric Light Company by an 18-mile (28.9-km.) line, under construction for the Cabot interests of Boston by F. T. Ley & Company, and as this organization is working in the vicinity of Rhode Island, it is also being utilized in a short piece of line work in the latter State.

SUMMARY OF ESTIMATED (NOT ACTUAL CONSTRUCTION) COST OF ENLARGING FACILITIES OF NEW ENGLAND POWER COMPANY.

1. Uxbridge station, increasing capacity by 12,500 kva..	\$768,500
2. Plant No. 5, increasing capacity from 12,600 kva. to 18,100 kva.	83,765
3. Pole line, single-circuit No. 1 coffer, 15 miles, Millbury to Connecticut State line.....	102,300
4. Additional switching equipment, Millbury substation..	4,200
Total	\$958,765

When asked about the prospect of constructing the Davis Bridge Reservoir, in Vermont, Mr. Harriman said that at present it is out of the question to raise the necessary money by private capital, but that the additional storage is greatly needed, and, with the 112,000,000-kw.-hr. it would furnish annually, would be the salvation of the New England power situation. A bill has lately been drawn by Counsel Buckley of the Council of National Defense appropriating \$200,000,000 for the use of the President of the United States on behalf of public utilities in such manner as he deems wise. It is hoped that New England will share in the benefits of this proposed act of Congress.

ELECTRIC POWER CONDITIONS IN THE DOMINION OF CANADA

Canadian Electrical Association Discusses Pressing
Needs of Central Sections of the Country Now
Enjoying Unprecedented Activity

The twenty-eighth annual meeting of the Canadian Electrical Association, which is affiliated with the National Electric Light Association, was held at the Chateau Laurier, Ottawa, on June 21. Considering the condition of electrical industry in Canada, the attendance was quite large, the central stations of the Dominion being seriously handicapped by labor shortage in the face of activity unprecedented in the history of the lighting companies. At the present time there is also a great shortage of power throughout the Province of Ontario, but the power conditions in the Province of Quebec are not quite so serious. It should be noted that from ocean to ocean the great centers of industry are supplied with electrical energy generated from water-power stations. In the eastern sections, notably in Hamilton and Montreal, large steam reserve stations are maintained, and inasmuch as nearly all the coal is obtained from the United States, the coal shortage of the Republic affects Canada as well. The tendency, therefore, is to load up the existing hydroelectric developments to the limit.

CONDITION OF CANADIAN UTILITIES

The general conditions obtaining in the central-station industry throughout the eastern section of Canada were reflected in the address of D. H. McDougall of Toronto, the president of the association. Difficulties in obtaining coal and money are apparently as common in Canada as they are in the United States, and the necessity for higher rates is just as pressing. Speaking of the immediate problems, Mr. McDougall said:

"The war and its accompanying sacrifices and hardships have made it necessary that each one of us should assume additional burdens and responsibilities. Our industry has had imposed on it additional duties in the way of operating problems and overloads that required all the skill, nerve and ingenuity that we could muster, and our staffs have been depleted further by conscription and the other war drains, making the maintenance of service a very difficult matter.

"Few of us are able to finance any new extensions to our properties or maturing bond issues. This handicap has been largely met by charging customers the cost of line extensions and by intensifying loads on present lines. Station increases have been almost impossible to finance. In some quarters this has been offset by taking on off-peak business, and this has required the study of factory conditions to educate customers to the necessity and possibility of such methods of operation. The result has been that higher load factors are experienced and some plants have been operated at a load factor deemed impossible even two or three years ago.

"The next difficulty has been with our employees, whose numbers have been decimated by military service, to which they have willingly responded, and by conscription, which I believe has affected us so far in a minor degree.

"I think I am safe in saying that great disorganization on account of these wholesale changes in staffs

has only been averted by the loyalty and unselfish performance of duty of those who for one reason or other were unable to answer the call of the bugle.

THE HYDROELECTRIC POWER COMMISSION

"The outstanding example of failure to live up to contract obligations in the service of electric power in Canada during the past year is the case of the Hydroelectric Commission of Ontario, which, with an unprecedented lack of foresight, made contracts for larger amounts of power than it was able to supply. The total amount of this shortage has been stated to be 100,000 hp., but, unlike the members of this association, the commission has so far been able to escape the consequences of this selling short of power, as it has refused to recognize the claims of its customers, based on the solemn contracts signed by it, and has pleaded that its shortage has been caused by the war.

"It is hard to believe that such immorality would be protected by the crown and that millions of dollars invested in plants depending on government contracts for their power should be shut down when many of them would otherwise be turning out munitions and other war necessities but for this breach of faith.

"This commission, in spite of its lack of business ability, is able to secure large sums for construction work, amounting to about \$2,000,000 a year, because its undertaking is supported by the government, although the works it is building cannot be of any service to the country for years to come, long after the war will surely be over. In the meantime it is diverting this money so much needed for war purposes from the use of the people of Canada. The amount of money expended by the Hydroelectric Commission so far in transmission and distribution plants is about \$70,000,000, and the estimated amount of taxes lost to the people, which they would collect from privately owned companies with similar properties, is about \$1,500,000 per year."

Other speakers at the morning session were T. C. Martin, secretary of the National Electric Light Association, who spoke of the work of the national body for the year and of its war committees; Willis MacLachlan of Toronto, who spoke on accident prevention, and with the assistance of operators from the Ottawa Electric Company, gave a demonstration of resuscitation from electric shock; A. A. Dion of Ottawa, whose report for the overhead-line committee dealt chiefly with the grounding of high-tension and secondary circuits, and J. F. Nield of Toronto, who reported on electrical apparatus.

Four reports were made at the afternoon session, all of which were commented on. William Volkman of the Toronto Power Company reported on the changes made during the past year in the manufacture of meters. A part of the report was devoted to the determination of power factor, because with the load conditions and the extremely high cost of additions to line capacity any relief which might be obtained by improving the power factor of consumers' loads is of great importance. Three methods for determining the power factor of loads were outlined in detail.

H. E. Randall of Montreal reported on the commercial light and power sales and on the use of electricity during the past year. The great value of the central-station industry to the country and the important part

it is accomplishing in the production of munitions, in solving the servant problem, in the conservation of fuel, man power and material, and in building up industrial conditions of Canada, were described in detail.

As the Canadian Electrical Association's representative on the National Electric Light Association's lighting sales bureau, E. N. Hyde of Montreal reported on industrial lighting conditions.

A very interesting report was presented by P. T. Davies of Montreal on rate research. It was pointed out that the obligations of customers in Canada to provide themselves with suitable electrical apparatus have been increased in view of the shortage of power and the high cost of machinery. Nearly all companies are requiring customers to keep power factors within reasonable limits at all times and to pay for any deficiencies. An abstract of the report of this committee will be published in a later issue.

Officers for the coming year were elected as follows: President, A. Monro Grier, Canadian Niagara Power Company, Toronto, Ont.; first vice-president, E. A. Dunlop, Pembroke (Ont.) Electric Light Company; second vice-president, C. S. Bagg, Montreal Light, Heat & Power Company, Cons.; third vice-president, A. P. Doddridge, Quebec Railway, Light, Heat & Power Company; secretary-treasurer, W. Volkman, Toronto Electric Light Company. The managing committee comprises D. H. McDougall, Toronto Electric Light Company; J. S. Norris, Montreal Light, Heat & Power Company, Cons.; P. T. Davies, Southern Canada Power Company, Montreal; R. B. McDunnough, Quebec Railway, Light, Heat & Power Company; J. S. Gould, Citizens' Electric Light Company, Smith's Falls, Ont.; H. M. Hopper, St. John (N. B.) Railway Company; L. Pratt, Dominion Power & Transmission Company, Hamilton, Ont.; J. B. Woodyatt, Southern Canada Power Company, Montreal; W. H. McIntyre, Ottawa Electric Company; R. J. Beaumont, Shawinigan Water & Power Company, Montreal; H. E. Randall, Shawinigan Water & Power Company; A. V. Gale, Hull (Que.) Electric Company; J. F. Nield, Toronto Electric Light Company, and the president of the N. E. L. A.

The proceedings ended with a banquet in the Chateau Laurier at which seventy-five were present. Addresses were made by the incoming president, A. Monro Grier, D. H. McDougall and John Murphy, electrical engineer of the Dominion Railway Commission.

BANKERS WORKING ON PUBLIC UTILITY RELIEF

Committees in Large Cities Take Up the Question of Providing for the Necessary Financing Requirements

In last week's issue of the ELECTRICAL WORLD the appointment of four New York bankers to consider public utility needs was reported. Committees are also being appointed in other cities with the idea that each local situation may be met directly in the community. In Philadelphia the committee is J. R. McAllister, John H. Mason, Effingham B. Morris, Arthur E. Newbold, Levi L. Rue, Joseph Wayne, Jr., and William P. Gest, chairman. The Chicago committee is George M. Reynolds, E. D. Hulbert and Frank O. Wetmore. A similar committee exists in Boston.

LABOR ARBITRATION IN GENERAL ELECTRIC PLANT

Company and Employees at Schenectady Works Agree to Submit Differences to Ex-President Taft and Frank P. Walsh

The Department of Labor announced at Washington on June 23 that the General Electric Company and 21,000 employees at the Schenectady works have agreed to submit differences to arbitration by ex-President William H. Taft and Frank P. Walsh, joint chairmen of the National War Labor Board. The company expressed a willingness, before arbitration was agreed upon, to increase wages 10 per cent; employees asked 25 per cent. The Department of Labor says:

Their agreement, signed by representatives of the company and of the men, binds both sides to abide by the decision of the arbitrators, whatever it may be. Intervention by the two chairmen of the board prevented a strike at the plant, it was brought out at the hearing. The men had voted to go out, but reconsidered the action when they were assured that the War Labor Board would assume jurisdiction.

Their demands are a 25 per cent increase in wages throughout the plant, which is 100 per cent organized; the application of the basic eight-hour day; modification of the physical test; equal pay for equal work, whether performed by men or by women, and an agreement by the company that such wage increase as may be granted shall be retroactive to May 1. The company demurred on the question of a retroactive increase, but agreed to it after the employees waived the point previously raised against the physical test.

Approximately 2800 women are employed in the plant. No complaints were made by the employees against the treatment they had received at the hands of the company. On the other hand, they praised the fairness of the officials, their willingness to meet with committees representing the workers at all times, as well as the cleanliness and general safety of the plant itself. They maintained their desire to serve the country by steady application to their tasks and offered only the arguments presented by many briefs and statistics that many of them are not receiving sufficient pay to make them able to meet the increased cost of living. It was brought out that all of the employees are owners of Liberty bonds.

WE HAVE just begun to appreciate the possibilities of social progress that lie in highly organized, genuinely co-operative industry and what is now called quantity production. The essential thing is to get everybody interested in the possibilities of increased production instead of in the paralyzing agitation which lays all emphasis upon the division of the product. If the commodities of trade which minister to the comfort and welfare of the people are produced in greater quantities and more economically than ever before, there is not the slightest doubt that there will be a broad distribution of them. Everybody who produces them will be striving to distribute them, and if the increase is in all kinds of products everybody will have something to give in exchange for the property or service of others.—*National City Bank, New York.*

MEETING OF THE N. E. L. A. SOUTHEASTERN SECTION

In the Atlanta Convention War-Time Questions Predominate—C. D. Flamigen, Athens, Ga.
Elected President

The meeting of the Southeastern Section, National Electric Light Association, was held on June 19 and 20 at the Piedmont Hotel, Atlanta, Ga. Each day's session was opened by the singing of the "Star-Spangled Banner," and each talk had interwoven with it some reference to the world-wide war.

The first day's session was opened by a talk from Rabbi David Marx of Atlanta on "What the Public Expects of Public Utilities." He stated that the times are changing so rapidly that it is hard for an ordinary man to keep pace with the general changes and it must be without question exceptionally hard for the professional man to keep abreast with the times and still keep up with the changes in his profession. A compliment was paid to the men of the central stations who have not only carried on their work but have responded liberally with their own time and their companies' resources whenever the government has called upon them. Where a public corporation has a monopoly the public is entitled to a dividend, these dividends to be paid in service. The company is entitled to dividends to be paid in money. He further stated that the public does not object to pay a fair profit on service which it buys. The question which is raised between the public and the public utilities company is therefore not what is profit but what is a fair profit.

W. H. Glenn, Georgia Railway & Power Company, Atlanta, spoke on "Some of Our War-Time Difficulties." Mr. Glenn stated that the central-station, although a manufacturer, still could not be properly classed with the ordinary commercial manufacturer. The ordinary manufacturer, when the burden is thrown upon him to increase his output, may either lengthen the hours of his labor or may run two or more shifts, thereby increasing his output without a material increase in overhead. Moreover, should a burden of government work be thrown on an ordinary manufacturer, he can be relieved from supplying his other customers. These customers may object, but when the situation is explained they, as a rule, will not make serious opposition. With the central station it is practically impossible to state just when the load will come on; and when the ordinary business has imposed on top of it government work—that is, power and light to war industries, such as new munition plants, cantonments, etc.—the central station cannot reduce facilities voluntarily for serving other customers.

Mr. Glenn stated that from ten hydroelectric companies in the South there was sold approximately 1,500,000,000 kw.-hr. This is generated entirely from water power, which in turn saves a thousand trains, of seventy-five cars each, of coal. He further stated that he did not believe that public utilities at the present time were asking permission to raise their rates in order to make a profit, but that they were desirous simply to break even.

John W. Lieb, vice-president New York Edison Company and president of the National Electric Light

Association, made a talk on "The N. E. L. A.—Its Work in Peace and War."

Mr. Lieb explained the workings of the different committees of the association and also the problems which they had been called upon to solve during the last twelve months. He also explained the formation of the National Committee on Gas and Electric Service.

L. K. Comstock, New York, spoke on "A Proposed System of Wage Adjustment." Mr. Comstock showed by a series of tables that it was possible to base wages on a certain definite sum and that wages could be adjusted from time to time in order to take care of the rise and fall in the cost of living.

The session of June 20 was opened by E. H. Sniffin, who spoke on "Co-operation Between Manufacturer and Utility." Mr. Sniffin stated that the output of central stations increased about 100 per cent every five years and that the expenditures increased in about the same ratio. He said that during the same period the average man had almost doubled his consumption of electrical energy, but it had cost him only 20 per cent more than the original amount. He said also that in 1902 there was for every \$100 of capitalization about \$75 invested. In 1912 for every \$100 capitalization there was \$100 invested. In 1917 for every \$100 capitalization there was approximately \$125 invested. He stated that he believed the solution of the manufacturers' cost problems lay in the straightening out of their annual sales curve. He also recommended that a system of progress payments be inaugurated similar to that used by the builders' trade.

The report of the committee on public policy was read by the chairman, John S. Bleecker, vice-president Columbus (Ga.) Power Company. After the reading of this report there was a general discussion regarding rates and policies of the different companies.

REPORT OF PUBLIC POLICY COMMITTEE

The committee reviewed the development of public policy, suggesting that its real function is to discover the policy of the public and that it should be called "the public's policy committee." To-day, the report added, the industry is recognized, as it surely must have become recognized sooner or later with or without the war, as a national necessity.

After referring to the support given to the utilities by President Wilson, Secretary of the Treasury McAdoo and Comptroller of the Currency Williams, the committee said:

Our real American public wants nothing so much as "fair play," and, if we recognize the fact that we are not free agents to do as we please with our properties but that we must follow the public's policy, we shall be upheld and supported by enlightened regulating authorities and made to be in fact as well as in name a vital, necessary cog in the national wheel, which, slowly but surely, firmly but fearlessly, patiently but persistently, is grinding a path toward world liberty and perpetual peace.

The following officers were elected to serve during the ensuing year: President, C. D. Flamigen, Athens, Ga.; first vice-president, George W. Wygant, Tampa, Fla.; second vice-president, S. B. Ireland, Montgomery, Ala.; executive committee, W. R. Collier of Atlanta, L. Newman of Birmingham, D. H. Cheney of Orlando, Fla., H. H. Carr of Raleigh, N. C., and C. M. Benedict of Charleston, S. C.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Employee in Interstate Service.—An employee injured while working on a main power line carrying alternating current to substations, which converted it to direct current for operating cars in interstate commerce, was not injured in interstate commerce, his employment being too remote, the Supreme Court of California held (171 P. 1071).

Change of Rates by Receiver.—The courts of the State have no jurisdiction to appoint receivers for the purpose of regulating the rates of public service corporations, and neither the courts nor the receivers of such corporations have jurisdiction to change legal rates without the consent of the Public Utilities Commission, but when the legal rates charged by the receiver of a public service corporation have been enjoined by a court of competent jurisdiction the receiver may put into effect rates to be charged until the commission establishes a new rate, the Supreme Court of Kansas held (172 P. 713).

Negligence of Fellow Employee.—One dealing with and transmitting a dangerous and deadly electric current, whenever reasonably chargeable with knowledge, or when the facts are such as to make it reasonably probable, that persons may lawfully come near its wires and be exposed to danger therefrom, must take every precaution accessible to obviate the danger of injury and must use the utmost care to keep and maintain the wires so as to prevent injury, the Kansas City Court of Appeals held in *Ratliff versus Mexico Power Company* (203 S. W. 232). In an action by the widow of an employee in a city laundry who, while in the city's power house under permission of its superintendent, was killed when a laundry pipe held by another laundry employee who was attempting to open the door of the power house came into contact with defendant's wires transmitting power to the power house and, establishing a contact, caused a fatal injury while deceased was lifting the latch to open the door, it was held on the evidence that defendant was negligent in not insulating its wires so as to prevent such contact. In such case the deceased was not a trespasser at the time he was killed; the negligence of deceased's fellow-servant in establishing a contact with defendant's transmission wire could not be imputed to the deceased, and furthermore the negligence of deceased's fellow-servant would not absolve defendant if its negligence concurred with that of the fellow-servant in causing death.

Reasonableness of Rate Order.—Evidence in the record examined in connection with the objections urged as to the values fixed by the commission being held to support reasonably the findings of fact as to values, and the presumption being that such order is reasonable, just and correct, the order must be affirmed, the Supreme Court of Oklahoma held in *Comanche Light & Power Company versus Turner* (172 P. 792).

Interference with Telephone Lines.—Under the laws authorizing the construction and maintenance along highways of electric transmission lines, but expressly providing that such a line shall not interfere with the service of telephone or telegraph lines already constructed on such highways, whether such a transmission line is properly or improperly constructed and operated is immaterial where interference with existing telephone or telegraph lines is shown, the Supreme Court of South Dakota held in *Tri-County Mutual Telephone Company versus Bridgewater Electric Power Company* (167 N. W. 501). The law adopts the rule that priority of time carries with it priority of right. Injunction is a proper remedy for a telephone line against a subsequently erected electric transmission line to enforce the protection against interference with operation given by express provision of Laws of 1913, Chap. 369, the telephone company not being restricted under the statutes to an action for damages from such interference.

Injuries from Dam Construction.—The Laws of 1907 provide that in case it shall be necessary to take, flow or injure any lands or property for the purpose of the construction or use of a dam the licensees shall be subject to the provisions and entitled to all benefits and remedies of the Statutes of 1898, paragraphs 3374-3406. Section 3 provides that for acquiring the necessary lands or rights, easements or privileges in lands necessary for the complete and successful construction of the dam and improvement of navigation the said licensees may enjoy the rights granted to corporations by the Statutes of 1898, paragraphs 1777-1777e. Paragraph 1777e provides that such corporations may acquire title to necessary lands or easements by purchase or lease or by eminent domain, and in case it shall be necessary to take, flow or injure lands and property, such lands and property or easements therein may be acquired in the manner prescribed by the statutes with reference to condemnation by railroads. The Supreme Court of Wisconsin (167 N. W. 445) held that a power company is liable for injury to lands made permanently unfit for agricultural purposes by the backing up of water by its dam, as well as for lands actually overflowed, the word "injure" being used in its popular sense, namely, an act resulting in damage. In authorizing power companies to erect dams the state may impose such terms as it chooses and the licensees must conform to them.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

A. I. E. E., Fort Wayne Section.—P. C. Morganthaler was elected chairman and O. B. Rinehart was elected secretary of the Fort Wayne (Ind.) Section of the American Institute of Electrical Engineers on May 31.

Jovian Electric League, Los Angeles.—John S. McGroarty gave an address at the June 12 meeting of the league on "The Patriots of Power." C. H. Pierson, advertising agent of the Southern California Edison Company, acted as chairman of the day.

A. I. E. E., Philadelphia Section.—J. H. Anderton presented an illustrated address on "The Big Creek Development of the Southern California Edison Company" before the Philadelphia Section of the American Institute of Electrical Engineers recently.

American Drop Forge Association.—At the fifth annual meeting of the American Drop Forge Association at Buffalo on June 21 Arthur D. Farr, sales manager of the Hess Steel Corporation, Baltimore, Md., presented a paper on "Electric Steel Making."

A. I. E. E., Washington Section.—For the coming year J. E. Smith has been elected chairman and Milton Flinders secretary of the Washington Section of the American Institute of Electrical Engineers. Motion pictures on "The War and the Electrical Industry" were shown at the last meeting.

Tri-State Water and Light Association.—The eighth annual convention of the Tri-State Water and Light Association of the Carolinas and Georgia was opened on June 13. Among the speakers at this three-day session were Thomas Fuller, T. W. Moore and C. H. Cabnett of Atlanta and J. E. Guilford of Macon.

Mississippi Electric Association.—H. F. Wheeler, general manager of the Hattiesburg Traction Company, was elected president, and L. O. Gordon, general manager of the Jackson Light & Traction Company, was elected secretary and treasurer of the Mississippi Electric Association at the annual meeting, held at Hattiesburg May 23 and 24.

Recommendation of I. E. S. Committee on Nomenclature and Standards.—A meeting of the committee on nomenclature and standards of the Illuminating Engineering Society was held recently in New York. As a standard value for the mechanical equivalent of light the figure 0.0015 watt per lumen is recommended. A sub-committee was appointed to prepare a recommendation regarding the proper crossing point of spectrophotometric curves.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Plot Rumored at Cleveland.—Timely discovery of two dry boilers at the municipal light plant at Cleveland, Ohio, on June 11 prevented an explosion. The other three boilers in the battery were flooded. A water tender, in the employ of the plant only a short time, disappeared. Detectives working on the matter hint in their reports at a German plot.

Cleveland Municipal Power Rates to Be Increased.—Light Commissioner W. E. Davis has announced that, effective July 1, the power rates charged by the municipal light plant of Cleveland, Ohio, will be increased. The increase will cover merely the increase in cost of production, he said, and no attempt will be made to secure a profit. Long-time contracts have stood in the way of such a step heretofore.

Lexington Franchise Amended to Increase Rates.—The Board of City Commissioners of Lexington, Ky., at a recent meeting approved a "rider" to the franchise of the Lexington Utilities Company permitting an increase of 20 per cent in commercial and power rates to all consumers. The company officials state that the charge is a war measure and is necessitated by increased cost of production.

Furnace Makers to Aid in Conservation.—Representatives of the stove and furnace manufacturers have been conferring with the conservation division of the War Industries Board regarding a program that is necessary to meet war conditions and promote the saving of iron and steel, fuel, transportation and labor. The furnace manufacturers have already suggested action which would mean a reduction of 75 per cent of the styles and sizes of furnaces now on the market.

Controversy at Paris, Ky., Gets Into Court.—Because the city had not paid its light bills for three months, the Paris (Ky.) Electric Light & Gas Company discontinued connections with the city rock quarry, city hall and fire department on June 11. A temporary restraining order was issued by the Bourbon Circuit Court. The company is operating without a contract, and the city claimed that its rates were unreasonable. This was given as a reason for withholding payment of the bill.

Cleveland Rate Case.—On June 20 the Ohio Supreme Court ruled that \$1,112,070 shall be deducted from the valuation of the Cleveland Electric Illuminating Company property, as fixed by the Public Utilities Commission. This means that the service rate will be based upon a valuation of \$18,549,172, instead of \$19,661,242, the latter being

the figure fixed by the commission. The deduction was made from the amount allowed by the commission for attaching business. All other portions of the valuation were sustained.

Rate Advances at Bylesby Properties.—Since Sept. 1, 1917, increased rates for utility service have become effective at 297 communities served by the following properties managed by H. M. Bylesby & Company: Fort Smith Light & Traction Company, Mobile Electric Company, Northern States Power Company, Oklahoma Gas & Electric Company, Ottumwa Railway & Light Company, Puget Sound Gas Company, San Diego Consolidated Gas & Electric Company, Tacoma Gas Company and Western States Gas & Electric Company.

Optical Glass Supplied Here.—At present, as a result of co-operation between the manufacturers and scientists, large quantities of optical glass of the kinds needed for military fire-control instruments are being produced of a quality equal in practically every respect to the best European glass. The need for a continuous and assured supply of optical glass is so great that the workmen trained in the details of manufacture and subject to draft are being withheld in order that their technical training may be utilized at this time. The required information and details of manufacture and the skill necessary for proper production have been gained at great expense and under high pressure.

Bankers Told of Utility Needs.—Charles G. Dawes of Chicago, speaking at Sycamore, Ill., before the twelfth annual meeting of Group 3 of the Illinois Bankers' Association, declared that the future financial solvency of the public utilities of the country depends upon increased rates for their products and their services. The utilities, Mr. Dawes declared, are paying war-time prices for materials, labor and betterments, with incomes based upon peace prices. "What this means in relation to the general financial conditions in the United States," he said, "may be inferred from the fact that there is outstanding upon public utilities in the United States a bonded indebtedness amounting to \$5,143,000,000."

Manufacturers' War Service Bulletin.—The General War Service Committee of the Electrical Manufacturing Industry has sent to every electrical manufacturer a copy of War Bulletin No. 35 of the Chamber of Commerce of the United States which, it says, "constitutes an official definition of less essential industry and describes how the War Industries Board will restrain all less essential industry in promoting industry essential to winning the war." Attention is particularly directed to the comment of the war service committee of the Chamber of Commerce of the United States, inviting suggestions regarding operations under the policies of the War Industries Board to the end that the board may be assisted in the administration of its policies to the desired end.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Higher Rates to Promote Development.—The California Railroad Commission has authorized the San Joaquin Light & Power Corporation to increase all electric rates by imposing a temporary surcharge of 10 per cent on all bills. The commission provides that the surcharge shall remain effective only until the end of 1918, or until the company's increased operating expenses have been met. The decision states that the amount paid by the company for fuel alone will increase from \$60,000 in 1917 to \$325,000 in 1918. The increase is due both to a shortage of snow and rainfall on the watersheds from which the company secures the water for its hydroelectric energy and to the increased cost of fuel oil. The company is directed to send out bills as formerly and to add an additional 10 per cent to meet the present increased cost of operation. The decision also establishes rules and regulations for extensions to be made by the company.

Increase Allowed in Colorado.—In allowing an increase in electric rates by the Colorado Springs Light, Heat & Power Company the Colorado Public Utilities Commission expresses the opinion that "such increases as are necessary at this time should be borne uniformly by the majority of the consumers of the company. Increases made in a prior order in this case were confined entirely to the large power consumers. While an increase in the rates to the small consumers will be made, the commission desires to call attention to the fact that even under the present war conditions such increased rates are lower than those paid by such consumers prior to the first order affecting the rates of this company. In the opinion of the commission no change should be made in the present rates for street lighting, sign and display lighting or electric heating." The fuel clause covering large light and power service follows: "The energy charges herein provided are based on coal costing not less than \$2 nor more than \$2.50 per ton delivered at the main steam plant of the company. When such coal cost is in excess of \$2.50 per ton as shown by the records of the company for the previous calendar month, the above base rates shall be increased 0.15 mill per kilowatt-hour for each increase of 10 cents per ton, and when such coal cost is less than \$2 per ton, the above base rates shall be decreased 0.15 mill per kilowatt-hour for each 10 cents per ton decrease in the cost of coal, provided that this fuel clause shall not apply to the first 20,000 kw.-hr. of monthly consumption."

J. Hadley Hatch of the Public Service Company of Northern Illinois has been commissioned an ensign and sent to Annapolis for four months' training. Mr. Hatch is twenty-two years old. He obtained his engineering education at Northwestern University.

Charles B. Hill, vice-president and general manager of the Cooper Hewitt Electric Company, Hoboken, N. J., who has been seriously ill for the last three months and was at one time believed to be in a very dangerous condition, has practically recovered and after a rest and vacation will be able to take charge of the company's affairs again.

A. B. Cole has been appointed assistant to the manager of the department of publicity, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to succeed M. C. Turpin, who has accepted a position in the Ordnance Department at Washington. Upon graduation in 1909 from the School of Electrical Engineering, Purdue University, where he made a specialty of steam and electric railway studies, Mr. Cole entered the engineering apprenticeship course of the Westinghouse company. He completed this work in 1911. While on the course he was engaged, in addition to the regular shop testing, on railway project work in the general engineering division and as a railway sales correspondent at East Pittsburgh and afterward in the Cincinnati district office. Recently Mr. Cole has been co-operating on publicity matters with the American Electric Railway Association war board at Washington, spending half of his time in Washington and the remainder in East Pittsburgh.

Dr. Charles W. Burrows, associate physicist of the National Bureau of Standards in charge of the magnetic section of that institution, has resigned and will take up the work of commercial research and consultation, with laboratories equipped for research on problems involving magnetic materials and apparatus, at Grasmere, borough of Richmond, New York City. In 1905 Dr. Burrows received the degree of doctor of philosophy from the University of Michigan. Since then he has been a member of the scientific staff of the National Bureau of Standards at Washington, D. C. During this period he has reduced practical magnetic testing to an exact science. The Burrows magnetic permeameter is an extensively used method for commercial as well as for precise magnetic measurements. His greatest achievement has been in the discovery and development of the science of magnetic analysis. Dr. Burrows is a fellow of the American Institute of Electrical Engineers and a member of the following committees: National Research Council, aeronautical instruments, submarine mines; National Safety Council, safety devices of the mining section; Railway Signal Association, direct-current relays; American Society for Testing Materials, magnetic testing (chairman), electrical standards, methods of testing, standing committees.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

C. A. Hall has been appointed manager of the electric light and power department of the Eastern Pennsylvania Railways Company, Pottsville, Pa., which property is operated by the J. G. White Management Corporation, New York, N. Y. After leaving school in 1904, Mr. Hall entered the employ of the Consolidated Light Company, Huntington, W. Va. In 1907 he joined the organization of the Ohio Valley Electric Railway Company at Huntington. He became superintendent of the Canonsburg (Pa.) Electric Light, Heat & Power Company in 1909, and following the purchase of this utility in 1911 by the West Penn Power Company of Pittsburgh, Pa., he was appointed local manager of that corporation in charge of the Canonsburg territory. Under Mr. Hall's management this property was entirely rebuilt and many improvements to the service were made.

Obituary

John Bottomley, vice-president and director of the Marconi Wireless Telegraph Company, died on June 16 in New York City, after a brief illness, at the age of seventy years. He was born in Ireland in 1848 and received his education at Queens College. In 1880 he came to America, took up the study of law and was admitted to the bar. In 1898 he first met Mr. Marconi and took up the task of introducing wireless telegraphy into American commerce. In 1902 he became general manager, secretary and treasurer of the Marconi Wireless Telegraph Company of America and later became vice-president. He was a past-president of the New York Electrical Society. Mr. Bottomley was a nephew of the late Lord Kelvin and a grandson of James Thomson, the scientist.

Dr. Eugene Wilson Caldwell, X-ray expert and inventor of many devices in the development of the use of this invention, died on June 20 as a result of injuries received many years ago while experimenting with the X-ray. He engaged in experimental work in telephony to lightships in 1894 and 1895 and for the next two years was assistant in the engineering department of the New York Telephone Company. In 1905 he obtained his medical degree. He became interested in the physical problem of the X-ray and was the first director of the Edward N. Gibbs Memorial X-Ray Hospital. Dr. Caldwell was the inventor of the Caldwell liquid interrupter of special forms of X-ray tubes and of many appliances for use with Roentgen rays.

C. O. Baker, president of the firm of Baker & Company, Inc., gold, silver and platinum refiners, died suddenly on June 13 in his sixty-first year. He was one of the pioneer platinum refiners in the United States and early in life had an important part in the promotion of electricity for general uses. For several years he was president of the Electrical Exhibition Company and was connected with many progressive enterprises in the electrical field. He was also for a number of years master of transportation for the National Electric Light Association.

Howard L. Coburn, for fourteen years chief engineer of the Ambursen Construction Company of New York and Boston and designer of some of the largest hydroelectric plants in the United States and Canada, died on June 21, after a short illness, of pneumonia. He was graduated from the Massachusetts Institute of Technology in 1887. Later, as a member of the firm of Lockwood, Greene & Company, he designed many of the largest cotton mills and power plants in the Southern States and New England. In 1904 he became chief engineer and director of the Ambursen Construction Company and in this capacity designed and constructed the Guayabal dam for the United States Irrigation Service in Porto Rico and the Bassano dam across the Bow River in Alberta, Canada. He also built the Shoshone and the Laprelle dams in Wyoming. In addition to this work he was associated as consulting engineer with Henry L. Doherty & Company, E. W. Clark & Company and H. M. Byllesby & Company.

P. T. Glidden, for several years manager of the Northern States Power Company, St. Paul division, died on June 18 after a lingering illness. Mr. Glidden was born in Massachusetts in 1870. At the age of nineteen he entered the employ of the Holtzer-Cabot Electric Company, leaving in 1893 to go with the Schaeffer Electrical Company. Two years later he joined the staff of the New York Edison Company and for eight years he was in the operating, business and commercial departments of the company. He spent 1903 with the Ohio Brass Company, and in 1904 he became manager of the new-business department of the Binghamton (N. Y.) Light, Heat & Power Company. After a year and a half he was elected vice-president and general manager and a few months later took charge of the Sayre (Pa.) Electric Company. A year later he became vice-president and general manager of the Easton (Pa.) Power Company, retaining management of the Binghamton and Sayre properties until he became associated with the Louisville Lighting Company. In 1913 he left Louisville to go to St. Paul as manager of the Consumers' Power Company. When this company a short time ago became the St. Paul division of the Northern States Power Company he retained the St. Paul managership. Mr. Glidden was president of the Minnesota Electrical Association during 1913-14.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

DISCOUNTS SHOULD DEPEND ON QUANTITY AND SERVICE

Economical Units of Manufacture, Cost for Distribution to Jobber and Then to Retailer the
Three Factors That Govern Price

The subject of trade discounts formed an interesting part of the address of J. Nelson Shreve, president of the Electric Cable Company, before the State convention of the New York Electrical Contractors' Association at Saratoga Springs this week.

In establishing prices, Mr. Shreve pointed out, the manufacturer must consider:

1. The most economical units in which he can manufacture.
2. A fair additional cost for distributing them in quantities used by the wholesale trade.
3. The further additional cost for distribution in quantities suitable for the retail trade.

Discount, it was stated, is the recognition by the manufacturer of the service function fulfilled by the jobber and the contractor. There are only two reasons for a discount, quantity purchase and service.

"A concern that claims maximum discounts," said Mr. Shreve, "from a manufacturer on any basis but that of quantity and service should not have the claim recognized. The fact that a concern is in the electrical jobbing or the contracting business, or a member of an association, is not sufficient reason for according the recognition asked for. To do so would be unjust to those whose services entitle them to the maximum consideration. Manufacturers' selling schedules should be arranged on a basis of differentials which attract and encourage the wholesaler to buy in the most economical units, and the retailer, in turn, to buy so as to render maximum service to the manufacturer, the jobber and the consumer."

EFFECT OF STEEL ORDER ON STOCK ACCUMULATION

Necessity of Shoving Orders of War Nature Ahead
Affords No Opportunity for Replacing Goods
Shipped from Stock

Now that it is impossible to obtain steel except where the goods are to be used for war work of some nature, a number of problems are arising that require a quick answer. According to a strict interpretation of the ruling, a manufacturer must show a bona fide war order before he can obtain a priority for steel shipment. Priority orders, however, constitute 100 per cent of steel production. Steel will not be shipped, therefore, for the manufacture of stock parts.

To carry this one step further, a manufacturer buying from a fabricator of parts cannot buy parts except for war work. If such be the condition, the manufacture for stock of goods involving steel is forbidden automatically. Such a condition would, of course, defeat the purposes of the government in many instances. In these cases business men have suggested that a remedy will soon be found and applied. Generally speaking, however, factories are filled up ahead of capacity and consequently will be able to place orders for steel coincidentally with receipt of order for finished products. In these cases no delay should result.

With the jobbers, however, the situation takes on a different complexion. Since the fall of 1915 the jobbing business has become more than ever before one of immediate de-

livery from jobber's storehouse. In order to render this service, stock naturally must be kept on hand. When the government wants some of this stock it gets it quickly, but there are no priority orders forthcoming for replenishing the stock.

In other words, the jobber by the very nature of his business is precluded from laying up a stock of steel goods after the stock held by manufacturers has been depleted. When that occurs the jobber will probably occupy the same position that he now holds with respect to conduit, the manufacturer shipping directly to the government user on jobber order.

COTTON COSTS REFLECTED IN ELECTRICAL GOODS

Advances of 100 to 350 per Cent in Cotton Goods
and Yarns Account for Much of the Higher
Cost of Insulated Wire, Tapes, Etc.

Rising prices of raw materials inevitably affect the cost of manufacturing electrical products of many kinds, though it is difficult to predict just what the influence of a given advance in raw-material cost will be upon the selling price of equipment in any particular case. There are two principal reasons for this—the latitude allowed the cost department or price-fixing branch of the manufacturing organization in compensating for the advance and the varying amounts of any particular material used in different types, forms or sizes of apparatus. Nevertheless, it is possible to instance actual figures drawn from practice to show that changes in raw or finished component material costs may have an appreciable effect upon the ultimate price of the finished product.

An investigation along this line was recently made by the ELECTRICAL WORLD with respect to the effect of price changes in cotton upon the selling price of electrical equipment. Cotton has undergone an extraordinary change in price since the beginning of the war. Spot cotton was quoted at 12.50 cents per pound in New York City on July 30, 1914, the day the Cotton Exchange closed, and on Nov. 16 of that year the price upon the reopening of the exchange had fallen to 7.75 cents. During the interim President Wilson inaugurated the "Buy a bale of cotton" movement, and at that time the price was about 10 cents. It is well known that since the fall of 1914 cotton has increased in price until it passed the 30-cent mark in the spring of this year, shot up to 36 cents or thereabout on a speculative drive, and the quotation of June 22 was 30.4 cents. Electrical insulation is dependent upon cotton as its base material, and of tapes alone probably 97 to 98 per cent are fabricated of cotton yarns. Wire covering and many other products are affected by the rising and falling prices of cotton, but it appears that the day-to-day temporary fluctuations have less influence upon the resulting cost of electrical equipment and supplies than the longer and more sweeping changes. The reason for this is doubtless that manufacturers are accustomed to purchasing raw material of a cotton base far ahead of the dates upon which this material is to be utilized in production, and the market price at some future time may be taken into account rather than the price actually paid some months previously for a given consignment of insulating material base, when the establishing of sales figures takes place.

The accompanying table gives an idea of the changes in price of gray goods, muslin, tape, varnished cloth and yarn since the war began, these increases ranging from 106 to 342 per cent. These materials all bear the marks of increased labor cost as well as of increased raw-cotton price,

and in the case of tape alone it is known that labor cost has increased certainly 50 per cent since the outbreak of the war.

On account of the increase in the price of material manufactured from cotton, the total cost of generators and motors, which are insulated with cotton tape, has been increased from 0.5 per cent to 1.5 per cent.

In the case of the coarser sizes of wire the range in price from the beginning of the war was from about 14 cents per pound to 39 cents, this being due in part of course to the increase in the price of copper and also to higher labor charges. An analysis by the cost department of a prominent wire maker indicates that of this increase probably about 7 cents per pound can properly be charged to the rise in the price of cotton from 12.5 cents to 30 cents. Magnet wire rose from 18 cents to 33 cents per pound between 1914 and 1918, and about 9 cents of this may be attributed to cotton price advance, the smaller wire having a relatively larger amount of cotton insulation.

The buyer of electrical machinery and supplies using cotton must therefore realize that raw material advances are properly a part of the increased cost of the products which he uses, and that the influence of such advances depends in large measure upon the amount of material involved in his purchase in relation to the increase in the cost of labor. The table follows:

	Before the War Prices	Last Paid Price	Approximate per Cent Ad- vance Last Paid Over Before War
68/72 gray goods.....	\$0.06 yd.	\$0.21 yd.	250
1/4 muslin	0.08 yd.	0.255 yd.	219
Cotton tape	0.385 gr. yd.	1.05 gr. yd.	173
Varnished cloth	0.108 yd.	0.307 yd.	184
Cotton yarn—coarse ..	0.215 lb.	0.95 lb.	342
Cotton yarn—fine	0.85 lb.	1.75 lb.	106

METAL MARKET SITUATION

Increased Production of Copper Assured—Imports Restricted—Price to Remain Unchanged

After the discussion about an increase in the official price of copper, it is now said there will be no change at the expiration of the time limit. The chief matter of interest taken up at the meeting last week in New York City of the producers and sales managers of the distributors of copper was that of shipments. The increased productive capacity of the mines was also brought forward, and it now appears there will be sufficient metal for all war work as well as for civilian users.

The War Trade Board has revoked all outstanding licenses for the importation of copper ore from overseas, except from Cuba, excepting for shipments made prior to June 10. No new licenses for shipments made from overseas after that date will be issued. The purpose of this regulation is to bring about the importation of copper matte (copper concentrates), instead of the bulkier crude ore.

Very slight changes have occurred in other metals.

NEW YORK METAL MARKET PRICES

	June 17	June 24
Copper:	£ s d	£ s d
London, standard spot....	110 0 0	110 0 0
Prime Lake	Cents per Pound	Cents per Pound
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25	26.25
Lead, trust price	7.82 1/2	7.82 1/2
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter....	Govt. price 15.00	Govt. price 15.00
Spelter, spot	8.07 1/2	8.57 1/2
Tin, Chinese*	90	90
Aluminum, 98 to 99 per cent.Govt. price †33.00		Govt. price †33.90

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire.....	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 13.75	13.50 to 13.75
Brass, light	10.50 to 11.00	10.50 to 11.00
Lead, heavy	6.00 to 6.50	7.00 to 7.25
Zinc, old scrap	6.00 to 6.12 1/2	6.25 to 6.50

*No Straits offering. †In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK IN TRADE

ADVANCES in the price of staples and other electrical merchandise, which started on the Atlantic seaboard, have reached the central sections of the country, the Pacific and Northwest States. Some further increases in New England are also reported, with still others on certain lines predicted. Sales continue to mount in size and further activity seems certain. The purchase of electrical equipment in the Pacific Northwest is running along high levels for new construction work in the shipyards and other industrial activities directly connected with war work. This is also true in other territory where similar enterprises are established. A general demand for conduit, with low stocks and tardy deliveries, is noted at the principal points of distribution. There is a call for new line material hard to meet. Wire sales in the smaller sizes exceed last year's volume, with unusual activity in No. 14 and circular-mil sizes. Transactions in domestic appliances show an increase.

The following sales on government account are officially reported: The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., and the Robbins & Myers Company of Springfield, Ohio, were recently awarded contracts by the United States Army Medical Corps for motor fans. The Quartermasters' Department placed an order with the Peerless Light Company of New York City for flashlights. The General Engineering Depot made contracts with the following: Westinghouse Electric & Manufacturing Company, motors; Western Electric Company of New York City, hydrometers and miconite plate; National Electric Supply Company, brake lining, rivets, patch and heat units, vulcanizers and electric fans; Sangamo Electric Company of Springfield, Ill., watt-hour meters; General Electric Company of Schenectady, N. Y., magnetos, fuses, voltmeters and other electrical material; Willard Storage Battery Company of Cleveland, Ohio, batteries.

President Wilson in an open letter has requested all employers engaged in war work to refrain, after Aug. 1, from recruiting unskilled labor excepting through the United States Employment Service. Labor conditions are unsatisfactory in spite of advancing wages, strikes and threatened strikes being numerous.

NEW YORK

No diminution in the volume of sales for the week on account of the recent advances in price is noticeable. There is evidence that jobbers, anticipating greater transportation difficulties in the fall than now, are placing orders for as large a quantity of staple goods as the manufacturers will accept. It is understood, however, that the only quotations made are those that prevail at the time of shipment.

Just what effect the increased freight rates which went into effect on Tuesday will have on the price of material and finished goods is not yet determined. The increased express rates of about 10 per cent date from Monday next, July 1. Labor shortage continues to be bothersome.

Collections are more than fair. Credits are carefully looked after. Trade acceptances are coming into more general use.

MOTORS.—On special designs of from 50 hp. to 100 hp. deliveries are very poor. Only on government orders is a preference given on priority delivery.

POLE HARDWARE.—Demand is strong, but it is getting more difficult to obtain an adequate supply. No change in prices has occurred during the week, but distributors state that revisions on a higher level may be expected.

HOUSEHOLD SPECIALTIES.—The increasing scarcity of domestic help and the trouble of holding employees is having a beneficial influence on the growing demand and enlarged sales of electric washing and ironing machines.

Sewing machines also are active, with factory deliveries weak and uncertain. Dealers and department stores have ordered freely in anticipation of the higher scale going into effect on sewing machines on Monday.

COLLECTIONS.—One jobber selling almost entirely to the government reports collections on a fifty-day to fifty-five day basis, which is about ten days longer than normal.

CONDUIT.—While conduit is in scant supply, sizes above $\frac{3}{4}$ in. are reported to be almost impossible to get. The statement that one jobber who carries a diversified stock of staples had a large quantity of conduit on hand was generally questioned. It is said that, outside of small orders which can be filled by shopping around, an order for 25,000 ft. of all sizes, if it could be handled, would command any price the seller might name.

SCHEDULE MATERIAL.—An active demand is reported for the entire line. No further change in prices is reported. Deliveries are backward and practically unaltered.

PORCELAIN.—The supply is short, and it is hard to have stocks replenished to anything near normal. Another price advance is looked for at almost any time.

LAMPS.—With accumulated stocks on standard sizes in the factories, though they are still behind on miniatures and flashlamps, a leading jobber states they never have caught up on candelabra lamps. Government orders are absorbing a large portion of the standard lamp output.

CONDULETS.—All sizes are in strong demand, with stocks low and replenishment no easy matter. No change in prices has occurred.

CHICAGO

Further encouragement was afforded those who are wishing for munition factories to come to Chicago by news that a considerable deal in real estate has been made at Riverdale, near that city, for a factory to cover several acres of ground. Ordinary building activities are still very weak. The wiring of old buildings, to which the attention of contractors has been diverted, still keeps ahead of general construction. On every side contractors in the city of Chicago are being advised to take up retail merchandising in connection with their construction activities. Among the manufacturers the steel situation, especially in regard to steel requirements for 1919, is all-absorbing. An authority in Chicago this week expressed the opinion that, even with the present demands of General Pershing, it would be possible for most of the factories to get pretty nearly all of their requirements for 1918 through the employment of seconds. The fact that steel prices did not advance on Friday, June 21, is taken to indicate that a steady influence will be exerted on the market. On the other hand, it is believed that the importance of the freight increase has not been fully appreciated. The discussion on trade acceptances at the meeting of electrical credit men in Chicago brought out that about 70 per cent of the members of this association are using the trade acceptance with results which range from fair to excellent.

Customers of jobbers who carry stocks went into the market before the freight increase took effect in some instances to buy conduit, rubber-covered wire, porcelain and other stock items, so that sales for the week just before the increase went into effect were a little higher than usual. There were no price changes this week, but further advances are expected when a full realization of the effect of the freight situation is reached. In such an item as sockets, for instance, it must be figured that there will be an increase of 25 per cent on the freight rate on the socket itself; but in addition to this there will be increased freight to pay on every product that goes into the socket.

FANS.—The cool weather of the week has interfered with an active movement for fans.

CONDUIT.—Galvanized conduit is especially scarce. Some of the jobbers have stocks of black.

DRY BATTERIES.—The prices on dry batteries have been increased to take care of the increased cost of freight. This amounts to about $\frac{1}{4}$ cent per dry battery for "Red Seal" brand in Chicago.

TAPE.—The extraordinary demand for tape has placed

most Chicago factories two months behind on delivery. Government orders are partly responsible.

BUSBAR SUPPORTS AND DISCONNECT SWITCHES.—Industrial companies are taking large quantities.

POTHEADS.—An active movement through central stations is taking place in potheads.

ELECTRIC IRONS.—The special sales week in electric irons was very successful.

RECEPTACLES.—The "more-sockets-for-more-service" campaign, now being promoted, is expected to stimulate the demand.

BOSTON

Business holds up well, with the usual war foundation and an increasing tendency toward the curtailment of non-essential industries. The government buying program seems inexhaustible. Collections are fairly good, but the electrical contractor's position is not so satisfactory as is desirable, owing to the extremely small amount of new construction work along building lines. It appears that the creation of an industrial barred zone in the East will limit development work more and more in war industries to the intensifying of production in existing plants. Here is a field for efficiency engineering, however, which will demand a good deal of electrical material in its cultivation.

FANS.—Unseasonably cold weather is holding back fan sales, and retail stocks are virtually standing still. Meanwhile the final shipments from the factories are preparing a jobbers' reserve.

FIRE-ALARM TELEGRAPH APPARATUS.—Municipal buying is rather below normal, although many systems now in service are relatively out of date and should be replaced. Curtailment by cities and towns is the cause of light business. The government, on the other hand, is installing a large amount of protective equipment in its plants, arsenals and navy yards. Fire protection in shipyards is an extremely live subject and is receiving the attention of engineers in many localities. Price advances have been slower than in many lines, probably not over 25 per cent in the last two years, but a further advance of about 10 per cent is expected in the near future.

MOTORS.—Shipments ordered six or eight months ago are now coming in, but the demand is so heavy that stocks are soon depleted. The country is being combed for large-sized units. A recent order for four 350-hp. motors was filled through Denver, Col., the units being rewound at St. Louis and shipped to Bridgeport, Conn., for munitions plant operation. Second-hand motor prices are following the same upward trend observed in new machinery. Small motors are fairly easy to obtain, at least in odd sizes. An inquiry at the end of last week for twelve 50-hp. machines for immediate delivery could not be satisfied.

INSULATING MATERIAL.—Ebony wood advanced in price about 10 per cent within a fortnight, and stocks are very low, owing to government demands. Prices hold firm on plain asbestos, with little opportunity to accumulate stocks of any real size. Large stocks of fiber conduit are on hand against the long-deferred time of central-station expansion. Government work takes less of this material than is often supposed, only about 2000 ft. being required even in a plant like the destroyer plant at Squantum.

INTERIOR TELEPHONE APPARATUS.—Industrial sales are at low volume, except in war plants working under great time pressure.

STORAGE BATTERIES.—Deliveries are hard to obtain, and stocks are accordingly low.

CONDUIT.—Stricter limitation of shipments to orders carrying priority numbers is the order of the day. Stocks are spotty, and the trend is toward reduced totals. It is difficult to see how an advance in price can be much longer postponed, in view of increased freight rates and the enormous demand for steel.

BATTERY-CHARGING EQUIPMENT.—Small motor-generators are in heavy demand, and controlling equipment, while not maintained in sizable or complete stocks, is being supplied on a four weeks' delivery basis. Some delay in the delivery of meters for panel service is being met.

ATLANTA

The Southeastern Section of the N. E. L. A. meeting at Atlanta, Ga., is the chief item of interest in the industry this week. Although in some cases central stations have been allowed to increase rates, a large number of petitions are being heard or waiting to be heard before the various state commissions. Monthly statements show that net earnings are growing less as the year advances, and while the commissions realize these conditions it is not expected that their work can be expedited unless the federal government suggests immediate relief in the way of surcharges.

Official announcement was authorized to the effect that Camp Hancock, Augusta, Ga., will be transferred from a tented to a regular cantonment type of army post, and at the same time an additional camp will be constructed with a new name. Both camps will house approximately 90,000 men for machine-gun and ordnance training. Preliminary estimates place expenditures for this work at \$4,000,000. Docks, terminals and warehouses will be constructed for the government at New Orleans, La., costing \$10,000,000. The Southern Truck & Car Corporation of Greensboro, N. C., has been organized with a capitalization of \$1,000,000 for the manufacture of 1-ton motor trucks. The International Graphelt Corporation of Birmingham, Ala., with a capital of \$1,000,000, will develop graphite properties in Alabama.

HEATING APPLIANCES.—Irons, grills and toasters are moving briskly, especially in Georgia and Florida. One manufacturer reports business for the first five months as being away ahead of the same period last year and the value per order 40 per cent higher.

TRANSFORMERS.—The demand for the larger power type from central stations has fallen off considerably. The call for the distributing type, however, remains steady. Factory facilities have improved and local stocks are coming up, even in the face of present transportation difficulties. A substantial order from a large central station, covering subway type, was reported by one manufacturer.

WIRE AND CABLE.—A power company this week has asked for bids on a large quantity of varnished-cambric lead-covered cable. The week has witnessed a big demand for both rubber-covered and weatherproof from No. 14 up to circular-mill sizes. Deliveries on the smaller sizes are being made from stock, and promises of four to six weeks on the heavier cables are being made.

SEATTLE

The volume of sales by both jobbers and dealers continues at high levels, although extraordinarily large sales are lacking. The volume to shipyards and allied plants is sustained, as were sales pertinent to new construction. Transportation congestion, both outgoing and incoming, is extremely irritating and is arousing constant worry and embarrassment. The labor situation shows no improvement.

The War Finance Corporation has granted the Northwestern Electric Company of Portland, Ore., a loan of \$1,000,000 to complete its steam-electric plant to serve the shipyards' and industrials' increasing needs. In the past week a contract was signed for the biggest job of telephone construction ever attempted in Clallam County. The Board of Public Works of Seattle has opened bids for furnishing generator sets, motors, transformers, poles, etc., costing approximately \$70,000. The Lewis County Commissioners have granted a franchise to the Central Light & Manufacturing Company to erect power lines in about six towns and along highways.

The wooden shipyard of Seattle, with six ways, has changed hands. Immediate improvements and enlargements are planned. Work doubling the capacity of Tacoma's steel shipyard to eight ways is started. The improvement also includes the construction of a 300-room hotel, dining and recreation hall, hospital, offices, machine shops and foundry, to cost approximately \$500,000. The housing campaign in Portland involves the construction of about 600 dwellings.

The embargo against all shipments of fir lumber for cross-arms, wood stave pipe, etc., issued by the Fir Production Board, is believed to be only temporary.

CONDUIT.—The demand is steadily increasing with the continued building of new shipyards and the expansion of established plants. Jobbers generally report low stocks, increasing demands and tardy deliveries. The policy of substituting in colors and sizes is relieving the local situation.

PORCELAIN.—The demand shows a continued upward trend which is met with insufficient stocks. Deliveries are extremely slow with no improvement in sight. Calls for new line construction are hard to meet. Industrial demands have priority rights and at present practically absorb the supply.

WIRE.—The volume of sales the past two weeks shows a decided increase from industrial and constructional sources. The amount of smaller sizes, used in residence construction, far exceeds the demands of years past. Shortages of all sizes exist. Shipments are irregular and unsatisfactory. Prices show no increase of moment.

MOTORS.—The larger sizes are extremely hard to obtain, but the smaller sizes are coming through comparatively quite well. The demand for larger sizes has not been heavy the past three weeks, but the demand for the smaller sizes continues brisk. Jobbers as a whole report stocks shot to pieces with no early signs of improvement. The demand from the shipyards is improving, although the improvement is felt to be only temporary. Stocks are being replenished slowly. The industrial demand continues large.

DOMESTIC APPLIANCES.—Washing machines were prime movers last week and the movement is growing. Jobbers believe a shortage of female help will further increase sales. Sales of electric ranges, irons, etc., are also on the increase. Demands are met to date but an acute shortage is imminent unless deliveries improve.

SAN FRANCISCO

Reviewing the present electrical conditions, one finds ordinary staple house-wiring business to be a small percentage of its normal volume. Dealers' counter business is poor, although there is a brisk sale for larger household devices. Industrial and government business is large, although mostly covering maintenance material rather than new construction, for the time being at least. There is no change in the status of credits or in the character of collections.

Los Angeles building permits for May totaled 639, valued at \$1,306,000. The workmen's housing question is growing more serious. Fifty bungalows are to be erected near Lodi, costing from \$1,500 to \$2,000 each. One hundred cottages, valued at from \$2,000 to \$3,000 each, are to be erected in the vicinity of Vallejo, the seat of the great government navy yard of Mare Island. Other government work reported covers a quarter-million-dollar marine hospital at the Presidio in San Francisco and the alterations and additional construction at the San Francisco mint. The State of California is receiving bids for the construction of a large State building in Sacramento.

TAPE.—The higher grades of tape have just advanced 10 per cent. The commercial grades of friction tape are now within 25 per cent of the value of rubber tape.

FUSE PLUGS.—Fuse plugs have just advanced 10 per cent, selling now in package lots at 5 cents each on the Pacific Coast to dealers.

FLEXIBLE CONDUIT.—Flexible non-metallic conduit has just advanced 17 per cent. Sales are not running so high as last year by perhaps 15 per cent.

SCHEDULE MATERIAL.—Stocks of switches and similar material have advanced from 15 to 20 per cent, following close on the heels of a 10 per cent advance of a few weeks ago.

TELEPHONE MATERIAL.—Very little extension work is reported on rural telephone lines or by the government lines.

BAKE OVENS.—The general coal situation has produced a number of interesting inquiries for electric bake ovens and large electric ranges. A large electrical equipment has recently been installed in Camp Curry and is reported as being very satisfactory.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased

freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor	
E. & S. Size	List Per 1000 Ft.
No. 14 solid	\$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00
Twin-Conductor	
No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor	
Less than coil	No. 14 Solid List to + 15%
Coil to 1000 ft.	No. 12 Solid List to + 15%
Twin-Conductor	
Less than coil	No. 14 Solid List to \$120.00
Coil to 1000 ft.	No. 12 Solid List to \$100.00
Less than coil	No. 12 Solid List to + 15%
Coil to 1000 ft.	No. 10 Solid List to + 10%

DISCOUNT—CHICAGO

Single-Conductor	
Less than coil	No. 14 Solid List to + 20%
Coil to 1000 ft.	No. 12 Solid List to + 20%
Less than coil	No. 12 Solid List to + 20%
Coil to 1000 ft.	No. 10 Solid List to + 20%
Twin-Conductor	
Less than coil	No. 14 Solid List to + 20%
Coil to 1000 ft.	No. 12 Solid List to + 20%
Less than coil	No. 12 Solid List to + 20%
Coil to 1000 ft.	No. 10 Solid List to + 20%

ATTACHMENT PLUGS

List ranges from \$0.22 to \$0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. + 10% to 24.00c.
1/5 to std. pkg. 5% to 19.80c.
Std. pkg. 23% to 18.75c.

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. 10% to + 20%
1/5 to std. pkg. List to 20%
Std. pkg. 28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 60	.35	.35
50 to barrel	.31	.32
Barrel lots	.285	.295

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	\$0.40	\$0.40
12 to 50	.35	.35
50 to barrel	.3190-.3293	.3290-.33
Barrel lots	.2890-.2995	.2990-.30

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	\$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25-50	35.00
2	25-50	45.00
2 1/2	25-50	52.00

NET PER 100 FT.—NEW YORK

Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp. ... List to \$82.50	15% to \$67.50
3/8-in. d. stp. ... List to \$4.00	List to 69.00
1/2-in. s. stp. ... List to 110.00	15% to 90.00
1/2-in. d. stp. + 10% to 112.00	List to 92.00

NET PER 1000 FT.—CHICAGO

Less Than Coil	Coil to 1000 Ft.
1/2-in. single strip ... List	\$63.75
3/8-in. double strip ... 78.50-78.75	71.25-85.00
3/8-in. single strip ... List	85.00
1/2-in. double strip ... 105.00	94.50-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	\$0.05 1/2	1	\$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$25.00-\$49.50	\$24.00-\$41.25
1/4-in.—	\$25.00-\$49.50	\$28.00-\$45.00
3/8-in.—	\$30.00-\$54.00	\$23.00-\$33.00
1/2-in.—	\$30.00-\$54.00	\$26.00-\$36.00

NET PER 1000 FT.—CHICAGO

Less Than \$15 List	\$15 to \$60 List	\$60 to \$150 List
7/32-in.—	\$55.00-\$60.00	\$25.00-\$30.00
1/4-in.—	\$55.00-\$60.00	\$22.50-\$26.50
3/8-in.—	\$60.00-\$65.00	\$27.00-\$32.50
1/2-in.—	\$60.00-\$65.00	\$25.00-\$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
1/4	\$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	\$0.05	\$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

Less than 2500 lb. ... 6.8% to 8.9%
2500 to 5000 lb. ... 6% to 14%
(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

Less than 2500 lb. ... 6.8% to 8.9%
2500-5000 lb. ... 7.3% to 9.3%
(For galvanized deduct six points from above discounts.)

FLAT IRONS

NEW YORK

List price \$5.00 to \$6.00
Discount 25% to 30%

CHICAGO

List price \$5.00 to \$6.00
Discount 25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	2.60
450-amp. to 600-amp.	10	5.50
600-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	\$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. 10% to 30%
1/5 to std. pkg. 20% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. 30%
1/5 to std. pkg. 40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

Per 100 Net
Less than 1/5 std. pkg. List to \$5.50
1/5 to std. pkg. 15% to \$4.75
Standard packages, 500. List, each \$0.07

CHICAGO

Per 100 Net
Less than 1/5 to std. pkg. \$7.00
1/5 to std. pkg. 5.75
Standard packages, 500. List, each \$0.07

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List. Each
Regular, clear:		
10 to 40-watt-B.....	100	\$0.30
60-watt-B.....	100	.35
100-watt-B.....	24	.70
75-watt-C.....	50	.70
100-watt-C.....	24	1.10
200-watt-C.....	24	2.20
300-watt-C.....	24	3.25
Round bulbs, 3 1/2-in., frosted:		
15-watt-G 25.....	50	.53
25-watt-G 25.....	50	.55
40-watt-G 25.....	50	.55
Round bulbs, 3 3/4-in., frosted:		
60-watt-G 30.....	24	.77
Round bulbs, 4 1/4-in., frosted:		
100-watt-G 35.....	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.....List
Std. pkg.10%

DISCOUNT—CHICAGO

Less than std. pkg.....List
Std. pkg.10%

LAMP CORD

Ottom Covered, Type C, No. 18
NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$29.13 to \$33.80
Coil to 1000 ft.....	26.22 to 28.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.).....	\$29.00 to \$30.00
Coil to 1000 ft.....	21.50 to 25.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150
NEW YORK

Net per 100	\$21.75
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CHICAGO

Net per 100.....	\$21.75 to \$30.00
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OUTLET BOXES

Nos.	List. per 100
101—A, A1 1/2, 4 S.C., 6200, 320.....	\$30.00
102—B.A., 6200, S.E., 300, A.X., 1 1/2 4 S.....	30.00
103—C.A., 9, 4R, B 1 1/2.....	25.06
106—F.A., 7, C.S., 1 1/2, 3 R.....	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$10.00	30% to 33%	20% to 27%
\$10.00 to \$50.00	35% to 42%	25% to 37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$10.00 list....	40%	35%
\$10.00 to \$50.00 list....	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	5% to 10%
1/5 to std. pkg.....	15% to 20%
Std. pkg.	25% to 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	10%
1/5 to std. pkg.....	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80 to \$20.00
1/5 to std. pkg.....	14.80 to 20.00
Standard package, 2200. List per 1000.	\$20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.....	\$15.80
1/5 to std. pkg.....	14.80
Standard package, 2200. List per 1000.	\$20.

PORCELAIN KNOBS

NEW YORK

	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net. 5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85	\$30.70 to \$30.75
1/5 to std. pkg.....	11.10	24.20

CHICAGO

	Std. Pkg. 3500	Std. Pkg. 4000
Per 1000 Net. 5 1/2 N.C.—Solid Nail-it—N.C.		
Less than 1/5 std. pkg.....	\$11.85 to \$12.00	\$20.75 to \$30.75
1/5 to std. pkg.....	11.10	24.20 to 40.80

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
1/4-in. cap key and push sockets. 500	\$0.33	
1/4-in. cap keyless socket..... 500	.30	
1/4-in. cap pull socket..... 250	.60	

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....+ 10%
1/5 to std. pkg.....5%

NET PER 100—CHICAGO

Less than 1/5 std. pkg....10% to 29.70 cts.
1/5 std. pkg.....20% to 26.40 cts.

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.....	\$0.80
60-amp. S. P. S. T.....	1.20
100-amp. S. P. S. T.....	2.25
200-amp. S. P. S. T.....	3.48
300-amp. S. P. S. T.....	5.34
Low Grade:	
30-amp. D. P. S. T.....	1.20
60-amp. D. P. S. T.....	1.78
100-amp. D. P. S. T.....	3.38
200-amp. D. P. S. T.....	5.20
300-amp. D. P. S. T.....	8.00
30-amp. 3 P. S. T.....	1.80
60-amp. 3 P. S. T.....	2.68
100-amp. 3 P. S. T.....	5.08
200-amp. 3 P. S. T.....	7.80
300-amp. 3 P. S. T.....	12.00
Low Grade:	
30-amp. S. P. S. T.....	0.42
60-amp. S. P. S. T.....	0.74
100-amp. S. P. S. T.....	1.50
200-amp. S. P. S. T.....	2.70
30-amp. D. P. S. T.....	0.68
60-amp. D. P. S. T.....	1.22
100-amp. D. P. S. T.....	2.50
200-amp. D. P. S. T.....	4.50
30-amp. 3 P. S. T.....	1.02
60-amp. 3 P. S. T.....	1.84
100-amp. 3 P. S. T.....	3.76
200-amp. 3 P. S. T.....	6.76

DISCOUNT—NEW YORK

	High Grade
Less than \$10 list.....	List to + 10%
\$10 to \$25 list.....	List to 15%
\$25 to \$50 list.....	10% to 20%
	Low Grade
Less than \$10 list.....	List to 10%
\$10 to \$25 list.....	10% to 25%
\$15 to \$50 list.....	15% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than \$10 list.....	+ 5%
\$10 to \$25 list.....	11% to + 10%
\$25 to \$50 list.....	14% to + 14%
	Low Grade
Less than \$10 list.....	5% to + 5%
\$10 to \$25 list.....	8% to 16%
\$25 to \$50 list.....	16% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole.....	250	\$0.28
5-amp. single-pole, ind.....	250	.32
10-amp. single-pole.....	100	.48
10-amp. single pole, ind.....	100	.54
5-amp. three-point.....	100	.54
10-amp. three-point.....	50	.76
10-amp., 250-volt, D. P.....	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.....	100	\$0.45
10-amp. three-way.....	50	.70
10-amp. double-pole.....	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....	+ 10%
1/5 to std. pkg.....	5%
Std. pkg.	23%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....	List to + 20%
1/5 to std. pkg.....	List to 20%
Std. pkg.	List to 28%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List. Each
No. 155	\$0.34
No. 160 .....	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than \$2.00		
list.....	List to 20%	List
\$2.00 to \$10.00		
list.....	10% to 25%	5%
\$10.00 to \$50.00		
list.....	20% to 30%	10%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than \$2.00		
list.....	25% to 50%	20% to 40%
\$2.00 to \$10.00		
list.....	25% to 64%	20% to 52%
\$10.00 to \$50.00		
list.....	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	\$5.00 to \$6.00
Discount	25% to 30%

CHICAGO

List price	\$5.00 to \$6.00
Discount	25% to 30%

WIRE ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.....	\$0.42 1/4—\$0.50
No. 18, full spools.....	0.40 1/4—0.45

CHICAGO

	Per Lb. Net
No. 18, less than full spools.....	\$0.57 1/2—\$0.65
No. 18, full spools	0.50 1/2—0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.	
14..	\$15.00—\$18.00	\$12.00—\$14.00	\$10.50—\$12.50	
12..	21.78—26.25	19.97—20.62	16.13—16.33	
10..	32.47—33.18	27.67—28.65	21.50—22.40	
8..	38.61—51.24	35.10—40.26	30.01—31.47	
6..	55.60—81.06	50.04—63.69	47.54—50.79	

CHICAGO

	Price per 1000 Ft. Net			
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.	
14.....	\$18.00—\$19.00	\$13.00—\$14.00	\$11.50—\$12.50	
12.....	25.33—27.53	21.78—25.33	14.97—22.02	
10.....	33.02—35.21	30.03—30.48	27.66—28.23	
8.....	46.09—49.14	41.98—42.54	35.10—39.42	
6.....	54.14—67.28	61.76—72.12	52.78—60.10	

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.....	\$37.00 to \$37.43
25 to 50 lb.....	33.25 to 37.85
50 to 100 lb.....	32.25 to 37.10

CHICAGO

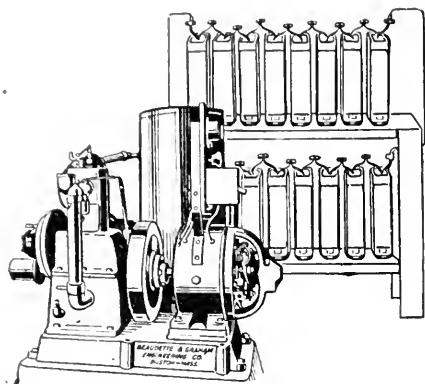
	Per 100 Lb. Net
Less than 25 lb.....	\$37.00 to \$37.43
25 to 50 lb.....	36.00 to 36.43
50 to 100 lb.....	35.00 to 35.42

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Farm Lighting Plant of Many Uses

Additional devices such as water pumps, milking machines, etc., can be operated by a direct-connected farm lighting plant that is being marketed by the Beaudette & Graham Engineering Company, 10 Lincoln Street, Boston.



EXTRA PULLEY ON SHAFT DELIVERS
MECHANICAL ENERGY

ton. This is accomplished by means of a small extra pulley attached to the extension shaft of the engine which permits a belt to be used. The multipolar ball-bearing generator is driven by a four-cycle, 1100-r.p.m., $2\frac{1}{2}$ -hp. water-cooled gasoline engine and is semi-automatic.

Combination Steam and Electric Radiator

Heat can easily be obtained from a combination steam-electric radiator which in reality is an electrically operated steam-flash generator. This radiator is marketed by the Electro Steam Radiator Company, 125 South Wells Street, Chicago. The device has the same appearance as the steam or hot-water radiator. The radiator is tightly sealed under a vacuum so that the same water is used over and over again as the heat-producing medium. The heating element used in the radiator is manufactured by the General Electric Company of Schenectady, N. Y.

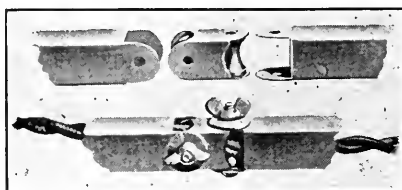
Washing Machine for Use with Small Lighting Plant

Some of the washing machines manufactured by the Grinnell Washing Machine Company of Grinnell, Iowa, can now be used with the ordinary Delco lighting outfit. They are equipped with a special Emerson electric motor rated at 32 volts, 8 amp. and 1600

r.p.m. The machine is run by means of an internal gear connected directly to the motor. The manufacturers claim that they are economical in the use of electricity. The wringer of this washer not only swings but locks in position and is driven directly by the main shaft. Drains eliminate the necessity of lifting and stooping in the use of the washer.

Adjustable Fixture for Industrial Use

A line of adjustable fixtures for industrial use has been developed and placed upon the market by the American Fixture Company, 232 West Water Street, Milwaukee, Wis. These fixtures are simple in design and are capable of many variations. Both of the parts are of sheet steel, and they are welded together by acetylene. With a stock of various sizes it is possible to make up very quickly almost any style and size of fixture desired. The fixture may be attached to the ceiling, wall or floor, at the same time allowing the light to be directed in any direction by use of the universal joint. Furthermore, the man-



ANY STYLE OF FIXTURE CAN BE MADE
FROM STOCK PARTS

ufacturers state that once the fixture has been placed in a certain position it will retain that position until it is manually changed.

Automatic Rack for Electric Soldering Irons

Electric soldering irons which are left lying on a bench or other convenient place when not in use gather dirt and become a hazard. If the current is turned off, the iron cools down to such a degree that considerable delay is caused when the iron is again desired for use. To overcome this the Cutler-Hammer Manufacturing Company of Milwaukee and New York has recently developed an automatic soldering iron rack and control panel which is said to decrease the amount of energy taken by the iron. It keeps the iron from overheating, prevents burn-outs and saves energy. The rack consists of a small slate panel arranged for wall

mounting and carrying a support for the iron which acts on the principle of the telephone receiver hook. When the iron rests on the support or hook it bears the support down and resistance which is mounted on the back of the panel is inserted in circuit with the iron. Taking the weight from the hook disconnects the resistance from the soldering iron circuit and allows full current to flow. Below the hook, on the same panel, there are a push-button switch and a receptacle to which the



IRON KEPT WARM WHEN NOT IN USE

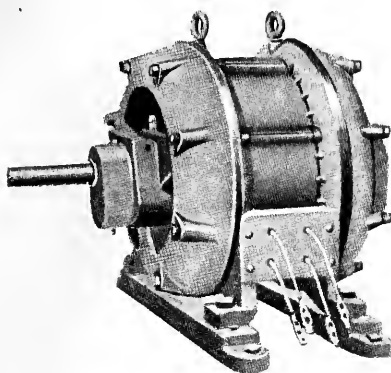
plug of the soldering iron cord is connected.

The little panel is therefore a complete switchboard which may be mounted on the wall or machine within reach of the workman. When not in use and at night the switch is snapped "off," which completely opens the circuit to the iron. These automatic racks are designed for use with Cutler-Hammer soldering irons, but may be used with similar types as well.

Well-Balanced Induction Motor

Conservatism of design is a feature that is claimed for an induction motor manufactured by the Cleveland Electric Motor Company, 5519 Euclid Avenue, Cleveland, Ohio. It is designed so to proportion the various electrical features as to secure the motor best suited for general service conditions. No characteristic has been unduly developed at the expense of other qualities, but the whole design has been well balanced. The manufacturers claim that high efficiency and power factor are obtained; the starting torque is high and the maximum or pull-out torque and overload capacity are very liberal. The air gap has been made as large as possible for good design. The motor is very efficiently ventilated and has low operating temperatures. The constant-speed squirrel-cage induction motor illustrated is designated as type "M." For large starting torque or where the current is to be kept at a

minimum value the wound-rotor type of motor is used. This motor is designated as type "MW." Both types are made in ratings of from 2 hp. to 50 hp. in standard frequencies of 60, 50, 40 and 25 cycles for either two-phase or three-phase and 110, 220 or 550-volt service. Continuously rated motors will carry full load for twenty-four hours



MOTOR IS WELL VENTILATED

with a temperature rise of not over 40 deg. C. and 25 per cent overload for two hours with a rise of 55 deg. C.

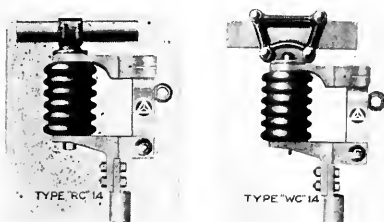
Powerful currents of air are set up by the rotor fans. These currents are directed by the bracket housing through the rotor, winding around and over the center coils, and out through the ventilation ducts provided by the fingers on the stator end ring. All parts of the motor are effectively exposed to this ventilation, and cooling does not depend upon radiation alone.

Generator for Charging Storage Batteries

Storage batteries for lighting automobiles and motorcycles can be efficiently charged by means of a generator recently placed upon the market by the Carleton Company, 170 Summer Street, Boston, Mass. The generator is designed to charge any 6-volt battery, but its output at normal speed is 7 volts and 7 amp.

Bus-Type Disconnecting Switches

Flexible disconnecting switches that can be attached directly to the busbar are shown in the accompanying illustration.



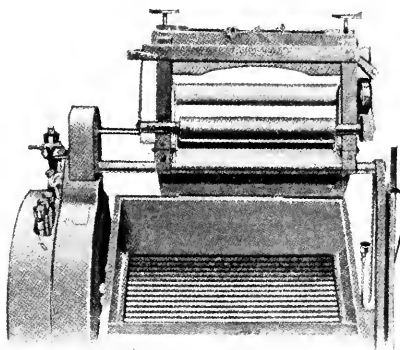
SWITCH BLADE CAN BE PLACED IN ANY POSITION

tration as manufactured by the Delta-Star Electric Company, 2433 Fulton Street, Chicago. These switches are made for attaching to either round or

flat busbars with various ratings as desired. By means of adjustable clamps they may be held in any position on the busbars and they have terminal connection lugs that can be clamped to either the front or the rear surface of the load switch terminal. The switch blades can be placed in line with or at right angles to the bus or in any intermediate position desired.

Washing Machine with Safety Features

A washing machine equipped with an automatic safety stop, an automatic conveyor and a safety release is being manufactured by the Chicago Dryer Company, 624-630 South Wabash Avenue, Chicago. The driving mechanism of the wringer is so arranged that in event of clothes winding around the rubber rolls the wringer is automatically thrown out of gear and stops instantly. There is no necessity for touching levers of any kind in an emergency. The mechanism is adjustable, and adjustment may be made so that the wringer will stop on a light, medium



WRINGER AUTOMATICALLY STOPS IF ANYTHING IS WRONG

or heavy pressure. By pushing the lever at the top of the wringer the cross-bar is instantly released and the top rubber roll is raised about 6 in. (15.2 cm.) above the lower roll. This safety release is another feature. The automatic conveyor consists of a revolving roll in front of the rolls of the wringer. As this conveyor revolves it carries the clothes into the rubber rolls of the wringer, thus eliminating the necessity of bringing the hands or fingers close to the rubber rolls when feeding. A 1/6-hp. motor is used to drive these machines.

Direct-Connected Motor-Driven Pump

For obtaining vacuum in heating plants the Viking Pump Company, Cedar Falls, Iowa, is manufacturing a line of motor-driven, direct-connected pumps. The pump with a condensation tank is installed in the return pipe line and arranged so that when the tank becomes filled to a certain level the switch automatically starts the pump and operates it until the tank is emptied. The switch then breaks the cir-

cuit. It is claimed that these pumps handle liquids of any viscosity, ranging from ether and gasoline to the heaviest liquid.

Motor-Driven Lawn Mower

A lawn mower in which the 20-in. (51-cm.) blades are driven by a 1/6-hp. electric motor is being manufactured by the Palmer Electric Company,



GRASS MAY BE CUT WITH A MINIMUM PHYSICAL EFFORT

50 Park Place, Detroit, Mich. The motor is also made in another style, using 1/4 hp. and driving 31-in. (76-cm.) blades. On this machine the motor is belted to the shaft on which the blades are attached, which has no connection with the wheels of the machine. The machine must be manually pushed, but the motor revolves the blades so that the only physical effort required is that of getting the mower over the ground. Energy is supplied to the motor through a long, flexible waterproof cord.

Automobile Valve Grinder

Valves for automobiles can be efficiently and smoothly ground by means of a valve grinder that has been placed upon the market by the Stenman Electric Valve Grinder Company, Inc., 42 Southbridge Street, Worcester, Mass. The manufacturers claim that this grinder will operate on any type of valve made and will give a perfect seal in a very short time. A feature of the grinder is the oscillating motion produced, which has a frequency of 800 oscillations per minute.

Inclosed Safety Switch

An inclosed safety switch approved by the Industrial Accident Commission of California and the Department of Electricity of the city of San Francisco is being manufactured by the California Electrical Construction Company, 641 Mission Street, San Francisco, Cal. The switches are simple, safe, self-locking and cannot get out of order, according to the manufacturers. They are known as the "Ceco" and are inclosed in a black enameled box with hinged cover. Its construction is such that when the switch is closed the box is locked, and to open the box the switch must first be opened.

Trade Notes

THE GARDNER ELECTRICAL MANUFACTURING COMPANY has removed from Ray Point to Emeryville, Cal.

BRITAIN'S ELECTRIC MOTOR COMPANY is the new name of the Langdon-Davies Electric Motor Company of London, Eng.

THE EDISON STORAGE BATTERY COMPANY of Orange, N. J., has opened a sales office at 740 Land Title Building, Philadelphia. J. A. Hurst, sales engineer of the Edison company, is in charge.

THE WAR TRADE BOARD of Washington, D. C., in supplement No. 4 of May 31, publishes a "Cumulative Supplement to Enemy Trading List, Revised." It contains additions, removals and corrections from March 15 to May 31.

THOMAS A. EDISON, INC., of Orange, N. J., on July 1 will inaugurate an eight-hour day with time and a half for overtime. This means a wage increase of \$500,000 and affects 8000 employees. The plant was formerly on a ten-hour basis.

E. M. RAETZ of the Foster-Raetz Electric Company of Rochester, Minn., has associated himself with Paul D. Richardson, Minneapolis, Minn., in the sale of the Stromberg electric time systems and the "Autocall" signal system for the Northwest.

THE WESTINGHOUSE ELECTRIC PRODUCTS COMPANY, formerly operating under the name of the Copeman Electric Stove Company, has removed its plant from Flint, Mich., to Mansfield, Ohio. The purchase of the Mansfield property was referred to in a previous issue of the ELECTRICAL WORLD.

THE AMERICAN CHAMBER OF COMMERCE of Paris, France, in its fortnightly information pamphlet, publishes a list of articles which are prohibited for exportation and re-exportation. Among other commodities is given that of compositions of products for electric insulation and tubes and pipes for boilers.

THE SMITH & HEMENWAY CO., INC., of New York City, whose plant at Irvington, N. J., is very largely given over to the making of tools for the government, is completing another building. New machinery of the latest design is being installed. Late last year the factory in Hill, N. H., added a new building.

THE LALLEY-WILSON ELECTRIC COMPANY of Omaha, Neb., distributor for the Lallely electric light and power plants for farm use in four States, desires to secure catalogs, literature and jobbers' prices on 32-volt motors and 32-volt appliances of all kinds, together with lighting fixtures and wiring appliances suitable for 32-volt plants. The company is preparing its first catalog.

THE CORN EXCHANGE NATIONAL BANK of Philadelphia has issued a pamphlet entitled "What Other Nations Have Done to Help Their Disabled Soldiers and Sailors." The information is compiled largely from reports and publications issued by the authority of the British Ministry of Pensions, and includes also data from Belgian, French and American sources.

THE AVERY & LOEB ELECTRICAL COMPANY of Columbus, Ohio, has discontinued its electrical contracting business, according to reports, and is devoting its energies to the jobbing of supplies and fixtures. This has required additional room, and for the purpose the company has acquired 2100 sq. ft. more floor space, making 30,000 sq. ft. in all and covering five floors and basement of the building occupied. The sales organization has been augmented by several young women.

THE BOOTH-HALL COMPANY of Chicago, metallurgists, engineers and builders of electric furnaces, has just concluded arrangements with the Bradford-Ackermann Corporation, 30 East Forty-second Street, New York City, to take entire charge of sales in the eastern section of the United States. C. C. Bradford and A. H. Ackermann are both graduate electrical engineers. Mr. Ackermann was formerly vice-president and general manager of the United States Heat & Light Corporation, Niagara Falls, N. Y., and Mr. Bradford was general sales manager of the same company.

KOCH & SANDIDGE of Chicago is a new firm handling the sales engineering work for the "Jiffy" cutting tools and similar products made by the Universal Tool & Appliance Company of Milwaukee, Wis. Paul W. Koch, although a partner in the business, will remain active as presi-

dent and general manager of the Electrical Sales Engineers, Inc., of Chicago. He is a graduate of Illinois University. John H. Sandidge has been connected with the Cooper Hewitt Electric Company for more than six years, being sales manager in the Chicago district for five years and recently Wisconsin manager with offices in Milwaukee. He was at one time with the Commonwealth Edison Company as illuminating engineer for its contract department. Mr. Sandidge is a graduate of Tulane University. He will also become associated with the Electrical Sales Engineers, Inc., in selling products of the Condit Electrical Manufacturing Company.

THE CONTINENTAL PIPE MANUFACTURING COMPANY has purchased the plants and good will of the following long-established concerns: Pacific Coast Pipe Company, Seattle; Washington Pipe & Foundry Company, Tacoma; National Tank & Pipe Company (pipe department), Portland; Portland Wood Pipe Company, Portland. The general offices of the company are at 4515 Fourteenth Avenue, N. W., Seattle, Wash. The Eastern offices of the company are in the Woolworth Building, New York City. Plants for the manufacture of wire-wound and continuous-stave pipe are operated in Seattle, Tacoma and Portland. Officers of the Continental company are: Leo H. Long, president, formerly president of the Washington Pipe & Foundry Company; T. B. Garrison, vice-president, formerly president of the Pacific Coast Pipe Company; F. M. Kirsch, vice-president, formerly vice-president of the National Tank & Pipe Company; W. E. Russell, secretary, formerly vice-president of the Washington Pipe & Foundry Company, and L. Murray Grant, general manager. Mr. Grant was chief engineer of the Pacific Coast Pipe Company. A strong technical staff has been built up by the new organization, the following well-known engineers being included, the former connections of each being indicated: H. D. Coale, National Tank & Pipe Company; R. B. Fulton, Pacific Coast Pipe Company; E. J. Bartells, Pacific Creosoting Company, and Frank C. Kelsey, who takes the New York offices of the Continental Pipe Manufacturing Company in the Woolworth Building.

Trade Publications

MOTORS—The Wagner Electric Manufacturing Company, St. Louis, Mo., has issued a calendar poster.

LIGHTING UNITS.—"Peelites" lighting units are described and illustrated in a circular that is being distributed by the Peerless Light Company, Chicago.

SUPPORTING STRIPS.—The Ohio Distributing Company, Chicago, Ill., has issued a circular describing the Kruse metal supporting strips for switchboxes.

CLAMPS AND SWITCHES.—W. N. Matthews & Brother of St. Louis, Mo., have issued a circular describing and illustrating their "Fuswitch" and boltless clamps.

DESK AND PIANO LAMPS.—"Verdelite" desk and piano lamps are described in a booklet that has been issued by the Faries Manufacturing Company of Decatur, Ill.

DISCONNECTING HANGARS.—"The Human Nature Side of Lamp Cleaning" is the title of a circular being distributed by the Thompson Electric Company, Cleveland, Ohio.

WASHING MACHINES.—The "1900" washing machine is described and illustrated in a circular being distributed by Wallace B. Hart, 46 East Forty-first Street, New York City.

PLACARDS.—The Cleveland service office of the Burke Electric Company, Erie, Pa., is distributing a placard emphasizing the fact that electricity should be saved whenever possible.

ELECTRIC SPECIALTIES.—The Anderson Electric Specialty Company, 118 South Clinton Street, Chicago, has published list No. 2B, describing and illustrating the Anderson dental and laboratory appliances.

PAPER.—The Mitchell-Rand Manufacturing Company, 99 John Street, New York, is circulating a card to which is attached a sample of "Tuflex" red-rope paper for use in armature slots and various other places in generators and motors.

BALL BEARINGS.—The U. S. Ball Bearing Manufacturing Company, Chicago, has compiled and is distributing some data sheets of information regarding dimensions of all types of Strom bearings.

Engineering data and other information of interest are also included in this catalog.

POCKET WIRING CHART.—The engineering department of the National Lamp Works of the General Electric Company has issued a wiring chart for use in selecting the proper size of wire for country home-lighting installations. This chart, together with installation suggestions for country home lighting, is made in a convenient pocket size and is contained in a protecting envelope.

BALL BEARINGS.—The first edition of the "New Departure Ball Bearing Manual," which is a practical guide for users of ball bearings is being distributed by the New Departure Manufacturing Company of Bristol, Conn. This is a complete and concise treatise on ball bearings and discusses the best installation practice and also improved methods of lubrication and adjustments. It includes full descriptions and dimensions of the "New Departure" double-row and single-row "Radax" magneto ball bearings.

WROUGHT-IRON PIPE.—A dot chart showing the corrosion of iron versus steel pipe in hot-water mains has been compiled by the A. M. Byers Company, 235 Water Street, Pittsburgh, Pa. This chart is based on a recent investigation of the hot-water lines in 125 buildings. Brass was used in about thirty-five of these buildings, steel in twenty-five and iron in sixty-five. All the records obtained, giving name and location of each of the buildings investigated, are contained in Byers Bulletin No. 30, which is also being distributed.

New Incorporations

THE GARBER (OKLA.) LIGHT & ICE COMPANY has been incorporated with a capital stock of \$20,000 by William Musser and others.

THE MASSILON (OHIO) ENGINEERING & ELECTRIC COMPANY has been incorporated with a capital stock of \$15,000 by J. E. and J. M. Lewis.

THE GLEN BROOK POWER COMPANY of Munfordville, Ky., has been incorporated with a capital stock of \$30,000 by R. D. Lane, C. R. Garden and H. A. Watkins.

THE BELTHOOVER ELECTRIC COMPANY of Cincinnati, Ohio, has been incorporated with a capital stock of \$20,000 by Charles M. Belthoover, John D. Belthoover, George M. Belthoover and others.

THE LOUISVILLE (KY.) STORAGE BATTERY COMPANY has been chartered with a capital stock of \$15,000 by W. G. Heist, A. G. Heist and Walter Huffaker. The company proposes to manufacture storage batteries.

THE BOYLAN & CONROY COMPANY of Geneva, N. Y., has been chartered by H. H. Burdick, C. R. Conroy and W. L. Boylan of Hornell. The company is capitalized at \$20,000 and proposes to manufacture farm tractors and electrical accessories.

THE LINN GROVE (IND.) LIGHT & POWER COMPANY has been incorporated by Harry Meshberger, Rufus Meshberger, Albert A. Yordy, George S. Gottschalk and Michael Miller. The company is capitalized at \$10,000 and proposes to generate and distribute electricity.

THE AREWELL CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$2,000,000 for the purpose of manufacturing electrical machinery. The incorporators are: M. M. Clancy, C. L. Rimlinger and F. A. Armstrong.

THE FALLS EQUIPMENT COMPANY of Niagara Falls, N. Y., has been incorporated with a capital stock of \$100,000 to manufacture electrical, mechanical, heating and lighting equipment. The incorporators are: F. W. Korff, 152 North Transit Street, Lockport, and C. Jones and R. D. Glennie of La Salle.

THE TURBINE ENGINEERING CORPORATION of Buffalo, N. Y., has been incorporated with a capital stock of \$100,000 by J. A. Carmon, 47 High Street; C. J. Bush, 549 Grider Street, and A. L. Vickery, Exeter Terrace, Buffalo, N. Y. The company proposes to manufacture engines, machinery, turbines, etc.

W. L. HOLAHAN, INC., of New York, N. Y., has been incorporated by W. L. Holahan, M. A. Holahan, 44 West Sixty-fifth Street, and L. Holahan, 404 West Fifty-eighth Street, New York City. The company is capitalized at \$50,000 and proposes to do a general electrical engineering business, trucking business, lumber-merchant, coach-building business, etc.

New England States

NASHUA, N. H.—The New England Power Company has petitioned the City Council for right of way over certain highways for the erection of an electric transmission line to supply electricity to the mills of the Nashua Manufacturing Company.

FAIRHAVEN, VT.—Preparations are being made by the Western Vermont Power & Light Company to rebuild its substation at the plant of the Eureka State Company near Lake Bomosen, recently destroyed by fire. The loss is estimated at \$5,000.

BOSTON, MASS.—Contract has been awarded by the Navy Department, Washington, D. C., to Chandler & Joyce, 178 High Street, Boston, for alterations and improvements to the power plant at the local navy yard. The cost of the work is estimated at \$31,000.

GARDNER, MASS.—The Selectmen have ratified a contract with the Gardner Electric Light Company to furnish 750 electric street lamps at \$18.75 each per year. After July 1 gas street lamps (93) will be discontinued, which will be replaced with electric lamps.

HOLYOKE, MASS.—Contract has been awarded by the Worthington Pump & Machinery Corporation for an addition to machine shop, 90 ft. by 200 ft., and addition to foundry, 80 ft. by 180 ft., at its Dean Works in Holyoke.

ORANGE, MASS.—Contract has been awarded by the New Home Sewing Machine Company of Orange for the construction of an addition to its plant, to cost about \$75,000. Other large extensions are contemplated by the company.

SHERBORN, MASS.—Plans are being prepared for the erection of a large power plant at the Sherborn Reformatory for Women, to cost about \$70,000.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received by W. W. Wotherspoon, superintendent of public works, Capitol, Albany, until July 23, for furnishing, testing and delivering electric capstans and trolley hoists at Pier 6, East River, and West Fifty-third Street Pier, New York City, and electric capstans at the Utica Terminal Pier, under terminal contract No. 109. Plans may be seen and specifications, blank form of contract, etc., may be secured at the above office, at the office of the assistant superintendent of public works for the Middle Division at Syracuse; at the office of the assistant superintendent of public works for the Western division at Rochester, and at the canal office, Spaulding Exchange, Buffalo, N. Y.

BROOKLYN, N. Y.—Paul M. Marko & Company, 1101 Bedford Avenue, have filed notice of increase in capital stock from \$50,000 to \$75,000, the proceeds to be used for business extensions. The company manufactures storage batteries, etc.

BUFFALO, N. Y.—Plans have been filed by the Buffalo General Electric Company for the construction of an electric power station, 100 ft. by 100 ft., to cost about \$25,000.

BUFFALO, N. Y.—Plans have been prepared by the Pullman Company, Marine Bank Building, for the erection of a new power house, to cost about \$27,000, at its works at 1770 Broadway.

BUFFALO, N. Y.—The National Aniline & Chemical Company is contemplating the construction of a machine shop, to cost about \$85,000, at its plant on Abbott Road. Plans are also being prepared by the company for an addition, 200 ft. by 200 ft., at its works.

GALWAY, N. Y.—Plans are under consideration by the board of managers of the Saratoga County Homestead Sanitarium for the construction of an addition to the power plant at the institution, to cost about \$12,000.

GARDENVILLE, N. Y.—Plans are being prepared by the Pennsylvania Railroad Company for the erection of a new engine plant, in connection with additions to its local plant, to cost about \$75,000.

NEW YORK, N. Y.—Bids will be received by Thomas J. Drennan, fire commissioner, eleventh floor, Municipal Building, New York City, until July 8, for furnishing cable. Blank forms and further information may be obtained on application to the above office.

NIAGARA FALLS, N. Y.—Plans have been prepared for an addition to the plant of the United States Light & Heat Corporation, 3215 Highland Avenue.

ROCHESTER, N. Y.—The Bridgeford Tool & Machine Works, Winton Road, North, contemplates the construction of a new

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

power plant at its works. A. H. Ingle is president.

WARWICK, N. Y.—A new electric power plant will be built in connection with the group of buildings to be erected at Warwick by the Board of Inebriety, 300 Mulberry Street, New York City. The cost of the buildings is estimated at about \$200,000. Chauncey Matlock, 30 East Forty-second Street, New York City, is electrical engineer. Sylvan S. Levy is president of board.

BAYONNE, N. J.—Plans have been prepared by Shattuck & Hussey, 19 South La Salle Street, architects, Chicago, Ill., for the recreation building to be erected and equipped by the Associated Industry of Bayonne, to cost approximately \$250,000. The building will be wired for elaborate lighting and for motors required for pumps and ventilating fans.

BURLINGTON, N. J.—Plans are being prepared for a new boiler plant and cold storage room at the State Masonic Home, Jacksonville and Oxhead Roads, to cost about \$35,000.

DOVER, N. J.—The new plant of the New Jersey Power & Light Company is nearly completed and will soon be placed in operation. The old station at Boonton will probably be closed down.

HAMBURG, N. J.—At an election held recently the proposal to appropriate \$1,500 for lighting the streets of the town was rejected.

HOPEWELL, N. J.—Plans are under consideration by the Borough Council for the installation of new electrically operated pumping equipment at the municipal water-works.

JERSEY CITY, N. J.—Plans have been filed and contract awarded by the Erie Railroad Company for the construction of a new power house, 35 ft. by 85 ft., at its local works.

KEARNY, N. J.—The Federal Shipbuilding Company has acquired two additional tracts of land adjoining its works at Kearny on the Hackensack River, one 249 ft. by 1472 ft. and the other 250 ft. by 954 ft., which will be used for proposed expansion of the plant.

NEWARK, N. J.—Contract has been awarded by the Nucuo Butter Company, Fourth Street, to the American Concrete Steel Company, 31 Clinton Street, Newark, for the erection of a large power plant, 100 ft. by 100 ft., at its works, to cost about \$40,000.

NEWARK, N. J.—Arrangements are being made by the Star Electric Motor Company, 245 New Jersey Railroad Avenue, Newark, for the construction of a new plant to be located at New Jersey Railroad Avenue, Miller and King Streets, to cost about \$25,000.

PASSAIC, N. J.—Preliminary plans are being prepared for a new power house about 80 ft. by 150 ft., for the New York Baiting & Packing Company, 91 Chambers Street, to be erected at its local plant on Passaic Street. Lockwood, Greene & Company, 101 Park Avenue, New York, N. Y., are architects and engineers.

POMPTON LAKES, N. J.—Bids will be received by the Borough Council, Pompton Lakes, until July 2 as follows: (1) For the erection of a hydraulic power plant building; (2) two vertical hydraulic turbines; (3) two electric generators and switchboards. Plans and specifications are on file in the office of J. Frank Cornelius, borough clerk. S. Firestone is consulting engineer.

TRENTON, N. J.—Plans are being prepared for the installation of two electrically operated pumping units of 20,000,000 gal. capacity per day at the municipal water-works station. One of the units is to be of high lift and the other of the low lift type.

CHESTER, PA.—Plans have been completed by Clarence W. Brazer of Chester for the construction of a new town in Tinicum Township, near the Westinghouse Electric & Manufacturing Company's plant near Essington, which will include the erection of 1154 buildings and involve an expenditure of several million dollars.

CHESTER, PA.—The Emergency Fleet Corporation has entered into an agreement with the Public Service Commission for the construction of a new electric railway along the Chester Pike, extending from Chester

to Darby, to cost about \$1,000,000. This line is to provide transportation facilities for workers in the nearby shipbuilding plants and other industrial plants engaged on government contracts.

MIDDLEBURG, PA.—Plans are being considered by the Juniata Public Service Company, which is negotiating for the purchase of the property of the Middleburg Light, Heat & Power Company, to connect the plant of the State Center Electric Company of State College and the plant of the Juniata Public Service Company. The latter company is planning to increase the output of its plant to about 5000 hp.

NICETOWN, PA.—Considerable new equipment will be required for the new gun plant of the Midvale Steel & Ordnance Company to be erected at Nicetown, which will include 27 electrically driven cranes, as follows: Five 100-ton, one 75-ton, eight 50-ton, one 30-ton, three 25-ton, eight 10-ton, and one 5-ton; also turning lathes, grinders, drills, milling machines, etc.

PHILADELPHIA, PA.—Work has begun on the erection of a transformer building for the Philadelphia Rapid Transit Company, to be erected at Eightieth Street and Eastwick Avenue. The cost of the building is estimated at about \$30,000.

PITTSBURGH, PA.—Contract has been placed by the McClintic-Marshall Company for 50 six-ton cranes and eight 10-ton cranes with Manning, Maxwell & Moore for the extensions to be made to its Pottstown fabricating plant. The company also contemplates the purchase of machine tools and additional crane equipment for both its Pottstown and Rankin plants.

WILMINGTON, DEL.—The United States Shipping Board has awarded the contract for the construction of Union Park Gardens at Wilmington, to provide homes for workers employed in the shipyards in the vicinity of Wilmington, to the Lynch Construction Company of Waterbury, at \$2,500,000. The contract provides for the installation of public utilities including a water service, gas and electric light systems, etc.

CURTIS BAY, MD.—Plans are being prepared for the erection of three buildings, each 60 ft. by 110 ft., for the Curtis Bay Copper & Iron Works, to be used as machine shops, and other work for the manufacture of copper and iron specialties as well as ship repair parts and castings. The main office of the company will be located at South Baltimore. William F. Cochran is chief engineer.

LANGDON, D. C.—Contract has been awarded by the Corby Company for the erection of a new boiler plant at its works in Langdon, to cost about \$10,000, to F. L. Wagner, 1413 H Street, N. W., Washington.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, contemplates the construction of a power house at St. Julien's Creek (specification No. 3072), to cost about \$75,000.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 5 for supplying to the various federal buildings, marine hospitals and quarantine stations under the control of the Treasury Department portable desk lamps during the fiscal year ending June 30, 1919.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent of the Post Office Department, Washington, D. C., until July 9 for furnishing electrical supplies, baggage trucks, etc., for the use of the postal service as they may be ordered from time to time during the fiscal year beginning July 1, 1918, and ending June 30, 1919. Blanks for proposal and further information may be obtained upon application to the purchasing agent.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to be delivered at the various navy yards and naval stations as follows: Various, Schedule 1839—182,000 dry flashlight batteries, 68,000 flashlights without batteries; Schedule 1845—miscellaneous dynamo, engine and fire room clocks; Schedule 1861—miscellaneous prismatic reflectors and globes, miscellaneous globes, shades, etc., Norfolk, Va.; Schedule 1845—400 single and double throw switch boxes, Brooklyn, N. Y.; Schedule 1849—400 coating trucks. Applications for proposals should designate the schedule desired by number.

North Central States

CINCINNATI, OHIO.—William T. Johnston Company, Third and Vine Streets, Cincinnati, is reported to be in the market for a 100-kw., 220-volt, three-wire gener-

ator directly connected to engine, (Skinner) preferred.

CINCINNATI, OHIO.—The Union Gas & Electric Company of Cincinnati has closed a contract with the United States government to furnish all the power required for the new nitrate plant of the government to be located at Elizabethtown, about 20 miles from Cincinnati. The plant, it is expected, will be ready for full operation about Jan. 1, 1912, and will require about 35,000 kw. daily. Electricity will also be furnished by the company during the period of construction. A new station equipped with two generating units of 30,000 kw. each has just been completed. Work will begin at once on the installation of an additional unit of 30,000 kw., bringing the total output to 90,000 kw.

FINDLAY, OHIO.—The Grant Motor Corporation of Cleveland has awarded the W. J. Thompson & Son Company of Cleveland the general contract for the construction of three one-story buildings, 50 ft. by 190 ft., 50 ft. by 146 ft. and 30 ft. by 66 ft., respectively; two buildings, 50 ft. by 210 ft., and an office building, at its Findlay plant. The plant will be used for the machining of 155-mm. shells. The W. S. Ferguson Company of Cleveland has charge of the engineering work.

FULTON, KY.—The Illinois Central Railroad Company is contemplating the erection of various units at Fulton, including a boiler house, 40 ft. by 150 ft., two 150-hp. boilers, one 85-ft. electric turntable, etc., to cost about \$225,000. A. S. Baldwin, 135 East Eleventh Street, Chicago, Ill., is chief engineer.

LOUISVILLE, KY.—The Board of Public Works has asked local architects to prepare plans for the proposed river warehouse and terminal. The installation of electrically operated trams to carry freight from the steamboats to the warehouses is under consideration.

LOUISVILLE, KY.—The Board of Water Works has authorized President S. Zorn to ask for bids for a new pumping engine, from 30,000,000 to 40,000,000 gal. per day, for the Crescent Hill plant, and also for the purchase of boilers and new equipment for the Riverside station.

MUNFORDVILLE, KY.—The Glen-Brook Power Company, recently incorporated with a capital stock of \$30,000, is contemplating the construction of a power plant. R. D. Lane and others are interested in the company.

CANNELTON, IND.—Plans have been prepared for a new building, 230 ft. by 130 ft., at the works of the Indiana Cotton Mills, to provide space for additional looms. The building will be equipped with all modern appliances and will cost more than \$200,000.

FRANKFORT, IND.—Steps have been taken by the City Council for improvements to the municipal electric-light plant.

HAMMOND, IND.—The Standard Steel Car Company has awarded contract to Manning, Maxwell & Moore for a 1000-ton hydraulic press to be installed in its Hammond works; also for accumulator, pumps and accessories.

INDIANAPOLIS, IND.—The Cleveland, Cincinnati, Chicago & St. Louis Railroad Company is contemplating new construction work involving an expenditure of about \$11,000,000, which will include the construction of a new roundhouse and terminal at Galion, Ohio, to cost about \$1,000,000, and improvements at its terminal in Cincinnati, to cost about \$500,000. E. M. Costin, Indianapolis, Ind., is general superintendent.

NOBLESVILLE, IND.—Plans are being prepared by the Noblesville Heat, Light & Power Company for the erection of a dam across White River near Noblesville. It is estimated that sufficient power can be developed to operate about one-third of the plant. The cost of the work is estimated at about \$100,000. A. R. Holliday of Indianapolis is president and general manager.

LINCOLN, ILL.—The City Council is considering an issue of \$35,000 in bonds to acquire property necessary for the operation of the Lincoln municipal electric railway.

PEORIA, ILL.—Estimates are being secured by the Holt Manufacturing Company, which manufactures caterpillar tractors, on equipment for a new machine shop. The three shops now operated by the company are driven by electric power.

KENOSHA, WIS.—John D. Chubb, architect, 109 North Dearborn Street, Chicago, Ill., has been engaged by the Board of Education to prepare plans for two school buildings, each 150 ft. by 300 ft., two and three stories and basement, with manual training and domestic science departments.

KENOSHA, WIS.—Arrangements have

been completed by the Whither Motor Truck Company, now operating at Whithrop Harbor, Ill., for the erection of a new plant in Kenosha, where a site of 10 acres has been acquired. The main building will be 125 ft. by 300 ft. Considerable machinery and tools will be required.

MADISON, WIS.—A site has been purchased in Madison by Armour & Company on which it is proposed to erect a new cold storage and refrigerating plant, warehouse and branch headquarters building, to cost about \$75,000.

MILWAUKEE, WIS.—Plans have been completed and contracts will soon be awarded by the Globe Seamless Steel Tubes Company for the erection of two shop extensions, 130 ft. by 250 ft. and 130 ft. by 175 ft., at its main plant at Thirty-seventh and Burnham Streets, West Milwaukee. Orders, it is understood, will be placed at once for three electrically operated cranes and miscellaneous tools. Frank J. O'Brien is general manager.

RHINELANDER, WIS.—The Rhinelander Light & Power Company is contemplating the installation of a new turbo-generator unit (500 to 750 kw.) in its substation. Alterations and improvements in the water-works station are also under consideration by the company. E. A. Forbes is president and general manager.

WAUSAU, WIS.—The installation of a central lighting and heating plant in Wausau is reported to be under consideration by local business men.

HATFIELD, MINN.—The local dam of the hydroelectric plant of the Wisconsin Railway, Light & Power Company was recently damaged, causing a loss of about \$30,000.

ST. PAUL, MINN.—Bids will be received by the Minnesota State Board of Control, State Capitol Building, St. Paul, until July 2, for construction of the power house and laundry building and greenhouse, including general contract work, heating and ventilating, plumbing and electrical work, at the State Hospital for Crippled Children, Phalen Park, St. Paul. Plans and specifications may be obtained upon application to C. H. Johnston, architect, 715 Capital Bank Building, St. Paul, upon deposit of \$25.

WAHKON, MINN.—The General Light & Power Company of Carlton has submitted a proposal to the Commercial Club to supply electric service to the village of Wahkon.

NEOLA, IOWA.—At an election held recently the proposal to issue \$10,000 in bonds for improvements to the municipal electric-light plant and water-works system was carried.

SCHALLER, IOWA.—The Council is considering an issue of \$35,000 in bonds for the installation of a municipal electric-light plant.

WATERLOO, IOWA.—Bids are being received by the Board of Education, Waterloo (to close in July, no date set), for the construction of the Kingsley High School, including electric wiring, steam heating, vacuum cleaner, etc. The cost of the building is estimated at from \$140,000 to \$150,000. J. G. Ralston, Syndicate Building, Waterloo, is architect. J. E. Dempster, Lovitt & Johnson Building, is secretary of board.

KANSAS CITY, MO.—The L. Breitag & Son Construction Company, 3701 West Prospect Street, has been awarded the general contract for the construction of substation No. 2 at 101 Oak Street, for the Kansas City Railways Company. The proposed building will be 82 ft. by 48 ft., and will cost about \$25,000. Contracts for electric wiring, heating, plumbing, etc., will soon be awarded. C. E. Fritts is electrical engineer.

ST. JOSEPH, MO.—Plans are nearing completion and bids will soon be asked for the construction of a store building, including electric wiring, steam heating, plumbing, etc., for the Townsend & Ueberrhein Clothing Company to be erected at the corner of Sixth and Felix Streets, at a cost of about \$100,000. The plans provide for the installation of one or two electric passenger and freight elevators. Eckel & Aldrich, Corby-Forsee Building, are architects.

WEBB CITY, MO.—The Southwest Missouri Railroad Company is contemplating the construction of a railroad from Pilcher to Miami, Okla., a distance of 18 miles, to cost about \$150,000. The work will include roadbed, ties, rails, stations, cables, poles, cross-arms, etc. A. H. Rogers of Webb City is president.

PIERRE, S. D.—The municipal electric-lighting and water plant was recently destroyed by fire, causing a loss of about \$100,000.

HAVELOCK, NEB.—Contract has been awarded by the Hebb Motor Company for electric wiring for its new manufacturing plant to W. H. Petersen. The cost of the

plant is estimated at \$250,000. W. J. Assemacher, Orpheum Building, Lincoln, is general contractor. A. F. Hebb, 1333 P Street, Havelock, is owner.

SHELDON, NEB.—Contract will soon be awarded by the Nebraska Conference of Adventists, care of J. S. Rouse, College View, Neb., for the construction of a school dormitory, including electric wiring, heating, plumbing, etc. The cost of the building is estimated at about \$60,000. Elery Davis, Mutual Life Building, Lincoln, is architect.

AUGUSTA, KAN.—Bonds to the amount of \$45,000 have been voted for improvements to the municipal electric-light plant.

CHENEY, KAN.—Preparations are being made by the city of Cheney to erect an electric transmission line from the line of the Tri-County Light & Power Company to Cheney, a distance of about 12 miles, for which bids have been received.

KANSAS CITY, KAN.—Contracts, it is reported, will soon be awarded by the St. Mary's Academy, Leavenworth, for the construction of a hospital, three stories, 50 ft. by 105 ft., with two wings, 50 ft. by 60 ft., on Eighteenth and Taumoe Streets, in Kansas City, to cost about \$200,000. Wight & Wight, First National Bank Building, Kansas City, Mo., are architects.

MANHATTAN, KAN.—Bids will be received by J. A. Kimball, business manager, board of administration, Topeka, until July 9 for remodeling the old Agricultural Building at the Kansas State Agricultural College, to cost about \$50,000. Proposals will be asked later (separate contracts) for electric wiring, heating, plumbing, etc. Ray L. Gamble, Topeka, is state architect.

MORAN, KAN.—Improvements are contemplated to the water-works system, including the installation of an engine and generating unit, to cost about \$10,000.

PERU, KAN.—Preliminary plans are being prepared by Archer & Stevens, New England Building, Kansas City, Mo., for the construction of an electric-light plant and waterworks system in Peru, to cost from \$30,000 to \$35,000.

WOODSTON, KAN.—A company has been organized by local business men to construct and operate an electric-light plant in Woodston. The company is capitalized at \$10,000. Frank Shuttee is president and P. D. Scott is treasurer of the company.

Southern States

BRADENTOWN, FLA.—The installation of a municipal electric-lighting plant is under consideration by the City Council.

MIAMI, FLA.—Owing to the government having commandeered the machinery ordered for the new municipal electric light and water power station, it will be some time before it will be ready for operation. Work on the new well is progressing.

ST. PETERSBURG, FLA.—Bids will be received by the Board of Public Instruction of Pinellas County, Dixie M. Hollins, superintendent, Clearwater, until July 9 for electrical work in the St. Petersburg High School, St. Petersburg. Specifications may be obtained from the superintendent, Clearwater, and William B. Futner, architect, St. Louis, Mo.

COAL CREEK, TENN.—Contract has been awarded by the Magnet Knitting Mills of Clinton to the A. J. Stair Construction Company of Coal Creek for the construction of a mill building, 200 ft. by 60 ft., to cost about \$20,000. The building will be equipped with 550 knitting machines driven by electric motors, costing about \$50,000. Manley & Young, Holston Building, Knoxville, Tenn., are architects.

BIRMINGHAM, ALA.—Charles T. Lehman, 1921 Powell Avenue, Birmingham, is in the market for an air compressor of from 2000 to 3000 ft. capacity; three 150-hp. Scotch marine boilers and locomotive, economic or other portable types, must be over 1000-lb. pressure; one 200 to 250-kw. direct-current generator and three 90 to 110-hp. portable locomotive boilers.

TUCKER, ARK.—The Pine City Electric Company of Pine Bluff has been awarded contract to install an electric-lighting system at Penal Farm, to cost about \$3,500.

NEW ORLEANS, LA.—The economizer and boiler in the central power plant at Market and South Peters Streets of the New Orleans Railway & Light Company recently exploded, causing a loss of about \$50,000.

NEW ORLEANS, LA.—Plans have been completed by the Foundation Company, 233 Broadway, New York, N. Y., for the construction of a new shipbuilding plant at New Orleans, which will include four shipways, with machine shop, fabricating shop

riveting works and other structures for the manufacture of steel vessels. The cost is estimated at about \$1,000,000.

DURANT, OKLA.—The Durant Grain & Elevator Company, it is reported, will purchase machinery for an elevator with a capacity of 150,000 bushels and a mill with a daily output of 500 barrels. E. M. Stewart is manager.

PONCA CITY, OKLA.—The City Council is contemplating an issue of \$35,000 in bonds for improvements to the municipal electric-light plant.

YALE, OKLA.—The City Council has engaged Henry A. Pressy, City Hall, Oklahoma City, engineer, to prepare plans for the proposed municipal electric-light plant and waterworks system. An election will soon be called to vote on the proposal to issue \$200,000 in bonds for the work.

CHANDLER, TEX.—E. L. Green of Chandler, it is reported, is contemplating the construction of an electric-light and power plant in Chandler.

COLEMAN, TEX.—The City Council is considering extensions to the waterworks, involving an expenditure of about \$100,000, increasing the capacity from 500,000 to 1,000,000 gal. The proposed work will include the construction of a pumping station and possibly a 5,000,000-gal. dam.

FORT WORTH, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 18 for the installation of an electric passenger elevator, etc., in the United States post office and court house at Fort Worth. For details see Search-light section.

HOUSTON, TEX.—Contract has been awarded by the Houston, Richmond & Western Traction Company for the construction of the first section of 30 miles of its proposed electric railway that is to run between Houston and San Antonio, a distance of 186 miles, to Howard Kenyon of Houston. This section will extend from Houston to the Brazos River, a distance of 30 miles.

MARSHALL, TEX.—The Marshall Mill & Elevator Company is contemplating rebuilding its grain elevator and flour mill, recently destroyed by fire, at a cost of about \$75,000.

MARSHALL, TEX.—Arrangements are being made by the Texas & Pacific Railway Company to rebuild its shops at Marshall, recently destroyed by fire. The loss is placed at \$500,000, and includes main machine shops, tool room and power plant, air brake and coppersmith departments.

ORANGE, TEX.—The Orange Ice, Light & Water Company contemplates the purchase of a new 750-kw. generator and turbine and other machinery for its electric and water plant. It will also drill several additional artesian wells.

SABINAL, TEX.—The project of Charles A. Lindsey of Kansas City, Mo., and associates for the construction of a water storage and irrigation system near Sabinal, to cost about \$3,000,000, it is reported, meets with the approval of the State Board of Water Engineers. The plans provide for the construction of a dam across the Frio River at a point where two bluffs make what is known as a shut-in of that stream, where a large hydroelectric power plant will be installed. From this plant transmission lines will be extended to San Antonio, Uvalde, Sabinal and other towns and cities within a radius of 125 miles. Water will be furnished at first to irrigate about 50,000 acres of land, and will ultimately be extended to 200,000 acres.

Pacific and Mountain States

OLYMPIA, WASH.—Application has been made to the State engineer by George W. Dilling of Seattle for 11,000 second-feet of water from Skagit River, to be used for power purposes. It is estimated that 40,000 hp. can be developed at a cost of \$2,000,000.

PE ELL, WASH.—The Central Light & Manufacturing Company of Pe Ell has been granted a franchise by the Commissioners of Lewis County to erect and operate an electric transmission line along the National Park Highway from Walville to Meskill and to use the streets of the unincorporated towns of Walville, McCormick, Doty, Dryad and Meskill. The franchise covers a period of 50 years. The company will connect with the lines of the North Coast Power Company at Meskill.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, will recommend the immediate change from fuel oil to some substitute (owing to the scarcity of fuel oil) at the municipal electric power plant at Lake Union.

WENATCHEE, WASH.—The Chelan Falls Power Company has applied to the Commissioners of Chelan County for per-

mission to erect and operate an electric transmission in Chelan County.

KLAMATH FALLS, ORE.—The committee appointed by the City Council to consider the offer of the Keno Power Company to sell its light and power plant to the city, has reported that the city is financially unable to accept the offer.

PORTLAND, ORE.—The War Finance Corporation has given its approval of a loan of \$1,000,000 to the Northwestern Electric Company of Portland. The proceeds will be used for extensions to its system to enable it to furnish additional energy to be used in connection with shipbuilding plants.

ALAMEDA, CAL.—Work will be begun by the Bethlehem (Pa.) Shipbuilding Corporation on the construction of a new shipyard in Alameda on the San Francisco Bay. This yard will have its own fabricating machine, forge and boiler shops for making of all ship equipment. Orders, it is understood, will soon be placed for about 100 cranes, including both traveling and locomotive types.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has awarded contract for the construction of a substation at Slauson Junction to A. Nelson, at \$3,341.

LOS ANGELES, CAL.—Government aid to the amount of \$10,000,000 or more will be asked by the city of Los Angeles for the development of 210,000 hp. of hydroelectric power along the aqueduct under a plan launched by Mayor Woodman for a monopoly of power distribution in Los Angeles. Two objects are sought by the Mayor in the proposed project: First—To obtain a monopoly for the municipal power bureau of the distribution of power in Los Angeles; second—To release large quantities of fuel oil and natural gas now consumed by the gas and electric plants and private industries for domestic use. In return for this loan the city will offer the government first option on the 210,000 hp. of hydroelectric energy developed with this fund.

NEWPORT, CAL.—A committee has been appointed by the City Trustees to make investigations relative to the installation of electric lamps in Newport Heights. The city electrician, it is reported, has been instructed to purchase the necessary materials.

OCEANSIDE, CAL.—Plans are being considered by the Board of Supervisors for the installation of an electric street-lighting system in Oceanside.

RICHMOND, CAL.—Plans are being considered by the International Vegetable Oil Company for the construction of a large plant, which will require about 300 hp. in motors.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has decided to increase the height of Lake Spaulding. It has not yet been decided whether to raise it 10 ft. or 15 ft., with cost \$130,000 or \$200,000 respectively.

SAN FRANCISCO, CAL.—Work is progressing rapidly on the Hetch Hetchy project. The Eleanor dam, it is expected, will be completed by July 1. The 4000-hp. hydroelectric power plant at Early Intake, in three units, will soon be placed in operation; the transformers, compressors and other equipment for tunnel aqueduct have been installed. At the end of this aqueduct the second large power plant of over 50,000-hp. will be started.

SAN FRANCISCO, CAL.—An agreement has been signed by the Pacific Gas & Electric Company, the California-Oregon Power Company and the Northern California Power Company whereby the three systems will co-operate to cope with the war-time shortage of power for expanding industrial needs. Under the arrangement made a supply of 8000 kw. additional energy will be assured to the Pacific Gas & Electric Company throughout the year and 12,000 kw. during the winter months. The new construction required in this plan will involve an expenditure of about \$750,000, to be used as follows: (1) To reinforce and reconstruct the transmission line of the California-Oregon Power Company from Copco to Costella and to erect a 70,000-volt transmission line from Costella to Kennett of sufficient capacity to transmit 8500 kw. to the Northern California Power Company at Kennett; (2) the California-Oregon Power Company to finance the Northern California Power Company to the extent required to reinforce that company's line from Coleman to near Hamilton by the addition of a copper conductor to the west line to deliver to the Pacific Gas & Electric Company 8000 kw. at Colusa; (3) the Pacific company to erect a 60,000-volt transmission line from Colusa Corners, near Colusa, to the Drum-Cordelia; also to erect a 100,000-volt line and install a substation of 12,000-kw., 60,000/100,000 volts to deliver energy to that line. The construction work

for the Pacific Gas & Electric Company will be in charge of P. M. Downing, chief engineer; for the California-Oregon Power Company, P. O. Crawford and W. W. Shepard; for the Northern California Power Company, Edward Whaley, general manager.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has petitioned the Public Utilities Commission for permission to extend its system into the town of Perry, where it proposes to supply electricity for lumps, heaters and motors. The company has a franchise from the town for the proposed extension.

SALT LAKE CITY, UTAH.—Preparatory to beginning a large development, the Pope-Shenon Company, operating in the Salmon River country, has awarded a contract for the erection of a 9-mile electric transmission line, work on which will be started at once. The company has purchased considerable new machinery. The management, it is believed, will ultimately build a rail for the treatment of ores.

CONRAD, MONT.—Bonds to the amount of \$10,000 for lighting system have been sold.

SANTA FE, N. M.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 10 for repairs to heating, plumbing, conduit and wiring and lighting fixtures, etc., in the United States courthouse, etc., at Santa Fe.

Canada

PRINCETON, B. C.—The Kettle Valley Railway Company, it is reported, has purchased the cement plant buildings and property at East Princeton, which includes the power plant now under lease to the Canada Copper Corporation.

VANCOUVER, B. C.—The B. C. Box Company is contemplating the construction of a mill and box factory, with a daily capacity of 20,000 ft. The proposed plant will be driven by electricity.

VANCOUVER, B. C.—The Beaver Cove Lumber & Pulp Company, London Building, Vancouver, is contemplating the construction of lumber and pulp mills at Beaver Cove, to cost about \$250,000. W. H. White is general manager.

GLADSTONE, MAN.—The installation of a municipal electric-light plant to cost about \$15,000 in Gladstone is under consideration.

GODERICH, ONT.—The National Shipbuilding Company is reported to be considering the construction of a factory and concrete boiler shops, to cost about \$75,000.

PERTH, ONT.—The Hydro-Electric Power Commission of Ontario has purchased the High Falls power site at Perth.

WINDSOR, ONT.—Bid will be received by the Essex Border Utilities Commission at the office of Morris Knowles, Ltd., Royal Bank, Windsor, until July 8 for furnishing and testing three motor-driven pumping units, one having a normal rating of 500 imperial gal. per minute, and two having a normal rating of 1000 imperial gal. per minute. Plans and specifications are on file in the above office and in the office of Morris Knowles, Inc., 1200 Jones Building, Pittsburgh, Pa.

CHICOUTIMI, QUE.—The controlling interest in the property of the Saguenay Light & Power Company, which operates an electric light and power system in the town of Chicoutimi and surrounding country, has been acquired by the Chicoutimi Pulp Company, a subsidiary of the North American Pulp & Paper Company.

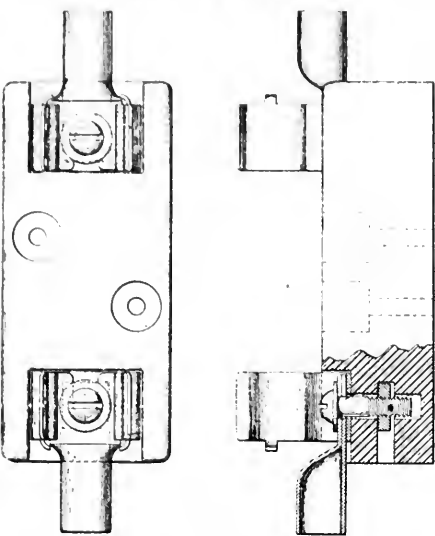
MONTREAL, QUE.—The high-tension transmission line of the Southern Canada Power Company with necessary substations, etc., connecting the cities of Sherbrooke and Granby and intervening territory has been completed and is now in operation. The substation is located in Granby. The company is also erecting an additional high-tension line between Drummondville and Sherbrooke.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 5 for furnishing refrigerating apparatus, block tin pipe, copper tubing, brass tubing, sheet brass, etc. Blanks and information relating to this circular (No. 1221) may be obtained at the above office or the offices of the assistant purchasing agents, 21 State Street, New York City; 606 Common Street, New Orleans, La.; and Fort Mason, San Francisco, Cal.

Record of Electrical Patents

Notes on Recent United States Patents

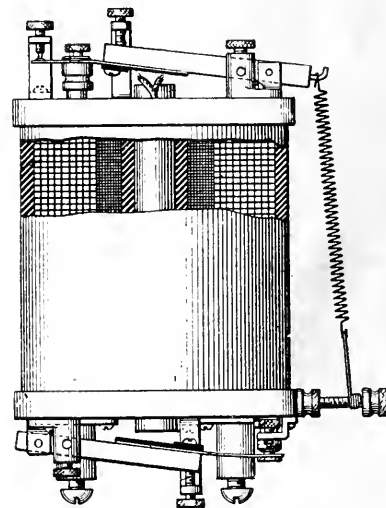


1,267,457—Clip

- 1,267,413 (115886). TRANSFORMER; Charles Le G. Portescue, Pittsburgh, Pa. App. filed May 4, 1916. Relates to the windings and insulation of transformers which are adapted for use with very high-voltage circuits.
- 1,267,415 (115887). LOAD INDICATOR FOR MOTOR TRUCKS; Frederick J. Troll, Baltimore, Md. App. filed July 20, 1917. Electromechanical means which may be applied to any motor truck.
- 1,265,421. FUSE DEVICE; Edmund O. Schweitzer and Alfred Herz, Chicago, Ill. App. filed March 13, 1914. Fuse devices intended for out-door overhead work.
- 1,267,418. SIGNALING BORN; William Kalsling, Chicago, Ill. App. filed June 11, 1914. Signaling devices for use with automobiles and motor boats.
- 1,267,433. AUTOMATIC SWITCH; James L. McQuarrie, Montclair, N. J. App. filed Dec. 30, 1916. Provides a switch for use in small telephone exchanges.
- 1,267,454. CIRCUIT CONTROLLER; Walter C. Reed, Dalton, Mass. App. filed Jan. 30, 1913. A circuit-controlling device of that type in which provision is made for opening and closing one or more electric circuits.
- 1,267,457. CLIP; Joseph Sachs, Hartford, Conn. App. filed July 26, 1916. Provision by which a conductor can be maintained in electrical connection with the clip.
- 1,267,470. RINGER; Frank M. Slough, Elyria, Ohio. App. filed May 8, 1914. Ringers to be used in connection with telephones.
- 1,267,483. ELECTRIC CONTROLLER; Kenneth M. Walley, Chicago, Ill. App. filed Jan. 19, 1914. Mechanism for controlling the intensity of electric current.
- 1,267,516. LOCK SWITCH; Warren R. Cox, Cleveland, Ohio. App. filed Sept. 7, 1915. A lock switch for the electrical ignition circuit of an automobile engine.
- 1,267,538. AUTOMOBILE SIGNAL; Edward J. Gensler, Buffalo, N. Y. App. filed June 7, 1916. Traffic signals for use on automobiles.
- 1,267,587. SOUND-REPRODUCING APPLIANCE; Herman G. Pape, New York, N. Y. App. filed Feb. 28, 1916. Relates to improvements in telephone receivers.
- 1,267,603. ELECTRIC SNAP SWITCH; Clarence C. Stirling, Hartford, Conn. App. filed Oct. 19, 1917. Switching members that can be easily and readily snapped between on and off positions through the agency of a single element.
- 1,267,604. SNAP SWITCH; Clarence C. Stirling, Hartford, Conn. App. filed Oct. 19, 1917. Snap switches of type involving the use of only a single element.
- 1,267,633. AIR SPEED INDICATOR FOR USE ON AEROPLANES AND THE LIKE; Frederic H. Clift, Barnes, London, England. App. filed Sept. 21, 1917. Indicators for denoting the speed at which aeroplanes are traveling.
- 1,267,673. MEANS FOR BONDING RAILS; Frederick C. Lavarack, Orange, N. J. App. filed Jan. 18, 1914. Means for double bonding rails for railway signal work.
- 1,267,711. ELECTRIC CONTROLLER; Orne H. Torgersen, Chicago, Ill. App. filed June 11, 1917. Electrical controlling mechanism for compressed-air apparatus.

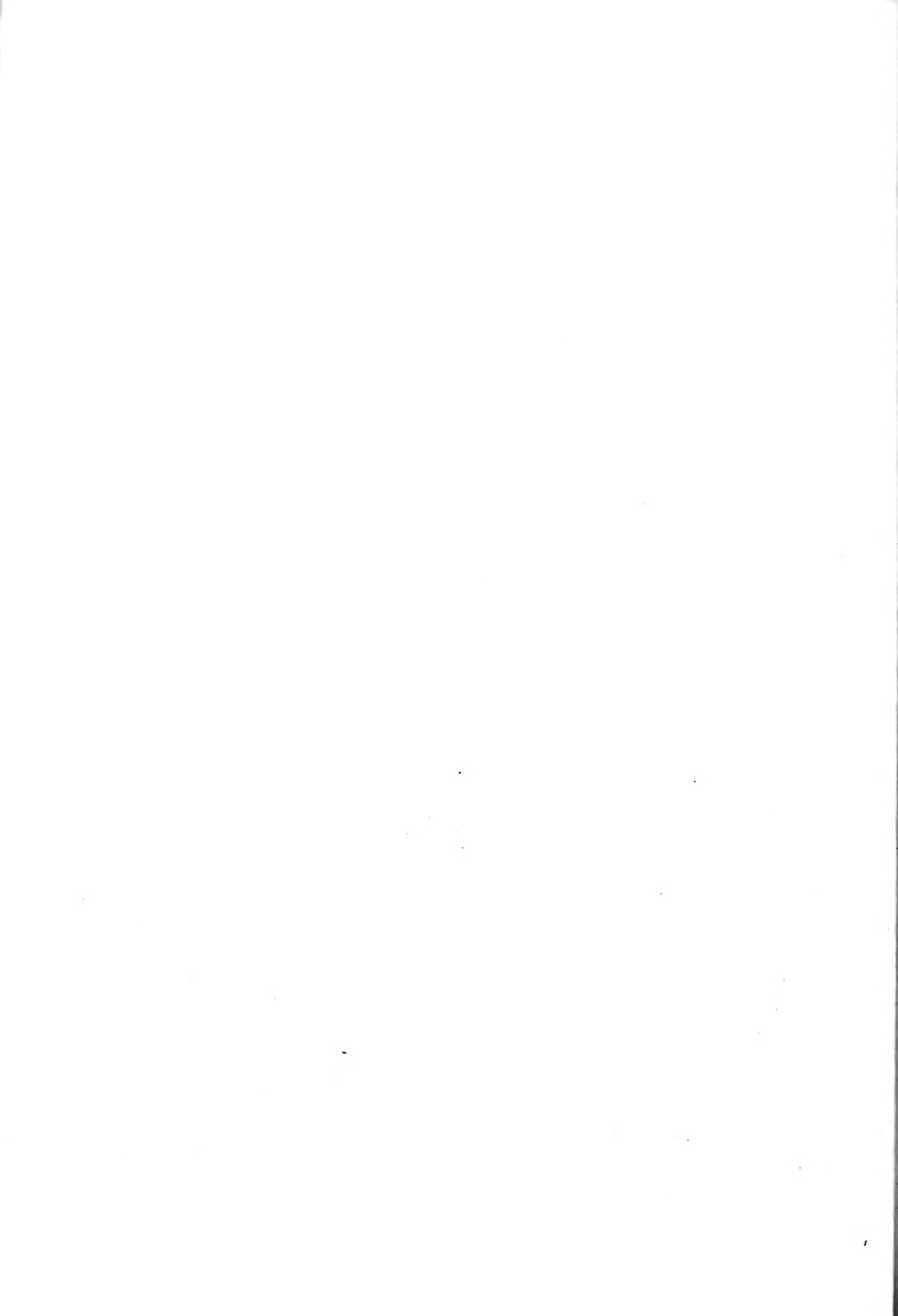
- 1,267,743. TELEPHONE SYSTEM; Wilson L. Campbell, La Grange, Ill. App. filed Oct. 7, 1907. Systems in which automatic service is provided.
- 1,267,751. VEHICLE SIGNAL; Harry C. Fairchild, Maplewood, N. J. App. filed Feb. 27, 1917. Vehicle signals operable in response to movement of the brake lever of the vehicle.
- 1,267,755. MAGNETO MACHINE; Harry E. Geist, Racine, Wis. App. filed April 12, 1916. Magnetos for ignition purposes.
- 1,267,767. STREET - TRAFFIC - CONTROLLING APPARATUS; Benjamin M. Harris, San Francisco, Cal. App. filed Oct. 18, 1916. Provides a variation in the character of the signals automatically.
- 1,267,784. TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Oct. 7, 1913. Automatic or semi-automatic telephone systems.
- 1,267,804. DEVICE FOR MOISTURE AND GAS PROOF TELEPHONE SETS; Eugene A. Reinke, Rochester, N. Y. App. filed May 13, 1915. Devices for use in mines.
- 1,267,817. SYSTEM OF CONTROL; Ray Stearns and William S. H. Hamilton, Schenectady, N. Y. App. filed March 24, 1916. An improved system of control for traction motors arranged for regenerative braking.
- 1,267,820. HOISTING SYSTEM; William C. Stevens, Summit, N. J. App. filed March 2, 1916. Hoisting systems for dock hoists.
- 1,267,828. DYNAMO - ELECTRIC MACHINE; John B. Wiard, Lynn, Mass. App. filed Sept. 28, 1917. Relates to the ventilation of dynamo-electric machines.
- 1,267,832. FILLED CABLE AND FLUID STOP; James Wilkinson, Pittsburgh, Mass. App. filed June 2, 1917. Provides a method of filling a portion of a stranded cable with a solidifiable fluid.
- 1,267,838. DYNAMO - ELECTRIC MACHINE; Sven R. Bergman, Lynn, Mass. App. filed Jan. 12, 1911. Means for ventilating dynamo-electric machines efficiently.
- 1,267,868. ELECTRIC CONDUCTOR; William C. Hayman, Schenectady, N. Y. App. filed March 9, 1916. Insulated electric conductors having coverings provided with one or more colored marking threads.
- 1,267,875. CASING FOR LAMP SOCKETS AND THE LIKE; Charles J. Klein, Milwaukee, Wis. App. filed April 8, 1912. Relates to incandescent lamp sockets, and more particularly to the non-current-carrying parts of such devices.
- 1,267,911. DISTRESS SIGNAL; Maurice Scholder, New York, N. Y. App. filed Oct. 13, 1916. Distress signals and fire alarms.
- 1,267,914. ELECTRICAL MEASURING INSTRUMENT; Robert Shand, Lynn, Mass. App. filed May 19, 1916. Improved instrument of the solenoid type.
- 1,267,916. SYSTEM OF CONTROL; Frank H. Shenard, New Rochelle, N. Y. App. filed April 29, 1915. Control systems for electric railway motors.
- 1,267,969. CURRENT-CONVERTING MACHINE; Arthur R. Bullock, Cleveland, Ohio. App. filed June 19, 1913. Provides a device in which the current converted is commutated.
- 1,267,980. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; Edward B. Craft, Hackensack, N. J. App. filed Dec. 19, 1914. Automatic switches for distributing calls.
- 1,267,983. DYNAMO - ELECTRIC MACHINE; James F. Curtis, Pitcairn, Pa. App. filed Feb. 9, 1914. Provides means for the reliable ventilation of certain types of dynamo-electric machines.
- 1,267,987. AUXILIARY SIGNAL SYSTEM; Lewis Degen, Pasadena, Cal. App. filed May 11, 1917. Signaling system for sending and receiving fire alarms.
- 1,267,993. DYNAMO - ELECTRIC MACHINE; George M. Eaton, Pittsburgh, Pa. App. filed May 4, 1915. Field-magnet pole pieces built up of laminations.

- 1,267,996. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINES; Allan B. Field, West Cliff-on-Sea, England. Provides means for bracing and spacing the overhanging end portions of coils of such machines.
- 1,267,997. COIL-SUPPORTING MEANS; Allan B. Field, West Cliff-on-Sea, England. App. filed Jan. 30, 1914. Means for supporting the overhanging end portions of coils of such machines.
- 1,268,014. AUTOMATIC PROTECTIVE DEVICE; Karl Karpplinen, Brisbane, Queensland, Australia. App. filed June 7, 1917. An automatic device for shunting excessive electrical potentials and amperages.
- 1,268,020. VENTILATING APPARATUS; Jan A. Kuyser, Edgewood, Pa. App. filed March 3, 1914. Ventilating means for dynamo-electric machines provided with two-layer armature windings.
- 1,268,025. ARC LAMP; George M. Little, Pittsburgh, Pa. App. filed Oct. 3, 1913. Improvements in supporting and guiding means for the movable electrodes of such lamps.
- 1,268,026. ARC LAMP; George M. Little, Pittsburgh, Pa. App. filed April 6, 1915. Regulating and feeding mechanisms of focusing-type arc lamps.
- 1,268,052. SYSTEM OF CONTROL; Laurence M. Perkins, Wilkinsburg, Pa. App. filed March 13, 1916. Systems of control of electric railway motors and the like during the regenerative period.
- 1,268,068. AUTOMATIC MANUAL TELEPHONE SYSTEM; Bernard D. Willis, Chicago, Ill. App. filed Jan. 18, 1910. Systems in which automatic switches are employed.
- 1,268,069. AUTOMATIC COMMON-BATTERY TELEPHONE SYSTEM; Edward D. Fales, Chicago, Ill. App. filed Nov. 6, 1906. Provides certain features of improvement.
- 1,268,072. COMBINED SELECTOR AND REPEATER APPARATUS FOR LOCAL-BATTERY TELEPHONE EXCHANGE SYSTEMS; Talbot G. Martin, Chicago, Ill. App. filed July 22, 1907. Relates to automatic or semi-automatic telephone exchange systems.
- 1,268,102. ELECTRIC LIGHT EXTENSION DEVICE; John B. Drumm, Winslow, Ariz. App. filed Aug. 31, 1914. Provides a compact drum mounting wherein the contacts are completely housed.
- 1,268,106. TELEPHONE SYSTEM; Adolf Franke, Grunewald, near Berlin, Germany. App. filed Sept. 3, 1913. Automatic telephone systems in which connections are established by means of selectors.
- 1,268,111. SYSTEM OF CONTROL FOR ELECTRIC ELEVATORS; Floyd C. Furlow, Montclair, N. J. App. filed Nov. 5, 1915. Provides means to control an elevator car automatically.
- 1,268,154. HANDY LAMP; Ralph R. Root, Cleveland, Ohio. App. filed May 4, 1914. A handy lamp that may be affixed upon a metal surface and supported by magnetic attraction.



1,267,483—Electric Controller

- 1,268,156. CONTROL MECHANISM FOR AUTOMATICALLY OPERATING APPARATUS; Harold Rowntree, Kenilworth, Ill. App. filed Sept. 29, 1913. Provides means for successively registering the calls for the operations of the apparatus.
- 1,268,173. ELECTRIC SWITCH; Alfred J. Stecker, Detroit, Mich. App. filed Jan. 18, 1917. Electric switches which may be conveniently operated by the thumb or finger.



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